Biology

Q. 1. Biological organisation starts with:

a. Atomic level
b. Submicroscopic molecular level
c. Cellular level
d. Organismic level

Sol. Correct choice: (2)

Q. 2. About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and:

a. calcium and phosphorous
b. phosphorus and sulphur
c. sulphur and magnesium
d. magnesium and sodium

Sol. Correct choice: (1)

Q. 3. Which one of the following is an example of negative feed back loop in humans?

a. Secretion of sweat glands and constriction of skin blood vessels when it is too hot.
b. Constriction of skin blood vessels and contraction of skeletal muscles when it is too cold.
c. Secretion of tears after falling of sand particles in to the eye
d. Salivation of mouth at the sight of delicious food.

Sol. When the set point of hypothalamus is disturbed by high temperature, it stimulates vasodilation and sweating while in low temperature there is vasoconstriction and shivering. Correct choice: (2)

Q. 4. What is common to whale, seal and shark?

a. Homoiothermy
b. Seasonal migration]
c. Thick subcutaneous fat
d. Convergent evolution

Sol. Shark is poikilothermous. All three species show adaptations for aquatic life while these are not closely related. Correct choice: (4)

Q. 5. Which one of the following is not a constituent of cell membrane?

a. Phospholipids
b. Cholesterol

c. Glycolipids
d. Proline

Sol. Correct choice: (4)

Q. 6. Select the wrong statement from the following:

a. The chloroplasts are generally much larger than mitochondria.
b. Both chloroplasts and mitochondria contain and inner and an outer membrane
c. Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane
d. Both chloroplasts and mitochondria contain DNA.

Sol. Correct choice: (3)

Q. 7. The overall goal of glycolysis, Krebs cycle and the electron transport system is the formation of:

a. Nucleic acids
b. ATP is small stepwise units
c. ATP in one large oxidation reaction
d. Sugars

Sol. Correct choice: (2)

Q. 8. If the mean and the median pertaining to a certain character of a population are of the same value, the following is most likely to occur:

a. a skewed curve
b. a normal distribution
c. a bi-modal distribution
d. a T -shaped curve

Sol. Correct choice: (2)

Q. 9. Which one of the following is a slime mould?

a. Anabaena
b. Rhizopus
c. Physarum
d. Thiobacillus

Sol. Physarum is an acellular slime mould. Correct choice: (3)

Q.10. For a critical study of secondary growth in plants, which one of the following pairs is suitable?

a. Wheat and maiden hair fern
b. Sugarcane and sunflower
c. Teak and pine
d. Deodar and fern

Sol. Secondary growth occurs in gymnosperms and dicots. Correct choice: (3)

Q.11. Which one of the following statements about Mycoplasma is wrong?

a. They cause disease in plants
b. They are also called PPLO
c. They are pleomorphic
d. They are sensitive to penicillin

Sol. Mycoplasma is not sensitive to penicillin due to absence of cell wall. Correct choice: (4)

Q.12. In the prothallus of vascular cryptogam, the antherozoids and eggs mature at different times. As a result:

a. self fertilization is prevented
b. there is no change in success rate of fertilization
c. there is high degree of sterility
d. one can conclude that the plant is apomictic

Sol. In vascular cryptogam i.e. in pteridophytes gametophyte is monoecious but protandrous to avoid self fertilization. Correct choice: (1)

Q.13. Two plants can be conclusively said to belong to the same species if they:

a. have same number of chromosomes
b. can reproduce freely with each other and form seeds
c. have more than 90 per cent similar genes
d. look similar and possess identical secondary metabolities.

Sol. The members of a species are inter-fertile and produce fertile offsprings. Correct choice: (2)

Q.14. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?

a. Chemical composition of the cell wall
b. Types of pigments present in the cell
c. Nature of stored food materials in the cell
d. Structural organization of thallus.

Sol. The various algae are classified mainly on the types of pigments present in their cells. Correct choice: (2)

Q.15. Flagellated male gametes are present in all the three of which one of the following sets?

a. Riccia, Dryopteris and Cycas
b. Anthoceros, Funaria and Spirogyra
c. Zygnema, Saprolegnia and Hydrilla
d. Fucus, Marsilea and Calotropis

Sol. The male gametes of bryophytes are biflagellete, and those of pteriodophytes are multiflagellate, except Selaginella having biflagellate gametes. The male gametes of gymnosperms are non motile except those of Cycas having multiciliate gametes. Correct choice: (1)

Q.16. In gymnosperms, the pollen chamber represents:

a. the microsporangium in which pollen grains develop
b. a cell in the pollen grain in which the sperms formed
c. a cavity in the ovule in which pollen grains are stored after pollination
d. an opening in the mega gametophyte through which the pollen tube approaches the egg.

Sol. In gymnosperms, below micropylar beak some of the cells of nucellus of ovule disintigerate to form pollen chamber. Correct choice: (3)

Q.17. Spore dissemination in some liverworts is aided by:

a. peristome teeth
b. elaters
c. indusium
d. calyptra

Sol. In some liverworts like Marchantia spore dispersal is due to hydrochasy and is aided by elaters. Correct choice: (2)

Q.18. Which pair of the following belongs to Basidiomycetes?

a. Morchella and Mushrooms
b. Birds' nest fungi and Pufballs
c. Pufballs and Claviceps
d. Peziza and Stink horns

Sol. Bird's nest fungi – Cyathus, Pufballs – Lycoperdon, Both belong to the class Basidiomycetes. Correct choice: (3)

Q.19. ICBN stands for:

a. Indian Code of Botanical Nomenclature
b. Indian Congress of Biological Names

c. International Code of Botanical Nomenclature
d. International Congress of Biological Names

Sol. ICBN is one of the codes of nomenclature. It stands for International Code of Botanical Nomenclature. Correct choice: (3)

Q. 20. Ergot of rye is caused by a species of:

a. Claviceps
b. Phytophthora
c. Uncinula
d. Ustilago

Sol. Ergot of rye is caused by Claviceps purpurea. Correct choice: (1)

Q. 21. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed:

a. Convergent evolution
b. Divergent evolution
c. Microevolution
d. Co-evolution

Sol. Correct choice: (1)

Q. 22. Adaptive radiation refers to:

a. Power of adaptation in an individual to a variety of environments
b. Adaptations due to Geographical isolation
c. Evolution of different species from a common ancestor
d. Migration of members of a species to different geographical areas

Sol. Correct choice: (3)

Q. 23. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for:

a. growth the movement
b. responsiveness to touch
c. interaction with the environment and progressive evolution
d. reproduction

Sol. Correct choice: (4)

Q. 24. The Finches of Galapogas islands provide an evidence in favour of:

a. Biogeographical Evolution
b. Special Creation
c. Evolution due to Mutation
d. Retrogressive Evolution

Sol. Correct choice: (1)

Q. 25. One of the important consequences of geographical isolation is:

a. Random creation of new species
b. No change in the isolation faunax
c. Preventing Speciation
d. Speciation through reproductive isolation

Sol. Correct choice: (4)

Q. 26. Industrial melanism as observed in peppered moth proves that:

a. Melanism is a pollution-generated feature
b. The true black melanic forms arise by a recurring random mutation
c. The melanic form of the moth has no selective advantage over lighter form in industrial area
d. The lighter-form moth has no selective advantage either in polluted industrial area or non-polluted area.

Sol. It is an example of directional selection. Correct choice: (2)

Q. 27. The concept of chemical evolution is based on:

a. Possible origin of life by combination of chemicals
b. Crystallization of chemicals under suitable environmental conditions
c. Interaction of water, air and clay under
d. Effect of solar radiation of chemicals

Sol. Correct choice: (1)

Q. 28. Among the human ancestors the brain size was more than 1000 CC in:

a. Homo habilis
b. Homo neanderthalensis
c. Homo erectus
d. Ramapithecus

Sol. Homo habilis had a cranial capacity in the range of 680-720 c.c. & that of Homo erectus erectus 775-990 c.c,

Homo erectus pekinensis 915-1200 c.c.
Homo neanderthalensis 1300-1600 c.c. Correct choice:

Q. 29. Which of the following pairs are correctly matched?

a. Crocodile	- 4-Chambered heart
b. Sea Urchin	- Parapodia
c. Obelia	– Metagenesis
d. Lemur	– Thecodont

(1) Only A and B
(2) A, C and D
(3) B, C and D
(4) Only A and D

Sol. Correct choice: (2)

Q. 30. Select the correct statement from the following:

a. Mutations are random and directional
b. Darwinian variations are small and directionless
c. Fitness is the end result of the ability to adapt and gets selected by nature
d. All mammals except whales and camels have seven cervical vertebrate.

Sol. It explains natural selection. Correct choice: (3)

Q. 31. Which one of the following is a matching pair of a body feature and the animal possessing it?

a. Ventral heart	- Scorpion
b. Post-anal tail	- Octopus
c. Ventral Central nervous system	– Leech
d. Pharyngeal gill slits absent in embryo	– Chamaeleon

Sol. Scorpion has dorsal heart. Post-anal tail is found only in chordates. Pharyngeal gill slits are present in the embryo of chameleon. Correct choice: (3)

Q. 32. What is common between parrot, platypus and kangaroo?

a. Ovoparity
b. Homoiothermy
c. Toothless jaws
d. Functional post -anal tail

Sol. Only birds & mammals are homoiothermous. Correct choice: (2)

Q. 33. What is true about Nereis, Scorpion, Cockroach and Silver fish?

a. They all belong to the same phylum
b. They all have jointed paired appendages
c. They all possess dorsal heart
d. None of them is aquatic

Sol. Correct choice: (3)

Q. 34. Which one of the following statement is correct?

a. Ontogeny repeats phylogeny
b. Stem cells are specialized cells
c. There is no evidence of the existence of gills during embryogenesis of mammals
d. All plant and animal cells are totipotent.

Sol. Correct choice: (1)

Q. 35. "Foolish Seedling" disease of rice led to the discovery of:

a. IAA
b. GA
c. ABA
d. 2, 4 – D

Sol. Foolish seeding disease (Bakane disease) of rice is due to a fungus Giberella fujikuroi. Yabuta and Sumuki obtained achemical from the fungus and called gibbrellic acid. Correct choice: (2)

Q. 36. Passage cells are thin- walled cells found in:

a. central region of style through which the pollen tube grows towards the ovary.
b. endodermis of roots facilitating rapid transport of water from cortex to pericycle.
c. phloem elements that serve as entry points for substances for transport to other plant parts.
d. testa of seed to enable emergence of growing embryonic axis during seed germination.

Sol. Passage cells also called transfusion tissue are found in the endodermis meant for rapid transport of water from cortex to pericycle. Correct choice: (2)

Q. 37. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is:

a. Quinone
b. Cytochrome

c. Iron-sulphur protein
d. Ferredoxin.

Sol. The first acceptor of electros from an excited chlorophyll is quinone. Correct choice: (1)

Q. 38. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is:

a. succinate dehydrogenase
b. lactate dehydrogenase
c. isocitrate dehydrogenase
d. malate dehydrogenase

Sol. Succinate dehydrogenase is a common enzyme for TCA and ETC. It is located on inner mitochondrial membrane. Rest of the TCA enzymes are present in mitochondrial matrix. Correct choice: (1)

Q. 39. The wavelength of light absorbed by Pr form of phytochrome is:

a. 620 nm
b. 640 nm
c. 680 nm
d. 720 nm

Sol. The Pr form of phytochrome receives red light (600-680 nm) and changes into Pfr. Correct choice: (3)

Q. 40. Opening of floral buds into flowers, is type of:

a. Autonomic movement of growth
b. Autonomic movement of locomotion
c. Autonomic movement of variation
d. Paratonic movement of growth.

Sol. Opening of floral bud into flowers, is due to epinasty, a type of autonomic movement of growth. Correct choice: (1)

Q. 41. Which one of the following pairs, is not correctly matched?

a. IAA - Cell wall elongation
b. Abscissic Acid - Stomatal closure
c. Gibberellic Acid - Leaf fall
d. Cytokinin - Cell division

Sol. Leaf fall is due to interaction of auxin and ethylene. Correct choice: (3)

Q. 42. One gene - one enzyme relationship was established for the first time in:

a. Diploccus pneumoniae
b. Neurospora crassa
c. Salmonella typhimurium
d. Escherichia Coli

Sol. One gene-one enzyme hypothesis was given by Beadle and Tatum in red mould (Neurospora crassa). Correct choice: (2)

Q. 43. Male gametes in angiosperms are formed by the division of:

a. Microspore mother cell
b. Microspore
c. Generative cell
d. Vegetative cell

Sol. During the development of male gametophyte first of all two cells – generative cell and tube nucleus are formed from a pollen. This twocelled stage is called pollen grain. Finally the generative cell divides to form 2-male gametes. Correct choice: (3)

Q. 44. Two cells A and B are contiguous. Cell A has osmotic pressure 10 atm, turgor pressure - 7atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be:

a. Movement of water of Cell A to B
b. Movement of water from Cell B to A
c. No movement of water
d. Equilibrium between the two

Sol. The direction of movement of water is from low to high DPD. Correct choice: (1)

Q. 45. In the leaves of C_4 plants, malic acid formation during CO_2 fixation occurs in the cells of:

a. Epidermis
b. Mesophyll
c. Bundle Sheath
d. Phloem

Sol. In C_4 plants, C_4 cycle occurs in mesophyll cells and C_3 cycle in bundle sheath cells. Correct choice: (2)

Q. 46. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganism?

a. Cicer arietinum

b. Casuarina equisetifolia
c. Crotalaria juncea
d. Cycas revolute

Sol. The filamentous nitrogen – fixing microorganism like Frankia occurs in root-nodules of non-leguminous plants like Casuarina and Alnus. Correct choice: (2)

Q. 47. Which one of the following is surrounded by a callose wall?

a. Pollen grain
b. Microspore mother cell
c. Male gamete
d. Egg

Sol. The microspore mother cells develops an internal layer of callose which breaks the plasmodesmatal connections among themselves. Correct choice: (2)

Q. 48. Which one of the following elements is not an essential micronutrient for plant growth?

a. Ca
b. Mn
c. Zn
d. Cu

Sol. Calcium is an essential macronutrient for plant growth. Correct choice: (1)

Q. 49. If you suspect major deficiency of antibodies in person, to which of the following would you look for confirmatory evidence?

a. Haemocytes
b. Serum albumins
c. Serum globulins
d. Fibrinogen in the plasma

Sol. Correct choice: (3)

Q. 50. Which one of the following is a fat -soluble vitamin and its related deficiency disease?

a. Calciferol – Pellagra
b. Ascorbic acid – Scurvy
c. Retinol – Xerophthalmia
d. Cobalamine – Beri-beri

Sol. Correct choice: (3)

Q. 51. Which one of the following mammalian cells is not capable of metabolising glucose to carbon-dioxide aerobically?

a. Red blood cells
b. White blood cells
c. Unstriated muscle cells
d. Liver cells

Sol. RBCs do not have mitochondria & thus can respire only anaerobically. Correct choice: (1)

Q. 52. Compared to a bull a bullock is docile because of:

a. lower levels of adrenalin / noradrenalin in its blood
b. higher levels of thyroxin
c. higher levels of cortisone
d. lower levels of blood testosterone

Sol. The bullock is castrated and therefore secretion of testosterone is not adequate. Correct choice: (4)

Q. 53. In the human female, menstruation can be deferred by the administration of:

a. FSH only
b. LH only
c. Combination of FSH and LH
d. Combination of estrogen and progesterone

Sol. Correct choice: (4)

Q. 54. In human body, which one of the following is anatomically correct?

a. Cranial nerves - 10 pairs
b. Floating ribs - 2 pairs
c. Collar bones – 3 pairs
d. Salivary glands –1 pair

Sol. Correct choice: (2)

Q. 55. In which one of the following preparations are you likely to come across cell junctions most frequently?

a. Hyaline cartilage
b. Ciliated epithelium
c. Thrombocytes
d. Tendon

Sol. Correct choice: (2)

Q. 56. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate?

a. Whole blood from pulmonary vein
b. Blood plasma
c. Blood serum
d. Sample from the thoracic duct of lymphatic system

Sol. Blood serum does not contain fibrinogen and few other clotting factors, thus it will not coagulate. Correct choice: (3)

Q. 57. Feeling the tremors of an earthquake a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action?

a. Gastrin
b. Thyroxin
c. Adrenaline
d. Glucagon

Sol. Correct choice: (3)

Q. 58. A person who is on a long hunger strike and is surviving only on water, will have:

a. less urea in his urine
b. more sodium in his urine
c. less amino acids in his urine
d. more glucose in his blood.

Sol. Correct choice: (1)

Q. 59. Which one of the following pairs of structures distinguishes a nerve cell from other types of cell?

a. Nucleus and mitochondria
b. Perikaryon and dendrites
c. Vacuoles and fibers
d. Flagellum and medullary sheath

Sol. Correct choice: (2)

Q.60. Which part of ovary in mam mals acts as an endocrine gland after evolution?

a. Vitelline membrane
b. Graafian follicle

c. Stroma
d. Germinal epithelium

Sol. Correct choice: (2)

Q. 61. During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge?

a. First positive, then negative and again back to positive
b. First negative, then positive and again back to negative
c. First positive, then negative and continue to be negative
d. First negative, then positive and continue to be positive.

Sol. Correct choice: (2)

Q. 62. A person is having problems with calcium and phosphorous metabolism in his body. Which one of the following glands may not be functioning properly?

a. Thyroid
b. Parathyroid
c. Parotid
d. Pancreas

Sol. Correct choice: (2)

Q. 63. Identify the odd combination of the habitat and the particular animal concerned:

a. Rann of Kutch - Wild Ass
b. Dachigam National Park - Snow Leopard
c. Sunderbans –Bengal Tiger
d. Periyar –Elephant

Sol. Dachigam National Park is for the conservation of Hangul.
Correct choice: (2)

Q. 64. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order?

a. S < DE < PE < SE
b. SE < S < PE < DE
c. SE < PE < S < DE
d. PE < S < SE < DE

Sol. BOD of distillery effluent is 40,000 mg / l and that of paper mill effluent and sewage is 190 mg/l and 30 mg/l, respectively. Correct choice: (2)

Q. 65. Which one of the following ecosystem types has the highest annual net primary productivity?

a. Temperate deciduous forest
b. Tropical rain forest
c. Tropical deciduous forest
d. Temperate evergreen forest

Sol. Tropical rain forest has highest annual net primary productivity (9000 K cal / m 2 / yr). Correct choice: (2)

Q. 66. Which one of the following is being utilized as a source of biodiesel in the Indian countryside?

a. Pongamia
b. Euphorbia
c. Beetroot
d. Sugarcane

Sol. Pongamia, Jatropa, Euphorbia are petrocrops. However, in the Indian countryside, Pongamia (Kanjar) is being utilized as a source of biodiesel. Correct choice: (1)

Q. 67. In a coal fires power plant electrostatic precipitators are installed to control emission of:

a. CO
b. SO_2
c. NO_X
d. SPM

Sol. Electrostatic precipitators control emission of suspended particle matter (SPM). Correct choice: (4)

Q. 68. Which one of the following is not a bioindicator of water pollution?

a. Sewage fungus
b. Sludge-worms
c. Blood-worms
d. Stone flies

Sol. Correct choice: (4)

Q. 69. A high density of elephant population in an area can result in:

a. Predation on one another
b. Mutualism
c. Intra specific competition
d. Inter specific competition

Sol. Intra-specific competition occurs between the members of the same species. Correct choice: (3)

Q. 70. Geometric representation of age structure is a characteristic of:

a. Ecosystem
b. Biotic community
c. Population
d. Landscape

Sol. Age structure is one of the characteristics of population. Correct choice: (3)

Q. 71. Which one of the following pairs of organisms are exotic species introduced in India?

a. Nile perch, Ficus religiosa
b. Ficus religiosa, Lantana camara
c. Lantana camara, Water hyacinth
d. Water hyacinth, Prosopis cineraria

Sol. Lantana camara and Eicchornia czassipes (water hyacinth) are exotic species. Correct choice: (3)

Q. 72. One of endangered species of Indian medicinal plants is that of:

a. Nepenthes
b. Podophyllum
c. Ocimum
d. Garlic

Sol. Podophyllum hexandrum - : (Papri), gives a drug from its rhizome; besides being stimulant and purgative and has destructive action on cancerous tissues. Correct choice: (2)

Q. 73. A genetically engineered micro-organism used successfully in bioremediation of oil spills is a species of:

a. Bacillus
b. Pseudomonas
c. Trichoderma
d. Xanthomonas

Sol. Pseudomonas putida (superbug) developed by genetic engineering by Anand Mohan Chakravorty is used to control oil spills. Correct choice: (2)

Q. 74. A sequential expression of a set of human genes occurs when a steroid molecule binds to the:

a. Ribosome
b. Transfer RNA
c. Messenger RNA
d. DNA sequence

Sol. Correct choice: (4)

Q. 75. The Okazaki fragments in DNA chain growth:

a. polymerize in the direction and explain DNA replication
b. result in transcription
c. polymerize in the direction and forms replication fork
d. prove semi-conservative nature of DNA replication

Sol. Replication occurs always in $5' - 3'$ direction. Okazaki fragments, synthesized on $3' - 5'$ DNA template, join to form lagging strand which grows in $3' - 5'$ direction. Correct choice: (1)

Q. 76. In the hexaploid wheat, the haploid (n) and basic (x) numbers of chromosomes are:

a. n = 21 and x = 7
b. n = 7 and x = 21
c. n = 21 and x = 21
d. n = 21 and x = 14

Sol. The basic number (x) of wheat is 7. Thus the 6x = 2n = 42 and n = 21. Correct choice: (1)

Q. 77. Molecular basis of organ differentiation depends on the modulation in transcription by:

a. Anticodon
b. RNA polymerase
c. Ribosome
d. Transcription factor

Sol. Correct choice: (4)

Q. 78. Telomere repetitive DNA sequence control the function of eukaryote chromosomes because they:

a. prevent chromosome loss
b. act as replicons
c. are RNA transcription initiator
d. help chromosome pairing

Sol. Telomerase seal the ends of the chromosomes. Correct choice: (1)

Q. 79. Inheritance of skin colour in humans is an example of:

a. codominance
b. chromosomal aberration
c. point mutation
d. polygenic inheritance

Sol. Inheritance of skin colour in human is controlled by three genes, A, B and C. Correct choice: (4)

Q. 80. A common test to find the genotype of a hybrid is by:

a. crossing of one F_1progeny with male parent
b. crossing of one F_2 progeny with male parent
c. crossing of one F_2 progeny with female parent
d. studying the sexual behaviour of F1 progenies.

Sol. To find the genotype of hybrid, it is test crossed. Correct choice: (1)

Q. 81. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle - like structure. What is it's DNA-binding sequence?

a. TATA
b. TTAA
c. AATT
d. CACC

Sol. The DNA binding sequence for RNA polymerase is called TATA box. Correct choice: (1)

Q. 82. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized, the F2 segregation will show:

a. Higher number of the parental types.
b. Higher number of the recombinant types.
c. Segregation in the expected 9: 3: 3: 1 ratio.
d. Segregation in 3:1 ratio.

Sol. When the linked genes are situated quite close, the chances of crossing over are highly reduced. Due to this, large number of parental gametes are formed and only few recombinant

gametes are formed. This results in higher number of parental types in F_2 generation as compared to recombinants.
Correct choice: (1)

Q. 83. In maize, hybrid vigour is exploited by:

a. Inducing mutations.
b. Bombarding the seeds with DNA.
c. Crossing of two inbred parental lines.
d. Harvesting seeds from the most productive plants.

Sol. Correct choice: (3)

Q. 84. Differentiation of organs and tissues in a developing organism, is associated with:

a. Deletion of genes
b. Developmental mutations
c. Differential expression of genes
d. Lethal mutations

Sol. Correct choice: (3)

Q. 85. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F1 generation?

a. 3 : 1
b. 50 : 50
c. 9 : 1
d. 1 : 3

Sol. This is a monohybrid test cross. Correct choice: (2)

Q. 86. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?

a. Through elimination of repetitive DNA.
b. Deletion of non-essential genes.
c. Super-coiling in nucleosomes.
d. DNAse digestion.

Sol. The nucleosome model explains the packaging of histone proteins and DNA in the chromatin material which forms the chromosome. Correct choice: (3)

Q. 87. In cloning of cattle a fertilized egg is taken out of the mother's womb and:

a. from this upto eight identical twins can be produced
b. the egg is divided into 4 pairs of cells which are implanted into the womb of others cows
c. in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb other cows.
d. in the eight cell stage the individual cells are separated under electrical field for further development in culture media.

Sol. As per the experiment performed by the scientist from Japan. Correct choice: (3)

Q. 88. Which one of the following statements is correct?

a. At present it is not possible to grow maize without chemical fertilizers.
b. Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
c. Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.
d. Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and potassium for plant nutrition in soil.

Sol. The Agricultural run off contains high concentration of chemical fertilizers. Which is discharge in near by lakes causes nutrient enrichment of lakes called eutrophication. Correct choice: (2)

Q. 89. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?

a. The population of its predators increases enormously.
b. S-shaped or sigmoid growth of this insect.
c. The food plants mature and die at the end of the rainy season.
d. Its population growth curve is of J-type.

Sol. A population which grows exponentially and crashes suddenly exhibits J-type growth curve. Correct choice: (4)

Q. 90. The two polynucleotide chains in DNA are:

a. semiconservative
b. parallel
c. discontinuous
d. antiparallel

Sol. The two chains in a dsDNA run in opposite direction one $5' \rightarrow 3'$ while other $5' \rightarrow 3'$ in opposite direction.

$5' \rightarrow 3'$

5' ← 3'

Correct choice: (4)

Q. 91. A plant requires magnesium for:

a. Cell wall development
b. Holdin g cells together
c. Protein synthesis
d. Chlorophyll synthesis

Q. 92. Probiotics are:

a. Live microbial food supplement
b. Safe antibiotics
c. Cancer inducing microbes
d. New kind of food allergens

Sol. Live microbial food supplements are called probiotics (e.g., curd). Correct choice: (1)

Q. 93. Bowman's glands are located in the:

a. olfactory epithelium of our nose
b. proximal end of uriniferous tubules
c. anterior pituitary
d. female reproductive system of cockroach

Sol. Correct choice: (1)

Q. 94. Increased asthamatic attacks in certain seasons are related to:

a. Low temperature
b. Hot and humid environment
c. Eating fruits preserved in tin containers
d. Inhalation of seasonal pollen

Sol. Correct choice: (4)

Q. 95. A human male produces sperms with genotypes AB, Ab, aB and ab pertaining to two diallelic characters in equal proportions. What is the corresponding genotype of this person?

a. AABB
b. AaBb
c. AaBB
d. AABb

Sol. The formula for gamete formation is 2n where n stands for number of heterozygous pairs. AaBb has 2 heterozygous pairs so it will form 4 types of gametes. Correct choice: (2)

Q. 96. Which one of the following pairs is wrongly matched?

a. Coliforms - Vinegar
b. Methanogens -Gobar gas
c. Yeast –Ethanol
d. Streptomycetes –Antibiotic

Sol. Coliforms are bacteria found in colon e.g. E. coli. For the preparation of vinegar Acetobacter aceti is employed. Correct choice: (1)

Q. 97. Which one of the following pairs is mismatched?

a. Bombyx mori -silk
b. Pila globosa -pearl
c. Apis indica –honey
d. Kenia lacca –lac

Sol. Pinctada vulgaris is a bivalve from which pearl is obtained. Correct choice: (2)

Q. 98. Which one of the following is viral disease of poultry?

a. Pasteurellosis
b. Salmonellosis
c. Coryza
d. New Castle disease

Sol. Correct choice: (4)

Q. 99. Ultrasound of how much frequency is beamed into human body for sonography?

a. 45 - 70 MHz
b. 30 - 45 MHz
c. 15 - 30 MHz
d. 1 - 15 MHz

Sol. Correct choice: (4)

Q. 100. Lysozyme that is present in perspiration, saliva and tears, destroys:

a. most virus-infected cells
b. certain fungi

c. certain types of bacteria
d. all viruses

Sol. Correct choice: (3)

Chemistry

Q. 1. With which of the following configuration an atom has the lowest ionization enthalpy?

a. $1s^2\ 2s^2\ 2p^6$
b. $1s^2\ 2s^2\ 2p^5$
c. $1s^2\ 2s^2\ 2p^3$
d. $1s^2\ 2s^2\ 2p^5\ 3s^1$

Sol. $1s^2\ 2s^2\ 2p^5\ 3s^1$ represents the excited state of a Neon atom. The energy needed to knock off an electron from the excited state of neon must be least. Correct choice is: (4)

Q. 2. An element, X has the following isotopic composition; ^{200}X:90% ; ^{199}X:8.0% ; ^{202}X:2.0% The weighted average atomic mass of the naturally occurring element X is closest to :

a. 199 amu
b. 200 amu
c. 201 amu
d. 202 amu

Sol. The weighted average atomic mass of element (X) = 0.9 (200) + 0.08 (199) + 0.02 (202) = 180 + 15.92 + 4.04 = $199.96 \approx 200$ Correct choice is: (2)

Q. 3. Concentrated aqueous sulphuric acid is 98% H 2SO 4 by mass and has a density of 1.80 g. mL^{-1} . Volume of acid required to make one litre of 0.1 M H_2SO_4 is,

a. 5.55 mL
b. 11.10 mL
c. 16.65 mL
d. 22.20 mL

Sol. Density = 1.80 g/ml

$\Rightarrow 1\,litre\ has\ 1800g\ H_2SO_4\ (impure)$

$\Rightarrow 1\,litre\ has\ 0.98\,(1800)g\ H_2SO_4\ (pure)$

$\Rightarrow 1\,litre\ has\ \frac{1764}{98}\ moles\ H_2SO_4 = 18\ M \Rightarrow Now, 18 \times V_1 = 0.1 \times 1 or, V_1 = \frac{0.1}{18} \times 1000 = 5.55\ ml$

Correct choice: (1)

Q.4. Consider the following sets of quantum numbers:

	n	I	M	s
(a)	3	0	0	+ ½
(b)	2	2	1	+ ½
(c)	4	3	-2	- ½
(d)	1	0	-1	- ½
(e)	3	2	3	+1/2

Which of the following sets of quantum number is not possible

a. a and c
b. b, c and d
c. a, b, c and d
d. b, d and e

Sol. Choice (b), (d) and (e) are incorrect. Remember that value of 'l' ranges from (0) to (n – 1) and values of 'm' range from (–l) to (+l). Correct choice: (4)

Q. 5. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is:

a. 1
b. $\frac{3}{5}$
c. $\frac{4}{5}$
d. $\frac{2}{5}$

Sol.

$$2\,MnO_4^- + 5SO_3^{2-} + H^+ \rightarrow 5SO_4^{2-} + 2Mn^{+2}$$

$$\Rightarrow Number\ of\ moles\ of\ KMnO_4\ that\ react\ with\ one\ mole\ SO_3^{2-}\ will\ be\ \frac{2}{5}$$

Correct choice : (4)

Q. 6. In a first-order reaction $A \rightarrow B$, if k is rate constant and initial concentration of the reactant A is 0.5 M then the half-life is :

a. $\frac{In\ 2}{K}$

b. $\frac{o.693}{o.5\,K}$

c. $\frac{\log 2}{K}$

d. $\frac{\log\ 2}{K\sqrt{o.5}}$

Sol. $t\,1/2\ for\ a\ first\ order\ reaction = \frac{0.693}{K} = \frac{2.303\log_{10} 2}{K} = \frac{In\ 2}{K}$

Correct choice: (1)

Q. 7. The reaction of hydrogen and iodine monochloride is given as:

$$H_{2(g)} + 2ICL_{(g)} \rightarrow 2HCl_{(g)} + l_{2(g)}$$

This reaction is of first order with respect to $H_{2(g)}\ and\ lCl_{(g)}$, following mechanisms were proposed :

Mechanism A : $H_{2(g)} + 2ICL_{(g)} \rightarrow 2HCl_{(g)} + l_{2(g)}$

Mechanism B : $H_{2(g)} + ICI_{(g)} \rightarrow HCL_{(g)} + HI_{(g)}\ :\ slow\ HI_{(g)} + ICI_{(g)} \rightarrow HCI_{(g)} + I_{2(g)};\ fast$

Which of the above mechanism (s) can be consistent with the given information about the reaction

a. A only
b. B only
c. 1 and 2 both
d. Neither 1 nor 2

Sol. The rate law is invariably determined from the slowest step of the mechanism. Therefore mechanism (B) is consistent with the data given for order of reaction. Correct choice: (2)

Q. 8. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately :

a. 40 minutes
b. 50 minutes
c. 45 minutes
d. 60 minutes

$(\log 4 = 0.60, \log 5 = 0.69)$

Sol.

$$k = \frac{2.303}{60}\log\frac{1}{0.4} = \frac{2.303}{60}\log\frac{10}{4} = \frac{2.303}{60}\log\frac{5}{2} = \frac{2.303}{60}(\log 5 - \log 2) = \frac{2.303}{60}(0.69 - 0.3) = \frac{2.303}{60}\times 0.39$$

$$t\,1/2 = \frac{2.303\times 0.3\times 60}{2.303\times 0.39} = 46.15 \approx 45\ \text{min}\ utes.$$

Correct choice: (3)

Q. 9. The equilibrium constant of the reaction :

$Cu(s) + 2Ag^{+}\,(aq) \rightarrow Cu^{2+}\,(aq) + 2Ag(s);\ E^{0} = 0.46\,V\ at\ 298\,K\ is$:

a. 4.0×10^{15}
b. 2.4×10^{10}
c. 2.0×10^{10}
d. 4.0×10^{10}

Sol. $\Delta G^{0} = -2\times 96500\times 0.46 = -88780\,j$

$?\,G^{0} = 2.303\,RT\log K_c\ or\ -88780 = -2.303\times 8.314\times 298\log K_c$

$or\ -88780 = -5705.84\log k_c\ or\ \log k_c = 15.55 \Rightarrow \left[K_c = 4\times 10^{15}\right]$

Correct choice: (1)

Q. 10. 0.5 molal aqueous solution of a weak acid (HX) is 20% ionized. If Kf for water is 1.86 K kg mol sup-1 , the lowering in freezing point of the solution is

a. – 0.56 K
b. – 1.12 K
c. 0.56 K
d. 1.12 K

$\Delta T_f = i\,K_f m = 1.2\times 1.86\times 0.5 = 1.12\,K$ Correct choice: (4)

Q. 11. The efficiency of a fuel cell is given by

a. $\frac{\Delta S}{\Delta G}$

b. $\frac{\Delta H}{\Delta G}$

c. $\frac{\Delta G}{\Delta S}$

d. $\frac{\Delta g}{\Delta H}$

Sol. Efficiency of a fuel cell $(n) = \frac{\Delta G}{\Delta H}$ Correct choice: (4)

Q. 12. Consider the following reactions:

a. $H^{+}_{(aq)} + OH^{-}_{aq} = H_2O_{(l)}, \Delta H = -X_1 Kj\ mol^{-1}$

b. $H_{2(g)} + \frac{1}{2} O_{2(g)} = H_2O_{(l)}, \ \Delta H = -X_2 Kj\ mol^{-1}$

c. $CO_{2(g)} + H_{2(g)} = CO_{(g)} + H_2O_{(l)} - X_3 Kj\ mol^{-1}$

d. $C_2H_{2(g)} + \frac{5}{2} O_{2(g)} = 2CO_{(g)} + H_2O_{(l)} + X_4 Kj\ mol^{-1}$

Enthalpy of formation of $H_2O(l)$ is

a. $+X_1\ KJ\ mol^{-1}$

b. $+X_2\ KJ\ mol^{-1}$

c. $+X_3\ KJ\ mol^{-1}$

d. $+X_4\ KJ\ mol^{-1}$

Sol. Heat of formation of $H_2O(l) = -X_2$ kJ / mol . Correct choice: (2)

Q. 13. Given that bond energies of

$H-$ and $CI-CI$ are $430\ KJmol^{-1}$ respectively and $\Delta_f H$ fo HCI is $-90 KJ\ mol^{-1}$,

Bond enthalpy of HCI is

a. $245\ KJ\ mol^{-1}$

b. $2909\ KJ\ mol^{-1}$

c. $380\ KJ\ mol^{-1}$

d. $425\ KJ\ mol^{-1}$

$H_2 + CI_2 \rightarrow 2HCI; \left[B.E_{H\_H} + B.E_{CI-CI}\right] - \left[2BE_{H-CI}\right] = \Delta H_R$

Sol. $[430 + 240] - [2.BE_{H-CI}] = 180 \; or \; 670 - 2(BE)_{H-CI} = 850 \; or \; BE_{H-CI} = 425 \; KJ \; mol^{-1}$

Correct choice: (4)

Q. 14. The Langmuir adsorption isotherm is deduced using the assumption

a. The adsorbed molecules interact with each other
b. The adsorption takes place in multilayers
c. The adsorption sites are equivalent in their ability to adsorb the particles
d. The heat of adsorption varies with coverage

Sol. angmuir adsorption has the following postulates

a. The isotherm is devised for adsorption equilibrium i.e., when rate of adsorption = rate of desorption
b. Adsorption at all sites is equivalent
c. Adsorption at a site is unaffected by adsorption at neighboring sites.

Correct choice: (3)

Q. 15. The following equilibrium constants are given

$N_2 + 3H_2 \leftrightarrow 2NH_3; K_1 \qquad N2 + O_2 \leftrightarrow 2NO; k_2 \qquad H_2 + \frac{1}{2} O_2 \leftrightarrow H_2O; K_3$

The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is

a. $K_1 K_2 / K_3$
b. $K_2 K_3^3 / K_1$
c. $K_{21} K_3^2 / K_1$
d. $K_2^{\,2} K_3 / K_1$

Sol.

$2NH_3 \rightarrow N_2 + 3H_2$ $\quad \frac{1}{K_1}$

$3H_2 + \frac{3}{2}O_2 \rightarrow 3H_2O$ $\quad K_3^3$

$N_2 + O_2 \rightarrow 2NO$ $\quad K_2$

$2NH_3 + \frac{5}{2}O_2 \rightarrow 2NO + 3H_2O$ $\quad \left[K^* = K_2K_3^3 / K_1\right]$

Correct choice: (2)

Q. 16. Caulate the pOH of a solution at 25^0C that contains

1×10^{-10} *M of hydronium ions, i.e.* H_3O^+ :

a. 1.000
b. 7.000
c. 4.000
d. 9.000

Sol. $\left[OH^-\right] = 10^{-4}\ mol/1;\ P^{OH} = 4$ Correct choice : (3)

Q. 17. Aweak acid, $HA\ has\ a\ K_a\ of\ 1.00\times10^{-5}.\ If\ 0.100$ mol of this acid is dissolved in one litre of water, the percentage of acid dissociated at equilibrium is closest to

a. 0.100%
b. 99.0%
c. 1.00%
d. 99.9%

Sol. We know that, $K_a = C\alpha^2\ or\ \alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{10^{-5}}{10^{-1}}} = 10^{-2}$ Correct choice: (3)

Q. 18. The fraction of total volume occupied by the atoms present in a simple cube is

a. $\frac{\pi}{4}$
b. $\frac{\pi}{6}$
c. $\frac{\pi}{3\sqrt{2}}$

d. $\frac{\pi}{4\sqrt{2}}$

Sol. Packing fraction for a simple cube $= \frac{\frac{4}{3}\left(\frac{a}{2}\right)^3}{a^3} = \frac{\pi}{6}$ Correct choice: (2)

Q. 19. Identify the correct order of the size of the following:

a. $Ca^{2+} < Ar < K^{+} < Cl^{-} < S^{2-}$
b. $Ca^{2+} + K^{+} < Ar < S^{2-} < Cl^{-}$
c. $Ca^{2+} + < K^{+} < Ar < Cl^{-} < S^{2-}$
d. $Ar < Ca^{2+} < K^{+} < Cl^{-} < S^{2-}$

Sol. Anions have the largest sizes followed by neutral atoms and then cations for a respective period. So, the correct order should be $Ca^{2+} + < K^{+} < Ar < Cl^{-} < S^{2-}$ Correct choice: (3)

Q.20. In which of the following pairs, the two species are iso-structural?

a. BrO_3^- and XeO_3
b. SF_4 and XeF_4
c. SO_3^{2-} and NO_3^-
d. BF_3 and NF_3

Sol. Both - BrO_3^- and XeO_3 have the central atom in SP^3. both these species are pyramidal.

Q. 21. The order of decreasing reactivity towards an electrophilic reagent, for the following:

a. Benzene
b. Toluene
c. Chlorobenzene
d. Phenol would be

a. d > b > a > c
b. a > b > c > d
c. b > d > a > c
d. d > c > b > a

Sol. The correct order is d > b > a > c. Correct choice: (1)

Q. 22. Predict the product C obtained in the following reaction of

$$CH3CH2-C\equiv CH\ CH + HCl \xrightarrow{Hl} B \rightarrow C$$

a. $CH_3CH_2-\underset{\displaystyle Cl}{\overset{\displaystyle I}{\underset{|}{\overset{|}{C}}}}-CH3$

b. $CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_2CH_2I$

c. $CH_3-CH_2-CH_2-\underset{\displaystyle Cl}{\overset{\displaystyle I}{\underset{|}{\overset{|}{C}}}}-H$

d. $CH_3-CH_2-\underset{\displaystyle CH_2Cl}{\overset{\displaystyle I}{\underset{|}{\overset{|}{CH}}}}$

$$CH_3CH_2-C\equiv CH \xrightarrow{HCl} CH_3-CH_2\underset{\displaystyle Cl}{\underset{|}{C}}=CH_2 \xrightarrow{Hl} CH_3-\underset{\displaystyle Cl}{\overset{\displaystyle I}{\underset{|}{\overset{|}{C}}}}-CH_3$$

Sol.
Correct choice: (1)

Q. 23. Which of the compounds with molecular formulaC5H10 yields acetone on ozonolysis?

a. 2 – Methyl – 1 – butene
b. 2 – Methyl – 2 – butane
c. 3 – Methyl – 1 – butane

d. Cyclopentane

Sol. $(CH_3)_2\,C = CH - CH_3 \xrightarrow[2-methyl\ 2-butene]{O_3} (CH_3)_2\,C = O + CH_3CHO$

Correct choice: (2)

Q. 24. If there is no rotation of plane polarized light by a compound in a specific solvent, thought to be chiral, it may mean that

a. the compound may be a racemic mixture
b. the compound is certainly a chiral
c. the compound is certainly meso
d. there is no compound in the solvent

Sol. The given compound was thought to be chiral because of a chiral carbon/s. If there is no optical activity, it means the compound must certainly be meso. Correct choice: (3)

Q. 25. For the following

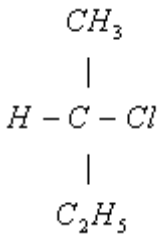
a. l–
b. Cl –
c. Br-

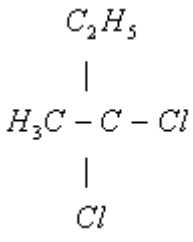
the increasing order of nucleophilicity would be:

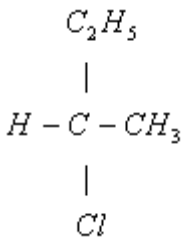
a. $Br^- < Cl^- < I^-$
b. $I^- < Br^- < Cl^-$
c. $Cl^- < Br^- < I^-$
d. $I^- < Cl^- < Br^-$

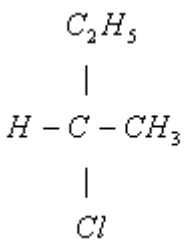
Sol. The order of nucleophilicities of halides ions in water (default solvent) will be $Cl^- < Br^- < I^-$ Correct choice: (3)

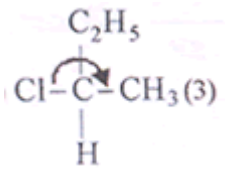
Q. 26. $CH_3 - CHCl - CH_2 - CH_3$ has a chiral centre. Which one of the following represents its R configuration?

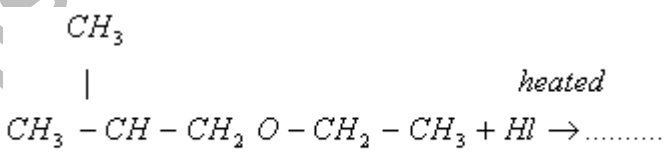
a. 

b. 

c. 

d. 

Sol. 



Q. 27. In the reaction

Which of the following compounds will be formed?

$$CH_3 - \underset{\displaystyle CH_3}{\overset{|}{CH}} - CH_2OH + CH_3 - CH_2 - I$$

a.

$$CH_3 - \underset{\displaystyle CH_3}{\overset{|}{CH}} - CH_2 - I + CH_3CH_2OH$$

b.

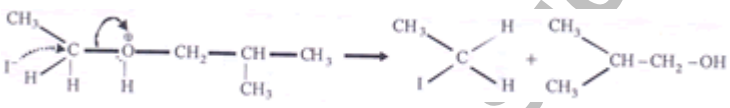
$$CH_3 - \underset{\displaystyle CH_3}{\overset{|}{CH}} - CH_3 + CH_3CH_2OH$$

c.

$$CH_3 - \underset{\displaystyle CH_3}{\overset{|}{CH}} - CH_2OH + CH_3CH_3$$

d.

Sol.



Correct choice: (1)

Q. 28. Which one of the following vitamins is water-soluble?

a. Vitamin A
b. Vitamin B
c. Vitamin E
d. Vitam in K

Sol. Vitamin (B) and vitamin (C) are water soluble, while Vitamin (A), (D), (E) and (K) are fat soluble. Correct choice: (2)

Q. 29. RNA and DNA are chiral molecules, their chirality is due to

a. D – sugar component
b. L – sugar component
c. Chiral bases
d. Chiral phosphate ester units

Sol. Deoxyribose and ribose sugars are D -chiral sugars in DNA and RNA. Correct choice: (1)

Q. 30. Which one of the following polymers is prepared by condensation polymerization?

a. Styrene]
b. Nylon – 66
c. Teflon
d. Rubber

Sol. Nylon-66 is a condensation polymer of hexamethylene diamine and adipic acid. \Correct choice: (2)

Q. 31. The correct order of $C-O)\ bond\ \ length\ among\ CO, CO_3^{-2}, CO_2\ is:$

a. $CO < CO_2 < CO_3^{2-}$
b. $CO_2 < CO_3^{2-} < CO$
c. $CO < CO_3^{2-} < CO_2$
d. $< CO_3^{2-} < CO_2 < CO$

Sol. The correct order of $C-O\ bond\ length\ will\ be\ CO < CO_2 < CO_3^{2-}$

Correct choice: (1)

Q. 32. Which one of the following ionic species has the greatest proton affinity to form stable compound?

a. I-
b. HS-
c. NH_2^-
d. E-

Sol. Strongest base would have the highest proton affinity i.e, NH_2^- Correct choice: (3)

Q. 33. In which of the following the hydration energy is higher than the lattice energy?

a. $SrSO_4$
b. $BaSO_4$
c. $MgSO_4$
d. $RaSO_4$

Sol. $MgSO_4$ is the most soluble out of the given alkaline earth metal sulphates. Correct choice: (3)

Q. 34. Which of the following statements, about the advantage of roasting sulphide ore before reduction is not true?

a. Roasting of the sulphide to the oxide is thermodynamically feasible.
b. Carbon and hydrogen are suitable reducing agents for metal sulphides.
c. The $\Delta_f G^\theta$ of the sulphide is greater than those for CS_2 and H_2S
d. The $\Delta_f G^\theta$ is negative for roasting of sulphide ore to oxide

Sol. Carbon and hydrogen are not suitable for reduction of sulphides directly. Correct choice: (2)

Q. 35. The correct order of increasing thermal stability of

$K_2CO_3, MgCO_3, CaCO_3$ and $BeCO_3$ is :

a. $K_2CO_3 < MgCO_3 < CaCO_3 < BeCO_3$
b. $BeCO_3 < MgCO_3 < K_2CO_3 < CaCO_3$
c. $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$
d. $MgCO_3 < BeCO_3 < < CaCO_3 < K_2CO_3$

Sol. The correct order is $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$

Correct choice: (3)

Q. 36. Sulphides ores of metals are usually concentrated by Froth Flotation process. Which one of the following sulphides oresoffers an exception and is concentrated by chemical leaching?

a. Sphalerite
b. Argentite
c. Galena
d. Copper pyrite

Sol. Argentite ore is leached with NaCN during extraction of silver in the Mc Arthur Forrest Cyanide process. Correct choice: (2)

Q. 37. Which one of the following anions is present in the chain structure of silicates?

a. SiO_4^{4-}
b. $Si_2O_7^{6-}$
c. $(SiO_3^{2-})_n$
d. $(Si_2O_5^{2-})_n$

Sol. Chain silicates have the general formula $(SiO_3^{2-})_n$ Correct choice: (4)

Q. 38. Which one of the following orders correctly represents the increasing acid strengths of the given acids?

a. $HOClO_3 < HOClO_2 < HOClO < HOCl$
b. $HOClO_3 < HOClO < HOClO_2 < HOClO_3$
c. $HOClO_3 < HOCl < HOClO_3 < HOClO_2$
d. $HOClO_2 < HOClO_3 < HOClO < HOCl$

Sol. The correct order is $HOClO_3 < HOClO < HOClO_2 < HOClO_3$
Correct choice: (2)

Q. 39. Which of the following oxidation states are the most characteristic for lead and tin respectively?

a. + 2, + 2
b. + 4, + 2
c. + 2, + 4
d. + 4, + 4

Sol. Among common characteristic states for Pb and Sn, we find +2 and +4 respectively. Correct choice: (3)

Q. 40. Identify the incorrect statement among the following:

a. Shielding power of 4f electrons is quite weak
b. There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu
c. Lanthanoid contraction is the accumulation of successive shrinkages
d. As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements

Sol. The atomic radii of 4d and 5d elements down the group become quite similar due to lanthanidecontraction. Correct choice: (4)

Q. 41. Which one of the following ions is the most stable in aqueous solution?

a. Mn^{3+}
b. Cr^{3+}
c. V^{3+}
d. Ti^{3+}

(Atomic number. Ti = 22, V = 23, Cr = 24, Mn = 25)

Sol . Cr^{3+} is the most stable ion in aqueous medium. Correct choice: (2)

Q. 42. The d electron configurations of Cr . Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour?

a. $[Cr(H_2O_6)]^{2+}$
b. $[Mn\ (H_2O_6)]^{2+}$
c. $[Fe(H_2O_6)]^{2+}$
d. $[Ni(H_2O_6)]^{2+}$

$(Atomic\ number.\ Cr + 24,\ Mn = 25,\ Fe = 26,\ Ni = 28)$

Sol. $AsH_2O\ ia\ a\ weak\ field\ ligand, [Ni(H_2O_6)]^{+2}$ will have two unpaired electrons and will show least paramagnetic character. Correct choice: (4)

Q. 43. Which of the following will give a pair of enantiomorphs?

a. $[Pt(NH_3)_4][PtCl_6]$
b. $[Co(NH_3)_4\ Cl_2]NO_2$
c. $[Cr(NH_3)_6][Co(CN)_6]$
d. $[Co(en)_2\ Cl_2]Cl$ $\quad (en = NH_2CH_2CH_2NH_2)$

Sol . The complex ion $[Co(en)_2\ Cl_2]^+$ can show optical isomerism in its cis-isomer, and will form a pair of enantiomorphs. Its trans-form will be optically inactive (meso). Correct choice: (4)

Q. 44. If NaCl is doped with $10^{-4}\ mol\ \%\ SrCl_2$, $the\ concentration\ of\ cation\ vacancies\ will\ be\ (N_A = 6.02\times10^{23}\ mol^{-1})$

a. $6.02\times10^{14}\ mol^{-1}$
b. $6.02\times10^{15}\ mol^{-1}$
c. $6.02\times10^{16}\ mol^{-1}$
d. $6.02\times10^{17}\ mol^{-1}$

Sol. Number of moles of cationic vacancies

$$\frac{10^{-4}}{10^2} = 10^{-6}\ mole$$

$$\Rightarrow Number\ of\ cationic\ vacancies = 10^{-6}\times6.02\times10^{23} = 6.02\times10^{17}$$ Correct choice: (4)

Q. 45. Which of the following presents the correct order of the acidity in the given compounds?

a. $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
b. $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$
c. $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
d. $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$

Sol. $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$ Correct choice: (1)

Q. 46. The product formed in Aldol condensation is

a. an alpha, beta unsaturated ester
b. a beta-hydroxy acid
c. a beta-hydroxy aldehyde or a beta-hydroxy ketone
d. an alpha-hydroxy aldehyde or ketone

Sol. Aldol condensation leads to formation of $\beta - hydroxy\ aldehyde\ or\ a\ \beta - hydroxy\ Ketone.$

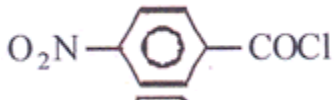
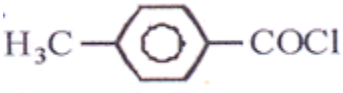
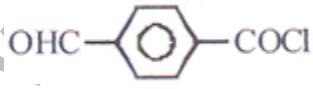
Correct choice: (3)

Q. 47. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc.HCl is called

a. Wolf-Kishner Reduction
b. Clemmensen Reduction
c. Cope Reduction
d. Dow Reduction

Sol. This is Clemmensen's reduction. Correct choice: (2)

Q. 48. Consider the following compounds

a. C_6H_5COCl
b. 
c. 
d. 

The correct decreasing order of their reactivity towards hydrolysis is

a. (b) > (d) > (a) > (c)

b. (b) > (d) > (c) > (a)
c. (a) > (b) > (c) > (d)
d. (d) > (b) > (a) > (c)

Sol. The attack of the nucleophile onto the carbonyl carbon is the rate-determining step. So, order must be (b) > (d) > (a) > (c) Correct choice: (1)

Q. 49. Which one of the following on treatment with 50% aqueous sodium

a. $\begin{array}{l} O \\ \| \\ CH_3 - C - CH_3 \end{array}$
b. $C_6H_5CH_2CHO$
c. C_6H_5CHO
d. $CH_3CH_2CH_2CHO$

Sol. Benzaldehyde has no $\alpha -$ hydrogen atom, so it can undergo Cannizaro reaction. Correct choice: (3)

Q. 50. Which one of the following on reduction with lithium aluminium hydride yields a secondary amine?

a. Methyl Cyanide
b. Nitroethane
c. Methylisocyanide
d. Acetamide

Sol. Methyl isocyanide on reduction with $LiAlH_4$ will give dimethylamine. Correct choice: (3)

Physics

Q. 1. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

a. $\left[ML^2T^{-3}I^{-2}\right]$
b. $\left[ML^2T^{-3}I^{-1}\right]$
c. $\left[ML^2T^{-2}\right]$
d. $\left[ML^2T^{-1}I^{-1}\right]$

Sol. $P = I^2\ R;\ R = PI^{-2} = \left[ML^2T^{-3}I^{-1}\right]$ Correct choice: (1)

Q. 2. A particle moving along x-axis has acceleration f, at time t, given $f = f_0\left(1-\frac{t}{T}\right)$, where f_o and T are constant. The particle at t = 0 has zero velocity. In the time interval between t = 0 and the instant when f = 0 , the particle's velocity (v_x) is

a. $\frac{1}{2}f_oT$
b. f_oT
c. $\frac{1}{2}f_oT^2$
d. f_oT^2

Sol.

$$\int_o^v dv = \int_o^t f dt \Rightarrow v = f_o\left(t-\frac{t}{2T}\right), \int_o^s ds = \int_o^T v dt \Rightarrow s = \frac{f_oT^3}{3} \quad v_{av} = \frac{s}{T} = \frac{f_oT}{3} \therefore \text{No alternative matches}$$

If they have asked instantaneous velocity when $f = o \text{ then } v = \frac{f_0T}{2}$ Correct choice: (1)

Q. 3. A car moves from X to Y with a uniform speed vu and returns to Y with a uniform speed vd .The average speed for this round trip is

a. $\frac{v_u+v_d}{2}$
b. $\frac{2v_u+v_d}{v_d+v_u}$
c. $\sqrt{v_uv_d}$
d. $\frac{v_d+v_u}{v_d+v_u}$

Sol. In question it must be car moves from X to Y and returns to X.

$$t_1 = \text{time taken from } X \text{ to } Y = \frac{S}{v_u}; t_2 = \text{time taken from } Y \text{ to } X = \frac{S}{v_d}; \text{average speed} = \frac{2S}{t_1+t_2} = \frac{2v_uv_d}{v_u+v_d}$$

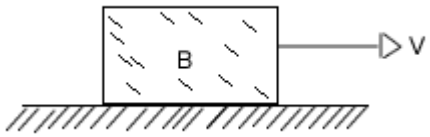
Correct choice: (2)

Q. 4. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its co-ordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of

a. 0^0
b. 30^0
c. 45^0
d. 60^0

Sol. $\tan\theta = \frac{3}{\sqrt{3}};\ \theta = 60^0$ Correct choice: (4)

Q. 5. A block B is pushed momentarily along a horizontal surface with an initial velocity V. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



a. V/g
b. $V/(g\mu)$
c. $(g\mu)V/$
d. g/V

Sol. $u = V;\ a = -\mu g;\ v = 0\ ;\ v = u + at;\ 0 = V - \mu gt;\ t = V/\mu g$ Correct choice: (2)

Q. 6. A vertical spring with force constant K is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d . The net work done in the process is

a. $mg(h-d)+\frac{1}{2}Kd^2$
b. $mg(h+d)+\frac{1}{2}Kd^2$
c. $mg(h+d)-\frac{1}{2}Kd^2$
d. $mg(h-d)-\frac{1}{2}Kd^2$

Sol. $W_{net} = work\ done\ by\ gravity + work\ done\ by\ spring \Rightarrow W_{net} = mg(h+d)-\frac{1}{2}Kd^2$

Correct choice: (3)

Q. 7. A wheel has angular acceleration of 3.0 rad/sec2 and an initial angular speed of 2.00 rad / sec. In a time of 2 sec it has rotated through an angle (in radian) of

a. 4
b. 6
c. 10
d. 12

Sol. $\alpha = 3\ rad/\sec^2;\ \omega_0 = 2\ rad/s;\ t = 2\ \sec;\ \theta = \omega_0 t + \frac{1}{2}\alpha t^2 = 10\ rad$ Correct choice: (3)

Q. 8.
$\vec{A}$ *and* $\vec{B}$ *are two vectors and* θ *is the angle between them, if* $\left|\vec{A}\times\vec{B}\right| = \sqrt{3}\left(\vec{A}\cdot\vec{B}\right)$ *the value of* θ *is*

a. 90^0
b. 60^0
c. 45^0
d. 30^0

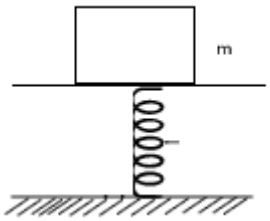
Sol. $\left|\vec{A}\times\vec{B}\right| = \sqrt{3}\left(\vec{A}\cdot\vec{B}\right),\ \left|\vec{A}\right|\left|\vec{B}\right|\sin\theta = \sqrt{3}\left|\vec{A}\right|\left|\vec{B}\right|\cos\theta \Rightarrow \tan\theta = \sqrt{3} \Rightarrow \theta = 60^0$ Correct choice: (2)

Q. 9. The position x of a particle with respect to time t along x -axis is given by $x = 9t^2 - t^3$ where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the $+_x$ direction?

a. 24 m
b. 32 m
c. 54 m
d. 81 m

Sol.
$v = \frac{dx}{dt} = 18t - 3t^2;\ \frac{dv}{dt} = 18 - 6t.$ *Velocity is maximum when* $\frac{dv}{dt}\ 0 \Rightarrow t = 3\ \sec,\ x = 54\ m$ Correct choice: (3)

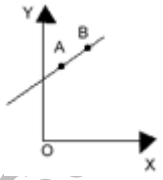
Q. 10. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan? $\left[Take\ g = 10\ m/s^2\right]$



a. 4.0 cm
b. 8.0 cm
c. 10.0 cm
d. any value less than 12.0 cm

Sol. $m\,\omega^2 A = mg;\ \omega = \sqrt{\frac{K}{m}} = 10 \Rightarrow A = \frac{g}{\omega^2} = \frac{10}{10^2} = 0.1m = 10.0\ cm$ Correct choice: (3)

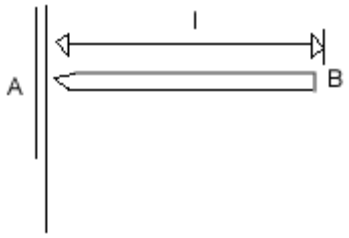
Q. 11. A particle of mass m moves in the XY plane with a velocity V along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B, then



a. $L_A < L_B$
b. $L_A > L_B$
c. $L_A = L_B$
d. The relationship between L_A and L_B depends upon the slope of the line AB

Sol. $L = mVd\ (d = perpendicular\ distance) \Rightarrow L_A = L_B$ Correct choice: (3)

Q. 12. A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $\frac{ml^2}{3}$, the initial angular acceleration of the rod will be



a. $\frac{3g}{2l}$
b. $\frac{2g}{3l}$
c. $mg\frac{1}{2}$
d. $\frac{3}{2}gl$

Sol. $mg\frac{1}{2}=\frac{ml^2}{3}\alpha\Rightarrow\alpha=\frac{3g}{2l}$ Correct choice: (1)

Q. 13. Two satellites of earth, S_1 *and* S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2. Which one of the following statements is true?

a. The kinetic energies of the two satellites are equal.
b. The time period of is S_1 four times that of S_2.
c. The potential energies of earth and satellite in the two cases are equal.
d. S_1 *and* S_2 are moving with the same speed.

Sol . As orbital velocity $v=\sqrt{\frac{GM}{R}}$ it is independent of mass of satellite Correct choice: (4)

Q. 14. Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature t^0C, the power received by a unit surface, (normal to the incident rays) at a distance R from the center of the sun is (where σ is the Stefan's constant).

a. $r^2\sigma(t+273)^4/R$
b. $4\pi r^2\sigma t^4/R^2$
c. $r^2\sigma(t+273)^4/4\pi R^2$
d. $16\pi^2r^2\sigma t^4/R^2$

Sol. Power radiated

$P = \sigma\, 4\,\pi r^2\,(t+273)^4;\ \frac{Powerreceived}{Area} = \frac{P}{4\pi R^2} = \frac{\sigma r^2}{R^2}(t+273)^4$ Correct choice: (1)

Q. 15. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 62^0C, its efficiency is doubled. Temperature of the source is

a. $99^0 C$
b. $124^0 C$
c. $37^0 C$
d. $62^0 C$

Sol. $\eta = 1 - \frac{T_2}{T_1};\ \frac{1}{6} = 1 - \frac{T_2}{T_1} \ldots (i)\ \frac{1}{3} = 1 - \frac{T_2 - 62}{T1} \ldots (ii),\ from\ (i)\ and\ (ii) \Rightarrow T_1 = 99^0 C$ Correct choice: (1)

Q. 16. A black body is at $727^0 C$. It emits energy at a rate which is proportional to

a. $(727)^4$
b. $(727)^2$
c. $(1000)^4$
d. $(1000)^2$

Sol. $P \propto T^4$ Correct choice: (3)

Q. 17. The frequency of a light wave in a material is $2 \times 10^{14}\ HZ$ and wavelength is 5000Å. The refractive index of material will be

a. 1.33
b. 1.40
c. 1.50
d. 3.00

Sol. $n = 2 \times 10^{14}\ HZ;\ \lambda = 5000 \times 10^{-10} m;\ v = n\,\lambda = 10^8\ m/s;\ \mu = \frac{c}{v} = 3$ Correct choice: (4)

Q. 18. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is

a. (1) zero
b. $0.5\,\pi$
c. π
d. $0.707\,\pi$

Sol. $x = A\sin(\omega t + \phi),\ v = A\omega\cos(\omega t + \phi),\ a = -A\omega^2\sin(\omega t + \phi) \therefore \text{Phase difference} = \frac{\pi}{2}$

Correct choice: (2)

Q. 19. The particle executing simple harmonic motion has a kinetic energy $K_0\cos^2\omega t$. The maximum values of the potential energy and the total energy are respectively

a. K_0 and K_0
b. 0 and $2K_0$
c. $\frac{K_0}{2}$ and K_0
d. K_0 and $2K_0$

Sol. $P \cdot E_{max} = K \cdot E_{max} = K_0$ Correct choice: (1)

Q. 20. A particle executes simple harmonic oscillation with an amplitude a . The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is

a. T / 2
b. T / 4
c. T / 8
d. T /12

Sol. $x = A\sin\omega t;\ \omega = \frac{2\pi}{T};\ x\ A/2\ when\ t = T/12$ Correct choice: (4)

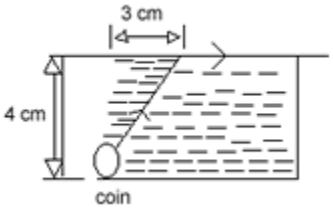
Q. 21. The electric and magnetic field of an electromagnetic wave are

a. in phase and perpendicular to each other
b. in phase and parallel to each other
c. in opposite phase and perpendicular to each other
d. in opposite phase and parallel to each other

Sol. $E_y(x,t) = E_o\sin(wt - kx),\ B_z(x,t) = B_o\sin(wt - kx)$

Correct choice: (1)

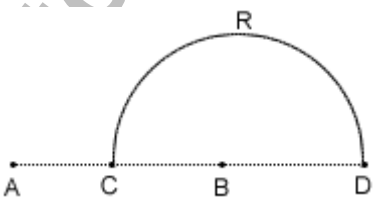
Q. 22. A small coin is resting on the bottom of a beaker filled with a liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface (see figure). How fast is the light traveling in the liquid?



a. $1.2\times10^{8}\ m/s$
b. $1.8\times10^{8}\ m/s$
c. $1.2\times10^{8}\ m/s$
d. $3.0\times10^{8}\ m/s$

Sol . $\mu \sin\ \theta = cons\tan t \Rightarrow \mu\times\frac{3}{5}=1\times\sin\ 90;\ \mu=\frac{5}{3};\ v=c/\ \mu=1.8\times10^{8}\ m/s$ Correct choice: (2)

Q. 23. Charges +q and -q are placed at points A and B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is



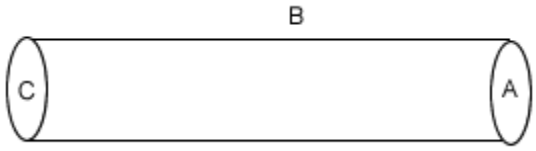
a. $-\frac{qQ}{6\pi\ \varepsilon_o L}$
b. $-\frac{qQ}{4\pi\ \varepsilon_o L}$
c.
d. $-\frac{qQ}{2\pi\ \varepsilon_o L}$

Sol. At C potential

$V_1 = 0;\ At\ D\ potential\ V_2 = \frac{kq}{3L} - \frac{kq}{L} = -\frac{2\,kq}{3L};\ W_{external} = Q\,(V_2 - V_1) = -\frac{Qq}{6\,\pi\,\varepsilon_o\,L}$

Correct choice: (1)

Q. 24. A hollow cylinder has a charge q coulomb within it. If f is the electric flux in units of volt × meter associated with the curved surface B, the flux linked with the plane surface A in units of volt × meter will be



a. $\frac{q}{\varepsilon_o} - \phi$

b. $\frac{1}{2}\left(\frac{q}{\varepsilon_o} - \phi\right)$

c. $\frac{q}{2\,\varepsilon_o}$

Sol. $\phi_{curved} + 2\,\phi_{plane} = \frac{q}{\varepsilon_0} \Rightarrow \phi_{plane} = \frac{q}{2\,\varepsilon_o} - \frac{\phi}{2}$ Correct choice: (2)

Q. 25. Three point charges +q, - 2q and +q are placed at points (x = 0, y = a, z = 0), (x = 0, y = 0, z = 0) and (x = a, y = 0, z = 0) respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are

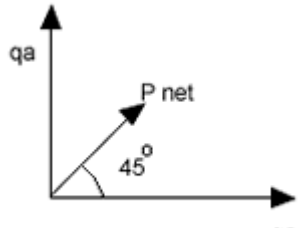
a. $\sqrt{2}\ qa\ along\ +x\ direction$

b. $\sqrt{2}\ qa\ along\ +y\ direction$

c. $\sqrt{2}\ qa\ along\ the\ line\ joining\ point\ s\ (x=0, y=0, z=0)\ and\ (x=a, y=a, z=0)$

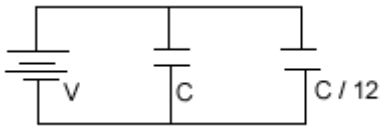
d. $qa\ along\ the\ line\ joining\ point\ s\ (x=0, y=0, z=0)\ and\ (x=a, y=a, z=0)$

Sol .



$P_{net} = \sqrt{2}\ qa$ Correct choice: (3)

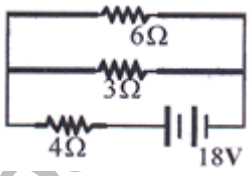
Q. 26. Two condensers, one of capacity C and the other of capacity C/2, are connected to a V-volt battery, as shown. The work done in charging fully both the condensers is



a. $\frac{1}{2}CV^2$
b. $2CV^2$
c. $\frac{1}{4}CV^2$
d. $\frac{3}{4}CV^2$

Sol. $U_i = 0; U_f = \frac{1}{2}\cdot\frac{3}{2}CV^2; W = \frac{3}{4}CV^2$ Correct choice: (4)

Q. 27. The total power dissipated in Watts in the circuit shown here is



a. 4
b. 16
c. 40
d. 54

Sol . $R_{eq} = 6\ \Omega; p = \frac{V^2}{R_{eq}} = \frac{18\times 18}{6} = 54\ W$ Correct choice: (4)

Q. 28. A steady current of 1.5 amp flows through a copper voltameter for 10 minute. If the electrochemical equivalent of copper is $30\acute{}10^{-5}$ gm coulomb^{-1} , the mass of copper deposited on the electrode will be

a. 0.27 gm
b. 0.40 gm
c. 0.50 gm
d. 0.67 gm

Sol . m = Zit; m = 0.27gm Correct choice: (1)

Q. 29. If the cold junction of a thermo-couple is kept at 0^0C and the hot junction is kept at T^0C, then the relation between neutral temperature (Tn) and temperature of inversion (Ti) is

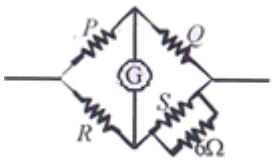
a. $T_n = T_i + T$
b. $T_n = T_i + T/2$
c. $T_n = 2T_i$
d. $T_n = T_i - T$

Sol . $T_n = \frac{T_i}{2}$ Correct choice: (2)

Q. 30. Three resistances P, Q, R each of 2Ω and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S?

a. 1Ω
b. 2Ω
c. 3Ω
d. 6Ω

Sol .



$\frac{P}{Q} = \frac{R}{S\,6/(S+6)}; P = Q = R = 2\Omega; \Rightarrow S = 3\Omega$ Correct choice: (3)

Q. 31. The resistance of an ammeter is 13Ω and its scale is graduated for a current upto 100 Amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 Amperes by this meter. The value of shunt-resistance is

a. $2\,K\Omega$
b. 20Ω
c. 2Ω
d. 0.2Ω

Sol. $I_{max} = I_{gmax}\left(\frac{G+S}{S}\right); I_{max} = 750\,A, I_{gmax} = 100\,A; G = 13\Omega \Rightarrow S = 2\Omega$

Correct choice: (3)

Q. 32. Under the influence of a uniform magnetic field a charge-particle is moving in a circle of radius R with constant speed V. The time period of the motion

a. depends on R and not on V
b. depends on V and not on R
c. depends on both R and V
d. is independent of both R and V

Sol. $T = \frac{2\pi m}{Bq}$ Correct choice: (4)

Q. 33. A charged particle (charge q) is moving in a circle of radius R with uniform speed v . The associated magnetic moment μ is given by

a. qvR
b. qv R / 2
c. qv R^2
d. qvR^2 / 2

Sol. $\mu = LA;\ I = \frac{q}{2\pi R / v}, A = \pi R^2 \Rightarrow \mu = \frac{qvR}{2}$ Correct choice: (2)

Q. 33. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

a. along a straight line
b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path

Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)

Q. 34. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

a. along a straight line
b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path

Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)

Q. 35. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flu σ f linked with the primary coil is given by $\phi = \phi_o + 4t, where\ \phi is in\ webers, t is\ time\ in\ \ seconds\ and\ \phi_o$ is a constant, the output voltage across the secondary coil is

a. 30 volts
b. 90 volts
c. 120 volts
d. 220 volts

Sol. $e_p = -\frac{d\phi_p}{dt} = 4Volt, N_p e_p = N_s e_s \Rightarrow e_s = 120\,Volts$ Correct choice: (3)

Q. 36. What is the value of inductance L for which the current is a maximum in a series LCR circuit with $C = 10\mu F\ and\ \omega = 1000\,\sec^{-1}$?

a. 10 mH
b. 100 mH
c. 1 mH
d. cannot be calculated unless R is known

Sol.

$\omega = \frac{1}{\sqrt{LC}} \Rightarrow L = \frac{1}{\omega^2 C} = 100mH\ \left(Although\ \omega is\ written\ 1000\,\sec^{-1}\ it\ must\ be\ 1000\,rad\ /\sec.\right)$ Correct choice: (2)

Q. 37. A transformer is used to light a 100W and 110V lamp from a 220V mains. If the main current is 0.5A, the efficiency of the transformer is approximately

a. 10%
b. 30%
c. 50%
d. 90%

Sol. $\eta = \frac{out\ put}{input} \times 100; \eta = \frac{100}{0.5 \times 220} 100 = 90.9\%$ Correct choice: (4)

Q. 38. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature then it will show

a. diamagnetism
b. paramagnetism

c. anti ferromagnetism
d. no magnetic property

Sol . Fact based Correct choice: (2)

Q. 39. A 5 watt source emits monochromatic light of wavelength $5000\,\overset{0}{A}$. When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photoelectrons liberated will

a. be reduced by a factor of 2
b. be reduced by a factor of 4
c. be reduced by a factor of 8
d. be reduced by a factor of 16

Q. 40. Monochromatic light of frequency is $6.0\times10^{14}\ HZ$ produced by a laser. The power emitted is $2\times10^{-3}\ W$. The number of photons emitted, on the average, by the source per second is

a. 5×10^{14}
b. 5×10^{15}
c. 5×10^{16}
d. 5×10^{17}

Sol . $nhv = 2\times10^{-3}; n = 5\times10^{15}$ Correct choice: (2)

Q. 41. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{charge\ on\ the\ ion}{mass\ of\ the\ ion}\right)$ will be proportional to

a. R
b. 1/R
c. $1/R^2$
d. R^2

Sol . Radius of path

$$R=\frac{mv}{qB}=\sqrt{\frac{2m\left(K\cdot E\right)}{qB}},\ where,\ K\cdot E=qV\Rightarrow R=\frac{\sqrt{2mqV}}{qB}\Rightarrow\frac{q}{m}=\frac{2V}{B^2R^2}$$ Correct choice: (3)

Q. 42. If the nucleus $^{27}_{13}$13 has a nuclear radius of about 3.6 fm, then $^{125}_{52}$ Te would have its radius approximately as

a. 4.8 fm
b. 6.0 fm
c. 9.6 fm
d. 12.0 fm

Sol. $\frac{R_2}{R_1}\left(\frac{A_2}{A_1}\right)^{1/3}; R_2 = R_1\left(\frac{125}{27}\right)^{1/3} = 3.6\times\frac{5}{3} = 6.0\ fm$ Correct choice: (2)

Q. 43. In radioactive decay process, the negatively charged emitted $\beta-$ particles are

a. the electrons orbiting around the nucleus
b. the electrons present inside the nucleus
c. the electrons produced as a result of the decay of neutrons inside the nucleus
d. the electrons produced as a result of collisions between atoms

Sol . When neutron decays as given $_0n^1 = {}_1H^1 + {}_{-1}e^0 + \bar{\nu}$ Correct choice: (3)

Q. 44. A nucleus $^{A}_{Z}X$ has nucleus A X
Z has mass represented by M (A, Z). If M_p and M_n denote the mass of proton and neutron respectively and B.E the binding energy in Me V then

a. $B.E = M(A,z) - ZM_p - (A-Z)M_n$
b. $B.E = \left[M(A,z) - ZM_p - (A-Z)M_n\right]c^2$
c. $B.E = \left[ZM_p + (A,z)M_n - M(A,Z)\right]c^2$
d. $B.E = \left[ZM_p + AM_n - M(A,Z)\right]c^2$

Sol. $B.E = \left[ZM_p + (A,z)M_n - M(A,Z)\right]c^2$ Correct choice: (3)

Q. 45. Two radioactive substances A and B have decay constants $5\lambda\ and\ \lambda$ respectively. At t = 0 they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/e)^2$ after a time interval

a. $\frac{1}{2\lambda}$

b. $\frac{1}{4\lambda}$
c. 4λ
d. 2λ

Sol. $\frac{N_A}{N_B} = \frac{N_0 e^{-\lambda t}}{N_0 e^{-\lambda 2t}}$ *Where* $\frac{N_A}{N_B} = \frac{1}{e^2}$; $\lambda_1 = 5\lambda, = \lambda_2 = \lambda$ *So,* $\frac{1}{e^2} = \frac{e^{-5\lambda t}}{e^{-2t}} \Rightarrow t = \frac{1}{2\lambda}$

Correct choice: (1)

Q. 46. The total energy of electron in the ground state of hydrogen atom is –13.6 eV. The kinetic energy of an electron in the firstm excited state is

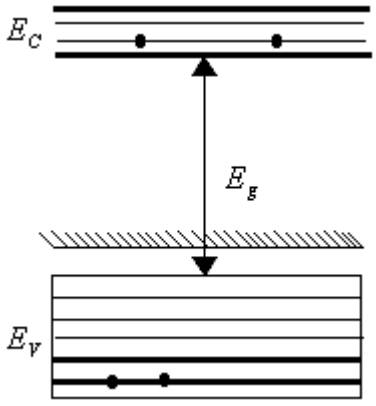
a. 1.7 eV
b. 3.4 eV
c. 6.8 eV
d. 13.6 eV

Sol. Total energy in 1st excited state

$= -\frac{13.6}{4} = -3.4eV$ *and* $K.E = -(total\ energy) = 3.4eV$

Correct choice: (2)

Q. 47. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is



a. an n-type semiconductor
b. a p-type semiconductor
c. an insulator
d. a metal

Sol. In diagram acceptor level is near valance band which will happen in p-type semiconductor.
Correct choice: (2)

Q. 48. A common emitter amplifier has a voltage gain of 50, an input impedance of $100\ \Omega$ and an output impedance of $200\ \Omega$. The power gain of the amplifier is

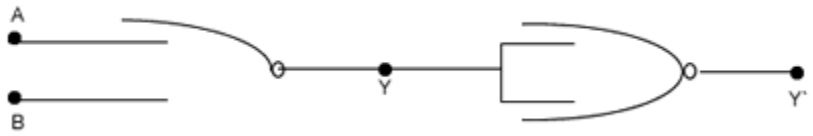
a. 100
b. 500
c. 1000
d. 1250

Sol.

Voltage gain, $A_v = 50$; *input impedance,* $Ri = 100\Omega$; *output impedance* $R_o = 200\Omega$. *the power gain of the* $= (A_v)^2 \times \frac{R_i}{R_0} = 1250$

Correct choice: (4)

Q. 49. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table



(i)

A	B	Y
0	0	0
0	1	1
1	1	1

(ii)

A	B	Y
0	1	0
1	0	0
1	1	1

(iii)

A	B	Y

0	0	1
0	1	1
1	0	1
1	1	0

(iv)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Q. 50. For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct?

a. $a = b = c \text{ and } \alpha = \beta = \gamma = 90^0$
b. $a \neq b \neq c \text{ and } \alpha \neq \beta \neq \gamma \neq 90^0$
c. $a \neq b \neq c \text{ and } \alpha = \beta = \gamma = 90^0$
d. $a = b = c \text{ and } \alpha \neq \beta \neq \gamma = 90^0$

Sol. the cubic system is the most symmetric out of all seven crystal systems. All edges for the unit cell are same i.e., a = b = c and all angles are right angles i.e., $\alpha = \beta = \gamma = 90^0$ Correct choice: (1)

PHYSICS

Choose the correct answer :

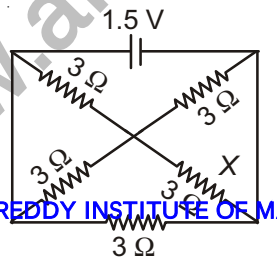
1. For a real object placed in front of a concave mirror, which of the following images cannot be formed by the mirror?
   (1) A real and enlarged image
   (2) A real and diminished image
   (3) A virtual and enlarged image
   (4) A virtual and diminished image

2. Which of the following is the expression for the magnification produced by a spherical mirror?
   (1) $\frac{v}{u}$ (2) $-\frac{v}{u}$
   (3) $\frac{u}{v}$ (4) $-\frac{u}{v}$

3. A light incident at an interface at an angle 60° is refracted into another medium at an angle 30°. If its speed in the first medium is C, then its speed in the second medium is
   (1) $\sqrt{2}C$ (2) $2C$
   (3) $\frac{C}{2}$ (4) $\frac{C}{\sqrt{3}}$

4. Radius of curvature of a concave lens is 20 cm. Where should real object be placed in front of it so that an image of magnification $\frac{1}{4}$ is formed?
   (1) 15 cm (2) 30 cm
   (3) 20 cm (4) 7.5 cm

5. Power dissipated across the resistor X is



   (1) 18.7 W (2) 0.187 W
   (3) 35.2 W (4) 0.352 W

6. According to Fleming's right hand rule, the index finger points in the direction of
   (1) Induced current
   (2) Magnetic field
   (3) Force
   (4) Current

7. Choose the incorrect statement among the following
   (1) Electric power can be transmitted over long distances without much loss of energy using AC
   (2) Alternating current changes its direction periodically
   (3) Electric fuse is connected in series with the circuit
   (4) The earth wire provides a low resistance path for the excess current flowing in the circuit

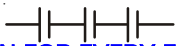
8. Match the following

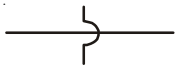
	Column I		Column II
a.	Hot springs	(i)	Solar panel
b.	Silicon	(ii)	Nuclear energy
c.	Uranium	(iii)	Biogas
d.	Methane	(iv)	Geothermal energy

   (1) a(ii), b(iv), c(i), d(iii) (2) a(iii), b(i), c(iv), d(ii)
   (3) a(iv), b(i), c(ii), d(iii) (4) a(iv), b(ii), c(i), d(iii)

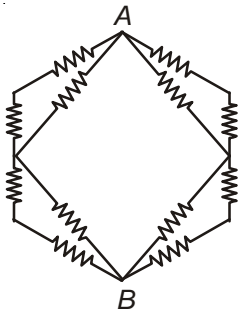
9. The temperature difference between the surface water and the deeper sections of sea is exploited to obtain
   (1) Tidal energy
   (2) Wave energy
   (3) Ocean thermal energy
   (4) Hydro-power

10. In a circuit diagram, a rheostat is shown by the symbol

(1)  (2) 

(3)  (4) 

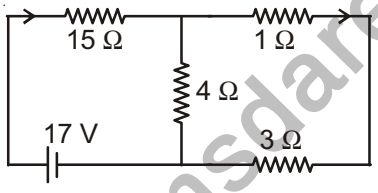
11. Find the equivalent resistance between points *A* and *B*, if each resistor is of resistance *r*.



(1) $\frac{4r}{3}$ (2) $\frac{2r}{3}$

(3) $\frac{r}{3}$ (4) r

12. In the electric circuit shown below, the maximum current flows through the resistor of resistance



(1) 4 Ω (2) 15 Ω

(3) 1 Ω (4) 3 Ω

13. Nichrome is an alloy of nickle, chromium, maganese and iron. Which of the following has the highest resistivity?

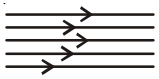
(1) Nickle

(2) Chromium

(3) Iron

(4) Nichrome

14. The magnetic field pattern that corresponds to that around a current carrying straight wire is

(1)  (2) 

(3)  (4) 

15. Choose the correct statement among the following.

(1) Magnetic field is stronger where field lines are farther apart

(2) Direct current changes its direction periodically

(3) Magnetic field around a current carrying solenoid is similar to that around a bar magnet

(4) Fleming's left hand rule gives the direction of induced current

16. The metallic body of an electric appliance is connected to the earth wire, so as to

(1) Avoid short circuit

(2) Provide low resistance path for leakage current

(3) Avoid overloading

(4) Reduce power loss

17. A straight wire carrying current in vertically upward direction is placed in a uniform magnetic field directed towards north. The magnetic force acting on the wire is towards

(1) North

(2) South

(3) East

(4) West

18. The mixture of cow dung and water that decomposes in a biogas plant to produce biogas is called

(1) Slurry (2) Fertiliser

(3) Manure (4) Marsh gas

19. A box type solar cooker has a cover of glass plate so as to

(1) Reflect more heat

(2) Absorb more heat

(3) Conduct more heat

(4) Trap heat radiations within the box

20. Which of the following can converge a light ray the most?

(1) A convex lens of focal length 20 cm

(2) A convex lens of focal length 10 cm

(3) A concave lens of focal length 20 cm

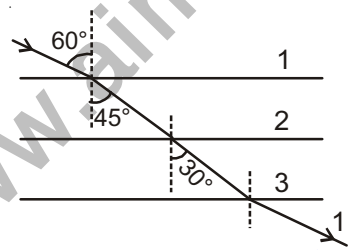
(4) A concave lens of focal length 10 cm

21. The power of a lens is 6 D. Find the magnification produced by it for a real object placed at 15 cm in front of it.

(1) 10 (2) – 10

(3) $\frac{1}{10}$ (4) $-\frac{1}{10}$

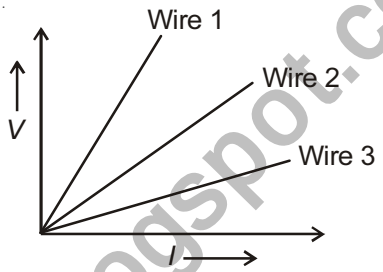
22. A light ray incident obliquely, passes into three media as shown in the figure. The refractive index of medium 3 with respect to medium 1 is



(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{1}{2}$

(3) $\sqrt{3}$ (4) 2

23. Voltage current graphs are drawn for three aluminium wires of same thickness at a given temperature. If the graphs obtained are as shown below, then the correct order of wires in the increasing order of their lengths is



(1) Wire 1 < Wire 2 < Wire 3

(2) Wire 3 < Wire 2 < Wire 1

(3) Wire 2 < Wire 3 < Wire 1

(4) Wire 1 < Wire 3 < Wire 2

24. A current of 2 A flows in a circuit for 30 s. The total charge flown through the circuit is

(1) 30 C

(2) 15 C

(3) 60 C

(4) 12 C

25. A proton moves away from a straight wire carrying some current. It will be deflected in the direction

(1) Of current flow

(2) Opposite to the current flow

(3) Perpendicular to the plane of wire and the proton

(4) Nowhere

26. Identify 'A' in the given chemical equation.

$A + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + H_2O$

(1) N_2 (2) NO_2

(3) HNO_3 (4) HNO_2

27. $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

Which of the following statements is incorrect for above reaction?

(1) Fe_2O_3 is getting reduced

(2) Al is getting oxidised

(3) Fe_2O_3 is an oxidising agent

(4) Al_2O_3 is reducing agent

28. The product(s) obtained during an exothermic reaction taking place in our body is/are

(1) Glucose and water

(2) Glucose and carbon dioxide

(3) Carbon dioxide and water

(4) Carbon dioxide only

29. An amphoteric oxide 'X' reacts with aqueous NaOH to form sodium aluminate. Identify the product when 'X' reacts with hydrochloric acid

(1) NaCl (2) $AlCl_3$

(3) Al_2Cl_3 (4) $NaAlO_2$

30. Which of the following is not a compound of sodium?

(1) Sodium carbonate

(2) Sodium amalgam

(3) Sodium acetate

(4) Sodium sulphate

31. In activity series, a metal is more reactive than lead but less reactive than zinc. It reacts with steam to form its oxide with chemical formula

(1) Fe_3O_4 (2) CaO

(3) MgO (4) FeO

32. Which of the following compounds has the least melting/boiling point?

(1) $MgCl_2$ (2) NaCl

(3) $CHCl_3$ (4) $CaCl_2$

33. Which of the following metals cannot be used to reduce copper oxide during metallurgy?

(1) Mercury (2) Sodium

(3) Calcium (4) Aluminium

34. Which of the following solutions has the highest hydronium ion concentration?

(1) Sodium sulphate (2) Sodium carbonate

(3) Acetic acid (4) Sulphuric acid

35. Total number of electrons present in M shell of S^{2-} ion is

(1) 8 (2) 6

(3) 4 (4) 2

36. The process of conversion of ethanol into ethanoic acid is

(1) A reduction reaction

(2) An addition reaction

(3) An oxidation reaction

(4) A hydrogenation reaction

37. The survival of aquatic life in rivers becomes difficult when the pH becomes less than

(1) 7.0 (2) 5.6

(3) 6.5 (4) 12.2

38. An acid present in atmosphere of venus in the form of yellow clouds reacts with sodium hydroxide to form

(1) Sodium chloride (2) Sodium carbonate

(3) Sodium nitrate (4) Sodium sulphate

39. During the process of anodising oxygen gas evolved

(1) In the form of oxide

(2) At cathode

(3) At anode

(4) In the electrolytic solution

40. The molecular formula of cyclohexane is

(1) C_6H_{12} (2) C_6H_{14}

(3) C_6H_{10} (4) C_6H_{15}

41. Consider the following statements,

I. The oily dirt gets collected in the centre of the micelle.

II. The hydrophobic part of a soap molecule remains towards water.

Choose the correct option.

(1) Statement I is correct, statement II is incorrect

(2) Statement II is correct, statement I is incorrect

(3) Both the statements are correct

(4) Both the statements are incorrect

42. Combustion of fossil fuel does not evolve

(1) Oxides of carbon (2) Oxides of sodium

(3) Oxides of sulphur (4) Oxides of nitrogen

43. Which of the following is not acidic in nature?

(1) Vinegar (2) Nettle sting

(3) Lime water (4) Lemon juice

44. Match the following.

Column I	Column II
a. Ethanol	(i) Sweet smelling substance
b. Methanol	(ii) Dehydrating agent
c. Sulphuric acid	(iii) Lethal
d. Ester	(iv) Organic solvent

(1) a(iv), b(i), c(ii), d(iii)

(2) a(iii), b(iv), c(ii), d(i)

(3) a(iv), b(iii), c(i), d(ii)

(4) a(iv), b(iii), c(ii), d(i)

45. Which of the following is not the member of same homologous series?

(1) CH_3COOH

(2) CH_3COCH_3

(3) CH_3CH_2COOH

(4) HCOOH

46. Which of the following steps is not involved in the process of extraction of carbonate ore of a moderately reactive metal?

(1) Concentration

(2) Roasting

(3) Calcination

(4) Refining

47. Which of the following metal pairs reacts with very dilute nitric oxide to produce hydrogen?

(1) Mg and Na

(2) Mg and Mn

(3) Mn and Si

(4) Cu and Si

48. Which of the following is not a covalent compound?

(i) NaCl (ii) HCl

(iii) CCl_4 (iv) $MgCl_2$

(1) (i) & (ii) (2) (ii) & (iii)

(3) (iii) & (iv) (4) (i) & (iv)

49. The decomposition of iron sulphate results in the formation of

(1) FeO, SO_2 & SO_3

(2) Fe_2O_3, O_2 & SO_3

(3) Fe_2O_3, SO_2 & SO_3

(4) Fe_3O_4 & SO_3

50. The lustrous non-metal is

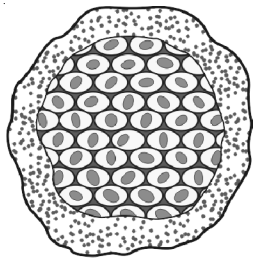
(1) Phosphorus (2) Iodine

(3) Sulphur (4) Gallium

51. All of the following structures are found in *Amoeba*, except
(1) Cilia (2) Nucleus
(3) Parapodia (4) Food vacuole

52. Central nervous system consists of X and Y where X is protected by cranium and Y is protected by
(1) Ribs (2) Skull
(3) Vertebral column (4) Spleen

53. Identify the mode of reproduction which is shown in the given diagram.



(1) Budding
(2) Multiple fission
(3) Binary fission
(4) Regeneration

54. Select the dominant traits of pea plant from the following.
a. Round shaped seeds
b. White coloured flowers
c. Tall height
(1) a, b & c (2) Only b
(3) Only c (4) a & c

55. Which of the following statements is **incorrect**?
(1) Sex in human beings is genetically determined
(2) All human females have single X chromosome
(3) All boys inherit Y chromosome from their father
(4) Human males have X and Y sex chromosomes

56. 'X' is the female reproductive part of the flower which consists of three parts A, B and C. A is the swollen bottom part and C is the sticky part. Identify X, B and C.
(1) X – Stamen, B – Style, C – Stigma
(2) X – Carpel, B – Ovary, C – Style
(3) X – Stamen, B – Anther, C – Stigma
(4) X – Carpel, B – Style, C – Stigma

57. In human beings, the respiratory pigment is
(1) Haemoglobin (2) Chlorophyll
(3) Melanin (4) Biliverdin

58. Which of the following glands is located in the human brain?
(1) Hypothalamus (2) Adrenal gland
(3) Pineal gland (4) Thyroid gland

59. In humans, the digestion of fats starts from
(1) Oesophagus (2) Mouth
(3) Stomach (4) Small intestine

60. Which of the following is used by human males to prevent pregnancy?
(1) Contraceptive oral pills
(2) Condom
(3) Loops
(4) Copper-T

61. Which of the following characteristics was selected by farmers to breed cauliflower from wild cabbage?
(1) Sterile flowers
(2) Arrested flower development
(3) Short distance between leaves
(4) Swollen parts

62. Which of the following structures transport urine from kidneys to urinary bladder?
(1) Urethra (2) Alveoli
(3) Nephrons (4) Ureters

63. Roots of plants are

(1) Positively geotropic

(2) Positively phototropic

(3) Negatively geotropic

(4) Negatively hydrotropic

64. Salivation and vomiting are controlled by

(1) Pons (2) Medulla

(3) Cerebrum (4) Cerebellum

65. The transport of soluble products of photosynthesis is called

(1) Respiration (2) Transpiration

(3) Translocation (4) Guttation

66. The wings of a bat and the wings of a bird are an example of

(1) Fossils (2) Homologous organs

(3) Analogous organs (4) Vestigial organs

67. Glucose $\xrightarrow{A}$ Pyruvate $\xrightarrow{B}$ $CO_2 + H_2O$ + Energy
The reactions A and B occur in

(1) Plasma and mitochondria, respectively

(2) Cytoplasm and mitochondria, respectively

(3) Endoplasmic reticulum and mitochondria, respectively

(4) Mitochondria and plasma, respectively

68. Find the **incorrect** match.

(1) Right atrium – Deoxygenated blood

(2) Left atrium – Deoxygenated blood

(3) Right ventricle – Deoxygenated blood

(4) Left ventricle – Oxygenated blood

69. Match the following

Column I	Column II
a. Ammonite	(i) Fish
b. Trilobite	(ii) Dinosaur
c. Rajasaurus	(iii) Invertebrate
d. Knightia	

(1) a(ii), b(iii), c(iii), d(i) (2) a(i), b(iii), c(ii), d(iii)

(3) a(iii), b(iii), c(ii), d(i) (4) a(iii), b(ii), c(i), d(ii)

70. What will be the blood group of the individual if its genotype is I^AI^B?

(1) A (2) B

(3) O (4) AB

71. **Statement 1** : Testes are located in the abdominal cavity.

Statement 2 : Testes secrete testosterone and estrogen.

(1) Both the statements are false

(2) Both the statements are true

(3) Statement-1 is true and statement-2 is false

(4) Statement-2 is true and statement-1 is false

72. Which of the following statements is **correct**?

(1) The female germ cells are produced in oviducts

(2) Zygote gets implanted in the lining of the uterus in human females

(3) Two eggs are produced by both oviducts every month

(4) The embryo gets nutrition from placenta which is located in vagina

73. Which of the following gases were used by Miller and Urey while conducting their experiments?

(1) Hydrogen sulphide, oxygen and nitrogen

(2) Oxygen, methane, ammonia and nitrogen

(3) Hydrogen, oxygen, methane and nitrogen

(4) Ammonia, methane and hydrogen sulphide

74. Which of the following hormones is released by the glands located on our excretory organ?

(1) Testosterone (2) Insulin

(3) Thyroxin (4) Adrenaline

75. Gustatory and olfactory receptors are located in

(1) Nose and ear, respectively

(2) Ear and tongue, respectively

(3) Tongue and nose, respectively

(4) Skin and nose, respectively

❑ ❑ ❑

(Sample Paper)

(Two Years Course for Medical (AIPMT) 2014-2016)

Answers

1.	(4)	16.	(2)	31.	(1)	46.	(2)	61.	(1)
2.	(2)	17.	(4)	32.	(3)	47.	(2)	62.	(4)
3.	(4)	18.	(1)	33.	(1)	48.	(4)	63.	(1)
4.	(2)	19.	(4)	34.	(4)	49.	(3)	64.	(2)
5.	(2)	20.	(2)	35.	(1)	50.	(2)	65.	(3)
6.	(2)	21.	(1)	36.	(3)	51.	(1)	66.	(3)
7.	(4)	22.	(3)	37.	(2)	52.	(3)	67.	(2)
8.	(3)	23.	(2)	38.	(4)	53.	(2)	68.	(2)
9.	(3)	24.	(3)	39.	(3)	54.	(4)	69.	(3)
10.	(3)	25.	(1)	40.	(1)	55.	(2)	70.	(4)
11.	(2)	26.	(3)	41.	(1)	56.	(4)	71.	(1)
12.	(2)	27.	(4)	42.	(2)	57.	(1)	72.	(2)
13.	(4)	28.	(3)	43.	(3)	58.	(3)	73.	(4)
14.	(3)	29.	(2)	44.	(4)	59.	(4)	74.	(4)
15.	(3)	30.	(2)	45.	(2)	60.	(2)	75.	(3)

BIOLOGY

1. Which one, of the following statements about all the four *of Spongilla,* Leech, Dolphin and Penguin*is correct.*
   (1) *Spongilla* has special collared cells called choanocytes, not found in the remaining three
   (2) All are bilaterally symmetrical
   (3) Penguin is homoiothermic while the remaining three are poikilothermic
   (4) Leech is a fresh water form while all others atemaririe

Ans. (1)

2. Which one of the following statements about human'sperm incorrect?
   (1) Acrosome servesas a sensory structure leading the sperm towards the ovum
   (2) Acrosome serves no particular function.
   (3) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
   (4) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation

Ans. (4)

3. The nerve centres which control the body temperature and the urge for eating are contained in
   (1) Cerebellum
   (2) Thalamus
   (3) Hypothalamus
   (4) Pons

Ans. (3)

4. What is true about RBCs in humans ?
   (1) They frarisport about 80 per cent oxygen pnly and the rest; 20 per cent of it is transported in dissolved state in blood plasma
   (2) They do not carry CO_2 at all
   (3) They carry about 20–25 per cent of CO_2
   (4) They do not carry CO_2 at all They carry about 20-25 per cent of CO_2 They transport 99.5 percent of O_2

Ans. (3)

5. Which one of the following is used as vector for cloning genes into higher organisms?
   (1) Rhizopus nigriccans
   (2) Retrovirus
   (3) Baculovirus
   (4) *Salmonella typhimurium*

Ans. (2)

6. Select the two corret statements out of the four (a–d) given below about lac operon.
   (1) Glucose or galactose may bind with the repressor and inactivate it
   (2) Inthe absence of lactose the repressor binds with the operatorregion
   (3) The z-gene codes for permease
   (4) This was elucidated byFrancois Jacob and Jacque Monod

Ans. (1)

7. The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons ?
   (1) Aleurone layer
   (2) Plumule
   (3) Cotyledons
   (4) Endosperm

Ans. (3)

8. Ringworm in humans is caused by:
   (1) Nematodes
   (2) Viruses
   (3) Bacteria
   (4) Fungi

Ans. (4)

9. The technical term used for the androecium in a flower of China rose *(Hibiscus rosasinensis)* is:
   (1) Polyandrous (2) Polyadelphous
   (3) Monadelphous (4) Diadelphous

Ans. (3)

10. Which one of the following is an example of *ex-situ* conservation ?
    (1) Sacred groves
    (2) National park
    (3) Wildlife sanctuary
    (4) Seed bank

Ans. (4)

11. Wind pollinated flowers are:
    (1) large producing abundant nectar and pollen
    (2) small, producing nectar and dry pollen
    (3) small, bright coloured producing large number of pollen grains
    (4) small, producing large number of dry pollen grains

Ans. (4)

12. Keel is characteristic of the flowers of:
    (1) *Calotropis*
    (2) Bean
    (3) Gulmohur
    (4) *Cassia*

Ans. (2)

13. The biomass available for consumption by the herbivores and the decomposers is called:
    (1) Standing crop
    (2) Gross primary productivity
    (3) Net primary productivity
    (4) Secondary productivity

Ans. (3)

14. Seminal plasma in human males is rich in:
    (1) DNA and testosterone
    (2) ribose and potassium
    (3) fructose and calcium
    (4) glucose and calcium

Ans. (3)

15. The principal nitrogenouse excretory compound in humans is synthesised:
    (1) in liver and also eliminated by the same through bile
    (2) in the liver, but eliminated mostly through kidneys
    (3) in kidneys but eliminated mostly through liver
    (4) in kidneys as well as eliminated by kidneys

Ans. (2)

16. Darwin's finches are a good example of:
    (1) Adaptive radiation
    (2) Convergent evolution
    (3) Industrial melanism
    (4) Connecting link

Ans. (1)

17. Which one of the following statements about morula in humans is *corect*?
    (1) It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote
    (2) It has more cytoplasm and more DNA than an uncleaved zygote
    (3) It has almost equal quantity of cytoplams as an uncleaved zygote but much more DNA
    (4) It has far *less* cytoplasm as well as *less* DNA than in an uncleaved zygote

Ans. (3)

18. An element playing important role in nitrogen fixation is:
    (1) Manganese (2) Zinc
    (3) Molybdenum (4) Copper

Ans. (3)

19. The two gases making highest relative contribution to the greenhouse gases are:
    (1) CFC_5 and N_2O (2) CO_2 and N_2O
    (3) CO_2 and CH_4 (4) CH_4 and N_2O

Ans. (3)

20. Toxic agents present in food which interfere with thyroxine synthesis lead to the development of:
    (1) simple goitre (2) thyrotoxicosis
    (3) toxic goitre (4) cretinism

Ans. (1)

21. In unilocular ovary with a single ovule the placentation is:
    (1) Free Central (2) Axile
    (3) Marginal (4) Basal

Ans. (4)

22. Apomictic embryos in *citrus* arise from:
    (1) Antipodal cells
    (2) Diploid egg
    (3) Synergids
    (4) Maternal sporophytic tissue in ovule

Ans. (4)

23. Which one of the following has its own DNA?
    (1) Lysosome (2) Peroxisome
    (3) Mitochondria (4) Dictyosome

Ans. (3)

24. The kind of epithelium which forms the inner walls of blood vessels is:
    (1) ciliated columnar epithelum
    (2) squamous epithelium
    (3) cuboidal epithelium
    (4) columnar epithelium

Ans. (2)

25. Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called:
(1) Karyogamy (2) Autogamy
(3) Xenogamy (4) Gitnogamy

Ans. (4)

26. The second maturation division of the mammalian ovum occurs:
(1) Until the nucleus of the sperm has fused with that of the ovum
(2) in the Graafian follicle following the first maturation division
(3) Shortly after ovulation before the ovum makes entry into the Fallopian tube
(4) Until after the ovum has been penetrated by a sperm

Ans. (4)

27. Which one of the following is *not* used in organic farming?
(1) *Oscillatoria* (2) Snail
(3) *Glomus* (4) Earthworm

Ans. (1)

28. Which two of the following changes (a-d) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more)?
(a) Increase in red blood cell size
(b) Increase in red blood cell production
(c) Increased breathing rate
(d) Increase in thrombocyte count
Changes occurring are:
(1) (a) and (d) (2) (a) and (b)
(3) (b) and (c) (4) (c) and (d)

Ans. (3)

29. A renewable exhaustible natural resource is:
(1) Minerals (2) Forest
(3) Coal (4) Petroleum

Ans. (2)

30. Slect the correct statement from the following :
(1) Biogas commonly called gobar gas, is *pure* methane
(2) Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria
(3) Biogas is produced by the activity of aerobic bacteria on animal waste
(4) *Methanobacterium* is an aerobic bacterium found in rumen of cattle

Ans. (2)

31. The permissible use of the teachnique amniocentesis is for:
(1) transfer of embryo into the uterus of a surrogate mother
(2) detecting any genetic abnormality
(3) detecting sex of the unborn foetus
(4) artificial insemination

Ans. (2)

32. The main arena of various types of activities of a cell is:
(1) Cytoplasm (2) Nucleus
(3) Plasma membrane (4) Mitochondrian

Ans. (1)

33. Phototropic curvature is the result of uneven distribution of:
(1) Cytokinins (2) Auxin
(3) Gibberellins (4) Phytochorme

Ans. (2)

34. Listed below are four respiratory capacities (a-d) and four jumbled respiratory volumes of a normal human adult:

	Respiratory capacities	Respiratory volumes
(a)	Rsidual volume	2500 mL
(b)	Vital capacity	3500 mL
(c)	Inspiratory reserve	1200 mL
(d)	Inspiratory capacity	4500 mL

Shich one of the following is the *correct* matchign of two capacities and volumes?
(1) (d) 3500 mL (a) 1200 mL
(2) (a) 4500 mL (b) 3500 mL
(3) (b) 2500 mL (c) 4500 mL
(4) (c) 1200 mL (d) 2500 mL

Ans. (1)

35. The signals for parturition originate from:
(1) Oxytocin released from maternal pituitary
(2) fully developed foetus only
(3) placenta only
(4) placenta as well as fully developed foetus

Ans. (4)

36. Select the *correct* statement from the ones given below with respect to dihybrid cross
(1) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones

(2) Tightly linked genes on the same chromosome show very few recombinations

(3) Tightly linked genes on the same chromosome show higher recombinations

(4) Genes far apart on the same chromosome show very few recombinations

Ans. (2)

37. Restriction endonucleases are enzymes which:

(1) restrict the action of the enzyme DNA polymerase

(2) remove nucleotides from the ends of the DNA molecule

(3) make cuts at specific positions within the DNA molecule

(4) recognize a specific nucleotide sequence for binding of DNA ligase

Ans. (3)

38. The part of Fallopian tube closest to the ovary is:

(1) Cervix (2) Ampulla

(3) Isthmus (4) Infundibulum

Ans. (4)

39. ABO blood groups in humans are controlled by the gene I. It has three alleles-A^A, I^B and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur?

(1) Four (2) Two

(3) Three (4) One

Ans. (1)

40. dB is a standard abbreviation used for the quantitative expression of

(1) the dominant *Bacilus* in a culture

(2) a certain pesticide

(3) the density of bacteria in a medium

(4) a particular pollutant

Ans. (4)

41. The one aspect which is *not* a salient feature of genetic code, is its being:

(1) Universal (2) Specific

(3) Degenerate (4) Ambiguous

Ans. (4)

42. The genotype of a plant showing the dominant phenotype can be determined by:

(1) Pedigree analysis (2) Back cross

(3) Test cross (4) Dihybrid cross

Ans. (3)

43. Which one of the following *does not* follow the central dogma of molecular biology?

(1) *Chlamydomonas* (2) HIV

(3) Pea (4) *Mucor*

Ans. (2)

44. Consider the following five statements regarding kidney transplant and select the *two correct* ones out of these.

(a) Even if a kidney transplant is proper the recipient may need to take immuno-suppresants for a long time

(b) The cell-mediated immune response is responsible for the graft rejection

(c) The B-lymphocytes are responsible for rejection of the graft

(d) The acceptance or rejection of a kidney transplant depends on specific interferons

The two *correct* statements are:

(1) (a) and (c) (2) (a) and (b)

(3) (b) and (c) (4) (c) and (d)

Ans. (2)

45. An improved variety of transgenic basmati rice:

(1) is completely resistant to all insect pests and diseases of paddy

(2) gives high yield but has no characterisitic aroma

(3) does not require chemical fertilizers and growth hormones

(4) gives high yield and is rich in vitamin A

Ans. (4)

46. Heartwood differs from sapwood in:

(1) Having dead and non0conducting elements

(2) Being susceptible to pests and pathogens

(3) Presence of rays and fibres

(4) Absence of vessels and parenchyma

Ans. (1)

47. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by sonie particular restriction enzyme?

(1) 5'-----GAATTC------3'
3'-----CTTAAG------5'

(2) 5'-----GACGTA------3'
3'-----GTCAGT------5'

(3) 5'-----CGTTCG------3'
3'-----ATGGTA------5'

(4) 5'-----GATATG------3'
3'-----CTACTA------5'

Ans. (1)

48. DNA or RNA segment tagged with a radioactive molecule is called:
(1) Clone (2) Plasmid
(3) Vector (4) Probe
Ans. (4)

49. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy>
(1) Sixth month (2) Third month
(3) Fourth month (4) Fifth month
Ans. (4)

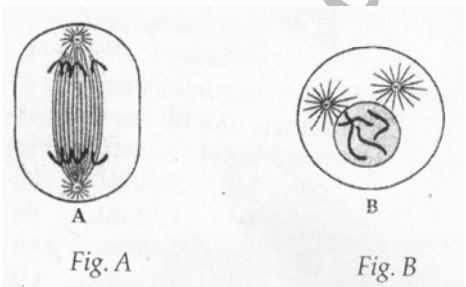
50. Which one of the following is *not* a micronutrient?
(1) Zinc (2) Boron
(3) Molybdenum (4) Magnesium
Ans. (4)

51. PGA as the first CO_2 fixation product was discovered in photosynthesis of:
(1) Angiosperm (2) Alga
(3) Bryophyte (4) Gymnosperm
Ans. (2)

52. Single-celled eukaryotes are included in:
(1) Archaea (2) Monera
(3) Protista (4) Fungi
Ans. (3)

53. Which one of the following symbols and its representation, used in human pedigree analysis is *correct*?
(1) □ = unaffected female
(2) ◆ = male affected
(3) □═○ = mating between relatives
(4) ○ = unaffected male
Ans. (3)

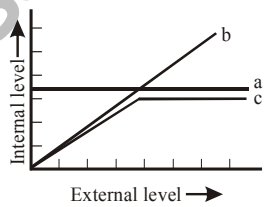
54. Which stages of cell division do the following figures A and B represent resectively?



(1) Late Anaphase - Prophase
(2) Prophase - Anaphase
(3) Mataphase - Telophae
(4) Telophase - Metaphase
Ans. (1)

55. Study the four statements (a-d) given below and select the two *Correct* ones out of them :
(a) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
(b) Predator star fish *Pisaster* helps in main taining species diversity of some inverte brates
(c) Predators ultimately lead to the extinction of prey species
(d) Production of chemicals such as nicotine, strychnine by the plants are metabolic dis orders
The two correct statements are :
(1) (a) and (d) (2) (a) and (b)
(3) (b) and (c) (4) (c) and (d)
Ans. (2)

56. The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively ?



(1) partial regulator conformer regulator
(2) regulator conformer partial regulator
(3) conformer regulator partial regulator
(4) regulator partial conformer regulator
Ans. (2)

57. Ovary is half-inferior in the flowers of :
(1) Brinjal (2) Cucumber
(3) Guava (4) Plum
Ans. (4)

58. Male and female gametophytes are independent and free-living in :
(1) *Pinus* (2) *sphagnum*
(3) Mustard (4) Castor
Ans. (2)

59. Photoperiodism was first characterised in :
(1) Tomato (2) Cotton
(3) Tobacco (4) Potato
Ans. (3)

60. Injury to adrenal cortex is not likely to affect the secretion of which one of the following ?
(1) Adrenaline
(2) Cortisol
(3) Aldosterone
(4) Both Androstenedione and Dehydroepiandrosterone

Ans. (1)

61. Coiling of garden pea tendrils around any support is an example of :
(1) Thigmotropism (2) Thermotaxis
(3) Thigmotaxis (4) Thigmonasty

Ans. (1)

62. Genetic engineering has been successfully used for producing :
(1) transgenic Cow-Rosie which produces high fat milk for making ghee
(2) animals like bulls for farm work as they have super power
(3) transgenic mice for testing safety of polio vac cine before use in humans
(4) transgenic models for studying new treatments for certain cardiac diseases

Ans. (3)

63. Which one of the following kinds of animals are *triploblastic* ?
(1) Ctenophores (2) Corals
(3) Flat worms (4) Sponges

Ans. (3)

64. Some hyperthermophilic organisms that grow in highly acidic (pH2) habitats belong to the two groups:
(1) Protists and mosses
(2) Liverworts and yeasts
(3) Eubacteria and archaea
(4) Cyanobacteria and diatoms

Ans. (3)

65. C_4 plants are more efficient in photosynthesis than C_3 plants due to :
(1) Presence of thin cuticle
(2) Lower rate of photorespiration
(3) Higher leaf area
(4) Presence of larger number of chloroplasts in the leaf cells

Ans. (2)

66. The chief water conducting elements of xylem in gymnosperms are :
(1) Transfusion tissue (2) Tracheids
(3) Vessels (4) Fibres

Ans. (2)

67. Cu ions released from copper-releasing Intra Uterine Devices (IUDs) :
(1) suppress sperm motility
(2) prevent ovulation
(3) make uterus unsuitable for implantation
(4) increase phagocytosis of sperms

Ans. (1)

68. Sertoli cells are found in :
(1) seminiferous tubules and provide nutrition to germ cells
(2) pancreas and secrete cholecystokinin
(3) ovaries and secrete progesterone
(4) adrenal cortex and secrete adrenaline

Ans. (1)

69. Which one of the following structures between two adjacent cells in an effective transport pathway ?
(1) Endoplasmic reticulum
(2) Plasmalemma
(3) Plasmodesmata
(4) Plastoquinones

Ans. (3)

70. The genetically-modified (GM) brinjal in India has been developed for :
(1) Enhancing mineral content
(2) Drought-resistance
(3) Insect-resistance
(4) Enhancing shelf life

Ans. (3)

71. Algae have cell wall made up of :
(1) Pectins cellulose and proteins
(2) Cellulose, cellulose and proteins
(3) Cellulose, galactans and mannans
(4) Hemicellulose, pectins and proteins

Ans. (3)

72. Which one of the following is one of the characteristics of a biological community ?
(1) Mortality
(2) Sex-ratio

(3) Stratification

(4) Natality

Ans. (3)

73. One example of animals having a single opening to the outside that serves both as mouth as well as anus is :

(1) *Ascidia* (2) *Fasciola*

(3) *Octopus* (4) *Asterias*

Ans. (2)

74. Satellite DNA is useful tool in :

(1) Forensic science

(2) Genetic engineering

(3) Organ transplantation

(4) Sex determination

Ans. (1)

75. One of the free-living, anaerobic nitrogen-fixer is :

(1) *Rhizobium* (2) *Azotobacter*

(3) *Beijenickia* (4) *Rhodospirillum*

Ans. (4)

76. A common biocontrol agent for the control of plant diseases in :

(1) *Glomus*

(2) *Trichoderma*

(3) Baculovirus

(4) *Bacillus thuringiensis*

Ans. (2)

77. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance ?

(1) Alleles do not show any blending and both the characters recover as such in F_2 generation.

(2) Factors occur in pairs

(3) The discrete unit controlling a particular char acter is called a factor

(4) Out of one pair of factors one is dominant, and the other recessive

Ans. (1)

78. Virus envelope is known as :

(1) Nucleoprotein (2) Core

(3) Capsid (4) Virion

Ans. (3)

79. If for some reason our goblet cells are non-functional, this will adversely affect :

(1) maturation of sperms

(2) smooth movement of food down the intestine

(3) production of somatostatin

(4) secretion of sebum from the sebaceous glands

Ans. (2)

80. Which one of the following statements about certain given animals is *correct* ?

(1) Insects are pseudocoelomates

(2) Flat worms (Platyhelminthes) are coelomates

(3) Round worms (Aschelminthes) are pseudocoe lomates

(4) Molluses are acoelomates

Ans. (3)

81. Breeding of crops with high levels of minerals, vitamins and proteins is called :

(1) Biomagnification (2) Micropropagation

(3) Somatic hybridisation

(4) Biofortification

Ans. (4)

82. Widal test is used for the diagnosis of :

(1) Tuberculosis (2) Typhoid

(3) Malaria (4) Pneumonia

Ans. (2)

83. The common nitrogen-fixer in paddy fields is :

(1) *Oscillatoria* (2) *Frankia*

(3) *Rhizobium* (4) *Azospirillum*

Ans. (4)

84. The energy-releasing metabolic process in which substrate is oxidised without an external electron acceptor is called :

(1) Aerobic respiration

(2) Photorespiration

(3) Glycolysis

(4) Fermentation

Ans. (4)

85. Which one of the following statements is *correct* with respect to AIDS ?

(1) AIDS patients are being fully cured cent per cent with proper care and nutrition

(2) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers

(3) The HIV can be transmitted through eating food together with an infected person

(4) Drug addicts are least susceptible to HIV in fection

Ans. (2)

86. Which one of the following statement in regard to the excretion by the human kidneys is *correct* ?
    (1) Nearly 99 per cent of the glomerular filtrate is reabsobed by the renal tubules
    (2) Ascending limb of Loop of Henle is imperme able to electrolytes
    (3) Descending limb of Loop of Henle is imperme able to water
    (4) Distal convoluted tubule is incapable of reab sorbing HCO_3^-

Ans. (1)

87. Some of the characteristics of Bt cotton are :
    (1) High yield and production of toxic protein crys tals which kill dipteran pests
    (2) High yield and resistance to bollworms
    (3) Long fibre and resistance to aphids
    (4) Medium yield, long fibre and resistance to beetle pests

Ans. (2)

88. *In vitro* fertilisation is a technique that involves transfer of which one of the following into the fallopian tube ?
    (1) Embryo of 32 cell stage
    (2) Zygote only
    (3) Embryo only, upto 8 cell stage
    (4) Either zygote or early embryo upto 8 cell stage

Ans. (4)

89. During mitosis ER and nucleolus begin to disappear at :
    (1) Late metaphase
    (2) Early prophase
    (3) Late prophase
    (4) Early metaphase

Ans. (2)

90. The plasma membrane consists mainly of :
    (1) proteins embedded in a polymer of glucose molecuse
    (2) proteins embedded in a carbohydrate bilayer
    (3) phospholipids embedded in a protein bilayer
    (4) proteins embedded in a phospholipid bilayer

Ans. (4)

91. Which one of the following is not a lateral meristem?
    (1) Phellogen
    (2) Intercalary meristem
    (3) Intrafascicular cambium
    (4) Interfascicular cambium

Ans. (2)

92. Membrane-bound organelles are *absent* in :
    (1) *Chlamydomonas*
    (2) *Plasmodium*
    (3) *Saccharomyces*
    (4) *Streptococcus*

Ans. (4)

93. Infectious proteins are present in :
    (1) Viroids
    (2) Satellite viruses
    (3) Gemini viruses
    (4) Prions

Ans. (4)

94. Vasa efferentia are the ductules leading from :
    (1) Vas deferens to epididymis
    (2) Epididymis to urethra
    (3) Testicular lobules to rete testis
    (4) Rete testis to vas deferens

Ans. (4)

95. If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect ?
    (1) The blood will tend to flow back into the left atrium
    (2) The flow of blood into the pulmonary artery will be reduced
    (3) The flow of blood into the aorta will be slowed down
    (4) The 'pacemaker' will stop working

Ans. (2)

96. Low Ca^{++} in the body fluid may be the cause of :
    (1) Angina pectoris
    (2) Gout
    (3) Tetany
    (4) Anaemia

Ans. (3)

97. Carrier ions like Na^+ facilitate the absorption of substances like :
    (1) fatty acids and glycerol
    (2) fructose and some amino acids
    (3) amino acids and glucose
    (4) glucose and fatty acids

Ans. (3)

98. Select the *correct* statement from the ones given below :
    (1) Chewing tobacco lowers blood pressure and heart rate
    (2) Cocaine is given to patients after surgery as it stimulates recovery
    (3) Barbiturates when given to criminals make them tell the truth
    (4) Morphine is often given to persons who have undergone surgery as a pain killer

Ans. (4)

99. Stirred-tank bioreactors have been designed for :
    (1) Ensuring anaerobic conditions in the culture vessel
    (2) Availability of oxygen throughout the process
    (3) Addition of preservatives to the product
    (4) Purification of the product

Ans. (2)

100. Which one of the following pairs is *incorrectly* matched ?
    (1) Corpusluteum – Relaxin (secretion)
    (2) Insulin – Diabetes mellitus (disease)
    (3) Glucagon – Beta cells (source)
    (4) somatostatin – Delta cells (source)

Ans. (3)

101. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:

(1) 12 V (2) 3V/2

(3) 3V/4 (4) 6V

Sol. [4]

$$\frac{mv^2}{R} = \frac{GM_e m}{R^2}$$

$$v = \sqrt{\frac{GM_e}{R}}$$

$$v \propto \frac{1}{\sqrt{R}}$$

$$\frac{V_A}{V_B} = \sqrt{\frac{R_B}{R_A}} = \sqrt{\frac{R}{4R}} = \frac{1}{2}$$

$$\frac{3V}{V_B} = \frac{1}{2}$$

$\mathbf{V_B = 6V}$

102. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to earth's field by placing a current carrying wire, the new time period of magnet will be

(1) 3s (2) 4s

(3) 1s (4) 2s

Sol.:[3]

$$T \propto \frac{1}{\sqrt{B}} \qquad \left(T = 2\pi\sqrt{\frac{I}{MB}}\right)$$

$$\frac{T_1}{T_2} = \sqrt{\frac{B_E - B_W}{B_E}}$$

$$\frac{2}{T_2} = \sqrt{\frac{24-18}{24}} = \sqrt{\frac{6}{24}} = \frac{1}{2}$$

$\mathbf{T_2 = 4\ sec}$

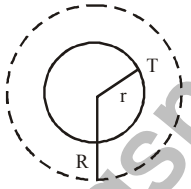
103. The total radiant energy per unit area, normal to the direction of indcidence , received at a distance R fropm the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K is given by

(1) $\sigma r^4 T^4 / r^4$ (2) $4\pi\sigma r^2 T^4 / R^2$

(3) $\sigma r^2 T^4 / R^2$ (4) $\sigma r^2 T^4 / 4\pi r^2$

(Where σ is Stefan's Constant)

Sol.:[3]



$$\frac{1}{A}\frac{dE}{dt} = \frac{\sigma 4\pi r^2 T^4}{4\pi R^2} = \frac{\sigma r^2 T^4}{R^2}$$

104. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/ s. The value of magnetic induction in Wb/m^2 at the centre of the ring is:

(1) $\frac{\mu_0 q}{2fR}$ (2) $\frac{\mu_0 qf}{2R}$

(3) $\frac{\mu_0 qf}{2\pi R}$ (4) $\frac{\mu_0 q}{2\pi fR}$

Sol.:[2]

$$B = \frac{\mu_0 i}{2R} = \frac{\mu_0}{2R} \times \frac{q}{T} = \boxed{\frac{\mu_0}{2R} qf}$$

105. Which of the following statement is false for the properties of electromagnetic waves?

(1) Both electric and magnetic field vectors are parallel to each other perpendicular to the direction of propagation of wave

(2) These waves do not require any material medium for propagation

(3) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time

(4) The energy in electromagnetic wave is divided equally between electric and magnetic vectors

Sol.:[1]

Conceptual

106. A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45°. for which of the following value of μ the ray can undergo total internal reflection?

(1) $\mu = 1.50$ (2) $\mu = 1.25$

(3) $\mu = 1.33$ (4) $\mu = 1.10$

Sol.:[1]

$$i > c \quad \sin i > \sin C$$

$$\sin 45^\circ > \frac{1}{\mu}$$

$$\mu > \frac{1}{\sin 45^\circ} = \sqrt{2}$$

107. Which one of the following statement is ***FALSE***?

(1) Minority cariers in a p-type semiconductor are electrons

(2) The resistance of intrinsic semiconductor decreases with increase of temperature

(3) Pure Si doped with trivalent impurities gives a p-type semiconductor

(4) Majority carriers in a n-type semiconductor are holes

Sol.:[4]

Coceptual

108. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a/2 distance from the centre, will be:

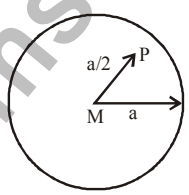
(1) $-\frac{GM}{a}$ (2) $-\frac{4GM}{a}$

(3) $-\frac{3GM}{a}$ (4) $-\frac{2GM}{a}$

Sol.:[3]

$$V_{atp} = -\frac{GM}{a} - \frac{GM}{a/2}$$

$$= -\frac{3GM}{a}$$



109. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge on an electron)

(1) $\sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$ (2) $\frac{4\pi\epsilon_0 Fd^2}{q^2}$

(3) $\frac{4\pi\epsilon_0 Fd}{e^2}$ (4) $\sqrt{\frac{4\pi\epsilon_0 Fe}{d^2}}$

Sol.:[1]

$$F = \frac{n^2e^2}{4\pi\epsilon_0 d^2}$$

$$\therefore \quad n = \sqrt{\frac{4\pi\epsilon_0 Fd^2}{e^2}}$$

110. A lens having focal lengh f and aperture of diameter d forms an image of intensity I. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively

(1) f and $\frac{3I}{4}$ (2) $\frac{f}{2}$ and $\frac{I}{2}$

(3) f and $\frac{I}{4}$ (4) $\frac{3f}{4}$ and $\frac{I}{2}$

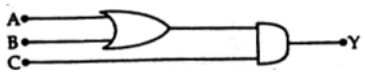
Sol.:[1]

$$f^{-1} = (\mu - 1)\left(\frac{2}{R}\right) \rightarrow \text{unchanged}$$

$I \propto$ Area of aperture

$$\frac{I'}{I} = \frac{A'}{A} = \frac{\pi\left(\frac{d^2}{4}\right) - \pi\left(\frac{d/2}{4}\right)^2}{\left(\pi\frac{d^2}{4}\right)} = \frac{3}{4}$$

111. To get an output Y = 1 from the circuit shown below, the input must be:



	A	B	C
(1)	1	0	1
(2)	1	0	0
(3)	0	1	0
(4)	0	0	1

Sol.:[1]

Boolean expression for output is

$$Y = (A + B) \cdot C$$

112. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

(1) $\Delta U = \Delta W$, in a adiabatic process

(2) $\Delta U = -\Delta W$, in a isothermal process

(3) $\Delta U = -\Delta W$, in a adiabatic process

(4) $\Delta U = \Delta W$, in a isothermal process

Sol.:[3]

In adiabatic $\Delta Q = 0$

$\therefore \quad \Delta U + \Delta W = 0 \qquad \therefore \quad \Delta U = -\Delta W$

113. The device that can act as a complete electronic circuit is:

(1) Junction transistor (2) Zener diode

(3) Junction diode (4) Integrated circuit

Sol.:[4]

Conceptual

114. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and $2v$ at any instant, then the speed of centre of mass of the system will be

(1) $1.5v$ (2) v

(3) $2v$ (4) zero

Sol.:[4]

$\vec{F}_{ext} = \vec{0}$ and $\vec{U}_{CM} = \vec{0}$

$\therefore \quad \vec{p}_i = \vec{p}_f = \vec{0}$ at any time

$\therefore \quad \vec{V}_i = \vec{V}_f = \vec{0}$

115. A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference 4V. When another parallel combination of n_2 capacitors, each of value C_2 is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2 in terms of C_1, is then:

(1) $2\frac{n_2}{n_1}C_1$ (2) $\frac{16C_1}{n_1n_2}$

(3) $\frac{2C_1}{n_1n_2}$ (4) $16\frac{n_2}{n_1}C_1$

Sol.:[2]

$$\frac{1}{2}n_2C_2(V)^2 = \frac{1}{2}\frac{C_1}{n_1}(4V)^2$$

$$\therefore \quad C_2 = \frac{16C_1}{n_1n_2}$$

116. A source S_1 is producing, 10^{15} photons per second of wavelength 5000Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100Å. Then (power of S_2)/ (power of S_1) is equal to

(1) 1.04 (2) 0.98

(3) 1.00 (4) 1.02

Sol.:[3]

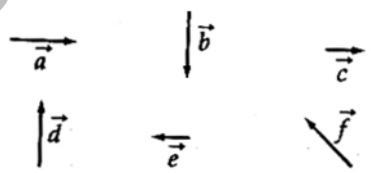
$$\text{Power} = \frac{\text{Energy emitted}}{\text{time}}$$

$$P = \frac{nh\nu}{t} = \frac{nhc}{\lambda t} \quad \therefore P \propto \frac{n}{\lambda}$$

$$\therefore \quad \frac{P_2}{P_1} = \frac{n_2}{n_1}\times\frac{\lambda_1}{\lambda_2} = \frac{1.02\times10^{15}}{10^{15}}\times\frac{5000}{5100}$$

$$= \frac{2}{100}\times50 = 1$$

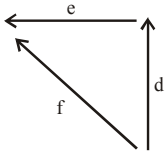
117. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true



(1) $\vec{d}+\vec{e}=\vec{f}$ (2) $\vec{b}+\vec{e}=\vec{f}$

(3) $\vec{b}+\vec{c}=\vec{f}$ (4) $\vec{d}+\vec{c}=\vec{f}$

Sol.:[1]



$\vec{d}+\vec{e}=\vec{f}$

118. A transverse wave is represented by $y = A\sin(wt-kx)$. For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

(1) $2\pi A$ (2) A

(3) $\pi A/2$ (4) πA

Sol.:[1]

$$V_{\text{of Wave}} = \frac{w}{K}$$

$$V_{\text{of Particle (max)}} = Aw$$

$$\therefore \quad \frac{w}{K} = Aw$$

$$\therefore \quad \frac{\lambda}{2\pi} = A \Rightarrow \lambda = 2\pi A$$

119. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts and amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t?

(1) 2Q (2) Q/2

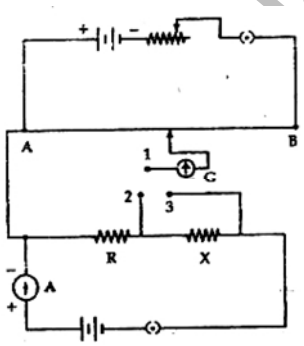
(3) Q/4 (4) Q/16

Sol.:[4]

$$\frac{Q}{t} = \frac{K(\pi r^2)(T_2 - T_1)}{l}$$

$$\left(\frac{Q}{t}\right)_{\text{new}} = K\frac{\pi\left(\frac{r}{2}\right)^2}{4l}(T_2 - T_1) = \frac{1}{16}\left(\frac{Q}{t}\right)$$

120. A potentiometer or circuit is set up as shown. The potential gradient, across the potentiometer wire, is k volt/ cm and the ammeter, present in the circuit, reads 10A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths l_1 cm and l_2 cm respectively. The magnitudes, of the resistors R and X, in ohms, are then, equal, respectively, to



(1) $k(l_2 - l_1)$ and kl_1 (2) kl_1 and kl_2

(3) $k(l_2 - l_1)$ and kl_2 (4) kl_1 and $k(l_2 - l_1)$

Sol.:[4]

$$V_{12} = kl_1 = V_R$$

$$V_{13} = kl_2 = V_R + V_X$$

$$\therefore \quad \frac{l_1}{l_2} = \frac{V_R}{V_R + V_X} = \frac{R}{R + X}$$

$$\frac{l_2}{l_1} = \frac{R + X}{R} = 1 + \frac{X}{R}$$

$$\therefore \quad \frac{X}{R} = \frac{l_2}{l_1} - 1 = \frac{l_2 - l_1}{l_1}$$

$$\therefore \quad V_X = k(l_2 - l_1)$$

$$V_R = kl_1$$

121. A ball is dropped from a high rise platform at t = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 s. What is the value of v? (Take g = 10 m/s^2)

(1) 40 m/s (2) 60 m/s

(3) 75 m/s (4) 55 m/s

Sol.:[3]

$$\frac{1}{2} \times g \times 18^2 = v[18 - 6] + \frac{1}{2}g[18 - 6]^2$$

$$5 \times 324 = v \times 12 + 5 \times 12^2$$

$$5 \times 324 = 12V + 5 \times 144$$

$$12v = 5[324 - 144] = 5[180]$$

$$v = \frac{5 \times 180}{12} = \boxed{75\,\text{m/s}}$$

122. The energy of a hydrogen atom in the ground state is –13.6 eV. The energy of a He^+ ion in the first excited state will be:

(1) –55.4 eV (2) –6.8 eV

(3) –13.6 eV (4) –27.2 eV

Sol.:[3]

$$E = -13.6\frac{Z^2}{n^2} = -13.6 \times \frac{Z^2}{2^2} = -13.6\,\text{eV}$$

123. Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?

(1) ionic bonding

(2) covalent bonding

(3) metallic bonding

(4) van der Waal's bonding

Sol.: [1]

Conceptual

124. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine

(1) 100 W (2) 800 W

(3) 400 W (4) 200 W

Sol.: [2]

$$P = F\nu$$

$$= \left(\frac{dp}{dt}\right)\nu = \left[\frac{d(mv)}{dt}\right]\nu$$

$$= \nu^2\left(\frac{dm}{dt}\right) = \nu\frac{dm}{dl}\times\frac{dl}{dv} = \nu^2.\frac{dm}{dl}.\nu$$

$$= \left(\frac{dm}{dl}\right)\nu^3 = 100\times 2^3 = 800\,W$$

125. A common emitter amplifier has a voltage gain of 50 , an input impedance of 100Ω and an output impedance of 200Ω. The power gain of the amplifier is

(1) 1250 (2) 50

(3) 500 (4) 1000

Sol.: [1]

$$V_g = \alpha\frac{R_L}{R_i} \Rightarrow 50 = \alpha\frac{200}{100} \Rightarrow \alpha = 25$$

$$P_g = \alpha\frac{R_L}{R_i} = (25)^2\frac{200}{100} = 1250$$

126. A conducting circular loop is placed in a uniform magnetic field B = .025 T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced emf when the radius is 2 cm, is:

(1) $\frac{\pi}{2}\mu V$ (2) $2\mu V$

(3) $2\pi\mu V$ (4) $\pi\mu V$

Sol.: [4]

$$\phi = \vec{B}\cdot\vec{S} = B\pi r^2$$

$$|e| = \frac{d\phi}{dt} = B2\pi r\frac{dr}{dt} = 0.025\times 2\pi\times 2\times 10^{-2}$$

$$|e| = \pi\mu V$$

127. The potential difference that must be applied to stop the fastest photo electrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be:

(1) –2.4 V (2) 12 V

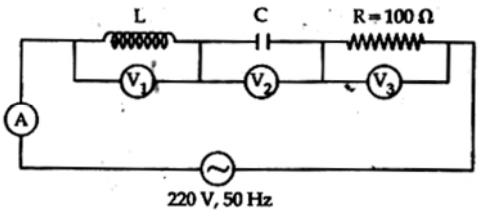
(3) 2.4 V (4) –1.2V

Sol.: [4]

$$e|V_0| = \frac{hc}{\lambda} - \phi \Rightarrow eV_0 = \frac{12400eVA^\circ}{2000A^\circ} - 5.01eV$$

$\Rightarrow |V_0| = 1.2$ volt , but stopping potential is always –ve. So V_0= –1.2 Volt

128. In the given circuit the reading of voltmeter V_1 and V_2 are 300 volts each. The reading of the voltmeter V_3 and ammeter A are respectively:



(1) 220 V, 2.0 A (2) 100 V, 2.0 A

(3) 150 V, 2.2 A (4) 220 V, 2.2 A

Sol.: [4]

As $V_1 = V_2 \Rightarrow IX_L = IX_C$, so, $X_L = X_C$

circuit is in resonance. So $V = V_3 = 220\,V$ and

$$I = \frac{V}{R} = \frac{220}{100} = 2.2A$$

129. A circular disk of moment of inertia I_t, is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_i. Another disk of moment of inertia I_b is dropped coaxially onto the rotating disk. Initially the second disk has zero angular sppeed. Eventually both the disks rotate with a constant angular speed ω_f. The energy lost by the initially rotating disc to friction is:

(1) $\frac{I_b - I_t}{(I_t + I_b)}\omega_i^2$ (2) $\frac{1}{2}\frac{I_b I_t}{(I_t + I_b)}\omega_i^2$

(3) $\frac{1}{2}\frac{I_b^2}{(I_t + I_b)}\omega_i^2$ (4) $\frac{1}{2}\frac{I_t^2}{(I_t + I_b)}\omega_i^2$

Sol.:[2]

Using conservation of angular momentum about central axis

$I_t\omega_i = (I_t + I_b)\omega_f$

$$\omega_f = \frac{I_t + \omega_i}{I_t + I_b} \qquad ...(i)$$

now, $KE_{lost} = \frac{1}{2}I_t\omega_i^2 - \frac{1}{2}(I_t + I_b)\omega_f^2$

putting ω_f from (i)

$$KE_{lost} = \frac{1}{2}\frac{I_bI_t}{I_b + I_t}(\omega_i)^2$$

130. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another massM is also suspended, the period of oscillation will now be:

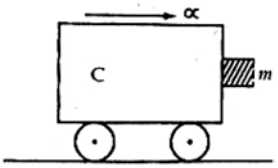
(1) 2T (2) $\sqrt{2}T$

(3) T (4) $T/\sqrt{2}$

Sol.:[2]

$$T = 2\pi\sqrt{\frac{m}{k}} \text{ if } m' = 2m,\ T' = \sqrt{2}T$$

131. A block of mass m is in contact with the cart C as shown in the figure.



The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies:

(1) $\alpha \geq \frac{g}{\mu}$ (2) $\alpha < \frac{g}{\mu}$

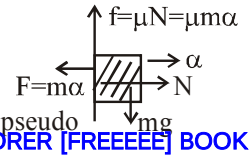
(3) $\alpha > \frac{mg}{\mu}$ (4) $\alpha > \frac{g}{\mu m}$

Sol.:[1]

$f = \mu N = \mu m\alpha$

for not falling

$\mu m\alpha \geq mg$



$$\alpha \geq \frac{g}{\mu}$$

132. A galvanometer has a coil of resistance 100 ohm and gives a full scale deflection for 30 mA current. If it is to work as a voltmeter of 30 volt range, the resistance required to be added will be:

(1) 500Ω (2) 500Ω

(3) 900Ω (4) 1800Ω

Sol.:[4]

$R_g = 100\Omega,\ i_g = 30\,m,\ V = 30\ V$

$$R_{se} = \left(\frac{V}{i_gR_g} - 1\right)R_g$$

$$= \left(\frac{30}{30\times10^{-3}\times100} - 1\right)\times100 = 900\Omega$$

133. A beam of cathode rays is subjected to crossed Electric (E) and Magnetic fields (B). The fields are adjusted such that the beam is not deflected. the specific charge of the cathode rays is given by:

(1) $\frac{2VE^2}{B^2}$ (2) $\frac{E^2}{2VB^2}$

(3) $\frac{B^2}{2VE^2}$ (4) $\frac{2VB^2}{E^2}$

(Where V is the potential difference between cathode and anode)

Sol.:[2]

$$Bqv = qE \qquad ...(i)$$

$$v = \frac{E}{B}$$

$$\frac{1}{2}mv^2 = qV$$

$$\frac{1}{2}m\frac{E^2}{B^2} = qV$$

$$\frac{q}{m} = \frac{E^2}{2B^2V}$$

134. Consider the following statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

(1) (A) is wrong and (B) is correct

(2) Both (A) and (B) are correct

(3) Both (A) and (B) are wrong

(4) (A) is correct and (B) is wrong

Sol.: [2]

Conceptual

135. The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minutes at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is:

(1) $5log_{10}2$ (2) $5log_e2$

(3) $log_e2/5$ (4) $\frac{5}{log_e2}$

Sol.: [2]

$$N = N_0e^{-\lambda t}$$

$$\frac{N_0}{e} = N_0e^{-\lambda\times5}$$

$$\lambda = \frac{1}{5}$$

$$T_{1/2} = \frac{\log_e 2}{\lambda} = 5\log_e 2$$

136. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if:

(1) $r \le \frac{\mu g}{\omega^2}$ (2) $r \ge \frac{\mu g}{\omega^2}$

(3) $r = \mu g\omega^2$ (4) $r < \frac{\omega^2}{\mu g}$

Sol.: [1]

$$f \ge m\omega^2 r$$

$$\mu mg \ge m\omega^2 r$$

$$\mu \ge \frac{\omega^2 r}{g}$$

$$r \le \frac{\mu g}{\omega^2}$$

137. A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is:

(1) 2.5 ampere (2) 50 ampere

(3) 3.6 ampere (4) 2.8 ampere

Sol.: [2]

$$n = 0.8 = \frac{440\times2}{220\times I}$$

$$I = 5A$$

138. A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to:

(1) $(\text{distance})^{-2}$ (2) $(\text{velocity})^{2/3}$

(3) $(\text{velocity})^{3/2}$ (4) $(\text{distance})^2$

Sol.: [3]

$$x = (t+5)^{-1}$$

$$v = -1(t+5)^{-2}$$

$$a = 2(t+5)^{-3}$$

139. The mass of a ^7_3Li nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of ^7_3Li nucleus is nearly:

(1) 3.9 MeV (2) 26 MeV

(3) 46 MeV (4) 5.6 MeV

Sol.: [4]

$$\frac{\text{B.E.}}{\text{nucleon}} = \frac{0.042\times931}{7} = 5.6\,\text{MeV}$$

140. The displacement of a particle alone the x axis is given by $x = a\sin^2\omega t$. The motion of the particle corresponds to:

(1) non simple harmonic motion

(2) simple harmonic motion of frequency $\omega/2\pi$

(3) simple harmonic motion of frequency ω/π

(4) simple harmonic motion of frequency $3\omega/2\pi$

Sol.: [3]

$$x = \frac{a(1-\cos2\omega t)}{2}$$

141. A The dimension of $\frac{1}{2}\in_0 E^2$, where $\in_0$ is permittivity of free space and E is electrif field, is

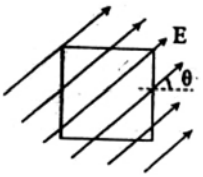
(1) ML^2T^{-1} (2) ML^2T^{-1}

(3) ML^2T^{-2} (4) $ML^{-1}T^{-2}$

Sol.:[4]

$$\frac{1}{2}\in_0 E^2 = \frac{\text{Energy}}{\text{volume}} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$

142. A square surface of side L meter in the plane of the paper is placed in a uniform electric field E (volt/ m) acting along the same plane at an angle θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface, in units of volt -m, is



(1) $EL^2\sin\theta$ (2) zero

(3) EL^2 (4) $EL^2\cos\theta$

Sol.:[2]

$$\phi = \vec{E}\cdot\vec{A}$$

$$= EA\cos 90^\circ = 0$$

143. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge Ze. Then the nucleus will be proportional to:

(1) $\frac{1}{m}$ (2) $\frac{1}{v^2}$

(3) $\frac{1}{Ze}$ (4) v^2

Sol.:[1]

144. Electromagnets are made of soft iron because soft iron has

(1) low retentivity and low coercive force

(2) high retentivity and low coercive force

(3) low retentivity and high coercive force

(4) hig retentivity and high coercive force

Sol.:[1]

145. A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed 2 m/s. When the stone reaches the floor, the distance of the man above the floor will be:

(1) 10 m (2) 20 m

(3) 99 m (4) 10.1 m

Sol.:[4]

$$\vec{P}_i = \vec{P}_t$$

$$0 = 50V_1 - 0.5\times 2$$

$$V_1 = \frac{1}{50}\text{m/s}$$

Time taken to reach floor = 10/2 = 5 sec.

Distance moved by man in 5 sec $= \frac{1}{50}\times 5 = \frac{1}{10}\text{m}$

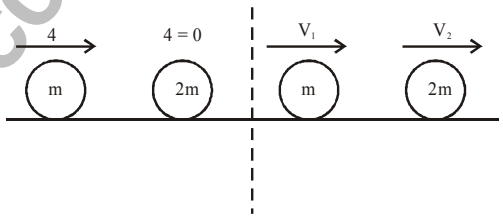
Distance from floor $= 10 + \frac{1}{10} = 10.1\text{m}$

146. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be:

(1) 1, 0.5 (2) 0, 2

(3) 0, 1 (4) 1, 1

Sol.:[3]



$$mu + 2m\times 0 = mv_1 + 2mv_2$$

$$v_1 + 2v_2 = 2 \quad \text{...(i)}$$

$$e = \frac{v_2 - v_1}{u_1 - u_2}$$

$$v_2 - v_1 = 1 \quad \text{..(ii)}$$

$$v_2 = 1\text{m/s}$$

$$v_1 = 0$$

147. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated (E.C.E. of chlorine is 0.367×10^{-6} Kg/C)

(1) 17.61×10^{-3} kg (2) 3.67×10^{-3} kg

(3) 1.76×10^{-3} kg (4) 9.67×10^{-3} kg

Sol.:[1]

$$n = ZIt \Rightarrow Z\frac{P}{V}t$$

$$= 0.367 \times 10^{-6} \times \frac{100 \times 10^3}{125} \times 60$$

$$= 17.61 \times 10^{-3}\ \text{kg}$$

148. A particle has initial velocity $\left(3\hat{i} + 4\hat{j}\right)$ and has acceleration $\left(0.4\hat{i} + 0.3\hat{j}\right)$. Its speed after 10 s is:

(1) 8.5 units (2) 10 units

(3) 7 units (4) $7\sqrt{2}$ units

Sol.:[4]

$$|\vec{v}| = |\vec{v}_x + \vec{v}_y|$$

$$= \left|(u_x + a_x t)\hat{i} + (u_y + a_y t)\hat{j}\right|$$

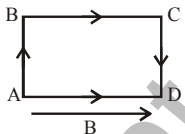
$$\left|7\hat{i} + 7\hat{j}\right| = 7\sqrt{2}$$

149. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loops is :

(1) $-3\vec{F}$ (2) $\vec{F}$

(3) $3\vec{F}$ (4) $-\vec{F}$

Sol.:[4]



$$F_{BC} = F_{AD} = 0$$

$$\vec{F}_{AB} = -\vec{F}_{CD}$$

150. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreaes to 2 beats per sec when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was:

(1) 516 Hz (2) 508 Hz

(3) 510 Hz (4) 514 Hz

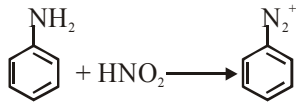
Sol.:[1]

$$f_T - f_P = 4$$

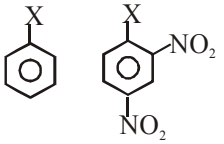
$$f_P = 508$$

151. Which of the following statements about primary amines is "False"?
(1) Aryl amines react with nitrous acid to produce phenols
(2) Alkyl amines are stronger bases than ammonia
(3) Alkyl amines are stronger bases than aryl amines
(4) Alkyl amines react with nitrous acid to produce alcohols

Ans. **(1)**

Sol. 

152. The correct order of increasing reactivity of C–X bond towards nucleophile in the following compound is



$(CH_3)_3C–X$ $(CH_3)_2CH–X$

(I) (II) (III) (IV)

(1) IV < III < I < II
(2) III < II < I < IV
(3) I < II < IV < III
(4) II < III < I < IV

Ans. **(3)**

Sol. I < II < IV < III

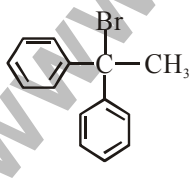
153. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be
(1) more than ΔH
(2) equal to zero
(3) less than ΔH
(4) equal to ΔH

Ans. **(4)**

Sol. Minimum value of $E_a = \Delta H$

154. Which one is most reactive towards S_N^1 reaction?
(1) $C_6H_6C(CH_3)(C_6H_5)Br$
(2) $C_6H_5CH_2Br$
(3) $C_6H_5CH(C_6H_5)Br$
(4) $C_6H_5CH(CH_3)Br$

Ans. **(1)**

Sol.  is most reactive

155. Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively
(1) +5 + 4, +3
(2) +3 , + 4, + 5
(3) +3, +5, +4
(4) + 5, +3, + 4

Ans. **(2)**

Sol. +3, +4, +5

156. If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its $K_{(SP)}$ is
(1) 5.00×10^{-6} M^3
(2) 5.00×10^{-7} M^3
(3) 4.00×10^{-6} M^3
(4) 4.00×10^{-7} M^3

Ans. **(2)**

Sol. $[H^+] = 10^{-12}$

$[OH^-] = 10^{-2}$

$$Ba(OH)_2 \rightleftharpoons \underset{\frac{10^{-2}}{2}}{Ba^{2+}} + 2\underset{10^{-2}}{OH^-}$$

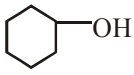
$$K_{sp} = [Ba^{2+}][OH^{-1}]^2$$

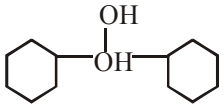
$$= \left(\frac{10^{-2}}{2}\right)(10^{-2})^2$$

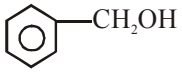
$$= 0.5 + 10^{-2} \times 10^{-4}$$

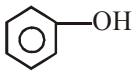
$$= 0.5 \times 10^{-6} = 5 \times 10^{-7}$$

157. Which of the following compounds has the most acidic nature?

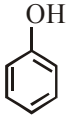
(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

Sol.  phenol is more acidic than alcohol.

158. Standard entropies of X_2, Y_2 and XY_3 are 60, 40 and 50 $J\ K^{-1}\ mol^{-1}$ respectively. For the reaction

$\frac{1}{2}X_2 + \frac{3}{2}Y_3 \rightleftharpoons XY_3, \Delta H = -30kJ$ to be at equilibrium, the temperature should be

(1) 1250 K
(2) 500 K
(3) 750 K
(4) 1000 K

Ans. **(3)**

Sol.

$$\Delta S = S_{product} - S_{reactant} = 50 - \left(\frac{1}{2}\times 60 + \frac{3}{2}\times 40\right) \quad \Big| \quad -40J = \Delta S \quad T = \frac{30\times 10^3}{-40} = \frac{30,000}{40}$$

159. Which of the following structures represents Neoprene polymer?

(1) $-\left(CH_2-\underset{Cl}{\underset{|}{C}}H\right)_n-$

(2) $-\left(\underset{C_6H_5}{\underset{|}{C}}H-CH_2\right)_n-$

(3) $-\left(CH_2-\underset{Cl}{\underset{|}{C}}=CH-CH_2\right)_n-$

(4) $-\left(CH_2-\underset{CN}{\underset{|}{C}}H\right)_n-$

Ans. **(3)**

Sol. $-\left(CH_2-\underset{Cl}{\underset{|}{C}}l=CH-CH_2\right)_n-$ is neoprane.

160. In which of the following pairs of molecules/ ions, the central atoms have sp^2 hybridization?

(1) NH_2^- and H_2O
(2) BF_3 and NH_2
(3) NO_2^- and NH_3
(4) BF_3 and NO_2^-

Ans. **(4)**

Sol. BF_3 and NO_2^- are sp^2 hybridised

161. Which one of the following does *not* exhibit the phenomenon of mutarotation?

(1) (+) Maltose
(2) (–) Fructose
(3) (+) Sucrose
(4) (+) Lactose

Ans. **(3)**

Sol. (+) Sucrose does not exhibit mutarotation.

162. Which one of the following ions has electronic configuration [Ar]$3d^6$?

(1) Fe^{3+}
(2) Co^{3+}
(3) Ni^{3+}
(4) Mn^{3+}

Ans. **(2)**

Sol. Co^{3+} ; (Ar) $3d^6$

163. Which of the following complex ion is not expected to absorb visible light?

(1) $\left[Fe(H_2)_6\right]^{2+}$
(2) $\left[Ni(H_2O)_6\right]^{2+}$
(3) $\left[Ni(CN)_4\right]^{2-}$
(4) $\left[Cr(NH_3)_6\right]^{3+}$

Ans. **(3)**

Sol. $[Ni(CN)_4]^2$ does not contain unpaired e^-

164. Property of the alkaline earth metals that increases with their atomic number

(1) Ionization energy
(2) Electronegativity
(3) Solubility of their hydroxides in water
(4) Solubility of their sulphates in water

Ans. **(3)**

Sol. Solubility of hydroxides of alkaline earthmetals increases down the group.

165. During the kinetic study of the reaction, 2A + B $\rightarrow$ C + D, following results were obtained:

Run	[A] mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D/mol L^{-1} min^{-1}
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data which one of the following is correct?

(1) $rate = k[A]^2[B]^2$
(2) $rate = k[A][B]^2$
(3) $rate = k[A]^2[B]$

(4) $\text{rate} = k[A][B]$

Ans. **(2)**

Sol. Rate law K [A][B]^2

166. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of Na_2CO_3 = 106 g mol^{-1})

(1) 1.90 M and 1.910 M

(2) 0.477 M and 0.477 M

(3) 0.955 M and 1.910 M

(4) 1.910 M and 0.955 M

Ans. **(4)**

Molarity of

$$Na_2CO_3 = \frac{25.3/100}{250} \times 100 = \frac{25.3 \times 1000}{106 \times 250} = 0.953$$

$$\underset{0.955}{Na_2CO_3} \rightarrow \underset{0}{2Na^+} + \underset{0}{CO_3^{2-}}$$

$0.955 \;.\; 0.955 \quad 2 \times 0.955 \quad 0.955$

$= 1.910 \quad 0.955$

167. In which one of the following species the central atom has type of hybridisation which is not the same as that present in the other three?

(1) $SbCl_5^{2-}$

(2) PCl_5

(3) SF_4

(4) I_3

Ans. **(1)**

$SbCl_5^{2-}$ is $sp3d^2$ hybridised and rest three are sp^3d hybridised

168. Which one of the following species does not exist under normal conditions?

(1) B_2

(2) Li_2

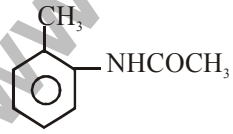
(3) Be_2^+

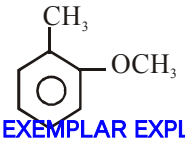
(4) Be_2

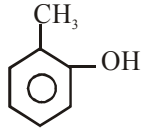
Ans. **(4)**

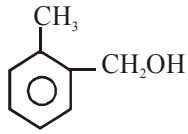
Bond order of Be_2 = 0; so under normal condition it does not exist

169. Which one is most reactive towards electrophilic reagent?

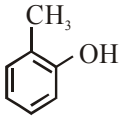
(1) 

(2) 

(3) 

(4) 

Ans. **(3)**

 most activating.

170. For the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ the value of rate of disappearance of N_2O_5 is given as 6.25×10^{-3} mol L^{-1}s^{-1}. The rate of formation of NO_2 and O_2 is given respectively as

(1) 6.25×10^{-3} mol L^{-1}s^{-1} and 3.125×10^{-3} mol L^{-1}s^{-1}

(2) 1.25×10^{-2} mol L^{-1}s^{-1} and 6.25×10^{-3} mol L^{-1}s^{-1}

(3) 6.25×10^{-3} mol L^{-1}s^{-1} and 6.25×10^{-3} mol L^{-1}s^{-1}

(4) 1.25×10^{-2} mol L^{-1}s^{-1} and 3.125×10^{-3} mol L^{-1}s^{-1}

Ans. **(4)**

$$\frac{-d[N_2O_5]}{dt} = \frac{1}{2}\frac{d[NO_2]}{dt} = \frac{2d(\sigma_2)}{dt}$$

$$\frac{d(N_2O_5)}{dt} = 6.25 \times 10^{-3}$$

$$\frac{d(NO_2)}{dt} = 2 \times 6.25 \times 10^{-3} = 1.25 \times 10^{-2}$$

$$\frac{d[O_2]}{dt} = \frac{1}{2} \times 6.25 \times 10^{-3} = 3.125 \times 10^{-3}$$

171. The correct order of the decreasing ionic radii among the following isoelectronic species is

(1) $S^{2-} > Cl^- > K^+ > Ca^{2+}$

(2) $K^+ > Ca^{2+} > Cl^- > S^{2-}$

(3) $Ca^{2+} > K^+ > S^{2-} > Cl^-$

(4) $Cl^- > S^{2-} > Ca^{2+} > K^+$

Ans. **(1)**

$S^{2-} > Cl^- > K^+ > Ca^{2+}$

172. AB crystallizes in a body centred cubic lattice with edge length ‘a’ equal to 387 pm. The distance between two appositively charged ions in the lattice is

(1) 200 pm
(2) 300 pm
(3) 335 pm
(4) 250 pm

Ans. **(3)**

$$r^+ + r^- = \frac{\sqrt{3}a}{2} = \frac{1.732 \times 387}{2} = 335 \text{ pm}$$

173. Which of the following ions will exhibit colour in aqueous solutions?

(1) Lu^{3+} (z = 71)
(2) Sc^{3+} (z = 21)
(3) La^{3+} (z = 57)
(4) Ti^{3+} (z = 22)

Ans. **(4)**

174. That is $[H^+]$ in mol/L of a solution that is 0.20 M in CH_3COONa and 0.10 M in CH_3COOH? a for $CH_3COOH = 1.8 \times 10^{-5}$

(1) 1.8×10^{-5}
(2) 9.0×10^{-6}
(3) 3.5×10^{-4}
(4) 1.1×10^{-5}

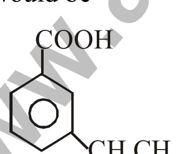
Ans. **(2)**

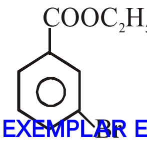
$$pH = pKa + \log\frac{(salt)}{[Acid]} = 4.74 + \log\frac{0.2}{0.1} = 4.74 + 0.3 = 5.04$$

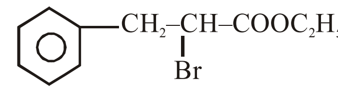
$$[H^+] = 9 \times 10^{-6}$$

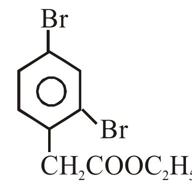
175. In a set of reactions, ethyl benzene yielded a product D

‘D’ would be

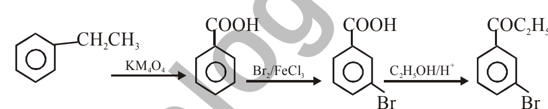
(1) 

(2) 

(3) 

(4) 

Ans. **(2)**



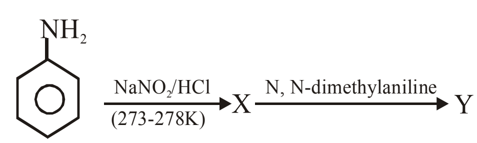
176. Which one of the following compounds is a peroxide?

(1) MnO_2
(2) NO_2
(3) KO_2
(4) BaO_2

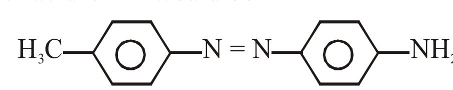
Ans. **(4)**

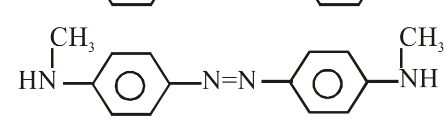
BaO_2

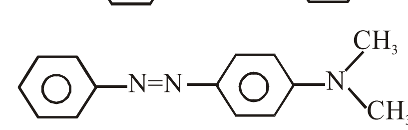
177. Amiline in a set of the following reactions yielded a coloured product ‘Y’

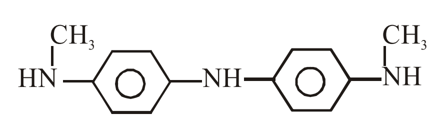


The structure ‘Y’ would be

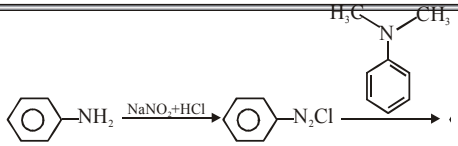
(1) 

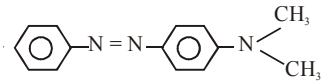
(2) 

(3) 

(4) 

Ans. **(3)**



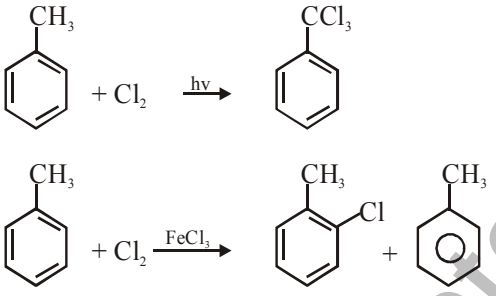


178. Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is
(1) $CH_3COOCOCH_3$
(2) CH_3COCl
(3) CH_3COOCH_3
(4) CH_3CONH_2

Ans. **(2)**

179. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light given 'Y'. Thus, 'X' 'X' and 'Y' are
(1) Y = o-and p-chlorotoluene, Y = Trichloromethyl benzene
(2) X = Benzyl chloride, Y = m - chlorotoluene
(3) X = Benzal chloride, Y = 0-chlorotoluene
(4) X = m - chlorotoluene, Y= p - chlorotoluene

Ans. **(1)**



180. Which one of the following is employed as Tranquilizer drug?
(1) Naproxen
(2) Mifepristone
(3) Promethazine
(4) Valium

Ans. **(4)**
Valium

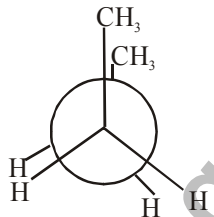
181. Which one of the following molecular hydrides acts as a Lewis acid?
(1) B_2H_6
(2) CH_4
(3) NH_3
(4) H_2O

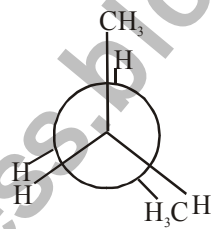
Ans. **(1)**
B_2H_6 is Lewis acid

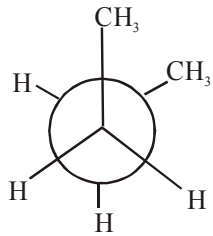
182. The number of atoms in 0.1 mol of a triatomic gas is : ($N_A = 6.02 \times 10^{23}$ mol^{-1})
(1) 3.600×10^{23}
(2) 1.800×10^{22}
(3) 6.026×10^{23}
(4) 1.806×10^{23}

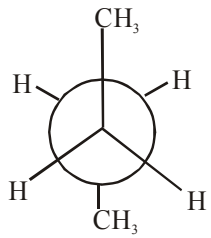
Ans. **(4)**
No. of atoms = $0.1 \times 6.02 \times 10^{23} \times 3$
$= 1.806 \times 10^{23}$

183. In the following the most stable conformation of a-butane is

(1) 

(2) 

(3) 

(4) 

Ans. **(4)**
Anti conformation is most stable

184. Acetamide is treated with the following reagents separately. Which one of these would yield methyl amine?
(1) Hot conc. H_2SO_4
(2) PCl_5

(3) $NaOH-Br_2$
(4) Sodalime

Ans. **(3)**

Hoffmann Bromamide reaction.

185. The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^+$ is due to

(1) Coordination isomerism
(2) Ionization isomerism
(3) Linkage isomerism
(4) Geometrical isomerism

Ans. **(4)**

Due to ionisation isomerism.

186. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?

(1) $BaSO_4$
(2) $SrSO_4$
(3) $CaSO_4$
(4) $BeSO_4$

Ans. **(4)**

$BeSO_4$

187. For the reduction of silver ions with copper metal the standard cell potential was found be +0.46 V at 25°C. The value of standard Gibbs energy, $\Delta G°$ will ($F = 96500\ C\ mol^{-1}$)

(1) –44.5 kJ
(2) –98.0 kJ
(3) –89.0 kJ
(4) –89.0 J

Ans. **(3)**

$= -2 \times 96500 \times 0.46 = -88.78 = -89$ kJ

188. A solution of sucrose (molar mass =342 g mol^{-1} has been prepared by dissolving 68.5 g of sucrose in 1000 g of water. The freezing point of the solution obtained will be (K_f for water = 1.86 K kg mol^{-1})

(1) +0.372°C
(2) –0.570°C
(3) –0.372°C
(4) +0.520°C

Ans. **(3)**

$$\Delta T_f = kf.m = 1.86 \times \frac{68.5}{342 \times 100} \times 1000$$

$$= 0.372$$

$$T_f = 0 - 0.372 = -0.372°C$$

189. Liquid hydrocarbons can be converted to a mixture of gaseous hydrocarbons by

(1) Distillation under reduced pressure
(2) Hydrolysis
(3) Oxidation
(4) Cracking

Ans. **(4)**

190. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to

(1) Increase in both i.e. number of ions and ionic ability of ions
(2) Increase in number of ions
(3) Increase in ionic mobility of ions
(4) 100% ionisation of electrolyte at normal dilution

Ans. **(2)**

Increase is due to increase in no. of ions.

191. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution of increase?

(1) Addition of 1.00 molal KI
(2) Addition of water
(3) Addition of NaCl
(4) Addition of Na_2SO_4

Ans. **(2)**

Addition of water came the increase in vapour presence

192. The correct order of increasing bond angles in the following species is

(1) $Cl_2O < ClO_2^- < ClO_2$
(2) $ClO_2^- < Cl_2O < ClO_2$
(3) $Cl_2O < ClO_2 < ClO_2^-$
(4) $ClO_2 < Cl_2O < ClO_2^-$

Ans. **(2)**

193. In which of the following equilibrium K_c and K_p are not equal

(1) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$
(2) $2C_{(s)} + O_2(g) \rightleftharpoons 2CO_{2(g)}$
(3) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
(4) $SO_{2(g)} + NO_{2(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$

Ans. **(2)**

$\Delta n_g \neq 0$ for $2C(s) + O_2(g) \rightleftharpoons 2CO_2(g)$

194. The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence

(1) $BBr_3 > BF_3 > BCl_3$
(2) $BF_3 > BCl_3 > BBr_3$
(3) $BCl_3 > BF_3 > BBr_3$

(4) $BBr_3 > BCl_3 > BF_3$

Ans. (4)

$BBr_3 > BCl_3 > BF_3$: due to $p\pi - p\pi$ back bonding.

195. Which of the following reactions will not result in the formation of carbon-carbon bonds?

(1) Wurtz reaction
(2) Friedel-Crafts acylation
(3) Reimer-Tieman reaction
(4) Cannizaro reaction

Ans. (4)

In Cannizaro's reaction no new C–C bond is formed.

196. Which of the following pairs has the same size?

(1) Zr^{4+}, Hf^{4+}

(2) $Zn^{2+}; Hf^{4+}$

(3) Fe^{2+}, Ni^{2+}

(4) $Zr^{4+}; Ti^{4+}$

Ans. (1)

197. In a buffer solution containing equal concentration of B^- and HB, the K_b for B^- is 10^{-10}. The pH of buffer solution is

(1) 6
(2) 4
(3) 10
(4) 7

Ans. (2)

$$pOH = pKb + \log\frac{[salt]}{[base]}$$

$$pOH = 10 + \log 1$$

$$pH = 4$$

198. Which of the following represents the correct order of electron affinity with negative sign for the elements O, S, F and Cl?

(1) F < S < O < Cl
(2) S < O < Cl < F
(3) Cl < F < O < S
(4) O < S < F < Cl

Ans. (4)

O < S < F < Cl

199. Crystal field stabilization energy for high spin d^4 octahedral complex is

(1) $-1.2\ \Delta_0$
(2) $-0.6\ \Delta_0$

(3) $-1.8\ \Delta_0$
(4) $-1.6\ \Delta_0 + P$

Ans. (2)

$$CFSE = -\frac{3}{5}\Delta_0 = -0.6\Delta_0$$

200. Given are cyclohexanol (I), acetic acid (II), 2, 4, 6-trinitrophenol (III) and phenol (IV). In these the order of decreasing acidic character will be

(1) II > III > IV > I
(2) III > IV > II > I
(3) III > II > IV > I
(4) II > III > I > IV

Ans. (3)

III > II > IV > I

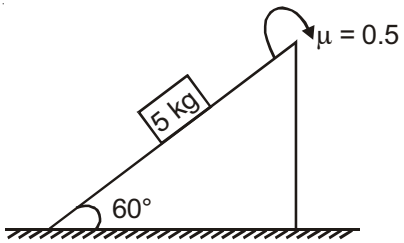
Choose the correct answer :

1. A body falls from a height of 120 m. After 2 s of fall, if gravity disappears then total time taken to reach the ground is (g = 10 m/s^2)

   (1) 9 s (2) 5 s

   (3) 7 s (4) 10 s

2. A block of mass 5 kg is placed on an inclined plane as shown in the figure. Force applied by incline plane on the block is (g = 9.8 m/s^2)



   (1) 25 N (2) 49 N

   (3) $25\sqrt{3}$ N (4) $\frac{25}{\sqrt{3}}$ N

3. Select correct statement(s) regarding collision.

   (1) During collision momentum of a colliding body is conserved along line of impact

   (2) During collision momentum of a colliding body is not conserved along a line perpendicular to line of impact

   (3) Momentum of a body along line perpendicular to line of impact is conserved

   (4) Momentum of a colliding body is not conserved along any time

4. If a force $\vec{F}$ acting on a body at a position $\vec{r}$ produces a torque $\vec{\tau}$ about origin, then choose the incorrect option

   (1) $\vec{\tau} = \vec{r} \times \vec{F}$ (2) $\vec{r}.\vec{\tau} \neq 0$

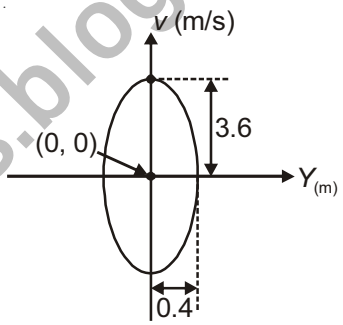
   (3) $\vec{\tau}.\vec{r} = 0$ (4) $\vec{\tau}.\vec{F} = 0$

5. When a weight of 10 kg is suspended from a copper wire of length 3 m and diameter 0.4 mm, its length increases by 2.4 cm. If the diameter of wire is doubled then extension in the length will be

   (1) 1.2 cm (2) 4.8 cm

   (3) 9.6 cm (4) 0.6 cm

6. Velocity of a particle is plotted against displacement as shown. The time period of oscillation



   (1) 2π s (2) π s

   (3) $\frac{2\pi}{3}$ s (4) $\frac{2\pi}{9}$ s

7. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg first part moving with velocity 12 ms^{-1} and 2 kg, second part moving with velocity of 8 ms^{-1}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be

   (1) 14 kg (2) 3 kg

   (3) 5 kg (4) 8 kg

8. In a gravity free space the liquid in a capillary tube will rise to

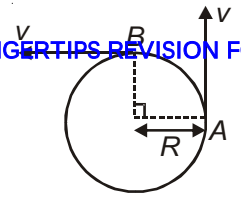
   (1) Slightly more height as on earth

   (2) Height equal to capillary outside liquid

   (3) Same height as on earth

   (4) Less height as on earth

9. In the figure shown find the average force on the particle between A and B (mass = m)



(1) $\frac{mv^2}{\sqrt{2}\pi R}$ (2) $\frac{2mv^2}{\pi R}$

(3) $\frac{2\sqrt{2}\,mv^2}{\pi R}$ (4) $\frac{\sqrt{2}\,mv^2}{\pi R}$

10. Star x emits maximum radiation of wavelength 4000 Å and star y emits maximum radiation of wavelength 8000 Å, then ratio of temperature of two stars is

(1) 2^3 (2) 2^4

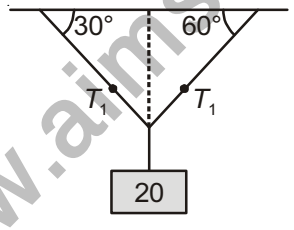
(3) 2^2 (4) 2

11. The separation between a node and next antinode in the vibrating air column is 25 cm. If speed of sound in air is 340 ms^{-1}, then frequency of vibration is

(1) 340 Hz (2) 300 Hz

(3) 330 Hz (4) 350 Hz

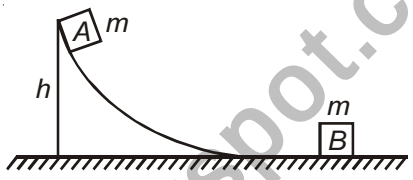
12. A block of mass 20 kg shown in the figure is in equilibrium. If strings are ideal, then ratio of tension developed in strings, is



(1) $\frac{T_1}{T_2}=\frac{1}{3}$ (2) $\frac{T_1}{T_2}=3$

(3) $\frac{T_1}{T_2}=\sqrt{3}$ (4) $\frac{T_1}{T_2}=\frac{1}{\sqrt{3}}$

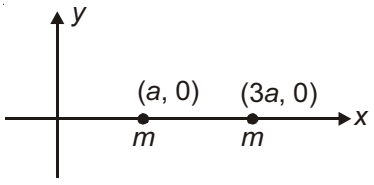
13. In the figure shown, the block A of mass m is released from the top of a frictionless wedge (which is fixed to the ground). Block A slides down the wedge and undergoes an elastic head on collision with block B. Ignore friction everywhere. The speed of B just after collision is



(1) $\sqrt{\frac{gh}{2}}$ (2) $\sqrt{8gh}$

(3) $\sqrt{2gh}$ (4) $\sqrt{gh}$

14. Two particle each of mass m are situated at x axis as shown in the figure. Moment of inertia of the system about an axis passing through their centre of mass and parallel to y-axis is



(1) ma^2 (2) $\frac{ma^2}{2}$

(3) $2ma^2$ (4) $3ma^2$

15. Two masses m and $4m$ are kept r distance apart. If $4m$ mass experiences $16F$ force due to mass m, then the force experienced by mass m due to $4m$ mass is

(1) $4F$ (2) F

(3) $16F$ (4) $\frac{F}{4}$

16. Which of the following statement is in accordance with Kirchhoff's law of thermal radiation?

(1) A good emitter is also a good absorber

(2) The rate of radiation depends on the fourth power of absolute temperature

(3) All bodies radiates as well as absorb thermal radiation at all temperatures except 0 K

(4) The wavelength corresponding to maximum intensity in thermal radiation decreases with increase in temperature

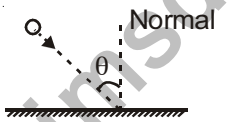
17. An object is moving toward east with speed 5 m/s. After t = 5 s, it is found to be moving towards north with speed 5 m/s, then average acceleration is

(1) $\frac{1}{\sqrt{2}}$ ms^{-2} N - W (2) $\sqrt{2}$ ms^{-2} N - W

(3) $\sqrt{2}$ ms^{-2} N - E (4) $\frac{1}{\sqrt{2}}$ ms^{-2} N - E

18. A ball strikes at an angle of incidence θ on a plane as shown in the figure. If it rebounds at right angle to the direction of incidence then value of θ is

[Take Coefficient of restitution = $\frac{1}{3}$]



(1) 60° (2) 53°

(3) 30° (4) 45°

19. A flywheel of mass 50 kg is rotating with angular speed 5 rad s^{-1}. If radius of gyration of the wheel is 2 m then its angular momentum will be

(1) 1000 kgm^{2}s^{-1} (2) 500 kgm^{2}s^{-1}

(3) 2000 kgm^{2}s^{-1} (4) 200 kgm^{2}s^{-1}

20. Eight identical spherical drops are falling a homogenous viscous medium with constant velocity 4 m/s. If all combines to form a single big drop, then the terminal velocity of big drop will be

(1) 8 m/s (2) 12 m/s

(3) 16 m/s (4) 24 m/s

21. Relation between time (t) and position (x) of a particle moving along x-axis is $t = ax^2 + bx$, where a and b are constants. Acceleration of the particle is

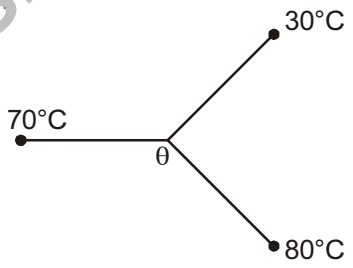
(1) $-2abv^2$

(2) $2bv^3$

(3) $-2av^3$

(4) $2av^2$

22. Three identical conductors are connected as shown. The temperature θ is



(1) 40°C

(2) 50°C

(3) 60°C

(4) 70°C

23. The minimum time in which a particle performing S.H.M can travel distance equal to one amplitude.

(1) $\frac{T}{2}$

(2) $\frac{T}{4}$

(3) $\frac{T}{6}$

(4) $\frac{T}{3}$

24. How many unpaired electrons are present in Mn?

(1) 6 (2) 7

(3) 4 (4) 5

25. The mixture of urea and naphthalene can be separated by

(1) Filtration (2) Distillation

(3) Chromatography (4) Sublimation

26. $CH_3 - CH = CH - CH_3 + Br_2 \longrightarrow CH_3 - \underset{\underset{Br}{|}}{CH} - \underset{\underset{Br}{|}}{CH} - CH_3$

is a/an

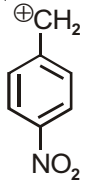
(1) Substitution reaction

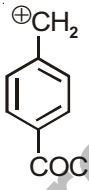
(2) Elimination reaction

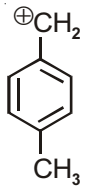
(3) Electrophilic addition reaction

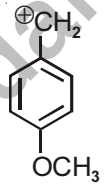
(4) Nucleophilic addition reaction

27. Which of the following is least stable carbocation?

(1) 

(2) 

(3) 

(4) 

28. pH of acid rain is

(1) 7.0 (2) 8.0

(3) 5.6 (4) 6.5

29. Total number of spectral lines present in visible region during transition from 2nd excited state to 5th excited state in hydrogen atom is

(1) 2 (2) 6

(3) Zero (4) 1

30. Which of the following relationship is correct?

(1) $K_c = K_p(RT)^{\Delta n_g}$

(2) $K_c = K_p + (RT)^{\Delta n_g}$

(3) $K_p = K_c(RT)^{\Delta n_g}$

(4) $K_p = K_c; \Delta n_g \neq 0$

31. Solubility product (K_{sp}) of $BaSO_4$ is correctly given by (where S = solubility)

(1) $K_{sp} = 27S^4$ (2) $K_{sp} = 108S^5$

(3) $K_{sp} = S^2$ (4) $K_{sp} = 4S^3$

32. Which is mismatched regarding isomerism mentioned?

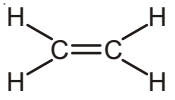
(1) Isopentane and Neopentane → Chain isomers

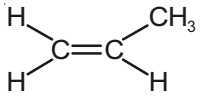
(2) $C_2H_5OC_2H_5$ and $CH_3OCH_2CH_2CH_3$ → Metamers

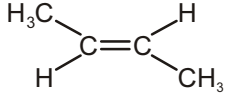
(3) $CH_3CH_2CH_2CH_2COOH$ and $CH_3CH_2COOC_2H_5$ → Functional isomers

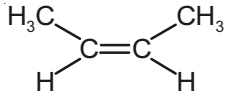
(4) 3° butanol and Isobutanol → Chain isomer

33. Which of the following alkene is the most stable?

(1) 

(2) 

(3) 

(4) 

34. The n-factor of $K_2Cr_2O_7$ in acidic medium is

$Cr_2O_7^{2-} + 14H^+ + \underset{\text{x (n-factor)}}{\underline{\quad\quad}} e^{\ominus} \longrightarrow 2Cr^{3+} + 7H_2O$

(1) 5 (2) 6

(3) 2 (4) 4

35. Which of the following given set of quantum numbers is incorrect?

(1) $n = 1,\ l = 0,\ m = -1,\ s = -\frac{1}{2}$

(2) $n = 4,\ l = 3,\ m = -4,\ s = +\frac{1}{2}$

(3) $n = 2,\ l = 2,\ m = 0,\ s = -\frac{1}{2}$

(4) All of these

36. Cerium (Z = 58) is placed in

(1) d-block, 7th period (2) f-block, 6th period

(3) d-block, 5th period (4) d-block, 6th period

37. The bond energies of H—H, Br—Br & HBr are 433, 192 & 365 kJ/mol respectively. The ΔH for the reaction, $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$ is

(1) + 26 kJ (2) – 105 kJ

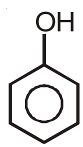
(3) – 26 kJ (4) + 105 kJ

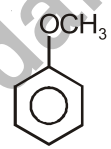
38. Hardness of water is because of the presence of

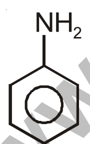
(1) $Mg(HCO_3)_2$ (2) $CaCl_2$

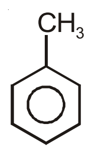
(3) $CaSO_4$ (4) All of these

39. For the following compounds

A. 

B. 

C. 

D. 

Correct order for rate of electrophilic substitution reaction is

(1) B > A > D > C (2) C > A > B > D

(3) D > B > A > C (4) B > A > C > D

40. Hybridisation of N in NH_3 is

(1) sp^3 (2) sp^2

(3) sp (4) Both sp^3 and sp^2

41. The hybridisation and shape of XeF_2 respectively are

(1) sp^3d, angular (2) sp, linear

(3) sp^3d^2, angular (4) sp^3d, non-planar

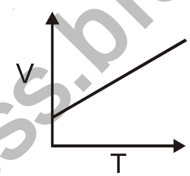
42. The planar structure is shown by

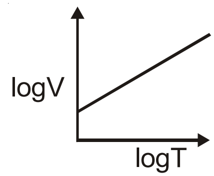
(1) CO_3^{2-} (2) BCl_3

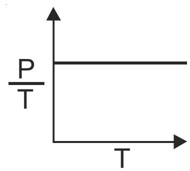
(3) $N(SiH_3)$ (4) All of these

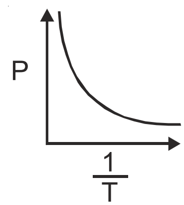
43. Correct graph for Charles' law

V = Volume, T = temperature in Kelvin.

(1) 

(2) 

(3) 

(4) 

44. $CH_3C \equiv CH \xrightarrow[H_2O,\Delta]{HgSO_4/H_2SO_4} \underset{\text{(Final)}}{X}$.

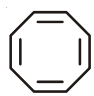
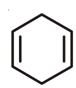
The product X is

(1) CH_3CH_2COOH (2) $CH_2{=}CH.OH$

(3) CH_3COOH (4) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

45. In which of the following glyoxal is not the only product of reductive ozonolysis?

(1)  (2) 

(3)  (4) 

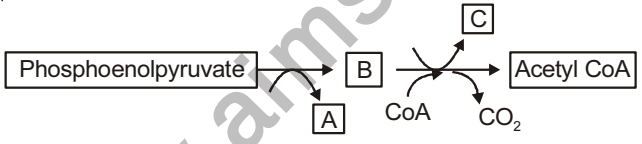
46. The organelle concerned with photorespiration is
(1) Lysosomes (2) Sphaerosomes
(3) Peroxisome (4) Centrosome

47. The most dramatic period of the cell cycle involves
(1) A major reorganisation of virtually all components of the cell
(2) Replication of DNA
(3) Duplication of most organelle
(4) Synthesis of tubulin proteins

48. The lens shaped opening, which occur in most woody trees and permit exchange of gases between atmosphere and internal tissue of stem is
(1) Stomata (2) Lenticels
(3) Bulliform cells (4) Bark

49. The phytohormone which stimulates the closure of stomata is
(1) Ripening hormone (2) Stress hormone
(3) Adenine derivative (4) Terpene derivative

50. Identify the A, B and C in the given reaction of respiration



	A	B	C
(1)	ADP + Pi	PGA	FADH
(2)	ATP	Citrate	NADH
(3)	NADH	Pyruvic acid	NADPH
(4)	ATP	Pyruvic acid	NADH

51. Which of the following is vascular archegoniates?
(1) *Pea* (2) *Marchantia*
(3) *Cycas* (4) *Ectocarpus*

52. The lowest category in taxonomic hierarchy is
(1) Genus (2) Species
(3) Class (4) Order

53. In biological N_2-fixation mechanism, to fix one molecular nitrogen into two molecules of ammonia, the number of electrons, protons and ATP required are respectively
(1) $6e^-$, $6H^+$, 12 ATP (2) $8e^-$, $8H^+$, 16 ATP
(3) $16e^-$, $16H^+$, 32 ATP (4) $12e^-$, $12H^+$, 24 ATP

54. The feature present in plant cell but absent in animal cell is
(1) Presence of membrane bound organelles
(2) Presence of rigid cell wall
(3) Absence of plastid
(4) Presence of centrosome

55. Proteinaceous endosperm layer in monocot seed is known as
(1) Aleurone layer (2) Scutellum
(3) Hilum (4) Storage region

56. Read the following statement carefully

"The organisms belonging to the same taxa have a common ancestor."

This statement is related to
(1) Artificial system of classification
(2) Natural system of classification
(3) Both (1) & (2)
(4) Phylogenetic system of classification

57. Whorled type of phyllotaxy found in
(1) China rose (2) Calotropis
(3) Guava (4) Alstonia

58. Ovary is half inferior in

(1) Hypogynous flower – Rose

(2) Perigynous flower – Guava

(3) Epigynous flower – Cucumber

(4) Perigynous flower – Plum

59. Cristae increases surface area and is present in

(1) Golgi bodies (2) Mitochondria

(3) ER (4) Chloroplast

60. Which of the following nitrogen metabolism microbe is not a chemoautotrophs?

(1) *Nitrococcus* (2) *Nitrosomonas*

(3) *Rhizobium* (4) *Nitrobacter*

61. Which of the following statement is correct?

(1) Conjoint open vascular bundles are common in stem and leaves

(2) All tissues on the innerside of the endodermis except pericycle constitute the stele

(3) There may be no variation in the length of filaments within a flower, as in *Salvia* and mustard

(4) Secondary meristems are derived from primary permanent tissues

62. Find the **correct** match w.r.t. mineral elements and their function

(1) Potassium – Opening and closing of stomata

(2) Sulphur – Carbohydrate translocation

(3) Zinc – Synthesis of chlorophyll

(4) Magnesium – Water splitting reactions

63. Which of the following is most obvious and technically complicated defining feature of life forms?

(1) Consciousness (2) Reproduction

(3) Metabolism (4) Growth

64. In which of the following pair of plants zygotic meiosis occurs?

(1) *Ulothrix* and *Pinus*

(2) *Ectocarpus* and *Spirogyra*

(3) *Anthoceros* and *Selaginella*

(4) *Volvox* and *Chlamydomonas*

65. The cell membrane of erythrocyte has approximately _____ percent protein and _____ percent lipids.

(1) 50, 50 (2) 40, 52

(3) 52, 40 (4) 40, 60

66. Which of the following are excluded from five kingdom system of classification?

(1) Mycoplasma (2) *Chlamydomonas*

(3) Slime moulds (4) Viroids

67. Kranz anatomy referes to

(1) Arrangement of cells in leaves of C_4 plants

(2) Arrangement of cells in leaves of C_3 plants

(3) Thin walled bundle sheath cell forming wreath

(4) Thick walled mesophyll cell with intercellular spaces

68. Swelling of wood in water is an example of

(1) Active absorption (2) Imbibition

(3) Exosmosis (4) Deplasmolysis

69. During urine formation, in which part of nephron, minimum reabsorption takes place

(1) DCT (2) PCT

(3) Glomerulus (4) Loop of Henle

70. Rapid spasm in muscle due to low Ca^{++} in body fluid occurs in

(1) Arthritis

(2) Muscular dystrophy

(3) *Myasthenia gravis*

(4) Tetany

71. Which of the muscle is under the control of autonomic nervous system?

(1) Skeletal muscle (2) Smooth muscle

(3) Cardiac muscle (4) Both (2) & (3)

72. Acromion process is the part of

(1) Clavicle (2) Humerus

(3) Scapula (4) Radius

73. Which of the following coelentrates exist in polyp and medusa forms and exhibit metagenesis?

(1) *Hydra* (2) *Obelia*

(3) *Aurelia* (4) Both (2) & (3)

74. Which of the following has been **correctly** matched?

(1) Bilateral symmetry : Ctenophora

(2) Eucoelomate : Aschelminthes

(3) Acoelomate : Platyhelminthes

(4) Schizocoelomate : Echinodermata

75. Enzyme carbonic anhydrase helps in

(1) Binding of O_2 and haemoglobin

(2) Transportation of O_2

(3) Binding of CO_2 and haemoglobin

(4) Transportation of CO_2

76. Which type of epithelium is found in ducts of glands and tubular part of nephrons in kidneys?

(1) Squamous epithelium

(2) Cuboidal epithelium

(3) Columnar epithelium

(4) Ciliated epithelium

77. In which of the following animal, both notochord and vertebral column is absent?

(1) *Doliolum* (2) *Branchiostoma*

(3) *Petromyzon* (4) *Scoliodon*

78. Adult haemoglobin has

(1) Primary structure of protein

(2) Secondary structure of protein

(3) Tertiary structure of protein

(4) Quaternary structure of protein

79. In *Periplaneta*, a pair of jointed, filamentous structures are present called anal cerci which arise from

(1) 9^{th} sternum in male only

(2) 10^{th} tergum in both male and female

(3) 9^{th} tergum in male only

(4) 9^{th} sternum in both male and female

80. Which of the following is brush border enzyme?

(1) Carboxypeptidase (2) Amylase

(3) Maltase (4) Nuclease

81. Amount of air left in lungs after normal expiration

(1) TV + ERV (2) TV + IRV

(3) TV + IRV + ERV (4) ERV + RV

82. A symptom of acute chest pain appears when no enough oxygen is reaching the heart muscle

(1) Heart failure (2) Heart attack

(3) Atherosclerosis (4) Angina

83. Tubular secretion is an important step in urine formation. In PCT their is selective secretion of

(1) H^+ (2) K^+

(3) NH_3 (4) All of these

84. Which of the following is a characteristic feature of red muscle fibres?

(1) More quantity of myoglobin

(2) Number of mitochondria are less

(3) Amount of sarcoplasmic reticulum is more

(4) Depend on anaerobic process for energy

85. Which of the following part of brain consists of fibre tract that interconnect different regions of the brain?

(1) Corpus callosum (2) Pons

(3) Cerebellum (4) Medulla

86. Which of the following structure of human ear helps in equalising the pressures on either sides of ear drum?

(1) Ear ossicles (2) Tympanic membrane
(3) Eustachian tube (4) Vestibular apparatus

87. Enzymes which catalyse linking of C–O, C–S, C–N, P–O etc bonds, belong to which of the following category?

(1) Isomerase (2) Ligases
(3) Lyases (4) Transferases

88. Choose the correct sequence of layer in the wall of alimentary canal from inside to outside

(1) Submucosa, serosa, muscularis and mucosa
(2) Muscularis, serosa, submucosa and mucosa
(3) Mucosa, muscularis, submucosa and serosa
(4) Mucosa, submucosa, muscularis and serosa

89. Which of the following does not excrete nitrogenous wastes as uric acid?

(1) *Columba*
(2) *Chelone*
(3) *Apis*
(4) *Prawn*

90. Given below is a list of some hormone

(a) Cortisol
(b) Insulin
(c) Adrenaline
(d) PRL

How many of the given hormones have extracellular receptor?

(1) One (2) Two
(3) Three (4) Four

❑ ❑ ❑

(Sample Paper)

(XII-cum-Medical Course for AIPMT - 2015)

Answers

1.	(3)	19.	(1)	37.	(2)	55.	(1)	73.	(2)
2.	(2)	20.	(3)	38.	(4)	56.	(4)	74.	(3)
3.	(3)	21.	(3)	39.	(2)	57.	(4)	75.	(4)
4.	(2)	22.	(3)	40.	(1)	58.	(4)	76.	(2)
5.	(4)	23.	(3)	41.	(4)	59.	(2)	77.	(1)
6.	(4)	24.	(4)	42.	(4)	60.	(3)	78.	(4)
7.	(3)	25.	(4)	43.	(2)	61.	(4)	79.	(2)
8.	(2)	26.	(3)	44.	(4)	62.	(1)	80.	(3)
9.	(3)	27.	(1)	45.	(4)	63.	(1)	81.	(4)
10.	(4)	28.	(3)	46.	(3)	64.	(4)	82.	(4)
11.	(1)	29.	(3)	47.	(1)	65.	(3)	83.	(4)
12.	(4)	30.	(3)	48.	(2)	66.	(4)	84.	(1)
13.	(3)	31.	(3)	49.	(2)	67.	(1)	85.	(2)
14.	(3)	32.	(4)	50.	(4)	68.	(2)	86.	(3)
15.	(3)	33.	(3)	51.	(3)	69.	(4)	87.	(2)
16.	(1)	34.	(2)	52.	(2)	70.	(4)	88.	(4)
17.	(2)	35.	(4)	53.	(2)	71.	(4)	89.	(4)
18.	(3)	36.	(2)	54.	(2)	72.	(3)	90.	(3)

Q. 1. Biological organisation starts with:

a. Atomic level
b. Submicroscopic molecular level
c. Cellular level
d. Organismic level

Sol. Correct choice: (2)

Q. 2. About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and:

a. calcium and phosphorous
b. phosphorus and sulphur
c. sulphur and magnesium
d. magnesium and sodium

Sol. Correct choice: (1)

Q. 3. Which one of the following is an example of negative feed back loop in humans?

a. Secretion of sweat glands and constriction of skin blood vessels when it is too hot.
b. Constriction of skin blood vessels and contraction of skeletal muscles when it is too cold.
c. Secretion of tears after falling of sand particles in to the eye
d. Salivation of mouth at the sight of delicious food.

Sol. When the set point of hypothalamus is disturbed by high temperature, it stimulates vasodilation and sweating while in low temperature there is vasoconstriction and shivering. Correct choice: (2)

Q. 4. What is common to whale, seal and shark?

a. Homoiothermy
b. Seasonal migration]

c. Thick subcutaneous fat
d. Convergent evolution

Sol. Shark is poikilothermous. All three species show adaptations for aquatic life while these are not closely related. Correct choice: (4)

Q. 5. Which one of the following is not a constituent of cell membrane?

a. Phospholipids
b. Cholesterol
c. Glycolipids
d. Proline

Sol. Correct choice: (4)

Q. 6. Select the wrong statement from the following:

a. The chloroplasts are generally much larger than mitochondria.
b. Both chloroplasts and mitochondria contain and inner and an outer membrane
c. Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane
d. Both chloroplasts and mitochondria contain DNA.

Sol. Correct choice: (3)

Q. 7. The overall goal of glycolysis, Krebs cycle and the electron transport system is the formation of:

a. Nucleic acids
b. ATP is small stepwise units
c. ATP in one large oxidation reaction
d. Sugars

Sol. Correct choice: (2)

Q. 8. If the mean and the median pertaining to a certain character of a population are of the same value, the following is most likely to occur:

a. a skewed curve
b. a normal distribution
c. a bi-modal distribution
d. a T -shaped curve

Sol. Correct choice: (2)

Q. 9. Which one of the following is a slime mould?

a. Anabaena
b. Rhizopus
c. Physarum
d. Thiobacillus

Sol. Physarum is an acellular slime mould. Correct choice: (3)

Q.10. For a critical study of secondary growth in plants, which one of the following pairs is suitable?

a. Wheat and maiden hair fern
b. Sugarcane and sunflower
c. Teak and pine
d. Deodar and fern

Sol. Secondary growth occurs in gymnosperms and dicots. Correct choice: (3)

Q.11. Which one of the following statements about Mycoplasma is wrong?

a. They cause disease in plants
b. They are also called PPLO
c. They are pleomorphic
d. They are sensitive to penicillin

Sol. Mycoplasma is not sensitive to penicillin due to absence of cell wall. Correct choice: (4)

Q.12. In the prothallus of vascular cryptogam, the antherozoids and eggs mature at different times. As a result:

a. self fertilization is prevented
b. there is no change in success rate of fertilization
c. there is high degree of sterility
d. one can conclude that the plant is apomictic

Sol. In vascular cryptogam i.e. in pteridophytes gametophyte is monoecious but protandrous to avoid self fertilization. Correct choice: (1)

Q.13. Two plants can be conclusively said to belong to the same species if they:

a. have same number of chromosomes
b. can reproduce freely with each other and form seeds
c. have more than 90 per cent similar genes
d. look similar and possess identical secondary metabolities.

Sol. The members of a species are inter-fertile and produce fertile offsprings. Correct choice: (2)

Q.14. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?

a. Chemical composition of the cell wall
b. Types of pigments present in the cell
c. Nature of stored food materials in the cell
d. Structural organization of thallus.

Sol. The various algae are classified mainly on the types of pigments present in their cells. Correct choice: (2)

Q.15. Flagellated male gametes are present in all the three of which one of the following sets?

a. Riccia, Dryopteris and Cycas
b. Anthoceros, Funaria and Spirogyra
c. Zygnema, Saprolegnia and Hydrilla
d. Fucus, Marsilea and Calotropis

Sol. The male gametes of bryophytes are biflagellete, and those of pteriodophytes are multiflagellate, except Selaginella having biflagellate gametes. The male gametes of gymnosperms are non motile except those of Cycas having multiciliate gametes. Correct choice: (1)

Q.16. In gymnosperms, the pollen chamber represents:

a. the microsporangium in which pollen grains develop
b. a cell in the pollen grain in which the sperms formed
c. a cavity in the ovule in which pollen grains are stored after pollination
d. an opening in the mega gametophyte through which the pollen tube approaches the egg.

Sol. In gymnosperms, below micropylar beak some of the cells of nucellus of ovule disintigerate to form pollen chamber. Correct choice: (3)

Q.17. Spore dissemination in some liverworts is aided by:

a. peristome teeth
b. elaters
c. indusium
d. calyptra

Sol. In some liverworts like Marchantia spore dispersal is due to hydrochasy and is aided by elaters. Correct choice: (2)

Q.18. Which pair of the following belongs to Basidiomycetes?

a. Morchella and Mushrooms
b. Birds' nest fungi and Pufballs
c. Pufballs and Claviceps
d. Peziza and Stink horns

Sol. Bird's nest fungi – Cyathus, Pufballs – Lycoperdon, Both belong to the class Basidiomycetes. Correct choice: (3)

Q.19. ICBN stands for:

a. Indian Code of Botanical Nomenclature
b. Indian Congress of Biological Names
c. International Code of Botanical Nomenclature
d. International Congress of Biological Names

Sol. ICBN is one of the codes of nomenclature. It stands for International Code of Botanical Nomenclature. Correct choice: (3)

Q. 20. Ergot of rye is caused by a species of:

a. Claviceps
b. Phytophthora
c. Uncinula
d. Ustilago

Sol. Ergot of rye is caused by Claviceps purpurea. Correct choice: (1)

Q. 21. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed:

a. Convergent evolution
b. Divergent evolution
c. Microevolution
d. Co-evolution

Sol. Correct choice: (1)

Q. 22. Adaptive radiation refers to:

a. Power of adaptation in an individual to a variety of environments
b. Adaptations due to Geographical isolation

c. Evolution of different species from a common ancestor
d. Migration of members of a species to different geographical areas

Sol. Correct choice: (3)

Q. 23. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for:

a. growth the movement
b. responsiveness to touch
c. interaction with the environment and progressive evolution
d. reproduction

Sol. Correct choice: (4)

Q. 24. The Finches of Galapogas islands provide an evidence in favour of:

a. Biogeographical Evolution
b. Special Creation
c. Evolution due to Mutation
d. Retrogressive Evolution

Sol. Correct choice: (1)

Q. 25. One of the important consequences of geographical isolation is:

a. Random creation of new species
b. No change in the isolation faunax
c. Preventing Speciation
d. Speciation through reproductive isolation

Sol. Correct choice: (4)

Q. 26. Industrial melanism as observed in peppered moth proves that:

a. Melanism is a pollution-generated feature
b. The true black melanic forms arise by a recurring random mutation
c. The melanic form of the moth has no selective advantage over lighter form in industrial area
d. The lighter-form moth has no selective advantage either in polluted industrial area or non-polluted area.

Sol. It is an example of directional selection. Correct choice: (2)

Q. 27. The concept of chemical evolution is based on:

a. Possible origin of life by combination of chemicals
b. Crystallization of chemicals under suitable environmental conditions
c. Interaction of water, air and clay under
d. Effect of solar radiation of chemicals

Sol. Correct choice: (1)

Q. 28. Among the human ancestors the brain size was more than 1000 CC in:

a. Homo habilis
b. Homo neanderthalensis
c. Homo erectus
d. Ramapithecus

Sol. Homo habilis had a cranial capacity in the range of 680-720 c.c. & that of
Homo erectus erectus 775-990 c.c,
Homo erectus pekinensis 915-1200 c.c.
Homo neanderthalensis 1300-1600 c.c. Correct choice:

Q. 29. Which of the following pairs are correctly matched?

a. Crocodile - 4-Chambered heart
b. Sea Urchin - Parapodia
c. Obelia – Metagenesis
d. Lemur – Thecodont

(1) Only A and B
(2) A, C and D
(3) B, C and D
(4) Only A and D

Sol. Correct choice: (2)

Q. 30. Select the correct statement from the following:

a. Mutations are random and directional
b. Darwinian variations are small and directionless
c. Fitness is the end result of the ability to adapt and gets selected by nature
d. All mammals except whales and camels have seven cervical vertebrate.

Sol. It explains natural selection. Correct choice: (3)

Q. 31. Which one of the following is a matching pair of a body feature and the animal possessing it?

a. Ventral heart - Scorpion
b. Post-anal tail - Octopus
c. Ventral Central nervous system – Leech
d. Pharyngeal gill slits absent in embryo – Chamaeleon

Sol. Scorpion has dorsal heart. Post-anal tail is found only in chordates. Pharyngeal gill slits are present in the embryo of chameleon. Correct choice: (3)

Q. 32. What is common between parrot, platypus and kangaroo?

a. Ovoparity
b. Homoiothermy
c. Toothless jaws
d. Functional post -anal tail

Sol. Only birds & mammals are homoiothermous. Correct choice: (2)

Q. 33. What is true about Nereis, Scorpion, Cockroach and Silver fish?

a. They all belong to the same phylum
b. They all have jointed paired appendages
c. They all possess dorsal heart
d. None of them is aquatic

Sol. Correct choice: (3)

Q. 34. Which one of the following statement is correct?

a. Ontogeny repeats phylogeny
b. Stem cells are specialized cells
c. There is no evidence of the existence of gills during embryogenesis of mammals
d. All plant and animal cells are totipotent.

Sol. Correct choice: (1)

Q. 35. "Foolish Seedling" disease of rice led to the discovery of:

a. IAA
b. GA
c. ABA
d. 2, 4 – D

Sol. Foolish seeding disease (Bakane disease) of rice is due to a fungus Giberella fujikuroi. Yabuta and Sumuki obtained achemical from the fungus and called gibbrellic acid. Correct choice: (2)

Q. 36. Passage cells are thin- walled cells found in:

a. central region of style through which the pollen tube grows towards the ovary.
b. endodermis of roots facilitating rapid transport of water from cortex to pericycle.
c. phloem elements that serve as entry points for substances for transport to other plant parts.
d. testa of seed to enable emergence of growing embryonic axis during seed germination.

Sol. Passage cells also called transfusion tissue are found in the endodermis meant for rapid transport of water from cortex to pericycle. Correct choice: (2)

Q. 37. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is:

a. Quinone
b. Cytochrome
c. Iron-sulphur protein
d. Ferredoxin.

Sol. The first acceptor of electros from an excited chlorophyll is quinone. Correct choice: (1)

Q. 38. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is:

a. succinate dehydrogenase
b. lactate dehydrogenase
c. isocitrate dehydrogenase
d. malate dehydrogenase

Sol. Succinate dehydrogenase is a common enzyme for TCA and ETC. It is located on inner mitochondrial membrane. Rest of the TCA enzymes are present in mitochondrial matrix. Correct choice: (1)

Q. 39. The wavelength of light absorbed by Pr form of phytochrome is:

a. 620 nm
b. 640 nm
c. 680 nm
d. 720 nm

Sol. The Pr form of phytochrome receives red light (600-680 nm) and changes into Pfr. Correct choice: (3)

Q. 40. Opening of floral buds into flowers, is type of:

a. Autonomic movement of growth
b. Autonomic movement of locomotion
c. Autonomic movement of variation
d. Paratonic movement of growth.

Sol. Opening of floral bud into flowers, is due to epinasty, a type of autonomic movement of growth. Correct choice: (1)

Q. 41. Which one of the following pairs, is not correctly matched?

a. IAA - Cell wall elongation
b. Abscissic Acid - Stomatal closure
c. Gibberellic Acid - Leaf fall
d. Cytokinin - Cell division

Sol. Leaf fall is due to interaction of auxin and ethylene. Correct choice: (3)

Q. 42. One gene - one enzyme relationship was established for the first time in:

a. Diploccus pneumoniae
b. Neurospora crassa
c. Salmonella typhimurium
d. Escherichia Coli

Sol. One gene-one enzyme hypothesis was given by Beadle and Tatum in red mould (Neurospora crassa). Correct choice: (2)

Q. 43. Male gametes in angiosperms are formed by the division of:

a. Microspore mother cell
b. Microspore
c. Generative cell
d. Vegetative cell

Sol. During the development of male gametophyte first of all two cells – generative cell and tube nucleus are formed from a pollen. This twocelled stage is called pollen grain. Finally the generative cell divides to form 2-male gametes. Correct choice: (3)

Q. 44. Two cells A and B are contiguous. Cell A has osmotic pressure 10 atm, turgor pressure - 7atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be:

a. Movement of water of Cell A to B
b. Movement of water from Cell B to A
c. No movement of water
d. Equilibrium between the two

Sol. The direction of movement of water is from low to high DPD. Correct choice: (1)

Q. 45. In the leaves of C_4 plants, malic acid formation during CO_2 fixation occurs in the cells of:

a. Epidermis
b. Mesophyll
c. Bundle Sheath
d. Phloem

Sol. In C_4 plants, C_4 cycle occurs in mesophyll cells and C_3 cycle in bundle sheath cells. Correct choice: (2)

Q. 46. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganism?

a. Cicer arietinum
b. Casuarina equisetifolia
c. Crotalaria juncea
d. Cycas revolute

Sol. The filamentous nitrogen – fixing microorganism like Frankia occurs in root-nodules of non-leguminous plants like Casuarina and Alnus. Correct choice: (2)

Q. 47. Which one of the following is surrounded by a callose wall?

a. Pollen grain
b. Microspore mother cell
c. Male gamete
d. Egg

Sol. The microspore mother cells develops an internal layer of callose which breaks the plasmodesmatal connections among themselves. Correct choice: (2)

Q. 48. Which one of the following elements is not an essential micronutrient for plant growth?

a. Ca
b. Mn
c. Zn
d. Cl

Sol. Calcium is an essential macronutrient for plant growth. Correct choice: (1)

Q. 49. If you suspect major deficiency of antibodies in person, to which of the following would you look for confirmatory evidence?

a. Haemocytes
b. Serum albumins
c. Serum globulins
d. Fibrinogen in the plasma

Sol. Correct choice: (3)

Q. 50. Which one of the following is a fat -soluble vitamin and its related deficiency disease?

a. Calciferol – Pellagra
b. Ascorbic acid – Scurvy
c. Retinol – Xerophthalmia
d. Cobalamine – Beri-beri

Sol. Correct choice: (3)

Q. 51. Which one of the following mammalian cells is not capable of metabolising glucose to carbon-dioxide aerobically?

a. Red blood cells
b. White blood cells
c. Unstriated muscle cells
d. Liver cells

Sol. RBCs do not have mitochondria & thus can respire only anaerobically. Correct choice: (1)

Q. 52. Compared to a bull a bullock is docile because of:

a. lower levels of adrenalin / noradrenalin in its blood
b. higher levels of thyroxin
c. higher levels of cortisone
d. lower levels of blood testosterone

Sol. The bullock is castrated and therefore secretion of testosterone is not adequate. Correct choice: (4)

Q. 53. In the human female, menstruation can be deferred by the administration of:

a. FSH only

b. LH only
c. Combination of FSH and LH
d. Combination of estrogen and progesterone

Sol. Correct choice: (4)

Q. 54. In human body, which one of the following is anatomically correct?

a. Cranial nerves - 10 pairs
b. Floating ribs - 2 pairs
c. Collar bones – 3 pairs
d. Salivary glands –1 pair

Sol. Correct choice: (2)

Q. 55. In which one of the following preparations are you likely to come across cell junctions most frequently?

a. Hyaline cartilage
b. Ciliated epithelium
c. Thrombocytes
d. Tendon

Sol. Correct choice: (2)

Q. 56. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate?

a. Whole blood from pulmonary vein
b. Blood plasma
c. Blood serum
d. Sample from the thoracic duct of lymphatic system

Sol. Blood serum does not contain fibrinogen and few other clotting factors, thus it will not coagulate. Correct choice: (3)

Q. 57. Feeling the tremors of an earthquake a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action?

a. Gastrin
b. Thyroxin
c. Adrenaline
d. Glucagon

Sol. Correct choice: (3)

Q. 58. A person who is on a long hunger strike and is surviving only on water, will have:

a. less urea in his urine
b. more sodium in his urine
c. less amino acids in his urine
d. more glucose in his blood.

Sol. Correct choice: (1)

Q. 59. Which one of the following pairs of structures distinguishes a nerve cell from other types of cell?

a. Nucleus and mitochondria
b. Perikaryon and dendrites
c. Vacuoles and fibers
d. Flagellum and medullary sheath

Sol. Correct choice: (2)

Q.60. Which part of ovary in mam mals acts as an endocrine gland after evolution?

a. Vitelline membrane
b. Graafian follicle
c. Stroma
d. Germinal epithelium

Sol. Correct choice: (2)

Q. 61. During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge?

a. First positive, then negative and again back to positive
b. First negative, then positive and again back to negative
c. First positive, then negative and continue to be negative
d. First negative, then positive and continue to be positive.

Sol. Correct choice: (2)

Q. 62. A person is having problems with calcium and phosphorous metabolism in his body. Which one of the following glands may not be functioning properly?

a. Thyroid
b. Parathyroid
c. Parotid

d. Pancreas

Sol. Correct choice: (2)

Q. 63. Identify the odd combination of the habitat and the particular animal concerned:

a. Rann of Kutch	- Wild Ass
b. Dachigam National Park	- Snow Leopard
c. Sunderbans	–Bengal Tiger
d. Periyar	–Elephant

Sol. Dachigam National Park is for the conservation of Hangul.
Correct choice: (2)

Q. 64. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order?

a. S < DE < PE < SE
b. SE < S < PE < DE
c. SE < PE < S < DE
d. PE < S < SE < DE

Sol. BOD of distillery effluent is 40,000 mg / l and that of paper mill effluent and sewage is 190 mg/l and 30 mg/l, respectively. Correct choice: (2)

Q. 65. Which one of the following ecosystem types has the highest annual net primary productivity?

a. Temperate deciduous forest
b. Tropical rain forest
c. Tropical deciduous forest
d. Temperate evergreen forest

Sol. Tropical rain forest has highest annual net primary productivity (9000 K cal / m 2 / yr). Correct choice: (2)

Q. 66. Which one of the following is being utilized as a source of biodiesel in the Indian countryside?

a. Pongamia
b. Euphorbia
c. Beetroot
d. Sugarcane

Sol. Pongamia, Jatropa, Euphorbia are petrocrops. However, in the Indian countryside, Pongamia (Kanjar) is being utilized as a source of biodiesel. Correct choice: (1)

Q. 67. In a coal fires power plant electrostatic precipitators are installed to control emission of:

a. CO
b. SO_2
c. NO_X
d. SPM

Sol. Electrostatic precipitators control emission of suspended particle matter (SPM). Correct choice: (4)

Q. 68. Which one of the following is not a bioindicator of water pollution?

a. Sewage fungus
b. Sludge-worms
c. Blood-worms
d. Stone flies

Sol. Correct choice: (4)

Q. 69. A high density of elephant population in an area can result in:

a. Predation on one another
b. Mutualism
c. Intra specific competition
d. Inter specific competition

Sol. Intra-specific competition occurs between the members of the same species. Correct choice: (3)

Q. 70. Geometric representation of age structure is a characteristic of:

a. Ecosystem
b. Biotic community
c. Population
d. Landscape

Sol. Age structure is one of the characteristics of population. Correct choice: (3)

Q. 71. Which one of the following pairs of organisms are exotic species introduced in India?

a. Nile perch, Ficus religiosa
b. Ficus religiosa, Lantana camara
c. Lantana camara, Water hyacinth
d. Water hyacinth, Prosopis cineraria

Sol. Lantana camara and Eicchornia czassipes (water hyacinth) are exotic species. Correct choice: (3)

Q. 72. One of endangered species of Indian medicinal plants is that of:

a. Nepenthes
b. Podophyllum
c. Ocimum
d. Garlic

Sol. Podophyllum hexandrum - : (Papri), gives a drug from its rhizome; besides being stimulant and purgative and has destructive action on cancerous tissues. Correct choice: (2)

Q. 73. A genetically engineered micro-organism used successfully in bioremediation of oil spills is a species of:

a. Bacillus
b. Pseudomonas
c. Trichoderma
d. Xanthomonas

Sol. Pseudomonas putida (superbug) developed by genetic engineering by Anand Mohan Chakravorty is used to control oil spills. Correct choice: (2)

Q. 74. A sequential expression of a set of human genes occurs when a steroid molecule binds to the:

a. Ribosome
b. Transfer RNA
c. Messenger RNA
d. DNA sequence

Sol. Correct choice: (4)

Q. 75. The Okazaki fragments in DNA chain growth:

a. polymerize in the $5' - to - 3'$ direction and explain $3' - to - 5'$ DNA replication
b. result in transcription
c. polymerize in the $3' - to - 5'$ direction and forms replication fork
d. prove semi-conservative nature of DNA replication

Sol. Replication occurs always in $5' - 3'$ direction. Okazaki fragments, synthesized on $3' - 5'$ DNA template, join to form lagging strand which grows in $3' - 5'$ direction. Correct choice: (1)

Q. 76. In the hexaploid wheat, the haploid (n) and basic (x) numbers of chromosomes are:

a. n = 21 and x = 7
b. n = 7 and x = 21
c. n = 21 and x = 21
d. n = 21 and x = 14

Sol. The basic number (x) of wheat is 7. Thus the 6x = 2n = 42 and n = 21. Correct choice: (1)

Q. 77. Molecular basis of organ differentiation depends on the modulation in transcription by:

a. Anticodon
b. RNA polymerase
c. Ribosome
d. Transcription factor

Sol. Correct choice: (4)

Q. 78. Telomere repetitive DNA sequence control the function of eukaryote chromosomes because they:

a. prevent chromosome loss
b. act as replicons
c. are RNA transcription initiator
d. help chromosome pairing

Sol. Telomerase seal the ends of the chromosomes. Correct choice: (1)

Q. 79. Inheritance of skin colour in humans is an example of:

a. codominance
b. chromosomal aberration
c. point mutation
d. polygenic inheritance

Sol. Inheritance of skin colour in human is controlled by three genes, A, B and C. Correct choice: (4)

Q. 80. A common test to find the genotype of a hybrid is by:

a. crossing of one F_1progeny with male parent
b. crossing of one F_2 progeny with male parent
c. crossing of one F_2 progeny with female parent
d. studying the sexual behaviour of F1 progenies.

Sol. To find the genotype of hybrid, it is test crossed. Correct choice: (1)

Q. 81. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle - like structure. What is it's DNA-binding sequence?

a. TATA
b. TTAA
c. AATT
d. CACC

Sol. The DNA binding sequence for RNA polymerase is called TATA box. Correct choice: (1)

Q. 82. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized, the F2 segregation will show:

a. Higher number of the parental types.
b. Higher number of the recombinant types.
c. Segregation in the expected 9: 3: 3: 1 ratio.
d. Segregation in 3:1 ratio.

Sol. When the linked genes are situated quite close, the chances of crossing over are highly reduced. Due to this, large number of parental gametes are formed and only few recombinant gametes are formed. This results in higher number of parental types in F_2 generation as compared to recombinants.
Correct choice: (1)

Q. 83. In maize, hybrid vigour is exploited by:

a. Inducing mutations.
b. Bombarding the seeds with DNA.
c. Crossing of two inbred parental lines.
d. Harvesting seeds from the most productive plants.

Sol. Correct choice: (3)

Q. 84. Differentiation of organs and tissues in a developing organism, is associated with:

a. Deletion of genes
b. Developmental mutations

c. Differential expression of genes
d. Lethal mutations

Sol. Correct choice: (3)

Q. 85. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F1 generation?

a. 3 : 1
b. 50 : 50
c. 9 : 1
d. 1 : 3

Sol. This is a monohybrid test cross. Correct choice: (2)

Q. 86. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?

a. Through elimination of repetitive DNA.
b. Deletion of non-essential genes.
c. Super-coiling in nucleosomes.
d. DNAse digestion.

Sol. The nucleosome model explains the packaging of histone proteins and DNA in the chromatin material which forms the chromosome. Correct choice: (3)

Q. 87. In cloning of cattle a fertilized egg is taken out of the mother's womb and:

a. from this upto eight identical twins can be produced
b. the egg is divided into 4 pairs of cells which are implanted into the womb of others cows
c. in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb other cows.
d. in the eight cell stage the individual cells are separated under electrical field for further development in culture media.

Sol. As per the experiment performed by the scientist from Japan. Correct choice: (3)

Q. 88. Which one of the following statements is correct?

a. At present it is not possible to grow maize without chemical fertilizers.
b. Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
c. Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.

d. Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and potassium for plant nutrition in soil.

Sol. The Agricultural run off contains high concentration of chemical fertilizers. Which is discharge in near by lakes causes nutrient enrichment of lakes called eutrophication.
Correct choice: (2)

Q. 89. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?

a. The population of its predators increases enormously.
b. S-shaped or sigmoid growth of this insect.
c. The food plants mature and die at the end of the rainy season.
d. Its population growth curve is of J-type.

Sol. A population which grows exponentially and crashes suddenly exhibits J-type growth curve. Correct choice: (4)

Q. 90. The two polynucleotide chains in DNA are:

a. semiconservative
b. parallel
c. discontinuous
d. antiparallel

Sol. The two chains in a dsDNA run in opposite direction one $5' \rightarrow 3'$ while other $5' \rightarrow 3'$ in opposite direction.

$5' \rightarrow 3'$

$5' \leftarrow 3'$

Correct choice: (4)

Q. 91. A plant requires magnesium for:

a. Cell wall development
b. Holdin g cells together
c. Protein synthesis
d. Chlorophyll synthesis

Q. 92. Probiotics are:

a. Live microbial food supplement
b. Safe antibiotics
c. Cancer inducing microbes

d. New kind of food allergens

Sol. Live microbial food supplements are called probiotics (e.g., curd). Correct choice: (1)

Q. 93. Bowman's glands are located in the:

a. olfactory epithelium of our nose
b. proximal end of uriniferous tubules
c. anterior pituitary
d. female reproductive system of cockroach

Sol. Correct choice: (1)

Q. 94. Increased asthamatic attacks in certain seasons are related to:

a. Low temperature
b. Hot and humid environment
c. Eating fruits preserved in tin containers
d. Inhalation of seasonal pollen

Sol. Correct choice: (4)

Q. 95. A human male produces sperms with genotypes AB, Ab, aB and ab pertaining to two diallelic characters in equal proportions. What is the corresponding genotype of this person?

a. AABB
b. AaBb
c. AaBB
d. AABb

Sol. The formula for gamete formation is 2n where n stands for number of heterozygous pairs. AaBb has 2 heterozygous pairs so it will form 4 types of gametes. Correct choice: (2)

Q. 96. Which one of the following pairs is wrongly matched?

a. Coliforms	- Vinegar
b. Methanogens	-Gobar gas
c. Yeast	–Ethanol
d. Streptomycetes	–Antibiotic

Sol. Coliforms are bacteria found in colon e.g. E. coli. For the preparation of vinegar Acetobacter aceti is employed. Correct choice: (1)

Q. 97. Which one of the following pairs is mismatched?

a. Bombyx mori -silk
b. Pila globosa -pearl
c. Apis indica –honey
d. Kenia lacca –lac

Sol. Pinctada vulgaris is a bivalve from which pearl is obtained. Correct choice: (2)

Q. 98. Which one of the following is viral disease of poultry?

a. Pasteurellosis
b. Salmonellosis
c. Coryza
d. New Castle disease

Sol. Correct choice: (4)

Q. 99. Ultrasound of how much frequency is beamed into human body for sonography?

a. 45 - 70 MHz
b. 30 - 45 MHz
c. 15 - 30 MHz
d. 1 - 15 MHz

Sol. Correct choice: (4)

Q. 100. Lysozyme that is present in perspiration, saliva and tears, destroys:

a. most virus-infected cells
b. certain fungi
c. certain types of bacteria
d. all viruses

Sol. Correct choice: (3)

CHEMISTRY

Q. 1. With which of the following configuration an atom has the lowest ionization enthalpy?

a. $1s^2\ 2s^2\ 2p^6$

b. $Is^2\ 2s^2\ 2p^5$
c. $Is^2\ 2s^2\ 2p^3$
d. $Is^2\ 2s^2\ 2p^5\ 3s^1$

Sol. $Is^2\ 2s^2\ 2p^5\ 3s^1$

$199.96 \approx 200$ Correct choice is: (2)

Q. 3. Concentrated aqueous sulphuric acid is 98% H 2SO 4 by mass and has a density of 1.80 g. mL^{-1} . Volume of acid required to make one litre of 0.1 M H_2SO_4 is,

a. 5.55 mL
b. 11.10 mL
c. 16.65 mL
d. 22.20 mL

Sol. Density = 1.80 g/ml

$\Rightarrow 1\,litre\ has\ 1800g\ H_2SO_4\ (impure)$

$\Rightarrow 1\,litre\ has\ 0.98\,(1800)g\ H_2SO_4\ (pure)$

$\Rightarrow 1\,litre\ has\ \frac{1764}{98}\ moles\ H_2SO_4 = 18\ M \Rightarrow Now, 18 \times V_1 = 0.1 \times 1\, or, V_1 = \frac{0.1}{18} \times 1000 = 5.55\ ml$

Correct choice: (1)

Q.4. Consider the following sets of quantum numbers:

	n	I	M	s
(a)	3	0	0	+ ½
(b)	2	2	1	+ ½
(c)	4	3	-2	- ½

b. $1s^2\ 2s^2\ 2p^5$
c. $1s^2\ 2s^2\ 2p^3$
d. $1s^2\ 2s^2\ 2p^5\ 3s^1$

Sol. $1s^2\ 2s^2\ 2p^5\ 3s^1$ represents the excited state of a Neon atom. The energy needed to knock off an electron from the excited state of neon must be least. Correct choice is: (4)

Q. 2. An element, X has the following isotopic composition; ^{200}X:90% ; ^{199}X:8.0% ; ^{202}X:2.0%
The weighted average atomic mass of the naturally occurring element X is closest to :

a. 199 amu
b. 200 amu
c. 201 amu
d. 202 amu

Sol. The weighted average atomic mass of element (X) = 0.9 (200) + 0.08 (199) + 0.02 (202) = 180 + 15.92 + 4.04 = $199.96 \approx 200$ Correct choice is: (2)

Q. 3. Concentrated aqueous sulphuric acid is 98% H 2SO 4 by mass and has a density of 1.80 g. mL^{-1} . Volume of acid required to make one litre of 0.1 M H_2SO_4 is,

a. 5.55 mL
b. 11.10 mL
c. 16.65 mL
d. 22.20 mL

Sol. Density = 1.80 g/ml

$$\Rightarrow 1\,litre\ has\ 1800g\ H_2SO_4\ (impure)$$

$$\Rightarrow 1\,litre\ has\ 0.98\,(1800)g\ H_2SO_4\ (pure)$$

$$\Rightarrow 1\,litre\ has\ \frac{1764}{98}\ moles\ H_2SO_4 = 18\ M \Rightarrow Now, 18 \times V_1 = 0.1 \times 1\, or, V_1 = \frac{0.1}{18} \times 1000 = 5.55\ ml$$

Correct choice: (1)

Q.4. Consider the following sets of quantum numbers:

	n	I	M	s
(a)	3	0	0	+ ½
(b)	2	2	1	+ ½
(c)	4	3	-2	- ½

c. $\frac{\log 2}{K}$

d. $\frac{\log\ 2}{K\sqrt{o.5}}$

Sol. $t\,1/2\ for\ a\ \ first\ order\ reaction = \frac{0.693}{K} = \frac{2.303\log_{10} 2}{K} = \frac{In\ 2}{K}$

Correct choice: (1)

Q. 7. The reaction of hydrogen and iodine monochloride is given as:

$$H_{2(g)} + 2ICL_{(g)} \rightarrow 2HCl_{(g)} + l_{2(g)}$$

This reaction is of first order with respect to $H_{2(g)}\ and\ ICl_{(g)}$, following mechanisms were proposed :

Mechanism A : $H_{2(g)} + 2ICL_{(g)} \rightarrow 2HCl_{(g)} + l_{2(g)}$

Mechanism B :

$H_{2(g)} + ICI_{(g)} \rightarrow HCL_{(g)} + HI_{(g)} : slow\ HI_{(g)} + ICI_{(g)} \rightarrow HCI_{(g)} + I_{2(g)};\ fast$

Which of the above mechanism (s) can be consistent with the given information about the reaction

a. A only
b. B only
c. 1 and 2 both
d. Neither 1 nor 2

Sol. The rate law is invariably determined from the slowest step of the mechanism. Therefore mechanism (B) is consistent with the data given for order of reaction. Correct choice: (2)

Q. 8. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately :

a. 40 minutes
b. 50 minutes
c. 45 minutes
d. 60 minutes

$(\log 4 = 0.60, \log 5 = 0.69)$

Sol.

$$k = \frac{2.303}{60}\log\frac{1}{0.4} = \frac{2.303}{60}\log\frac{10}{4} = \frac{2.303}{60}\log\frac{5}{2} = \frac{2.303}{60}(\log 5 - \log 2) = \frac{2.303}{60}(0.69 - 0.3) = \frac{2.303}{60}\times 0.39$$

$$t\,1/2 = \frac{2.303\times 0.3\times 60}{2.303\times 0.39} = 46.15 \approx 45\ \text{min}\ utes.$$

Correct choice: (3)

Q. 9. The equilibrium constant of the reaction :

$$Cu(s) + 2Ag^{+}\ (aq) \rightarrow Cu^{2+}\ (aq) + 2Ag(s);\ E^{0} = 0.46\,V\ at\ 298K\ is:$$

a. 4.0×10^{15}
b. 2.4×10^{10}
c. 2.0×10^{10}
d. 4.0×10^{10}

Sol.

$$\Delta G^{0} = -2\times 96500\times 0.46 = -88780\,j$$

$$?\,G^{0} = 2.303\,RT\log K_c\ or\ -88780 = -2.303\times 8.314\times 298\log K_c$$

$$or\ -88780 = -5705.84\log k_c\ or\ \log k_c = 15.55 \Rightarrow \left[K_c = 4\times 10^{15}\right]$$

Correct choice: (1)

Q. 10. 0.5 molal aqueous solution of a weak acid (HX) is 20% ionized. If Kf for water is 1.86 K kg mol sup-1 , the lowering in freezing point of the solution is

a. – 0.56 K
b. – 1.12 K
c. 0.56 K
d. 1.12 K

$\Delta T_f = i\,K_f m = 1.2\times 1.86\times 0.5 = 1.12\ K$ Correct choice: (4)

Q. 11. The efficiency of a fuel cell is given by

a. $\frac{\Delta S}{\Delta G}$
b. $\frac{\Delta H}{\Delta G}$

c. $\frac{\log 2}{K}$

d. $\frac{\log\ 2}{K\sqrt{o.5}}$

Sol. $t\,1/2\ for\ a\ first\ order\ reaction = \frac{0.693}{K} = \frac{2.303\log_{10} 2}{K} = \frac{In\ 2}{K}$

Correct choice: (1)

Q. 7. The reaction of hydrogen and iodine monochloride is given as:

$$H_{2(g)} + 2ICL_{(g)} \rightarrow 2HCl_{(g)} + l_{2(g)}$$

This reaction is of first order with respect to $H_{2(g)}\ and\ ICl_{(g)}$, following mechanisms were proposed :

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Which of the above mechanism (s) can be consistent with the given information about the reaction

a. A only
b. B only
c. 1 and 2 both
d. Neither 1 nor 2

Sol. The rate law is invariably determined from the slowest step of the mechanism. Therefore mechanism (B) is consistent with the data given for order of reaction. Correct choice: (2)

Q. 8. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately :

a. 40 minutes
b. 50 minutes
c. 45 minutes
d. 60 minutes

$(\log 4 = 0.60, \log 5 = 0.69)$

$$H_2 + CI_2 \rightarrow 2HCI; \left[B.E_{H\_H} + B.E_{CI-CI}\right] - \left[2BE_{H-CI}\right] = \Delta H_R$$

$$\left[430 + 240\right] - \left[2.BE_{H-CI}\right] = 180 \; or \; 670 - 2(BE)_{H-CI} = 850 \; or \; BE_{H-CI} = 425 \; KJ \; mol^{-1}$$

Correct choice: (4)

Q. 14. The Langmuir adsorption isotherm is deduced using the assumption

a. The adsorbed molecules interact with each other
b. The adsorption takes place in multilayers
c. The adsorption sites are equivalent in their ability to adsorb the particles
d. The heat of adsorption varies with coverage

Sol. angmuir adsorption has the following postulates

a. The isotherm is devised for adsorption equilibrium i.e., when rate of adsorption = rate of desorption
b. Adsorption at all sites is equivalent
c. Adsorption at a site is unaffected by adsorption at neighboring sites.

Correct choice: (3)

Q. 15. The following equilibrium constants are given

$$N_2 + 3H_2 \leftrightarrow 2NH_3; K_1 \qquad N2 + O_2 \leftrightarrow 2NO; k_2 \qquad H_2 + \frac{1}{2} O_2 \leftrightarrow H_2O; K_3$$

The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is

a. $K_1 K_2 / K_3$
b. $K_2 K_3^3 / K_1$
c. $K_{21} K_3^2 / K_1$
d. $K_2^{\,2} K_3 / K_1$

Sol.

$2NH_3 \rightarrow N_2 + 3H_2$ $\quad \frac{1}{K_1}$

$3H_2 + \frac{3}{2}O_2 \rightarrow 3H_2O$ $\quad K_3^3$

$N_2 + O_2 \rightarrow 2NO$ $\quad K_2$

$2NH_3 + \frac{5}{2}O_2 \rightarrow 2NO + 3H_2O$ $\quad \left[K^* = K_2K_3^3 / K_1\right]$

Correct choice: (2)

Q. 16. Caulate the pOH of a solution at 25^0C that contains

1×10^{-10} *M of hydronium ions, i.e.* H_3O^+ :

a. 1.000
b. 7.000
c. 4.000
d. 9.000

Sol. $\left[OH^-\right] = 10^{-4}\ mol/1;\ P^{OH} = 4$ Correct choice : (3)

Q. 17. Aweak acid, $HA\ has\ a\ K_a\ of\ 1.00\times10^{-5}.\ If\ 0.100$ mol of this acid is dissolved in one litre of water, the percentage of acid dissociated at equilibrium is closest to

a. 0.100%
b. 99.0%
c. 1.00%
d. 99.9%

Sol. We know that, $K_a = C\alpha^2\ or\ \alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{10^{-5}}{10^{-1}}} = 10^{-2}$ Correct choice: (3)

Q. 18. The fraction of total volume occupied by the atoms present in a simple cube is

a. $\frac{\pi}{4}$
b. $\frac{\pi}{6}$
c. $\frac{\pi}{3\sqrt{2}}$

d. $\frac{\pi}{4\sqrt{2}}$

Sol. Packing fraction for a simple cube $= \frac{\frac{4}{3}\left(\frac{a}{2}\right)^3}{a^3} = \frac{\pi}{6}$ Correct choice: (2)

Q. 19. Identify the correct order of the size of the following:

a. $Ca^{2+} < Ar < K^{+} < Cl^{-} < S^{2-}$
b. $Ca^{2+} + K^{+} < Ar < S^{2-} < Cl^{-}$
c. $Ca^{2+} + < K^{+} < Ar < Cl^{-} < S^{2-}$
d. $Ar < Ca^{2+} < K^{+} < Cl^{-} < S^{2-}$

Sol. Anions have the largest sizes followed by neutral atoms and then cations for a respective period. So, the correct order should be $Ca^{2+} + < K^{+} < Ar < Cl^{-} < S^{2-}$
Correct choice: (3)

Q.20. In which of the following pairs, the two species are iso-structural?

a. BrO_3^- and XeO_3
b. SF_4 and XeF_4
c. SO_3^{2-} and NO_3^-
d. BF_3 and NF_3

Sol. Both -

BrO_3^- and XeO_3 have the central atom in SP^3. both these species are pyramidal.

Q. 21. The correct order of $C-O)$ bond length among CO, CO_3^{-2}, CO_2 is :

a. $CO < CO_2 < CO_3^{2-}$
b. $CO_2 < CO_3^{2-} < CO$
c. $CO < CO_3^{2-} < CO_2$
d. $< CO_3^{2-} < CO_2 < CO$

Sol. The correct order of $C-O$ bond length will be $CO < CO_2 < CO_3^{2-}$

Correct choice: (1)

Q. 22. Which one of the following ionic species has the greatest proton affinity to form stable compound?

a. I-
b. HS-
c. NH_2^-
d. E-

Sol. Strongest base would have the highest proton affinity i.e, NH_2^- Correct choice: (3)

Q. 23. In which of the following the hydration energy is higher than the lattice energy?

a. $SrSO_4$
b. $BaSO_4$
c. $MgSO_4$
d. $RaSO_4$

Sol. $MgSO_4$ is the most soluble out of the given alkaline earth metal sulphates. Correct choice: (3)

Q. 24. Which of the following statements, about the advantage of roasting sulphide ore before reduction is not true?

a. Roasting of the sulphide to the oxide is thermodynamically feasible.
b. Carbon and hydrogen are suitable reducing agents for metal sulphides.
c. The $\Delta_f G^\theta$ of the sulphide is greater than those for CS_2 andH_2S
d. The $\Delta_f G^\theta$ is negative for roasting of sulphide ore to oxide

Sol. Carbon and hydrogen are not suitable for reduction of sulphides directly. Correct choice: (2)

Q. 25. The correct order of increasing thermal stability of

$K_2CO_3, MgCO_3, CaCO_3$ *and* $BeCO_3$ *is* :

a. $K_2CO_3 < MgCO_3 < CaCO_3 < BeCO_3$
b. $BeCO_3 < MgCO_3 < K_2CO_3 < CaCO_3$
c. $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$
d. $MgCO_3 < BeCO_3 < < CaCO_3 < K_2CO_3$

Sol. The correct order is $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$

Correct choice: (3)

Q. 26. Sulphides ores of metals are usually concentrated by Froth Flotation process. Which one of the following sulphides oresoffers an exception and is concentrated by chemical leaching?

a. Sphalerite
b. Argentite
c. Galena
d. Copper pyrite

Sol. Argentite ore is leached with NaCN during extraction of silver in the Mc Arthur Forrest Cyanide process. Correct choice: (2)

Q. 27. Which one of the following anions is present in the chain structure of silicates?

a. SiO_4^{4-}
b. $Si_2O_7^{6-}$
c. $\left(SiO_3^{2-}\right)_n$
d. $\left(Si_2O_5^{2-}\right)_n$

Sol. Chain silicates have the general formula $\left(SiO_3^{2-}\right)_n$ Correct choice: (4)

Q. 28. Which one of the following orders correctly represents the increasing acid strengths of the given acids?

a. $HOClO_3 < HOClO_2 < HOClO < HOCl$
b. $HOClO_3 < HOClO < HOClO_2 < HOClO_3$
c. $HOClO_3 < HOCl < HOClO_3 < HOClO_2$
d. $HOClO_2 < HOClO_3 < HOClO < HOCl$

Sol. The correct order is $HOClO_3 < HOClO < HOClO_2 < HOClO_3$

Correct choice: (2)

Q. 29. Which of the following oxidation states are the most characteristic for lead and tin respectively?

a. + 2, + 2
b. + 4, + 2
c. + 2, + 4
d. + 4, + 4

Sol. Among common characteristic states for Pb and Sn, we find +2 and +4 respectively. Correct choice: (3)

Q. 30. Identify the incorrect statement among the following:

a. Shielding power of 4f electrons is quite weak
b. There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu
c. Lanthanoid contraction is the accumulation of successive shrinkages
d. As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements

Sol. The atomic radii of 4d and 5d elements down the group become quite similar due to lanthanidecontraction. Correct choice: (4)

Q. 31. Which one of the following ions is the most stable in aqueous solution?

a. Mn^{3+}
b. Cr^{3+}
c. V^{3+}
d. Ti^{3+}

(Atomic number. Ti = 22, V = 23, Cr = 24, Mn = 25)

Sol . Cr^{3+} is the most stable ion in aqueous medium. Correct choice: (2)

Q. 32. The d electron configurations of Cr . Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour?

a. $[Cr(H_2O_6)]^{2+}$
b. $[Mn\ (H_2O_6)]^{2+}$
c. $[Fe(H_2O_6)]^{2+}$
d. $[Ni(H_2O_6)]^{2+}$

$(Atomic\ number.\ Cr + 24,\ Mn = 25,\ Fe = 26,\ Ni = 28)$

Sol. $AsH_2O\ ia\ a\ weak\ field\ ligand, [Ni(H_2O_6)]^{+2}$ will have two unpaired electrons and will show least paramagnetic character. Correct choice: (4)

Q. 33. Which of the following will give a pair of enantiomorphs?

a. $[Pt(NH_3)_4][PtCl_6]$
b. $[Co(NH_3)_4\ Cl_2]NO_2$

c. $[Cr(NH_3)_6][Co(CN)_6]$
d. $[Co(en)_2 Cl_2]Cl$ $(en = NH_2CH_2CH_2NH_2)$

Sol . The complex ion $[Co(en)_2 Cl_2]^+$ can show optical isomerism in its cis-isomer, and will form a pair of enantiomorphs. Its trans-form will be optically inactive (meso).
Correct choice: (4)

Q. 34. If NaCl is doped with
10^{-4} *mol* % $SrCl_2$, *the concentration of cation vacancies will be* $(N_A = 6.02 \times 10^{23}\ mol^{-1})$

a. $6.02 \times 10^{14}\ mol^{-1}$
b. $6.02 \times 10^{15}\ mol^{-1}$
c. $6.02 \times 10^{16}\ mol^{-1}$
d. $6.02 \times 10^{17}\ mol^{-1}$

Sol. Number of moles of cationic vacancies

$$\frac{10^{-4}}{10^2} = 10^{-6}\ mole$$

$$\Rightarrow Number\ of\ cationic\ vacancies = 10^{-6} \times 6.02 \times 10^{23} = 6.02 \times 10^{17}$$ Correct choice: (4)

Q. 35. Which of the following presents the correct order of the acidity in the given compounds?

a. $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
b. $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$
c. $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
d. $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$

Sol. $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$ Correct choice: (1)

Q. 36. The product formed in Aldol condensation is

a. an alpha, beta unsaturated ester
b. a beta-hydroxy acid
c. a beta-hydroxy aldehyde or a beta-hydroxy ketone
d. an alpha-hydroxy aldehyde or ketone

Sol. Aldol condensation leads to formation of
$\beta - hydroxy\ aldehyde\ or\ a\ \beta - hydroxy\ Ketone.$

Correct choice: (3)

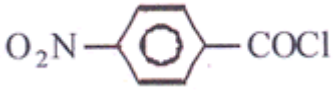
Q. 37. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc.HCl is called

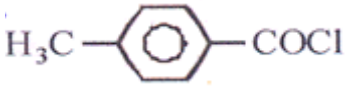
a. Wolf-Kishner Reduction
b. Clemmensen Reduction
c. Cope Reduction
d. Dow Reduction

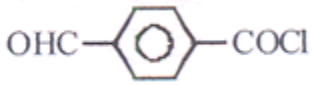
Sol. This is Clemmensen's reduction. Correct choice: (2)

Q. 38. Consider the following compounds

a. C_6H_5COCl

b. 

c. 

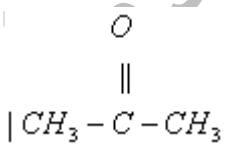
d. 

The correct decreasing order of their reactivity towards hydrolysis is

a. (b) > (d) > (a) > (c)
b. (b) > (d) > (c) > (a)
c. (a) > (b) > (c) > (d)
d. (d) > (b) > (a) > (c)

Sol. The attack of the nucleophile onto the carbonyl carbon is the rate-determining step. So, order must be (b) > (d) > (a) > (c) Correct choice: (1)

Q. 39. Which one of the following on treatment with 50% aqueous sodium

a. 

b. $C_6H_5CH_2CHO$

c. C_6H_5CHO

d. $CH_3CH_2CH_2CHO$

Sol. Benzaldehyde has no $\alpha -$ hydrogen atom, so it can undergo Cannizaro reaction. Correct choice: (3)

Q. 40. Which one of the following on reduction with lithium aluminium hydride yields a secondary amine?

a. Methyl Cyanide
b. Nitroethane
c. Methylisocyanide
d. Acetamide

Sol. Methyl isocyanide on reduction with $LiAlH_4$ will give dimethylamine. Correct choice: (3)

Q. 41. The order of decreasing reactivity towards an electrophilic reagent, for the following:

a. Benzene
b. Toluene
c. Chlorobenzene
d. Phenol would be

a. d > b > a > c
b. a > b > c > d
c. b > d > a > c
d. d > c > b > a

Sol. The correct order is d > b > a > c. Correct choice: (1)

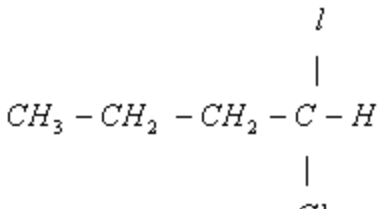
Q. 42. Predict the product C obtained in the following reaction of

$$CH3CH2-C\equiv CH\ CH + HCl \xrightarrow{HI} B \rightarrow C$$

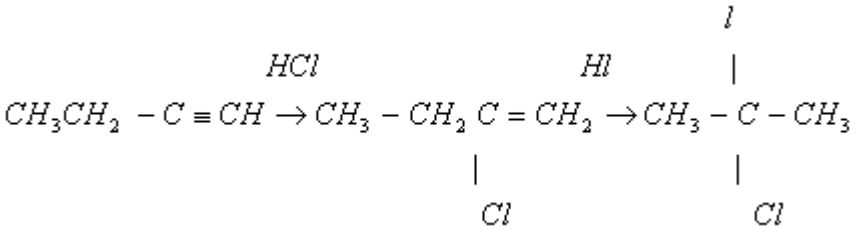
a. $CH_3CH_2-\underset{\displaystyle Cl}{\overset{\displaystyle I}{\underset{|}{\overset{|}{C}}}}-CH3$

b. $CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_2CH_2I$

c.



d.

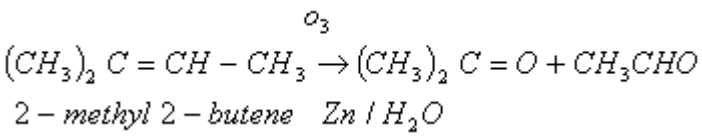


Sol.
Correct choice: (1)

Q. 43. Which of the compounds with molecular formulaC5H10 yields acetone on ozonolysis?

a. 2 – Methyl – 1 – butene
b. 2 – Methyl – 2 – butane
c. 3 – Methyl – 1 – butane
d. Cyclopentane

Sol.



Correct choice: (2)

Q. 44. If there is no rotation of plane polarized light by a compound in a specific solvent, thought to be chiral, it may mean that

a. the compound may be a racemic mixture
b. the compound is certainly a chiral
c. the compound is certainly meso
d. there is no compound in the solvent

Sol. The given compound was thought to be chiral because of a chiral carbon/s. If there is no optical activity, it means the compound must certainly be meso. Correct choice: (3)

Q. 45. For the following

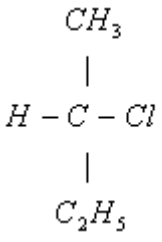
a. l–
b. Cl –
c. Br-

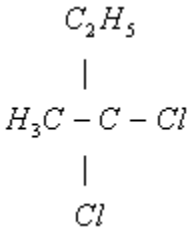
the increasing order of nucleophilicity would be:

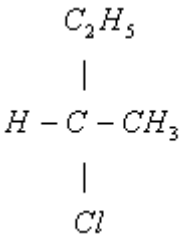
a. $Br^- < Cl^- < I^-$
b. $I^- < Br^- < Cl^-$
c. $Cl^- < Br^- < I^-$
d. $I^- < Cl^- < Br^-$

Sol. The order of nucleophilicities of halides ions in water (default solvent) will be $Cl^- < Br^- < I^-$ Correct choice: (3)

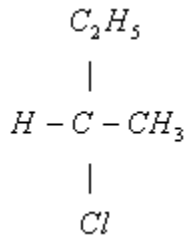
Q. 46. $CH_3 - CHCl - CH_2 - CH_3$ has a chiral centre. Which one of the following represents its R configuration?

a.


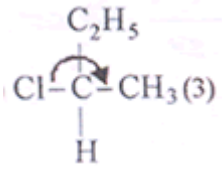
b.


c.


d.



Sol.



$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2\,O - CH_2 - CH_3 + HI \xrightarrow{heated} .....$$

Q. 47. In the reaction

Which of the following compounds will be formed?

a.

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2OH + CH_3 - CH_2 - I$$

b.

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - I + CH_3CH_2OH$$

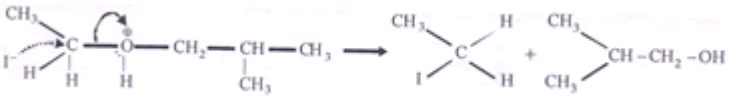
c.

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3 + CH_3CH_2OH$$

d.

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2OH + CH_3CH_3$$

Sol.



Correct choice: (1)

Q. 48. Which one of the following vitamins is water-soluble?

a. Vitamin A
b. Vitamin B
c. Vitamin E
d. Vitam in K

Sol. Vitamin (B) and vitamin (C) are water soluble, while Vitamin (A), (D), (E) and (K) are fat soluble. Correct choice: (2)

Q. 49. RNA and DNA are chiral molecules, their chirality is due to

a. D – sugar component
b. L – sugar component
c. Chiral bases
d. Chiral phosphate ester units

Sol. Deoxyribose and ribose sugars are D -chiral sugars in DNA and RNA. Correct choice: (1)

Q. 50. Which one of the following polymers is prepared by condensation polymerization?

a. Styrene]
b. Nylon – 66
c. Teflon
d. Rubber

Sol. Nylon-66 is a condensation polymer of hexamethylene diamine and adipic acid. \Correct choice: (2)

PHYSICS

Q. 1. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be

a. $\left[ML^2T^{-3}I^{-2}\right]$
b. $\left[ML^2T^{-3}I^{-1}\right]$

c. $\left[ML^2T^{-2}\right]$

d. $\left[ML^2T^{-1}I^{-1}\right]$

Sol. $P = I^2\ R;\ R = PI^{-2} = \left[ML^2T^{-3}I^{-1}\right]$ Correct choice: (1)

Q. 2. A particle moving along x-axis has acceleration f, at time t, given $f = f_0\left(1-\frac{t}{T}\right), where\ f_o\ and\ T$ are constant. The particle at t = 0 has zero velocity. In the time interval between t = 0 and the instant when f = 0 , the particle's velocity (v_x) is

a. $\frac{1}{2}f_oT$

b. f_oT

c. $\frac{1}{2}f_oT^2$

d. f_oT^2

Sol.

$$\int_o^v dv = \int_o^t fdt \Rightarrow v = f_o\left(t-\frac{t}{2T}\right), \int_o^s ds = \int_o^T vdt \Rightarrow s = \frac{f_oT^3}{3} \quad v_{av} = \frac{s}{T} = \frac{f_oT}{3} \therefore No\ alternative\ matches$$

If they have asked instantaneous velocity when $f = o\ then\ v = \frac{f_0T}{2}$ Correct choice: (1)

Q. 3. A car moves from X to Y with a uniform speed vu and returns to Y with a uniform speed vd .The average speed for this round trip is

a. $\frac{v_u+v_d}{2}$

b. $\frac{2v_u+v_d}{v_d+v_u}$

c. $\sqrt{v_uv_d}$

d. $\frac{v_d+v_u}{v_d+v_u}$

Sol. In question it must be car moves from X to Y and returns to X.

$t_1 = time\ taken\ from\ X\ to\ Y = \frac{S}{v_u}; t_2 = time\ taken\ from\ Y\ to\ X = \frac{S}{v_d}; average\ speed = \frac{2S}{t_1 + t_2} = \frac{2\,v_u v_d}{v_u + v_d}$

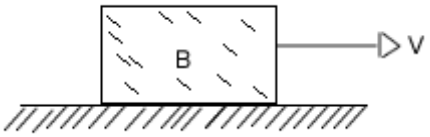
Correct choice: (2)

Q. 4. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its co-ordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x-axis an angle of

a. 0^0
b. 30^0
c. 45^0
d. 60^0

Sol. $\tan\theta = \frac{3}{\sqrt{3}}; \theta = 60^0$ Correct choice: (4)

Q. 5. A block B is pushed momentarily along a horizontal surface with an initial velocity V. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



a. V / g
b. $V / (g\,\mu)$
c. $(g\,\mu) V /$
d. g / V

Sol. $u = V; a = -\mu g; v = 0; v = u + at; 0 = V - \mu g t; t = V / \mu g$ Correct choice: (2)

Q. 6. A vertical spring with force constant K is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d . The net work done in the process is

a. $mg(h-d) + \frac{1}{2}Kd^2$
b. $mg(h+d) + \frac{1}{2}Kd^2$

c. $mg\left(h+d\right)-\frac{1}{2}Kd^2$

d. $mg\left(h-d\right)-\frac{1}{2}Kd^2$

Sol. $W_{net} = work\ done\ by\ gravity + work\ done\ by\ spring \Rightarrow W_{net} = mg\left(h+d\right)-\frac{1}{2}Kd^2$

Correct choice: (3)

Q. 7. A wheel has angular acceleration of 3.0 rad/sec2 and an initial angular speed of 2.00 rad / sec. In a time of 2 sec it has rotated through an angle (in radian) of

a. 4
b. 6
c. 10
d. 12

Sol. $\alpha = 3\ rad/\sec^2;\ \varpi_0 = 2\ rad/s;\ t = 2\ \sec;\ \theta = \varpi_0 t + \frac{1}{2}\alpha t^2 = 10\ rad$ Correct choice: (3)

Q. 8.

$\vec{A}$ *and* $\vec{B}$ *are two vectors and* θ *is the angle between them, if* $\left|\vec{A}\times\vec{B}\right| = \sqrt{3}\left(\vec{A}\cdot\vec{B}\right)$ *the value of* θ *is*

a. 90^0
b. 60^0
c. 45^0
d. 30^0

Sol.

$\left|\vec{A}\times\vec{B}\right| = \sqrt{3}\left(\vec{A}.\vec{B}\right),\ \left|\vec{A}\right|\left|\vec{B}\right|\sin\theta = \sqrt{3}\left|\vec{A}\right|\left|\vec{B}\right|\cos\theta \Rightarrow \tan\theta = \sqrt{3} \Rightarrow \theta = 60^0$ Correct choice: (2)

Q. 9. The position x of a particle with respect to time t along x -axis is given by $x = 9t^2 - t^3$ where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the $+_x$ direction?

a. 24 m
b. 32 m
c. 54 m

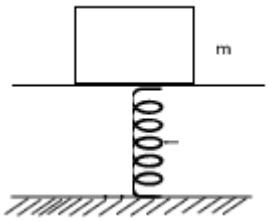
d. 81 m

Sol.

$v = \frac{dx}{dt} = 18t - 3t^2;\ \frac{dv}{dt} = 18 - 6t.\ Velocity\ is\ \max imum\ when\ \frac{dv}{dt}\ 0 \Rightarrow t = 3\ \sec,\ x = 54\ m$

Correct choice: (3)

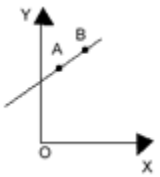
Q. 10. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan? $\left[Take\ g = 10\ m/s^2\right]$



a. 4.0 cm
b. 8.0 cm
c. 10.0 cm
d. any value less than 12.0 cm

Sol. $m\,\omega^2 A = mg;\ \omega = \sqrt{\frac{K}{m}} = 10 \Rightarrow A = \frac{g}{\omega^2} = \frac{10}{10^2} = 0.1m = 10.0\ cm$ Correct choice: (3)

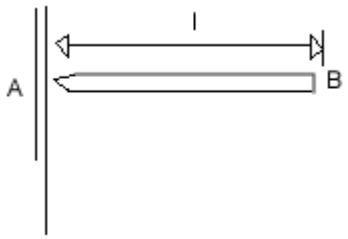
Q. 11. A particle of mass m moves in the XY plane with a velocity V along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B, then



a. $L_A < L_B$
b. $L_A > L_B$
c. $L_A = L_B$
d. The relationship between L_A and L_B depends upon the slope of the line AB

Sol. $L = mVd\ (d = perpendicular\ distance) \Rightarrow L_A = L_B$ Correct choice: (3)

Q. 12. A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about $A\ is\ \frac{ml^2}{3}$, the initial angular acceleration of the rod will be



a. $\frac{3g}{2l}$
b. $\frac{2g}{3l}$
c. $mg\frac{1}{2}$
d. $\frac{3}{2}gl$

Sol. $mg\frac{1}{2} = \frac{ml^2}{3}\alpha \Rightarrow \alpha = \frac{3g}{2l}$ Correct choice: (1)

Q. 13. Two satellites of earth, S_1 is four times the mass of S_2. Which one of the following statements is true? $S_1\ and\ S_2$ are moving in the same orbit. The mass of S_1 is

a. The kinetic energies of the two satellites are equal.
b. The time period of is S_1 four times that of S_2.
c. The potential energies of earth and satellite in the two cases are equal.
d. $S_1\ and\ S_2$ are moving with the same speed.

Sol . As orbital velocity $v = \sqrt{\frac{GM}{R}}$ it is independent of mass of satellite Correct choice: (4)

Q. 14. Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature t^0C , the power received by a unit surface, (normal to the

incident rays) at a distance R from the center of the sun is (where σ is the Stefan's constant).

a. $r^2 \sigma (t+273)^4 / R$
b. $4\pi r^2 \sigma t^4 / R^2$
c. $r^2 \sigma (t+273)^4 / 4\pi R^2$
d. $16\pi^2 r^2 \sigma t^4 / R^2$

Sol. Power radiated

$$P = \sigma 4\pi r^2 (t+273)^4; \frac{Powerreceived}{Area} = \frac{P}{4\pi R^2} = \frac{\sigma r^2}{R^2}(t+273)^4$$ Correct choice: (1)

Q. 15. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 62^0C, its efficiency is doubled. Temperature of the source is

a. $99^0 C$
b. $124^0 C$
c. $37^0 C$
d. $62^0 C$

Sol. $$\eta = 1 - \frac{T_2}{T_1}; \frac{1}{6} = 1 - \frac{T_2}{T_1} \ldots (i)\ \frac{1}{3} = 1 - \frac{T_2 - 62}{T1} \ldots (ii), from\ (i)\ and\ (ii) \Rightarrow T_1 = 99^0 C$$
Correct choice: (1)

Q. 16. A black body is at $727^0 C$. It emits energy at a rate which is proportional to

a. $(727)^4$
b. $(727)^2$
c. $(1000)^4$
d. $(1000)^2$

Sol. $P \propto T^4$ Correct choice: (3)

Q. 17. The frequency of a light wave in a material is $2 \times 10^{14}\ HZ$ and wavelength is 5000Å. The refractive index of material will be

a. 1.33
b. 1.40
c. 1.50

d. 3.00

Sol. $n = 2 \times 10^{14}\ HZ;\ \lambda = 5000 \times 10^{-10} m;\ v = n\lambda = 10^{8}\ m/s;\ \mu = \frac{c}{v} = 3$ Correct choice: (4)

Q. 18. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is

a. (1) zero
b. 0.5π
c. π
d. 0.707π

Sol.

$$x = A\sin(\omega t + \phi),\ v = A\omega\cos(\omega t + \phi),\ a = -A\omega^2\sin(\omega t + \phi) \therefore \text{Phase difference} = \frac{\pi}{2}$$

Correct choice: (2)

Q. 19. The particle executing simple harmonic motion has a kinetic energy $K_0\cos^2\omega t$. The maximum values of the potential energy and the total energy are respectively

a. K_0 and K_0
b. 0 and $2K_0$
c. $\frac{K_0}{2}$ and K_0
d. K_0 and $2K_0$

Sol. $P.E_{max} = K.E_{max} = K_0$ Correct choice: (1)

Q. 20. A particle executes simple harmonic oscillation with an amplitude a . The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is

a. T / 2
b. T / 4
c. T / 8
d. T /12

Sol. $x = A\sin\omega t;\ \omega = \frac{2\pi}{T};\ x\ A/2\ when\ t = T/12$ Correct choice: (4)

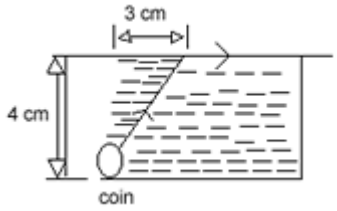
Q. 21. The electric and magnetic field of an electromagnetic wave are

a. in phase and perpendicular to each other
b. in phase and parallel to each other
c. in opposite phase and perpendicular to each other
d. in opposite phase and parallel to each other

Sol. $E_y\ (x,t) = E_o\ \sin\ (wt - kx),\ B_z\ (x,t) = B_o\ \sin\ (wt - kx)$

Correct choice: (1)

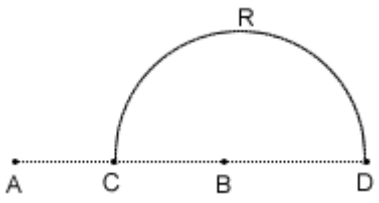
Q. 22. A small coin is resting on the bottom of a beaker filled with a liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface (see figure). How fast is the light traveling in the liquid?



a. $1.2\times10^8\ m/s$
b. $1.8\times10^8\ m/s$
c. $1.2\times10^8\ m/s$
d. $3.0\times10^8\ m/s$

Sol . $\mu\ \sin\ \theta = cons\tan t \Rightarrow \mu\times\frac{3}{5} = 1\times\sin\ 90;\ \mu = \frac{5}{3};\ v = c\ /\ \mu = 1.8\times10^8\ m/s$ Correct choice: (2)

Q. 23. Charges +q and -q are placed at points A and B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is



a. $-\frac{qQ}{6\pi\ \varepsilon_o L}$

b. $-\frac{qQ}{4\pi\varepsilon_o L}$

c.

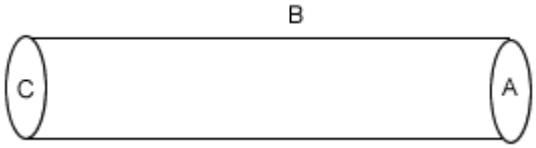
d. $-\frac{qQ}{2\pi\varepsilon_o L}$

Sol. At C potential

$$V_1 = 0;\ At\ D\ potential\ V_2 = \frac{kq}{3L} - \frac{kq}{L} = -\frac{2kq}{3L};\ W_{external} = Q(V_2 - V_1) = -\frac{Qq}{6\pi\varepsilon_o L}$$

Correct choice: (1)

Q. 24. A hollow cylinder has a charge q coulomb within it. If f is the electric flux in units of volt × meter associated with the curved surface B, the flux linked with the plane surface A in units of volt × meter will be



a. $\frac{q}{\varepsilon_o} - \phi$

b. $\frac{1}{2}\left(\frac{q}{\varepsilon_o} - \phi\right)$

c. $\frac{q}{2\varepsilon_o}$

Sol. $\phi_{curved} + 2\phi_{plane} = \frac{q}{\varepsilon_0} \Rightarrow \phi_{plane} = \frac{q}{2\varepsilon_o} - \frac{\phi}{2}$ Correct choice: (2)

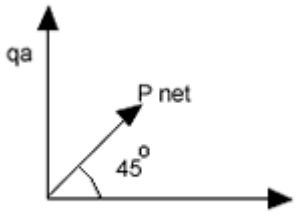
Q. 25. Three point charges +q, - 2q and +q are placed at points (x = 0, y = a, z = 0), (x = 0, y = 0, z = 0) and (x = a, y = 0, z = 0) respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are

a. $\sqrt{2}\ qa\ along + x\ direction$

b. $\sqrt{2}\ qa\ along + y\ direction$

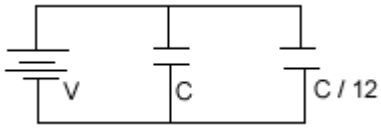
c. $\sqrt{2}\ qa\ along\ the\ line\ joining\ point\ s(x=0,y=0,z=0)\ and\ (x=a,y=a,z=0)$

d. $qa\ along\ the\ line\ joining\ point\ s(x=0,y=0,z=0)\ and\ (x=a,y=a,z=0)$



Sol . $P_{net} = \sqrt{2}\, qa$ Correct choice: (3)

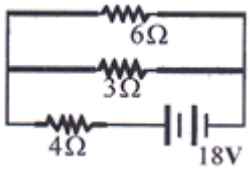
Q. 26. Two condensers, one of capacity C and the other of capacity C/2, are connected to a V-volt battery, as shown. The work done in charging fully both the condensers is



a. $\frac{1}{2} CV^2$
b. $2CV^2$
c. $\frac{1}{4} CV^2$
d. $\frac{3}{4} CV^2$

Sol. $U_i = 0; U_f = \frac{1}{2} \cdot \frac{3}{2} CV^2; W = \frac{3}{4} CV^2$ Correct choice: (4)

Q. 27. The total power dissipated in Watts in the circuit shown here is



a. 4
b. 16
c. 40
d. 54

Sol $R_{eq} = 6\ \Omega;\ p = \frac{V^2}{R_{eq}} = \frac{18 \times 18}{6} = 54\ W$ Correct choice: (4)

Q. 28. A steady current of 1.5 amp flows through a copper voltameter for 10 minute. If the electrochemical equivalent of copper is $30\acute{}10^{-5}$ gm coulomb^{-1} , the mass of copper deposited on the electrode will be

a. 0.27 gm
b. 0.40 gm
c. 0.50 gm
d. 0.67 gm

Sol . m = Zit; m = 0.27gm Correct choice: (1)

Q. 29. If the cold junction of a thermo-couple is kept at 0^0C and the hot junction is kept at T^0C, then the relation between neutral temperature (Tn) and temperature of inversion (Ti) is

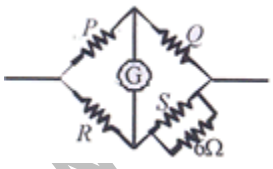
a. $T_n = T_i + T$
b. $T_n = T_i + T / 2$
c. $T_n = 2T_i$
d. $T_n = T_i - T$

Sol . $T_n = \frac{T_i}{2}$ Correct choice: (2)

Q. 30. Three resistances P, Q, R each of 2Ω and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S?

a. 1Ω
b. 2Ω
c. 3Ω
d. 6Ω

Sol .



$\frac{P}{Q} = \frac{R}{S\,6\,/\,(S+6)}; P = Q = R = 2\Omega, \Rightarrow S = 3\Omega$

Correct choice: (3)

Q. 31. The resistance of an ammeter is 13Ω and its scale is graduated for a current upto 100 Amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 Amperes by this meter. The value of shunt-resistance is

a. $2\,K\Omega$
b. $20\,\Omega$
c. $2\,\Omega$
d. $0.2\,\Omega$

Sol. $I_{max} = I_{gmax}\left(\frac{G+S}{S}\right); I_{max} = 750\,A, I_{gmax} = 100\,A; G = 13\Omega \Rightarrow S = 2\,\Omega$

Correct choice: (3)

Q. 32. Under the influence of a uniform magnetic field a charge-particle is moving in a circle of radius R with constant speed V. The time period of the motion

a. depends on R and not on V
b. depends on V and not on R
c. depends on both R and V
d. is independent of both R and V

Sol. $T = \frac{2\pi m}{Bq}$ Correct choice: (4)

Q. 33. A charged particle (charge q) is moving in a circle of radius R with uniform speed v . The associated magnetic moment μ is given by

a. qvR
b. qv R / 2
c. qv R^2
d. qvR^2 / 2

Sol. $\mu = IA;\ I = \frac{q}{2\pi R/v}, A = \pi R^2 \Rightarrow \mu = \frac{qvR}{2}$ Correct choice: (2)

Q. 33. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

a. along a straight line

b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path

Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)

Q. 34. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

a. along a straight line
b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path

Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)

Q. 35. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flu σ f linked with the primary coil is given by $\phi = \phi_o + 4t, where\ \phi is in\ webers, t is time\ in\ seconds\ and\ \phi_o$ is a constant, the output voltage across the secondary coil is

a. 30 volts
b. 90 volts
c. 120 volts
d. 220 volts

Sol. $e_p = -\frac{d\phi_p}{dt} = 4 Volt, N_p e_p = N_s e_s \Rightarrow e_s = 120 Volts$ Correct choice: (3)

Q. 36. What is the value of inductance L for which the current is a maximum in a series LCR circuit with $C = 10\mu F\ and\ \omega = 1000 \sec^{-1}$?

a. 10 mH
b. 100 mH
c. 1 mH
d. cannot be calculated unless R is known

Sol.

$\omega = \frac{1}{\sqrt{LC}} \Rightarrow L = \frac{1}{\omega^2 C} = 100 mH \left(Although\ \omega is\ written\ 1000 \sec^{-1}\ it\ must\ be\ 1000 rad/\sec.\right)$

Correct choice: (2)

Q. 37. A transformer is used to light a 100W and 110V lamp from a 220V mains. If the main current is 0.5A, the efficiency of the transformer is approximately

a. 10%
b. 30%
c. 50%
d. 90%

Sol. $\eta = \frac{out\ put}{input} \times 100; \eta = \frac{100}{0.5 \times 220} 100 = 90.9\%$ Correct choice: (4)

Q. 38. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature then it will show

a. diamagnetism
b. paramagnetism
c. anti ferromagnetism
d. no magnetic property

Sol . Fact based Correct choice: (2)

Q. 39. A 5 watt source emits monochromatic light of wavelength $5000\overset{0}{A}$. When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photoelectrons liberated will

a. be reduced by a factor of 2
b. be reduced by a factor of 4
c. be reduced by a factor of 8
d. be reduced by a factor of 16

Q. 40. Monochromatic light of frequency is $6.0 \times 10^{14}\ HZ$ produced by a laser. The power emitted is $2 \times 10^{-3}\ W$. The number of photons emitted, on the average, by the source per second is

a. 5×10^{14}
b. 5×10^{15}
c. 5×10^{16}
d. 5×10^{17}

Sol . $nhv = 2 \times 10^{-3}; n = 5 \times 10^{15}$ Correct choice: (2)

Q. 41. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{charge\ on\ the\ ion}{mass\ of\ the\ ion}\right)$ will be proportional to

a. R
b. 1/R
c. $1/R^2$
d. R^2

Sol . Radius of path

$$R=\frac{mv}{qB}=\sqrt{\frac{2m\left(K\cdot E\right)}{qB}},\ where,\ K\cdot E=qV\Rightarrow R=\frac{\sqrt{2mqV}}{qB}\Rightarrow\frac{q}{m}=\frac{2V}{B^2R^2}$$ Correct choice: (3)

Q. 42. If the nucleus $^{27}_{13}$13 has a nuclear radius of about 3.6 fm, then $^{125}_{52}$ Te would have its radius approximately as

a. 4.8 fm
b. 6.0 fm
c. 9.6 fm
d. 12.0 fm

Sol. $\frac{R_2}{R_1}\left(\frac{A_2}{A_1}\right)^{1/3}$; $R_2=R_1\left(\frac{125}{27}\right)^{1/3}=3.6\times\frac{5}{3}=6.0\ fm$ Correct choice: (2)

Q. 43. In radioactive decay process, the negatively charged emitted β^- particles are

a. the electrons orbiting around the nucleus
b. the electrons present inside the nucleus
c. the electrons produced as a result of the decay of neutrons inside the nucleus
d. the electrons produced as a result of collisions between atoms

Sol . When neutron decays as given ${}_0n^1={}_1H^1+{}_{-1}e^0+\bar{\nu}$ Correct choice: (3)

Q. 44. A nucleus $^{A}_{Z}X$ has nucleus A X
Z has mass represented by M (A, Z). If M_p and M_n denote the mass of proton and neutron respectively and B.E the binding energy in Me V then

a. $B.E = M(A,z) - ZM_p - (A-Z)M_n$
b. $B.E = \left[M(A,z) - ZM_p - (A-Z)M_n\right]c^2$
c. $B.E = \left[ZM_p + (A,z)M_n - M(A,Z)\right]c^2$
d. $B.E = \left[ZM_p + AM_n - M(A,Z)\right]c^2$

Sol. $B.E = \left[ZM_p + (A,z)M_n - M(A,Z)\right]c^2$ Correct choice: (3)

Q. 45. Two radioactive substances A and B have decay constants 5λ *and* λ respectively. At t = 0 they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/e)^2$ after a time interval

a. $\frac{1}{2\lambda}$
b. $\frac{1}{4\lambda}$
c. 4λ
d. 2λ

Sol. $\frac{N_A}{N_B} = \frac{N_0 e^{-\lambda t}}{N_0 e^{-\lambda 2t}}$ *Where* $\frac{N_A}{N_B} = \frac{1}{e^2}; \lambda_1 = 5\lambda, = \lambda_2 = \lambda$ *So,* $\frac{1}{e^2} = \frac{e^{-5\lambda t}}{e^{-\lambda t}} \Rightarrow t = \frac{1}{2\lambda}$

Correct choice: (1)

Q. 46. The total energy of electron in the ground state of hydrogen atom is –13.6 eV. The kinetic energy of an electron in the firstm excited state is

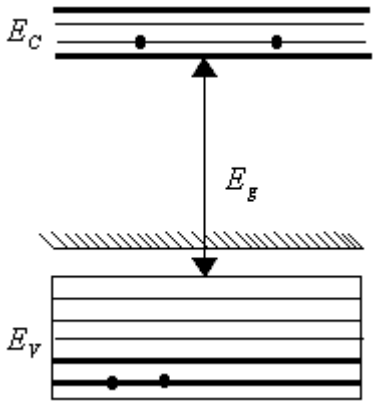
a. 1.7 eV
b. 3.4 eV
c. 6.8 eV
d. 13.6 eV

Sol. Total energy in 1st excited state

$= -\frac{13.6}{4} = -3.4eV$ *and* $K.E = -(total\ energy) = 3.4eV$

Correct choice: (2)

Q. 47. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is



a. an n-type semiconductor
b. a p-type semiconductor
c. an insulator
d. a metal

Sol. In diagram acceptor level is near valance band which will happen in p-type semiconductor. Correct choice: (2)

Q. 48. A common emitter amplifier has a voltage gain of 50, an input impedance of $100\ \Omega$ and an output impedance of $200\ \Omega$. The power gain of the amplifier is

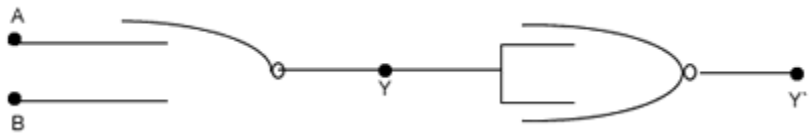
a. 100
b. 500
c. 1000
d. 1250

Sol.

Voltage gain, $A_v = 50$; *input impedance,* $Ri = 100\Omega$; *output impedance* $R_o = 200\Omega$. *the power gain of the* $= (A_v)^2 \times \frac{R_i}{R_0} = 1250$

Correct choice: (4)

Q. 49. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table



(i) A B Y

0	0	0
0	1	1
1	1	1

(ii)

A	B	Y
0	1	0
1	0	0
1	1	1

(iii)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(iv)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Q. 50. For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct?

a. $a = b = c \ and \ \alpha = \beta = \gamma = 90^0$

b. $a \neq b \neq c \ and \ \alpha \neq \beta \neq \gamma \neq 90^0$

c. $a \neq b \neq c \ and \ \alpha = \beta = \gamma = 90^0$

d. $a = b = c \ and \ \alpha \neq \beta \neq \gamma = 90^0$

Sol. the cubic system is the most symmetric out of all seven crystal systems. All edges for the unit cell are same i.e., a = b = c and all angles are right angles i.e., $\alpha = \beta = \gamma = 90^0$
Correct choice: (1)

PRELIM EXAMINATION

BIOLOGY

Q. 1. An element playing important role in nitrogen fixation is :

1. Molybdenum
2. Copper
3. Manganese
4. Zinc

Answer: (1)

Q. 2. Select the correct statement from the ones given below:

1. Barbiturates when given to criminals make them tell the truth
2. Morphine is often given to persons who have undergone surgery as a pain killer.
3. Chewing tobacco lowers blood pressure and heart rate
4. Cocaine is given to patients after surgery as it stimulates recovery

Answer: (2)

Q. 3. Listed below are four respiratory capacities (a − d) and four jumbled respiratory volumes of a normal human adult. Respiratory Respiratory
capacities volumes.

1. Residual volume 2500 mL
2. Vital capacity 3500 mL
3. Inspiratory reserve volume 1200 mL
4. Inspiratory capacity 4500 mL

Which one of the following is the correct matching of two capacities and volumes?

1. (b) 2500 mL, (c) 4500 mL
2. (c) 1200 mL, (d) 2500 mL
3. (d) 3500 mL, (a) 1200 mL
4. (a) 4500 mL, (b) 3500 mL

Answer: (3)

Q. 4. Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called:

1. Xenogamy
2. Geitonogamy
3. Karyogamy
4. Autogamy

Answer: (2)

Q. 5. ABO blood groups in humans are controlled by the gene I. It has three alleles – I^A, I^B and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur?

1. Three
2. One
3. Four
4. Two

Answer: (3)

Q. 6. Low Ca^{++} in the body fluid may be the cause of:

1. Tetany
2. Anaemia
3. Angina pectoris
4. Gout

Answer: (1)

Q. 7. The nerve centres which control the body temperature and the urge for eating recontained in:

1. Hypothalamus
2. Pons
3. Cerebellum
4. Thalamus

Answer: (1)

Q. 8. During mitosis ER and nucleolus begin to disappear at:

1. Late prophase
2. Early metaphase

3. Late metaphase
4. Early prophase

Answer: (1)

Q. 9. Darwin's finches are a good example of:

1. Industrial melanism
2. Connecting link
3. Adaptive radiation
4. Convergent evolution

Answer: (3)

Q. 10. Which stages of cell division do the following figures A and B represent respectively?

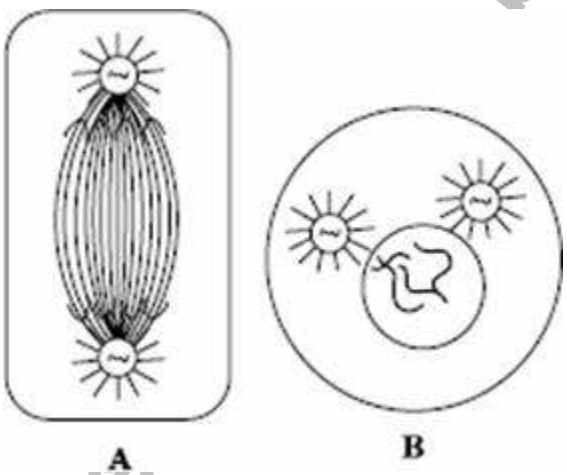


Fig. A Fig. B

1. Metaphase − Telophase
2. Telophase minus; Metaphase
3. Late Anaphase − Prophase
4. Prophase − Anaphase

Answer: (3)

Q. 11. The common nitrogen-fixer in paddy fields is:

1. Rhizobium
2. Azospirillum
3. Oscillatoria
4. Frankia

Answer: (2)

Q. 12. Which two of the following changes (a − d) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more)?

1. Increase in red blood cell size
2. Increase in red blood cell production
3. Increased breathing rate
4. Increase in thrombocyte count Changes occurring are :

(1) (b) and (c) (2) (c) and (d) (3) (a) and (d) (4) (a) and (b)

Answer: (1)

Q. 13. What is true about RBCs in humans?

1. They carry about 20 − 25 per cent of CO_2
2. They transport 99.5 per cent of O_2
3. They transport about 80 per cent oxygen only and the rest 20 per cent of it is transported in dissolved state in blood plasma
4. They do not carry CO_2 at all

Answer: (1)

Q. 14. The main arena of various types of activities of a cell is:

1. Plasma membrane
2. Mitochondrian
3. Cytoplasm
4. Nucleus

Answer: (3)

Q. 15. If for some reason our goblet cells are non-functional, this will adversely affect:

1. production of somatostatin
2. secretion of sebum from the sebaceous glands
3. maturation of sperms
4. smooth movement of food down the intestine

Answer: (4)

Q. 16. The plasma membrane consists mainly of:

1. phospholipids embedded in a protein bilayer
2. proteins embedded in a phospholipid bilayer
3. proteins embedded in a polymer of glucose molecules

4. proteins embedded in a carbohydrate bilayer

Answer: (2)

Q. 17. The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons?

1. Cotyledon
2. Endosperm
3. Aleurone layer
4. Plumule

Answer: (1)

Q. 18. The energy − releasing metabolic process in which substrate is oxidised without an external electron acceptor is called:

1. Glycolysis
2. Fermentation
3. Aerobic respiration
4. Photorespiration

Answer: (1)

Q. 19. Photoperiodism was first characterised in:

1. Tobacco
2. Potato
3. Tomato
4. Cotton

Answer: (1)

Q. 20 . The second maturation division of the mammalian ovum occurs:

1. Shortly after ovulation before the ovum makes entry into the Fallopian tube
2. Until after the ovum has been penetrated by a sperm
3. Until the nucleus of the sperm has fused with that of the ovum
4. in the Graafian follicle following the first maturation division

Answer: (2)

Q. 21. Satellite DNA is useful tool in:

1. Organ transplantation
2. Sex determination

3. Forensic science
4. Genetic engineering

Answer: (3)

Q. 22. Which one of the following does not follow the central dogma of molecular biology?

1. Pea
2. Mucor
3. Chlamydomonas
4. HIV

Answer: (4)

Q. 23. Which one of the following statements about human sperm is correct?

1. Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
2. The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation
3. Acrosome serves as a sensory structure leading the sperm towards the ovum
4. Acrosome serves no particular function.

Answer: (2)

Q 24. The genetically-modified (GM) brinjal in India has been developed for:

1. Insect-resistance
2. Enhancing shelf life
3. Enhancing mineral content
4. Drought-resistance

Answer: (1)

Q. 25. Apomictic embryos in citrus arise from:

1. Synergids
2. Maternal sporophytic tissue in ovule
3. Antipodal cells
4. Diploid egg

Answer: (2)

Q. 26. One example of animals having a single opening to the outside that serves both as mouth as well as anus is:

1. Octopus
2. Asterias
3. Ascidia
4. Fasciola

Answer: (3)

Q. 27. Membrane-bound organelles are absent in :

1. Saccharomyces
2. Streptococcus
3. Chlamydomonas
4. Plasmodium

Answer: (2)

Q. 28. Keel is characteristic of the flowers of :

1. Gulmohur
2. Cassia
3. Calotropis
4. Bean

Answer: (4)

Q. 29. The kind of epithelium which forms the inner walls of blood vessels is :

1. cuboidal epithelium
2. columnar epithelium
3. ciliated columnar epithelium
4. squamous epithelium

Answer: (4)

Q .30. Which one of the following has its own DNA?

1. Mitochondria
2. Dictyosome
3. Lysosome
4. Peroxisome

Answer: (1)

Q .31. Select the correct statement from the following:

1. Biogas is produced by the activity of aerobic bacteria on animal waste

2. Methanobacterium is an aerobic bacterium found in rumen of cattle
3. Biogas, commonly called gobar gas, is pure methane
4. Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria

Answer : (4)

because small amounts are used as inoculum in secondary treatment or biological treatment stage of sewage treatment.

Q .32. Study the four statements (a − d) given below and select the two correct ones out of them:

1. A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers
2. Predator star fish Pisaster helps in maintaining species diversity of some invertebrates
3. Predators ultimately lead to the extinction of prey species.
4. Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders

The two correct statements are:

1. (b) and (c)
2. (c) and (d)
3. (a) and (d)
4. (a) and (b)

Answer: (4)

Q .33. Breeding of crops with high levels of minerals, vitamins and proteins is called:

1. Somatic hybridisation
2. Biofortification
3. Biomagnification
4. Micropropagation

Answer: (2)

Q .34. Widal test is used for the diagnosis of:

1. Malaria
2. Pneumonia
3. Tuberculosis
4. Typhoid

Answer: (4)

Q. 35. In vitro fertilisation is a technique that involves transfer of which one of the following into the fallopian tube?

1. Embryo only, upto 8 cell stage
2. Either zygote or early embryo upto 8 cell stage
3. Embryo of 32 cell stage
4. Zygote only

Answer: (1)

because the embryo is introduced into fallopian tube.

Q. 36. Which one of the following structures between two adjacent cells is an effective transport pathway?

1. Plasmodesmata
2. Plastoquinones
3. Endoplasmic reticulum
4. Plasmalemma

Answer: (1)

Q. 37. Single-celled eukaryotes are included in:

1. Protista
2. Fungi
3. Archaea
4. Monera

Answer: (1)

Q. 38. In unilocular ovary with a single ovule the placentation is :

1. Marginal
2. Basal
3. Free Central
4. Axile

Answer: (2)

Q. 39. Sertoli cells are found in:

1. ovaries and secrete progesterone
2. adrenal cortex and secrete adrenaline

3. seminiferous tubules and provide nutrition to germ cells
4. pancreas and secrete cholecystokinin

Answer: (3)

Q. 40. Which one of the following cannot be explained on the basis of Mendel's Law of Dominance?

1. The discrete unit controlling a particular character is called a factor
2. Out of one pair of factors one is dominant, and the other recessive
3. Alleles do not show any blending and both the characters recover as such in F_2 generation.
4. Factors occur in pairs

Answer: (3)

Q. 41. The chief water conducting elements of xylem in gymnosperms are:

1. Vessels
2. Fibres
3. Transfusion tissue
4. Tracheids

Answer: (4)

Q. 42. Ringworm in humans is caused by :

1. Bacteria
2. Fungi
3. Nematodes
4. Viruses

Answer: (2)

Q. 43. Which one of the following is not a micronutrient?

1. Molybdenum
2. Magnesium
3. Zinc
4. Boron.

Answer: (2)

Q. 44. Vasa efferentia are the ductules leading from:

1. Testicular lobules to rete testis

2. Rete testis to vas deferens
3. Vas deferens to epididymis
4. Epididymis to urethra

Answer: (2)

Q. 45. Select the two correct statements out of the four (a − d) given below about lac operon.

1. Glucose or galactose may bind with the repressor and inactivate it
2. In the absence of lactose the repressor binds with the operator region
3. The z-gene codes for permease
4. This was elucidated by Francois Jacob and Jacque Monod
   The correct statements are:

1. (b) and (c)
2. (a) and (c)
3. (b) and (d)
4. (a) and (b)

Answer: (3)

Q. 46. The genotype of a plant showing the dominant phenotype can be determined by :

1. Test cross
2. Dihybrid cross
3. Pedigree analysis
4. Back cross

Answer: (1)

Q. 47. PGA as the first CO_2 fixation product was discovered in photosynthesis of:

1. Bryophyte
2. Gymnosperm
3. Angiosperm
4. Alga

Answer: (4)

Q. 48. Seminal plasma in human males is rich in :

1. fructose and calcium
2. glucose and calcium
3. DNA and testosterone
4. ribose and potassium

Answer: (1)

Q. 49. A common biocontrol agent for the control of plant diseases is :

1. Baculovirus
2. Bacillus thuringiensis
3. Glomus
4. Trichoderma

Answer: (4)

Q. 50. Injury to adrenal cortex is not likely to affect the secretion of which one of the following?

1. Aldosterone
2. Both Androstenedione and Dehydroepiandrosterone
3. Adrenaline
4. Cortisol

Answer: (3)

Q. 51. Which one of the following pairs is incorrectly matched?

1. Glucagon − Beta cells (source)
2. Somatostatin − Delta cells (source)
3. Corpusluteum − Relaxin (secretion)
4. lnsulin − Diabetes mellitus (disease)

Answer: (1)

Q. 52. Select the correct statement from the ones given below with respect to dihybrid cross.

1. Tightly linked genes on the same chromosome show higher recombinations
2. Genes far apart on the same chromosome show very few recombinations
3. Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones
4. Tightly linked genes on the same chromosome show very few recombinations.

Answer: (4)

Q. 53. Which one of the following statements in regard to the excretion by the human kidneys is correct?

1. Descending limb of Loop of Henle is impermeable to water
2. Distal convoluted tubule is incapable of reabsorbing HCO_3

3. Nearly 99 per cent of the glomerular filtrate is reabsorbed by the renal tubules.
4. Ascending limb of Loop of Henle is impermeable to electrolytes

Answer: (3)

Q. 54. The biomass available for consumption by the herbivores and the decomposers is called :

1. Net primary productivity
2. Secondary productivity
3. Standing crop
4. Gross primary productivity

Answer: (1)

Q. 55. If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect?

1. The flow of blood into the aorta will be slowed down
2. The ' pacemaker ' will stop working
3. The blood will tend to flow back into the left atrium
4. The flow of blood into the pulmonary artery will be reduced

Answer: (4)

Q. 56. Ovary is half-inferior in the flowers of :

1. Guava
2. Plum
3. Brinjal
4. Cucumber

Answer: (2)

Q. 57. Which one of the following is used as vector for cloning genes into higher organisms ?

1. Baculovirus
2. Salmonella typhimurium
3. Rhizopus nigricans
4. Retrovirus

Answer: (4)

Q. 58. The one aspect which is not a salient feature of genetic code, is its being:

1. Degenerate
2. Ambiguous
3. Universal
4. Specific

Answer: (2)

Q. 59. Which one of the following is an example of ex-situ conservation?

1. Wildlife sanctuary
2. Seed bank
3. Sacred groves
4. National park

Answer: (2)

Q. 60. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme?

1. 5′ ———— CGTTCG ———— 3′
   3′ ———— ATGGTA ———— 5′
2. 5′ ———— GATATG ———— 3′
   3′ ———— CTACTA ———— 5′
3. 5′ ———— GAATTC ———— 3′
   3′ ———— CTTAAG ———— 5′
4. 5′ ———— CACGTA ———— 3′
   3′ ———— CTCAGT ———— 5′

Answer: (3)

Q. 61. Which one of the following statements is correct with respect to AIDS?

1. The HIV can be transmitted through eating food together with an infected person
2. Drug addicts are least susceptible to HIV infection
3. AIDS patients are being fully cured cent per cent with proper care and nutrition
4. The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers.

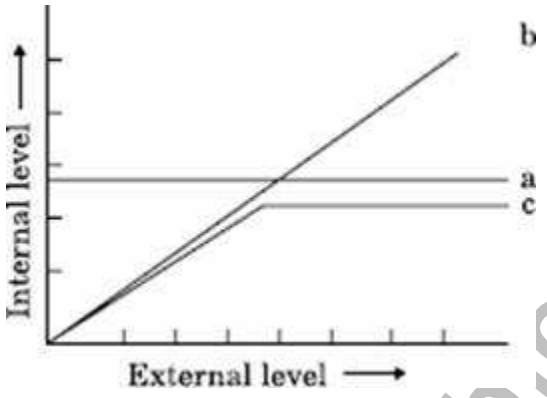
Answer: (4)

Q. 62. Phototropic curvature is the result of uneven distribution of :

1. Gibberellin
2. Phytochrome
3. Cytokinins
4. Auxin

Answer: (4)

Q. 63. The Figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively?



	(a)	(b)	(c)
1)	conformer	regulator	partial regulator
2)	regulator	partial regulator	conformer
3)	partial regulator	regulator	conformer
4)	regulator	conformer	partial regulator

Answer: (4)

Q. 64. Male and female gametophytes are independent and free-living in:

1. Mustard
2. Castor
3. Pinus
4. Sphagnum

Answer: (4)

Q. 65. The technical term used for the androecium in a flower of China rose (Hibiscus rosasinensis) is:

1. Monadelphous

2. Diadelphous
3. Polyandrous
4. Polyadelphous

Answer: (1)

Q. 66. Virus envelope is known as:

1. Capsid
2. Virion
3. Nucleoprotein
4. Core

Answer: (1)

Q. 67. The permissible use of the technique amniocentesis is for:

1. detecting sex of the unborn foetus
2. artificial insemination
3. transfer of embryo into the uterus of the surrogate mother
4. detecting any genetic abnormality

Answer: (4)

Q. 68. One of the free-living, anaerobic nitrogen-fixer is:

1. Beijernickia
2. Rhodospirillum
3. Rhizobium
4. Azotobacter

Answer: (2)

Q. 69. DNA or RNA segment tagged with a radioactive molecule is called:

1. Vector
2. Probe
3. Clone
4. Plasmid

Answer: (2)

Q. 70. The signals for parturition originate from:

1. placenta only
2. placenta as well as fully developed foetus

3. oxytocin released from maternal pituitary
4. fully developed foetus only

Answer: (2)

Q. 71. The principal nitrogenous excretory compound in humans is synthesised:

1. in kidneys but eliminated mostly through liver
2. in kidneys as well as eliminated by kidneys
3. in liver and also eliminated by the same through bile
4. in the liver, but eliminated mostly through kidneys

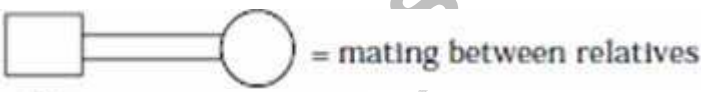
Answer: (4)

Q. 72. Carrier ions like Na+ facilitate the absorption of substances like:

1. amino acids and glucose
2. glucose and fatty acids
3. fatty acids and glycerol
4. fructose and some amino acids

Answer: (1)

Q. 73. Which one of the following symbols and its representation, used in human pedigree analysis is correct?

1. 

2. 

3. 

4. 

Answer: (1)

Q. 74. Toxic agents present in food which interfere with thyroxine synthesis lead to the development of:

1. toxic goitre
2. cretinism
3. simple goitre
4. thyrotoxicosis

Answer: (3)

Q. 75. Which one of the following statements about all the four of Spongilla, Leech, Dolphin and Penguin is correct?

1. Penguin is homiothermic while the remaining three are poikilothermic
2. Leech is a fresh water form while all others are marine
3. Spongilla has special collared cells called choanocytes, not found in the remaining three
4. All are bilaterally symmetrical

Answer: (3)

Q. 76. The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?

1. Fourth month
2. Fifth month
3. Sixth month
4. Third month

Answer: (2)

Q. 77. Which one of the following kinds of animals are triploblastic?

1. Flat worms
2. Sponges
3. Ctenophores
4. Corals

Answer: (1)

Q. 78. Which one of the following statements about certain given animals is correct?

1. Round worms (Aschelminthes) are pseudocoelomates
2. Molluscs are acoelomates
3. Insects are pseudocoelomates
4. Flat worms (Platyhelminthes) are coelomates

Answer: (1)

Q. 79. Cu ions released from copper − releasing Intra Uterine Devices (IUDs):

1. make uterus unsuitable for implantation
2. increase phagocytosis of sperms
3. suppress sperm motility

4. prevent ovulation

Answer: (3)

Q. 80. Restriction endonucleases are enzymes which:

1. make cuts at specific positions within the DNA molecule
2. recognize a specific nucleotide sequence for binding of DNA ligase
3. restrict the action of the enzyme DNA polymerase
4. remove nucleotides from the ends of the DNA molecule

Answer: (1)

Q. 81. Which one of the following is not a lateral meristem?

1. Intrafascicular cambium
2. Interfascicular cambium
3. Phellogen
4. Intercalary meristem

Answer: (4)

Q. 82. A renewable exhaustible natural resource is:

1. Coal
2. Petroleum
3. Minerals
4. Forest

Answer: (4)

Q. 83. C_4 plants are more efficient in photosynthesis than C_3 plants due to:

1. Higher leaf area
2. Presence of larger number of chloroplasts in the leaf cells
3. Presence of thin cuticle
4. Lower rate of photorespiration

Answer: (4)

Q. 84. Algae have cell wall made up of:

1. Cellulose, galactans and mannans
2. Hemicellulose, pectins and proteins
3. Pectins, cellulose and proteins
4. Cellulose, hemicellulose and pectins

Answer: (1)

Q. 85. Some hyperthermophilic organisms that grow in highly acidic (pH2) habitats belong to the two groups:

1. Eubacteria and archaea
2. Cyanobacteria and diatoms
3. Protists and mosses
4. Liverworts and yeasts

Answer: (1)

Q. 86. Genetic engineering has been successfully used for producing:

1. transgenic mice for testing safety of polio vaccine before use in humans
2. transgenic models for studying new treatments for certain cardiac diseases
3. transgenic Cow − Rosie which produces high fat milk for making ghee
4. animals like bulls for farm work as they have super power

Answer: (1)

Q. 87. Some of the characteristics of Bt cotton are:

1. Long fibre and resistance to aphids
2. Medium yield, long fibre and resistance to beetle pests
3. High yield and production of toxic protein crystals which kill dipteran pests
4. High yield and resistance to bollworms

Answer: (4)

Q. 88. Heartwood differs from sapwood in:

1. Presence of rays and fibres
2. Absence of vessels and parenchyma
3. Having dead and non-conducting elements
4. Being susceptible to pests and pathogens

Answer: (3)

Q. 89. Consider the following four statements (a − d) regarding kidney transplant and select the two correct ones out of these.

1. Even if a kidney transplant is proper the recipient may need to take immuno-suppresants for a long time
2. The cell-mediated immune response is responsible for the graft rejection
3. The B-lymphocytes are responsible for rejection of the graft

4. The acceptance or rejection of a kidney transplant depends on specific interferons.

The two correct statements are:
(1) (b) and (c) (2) (c) and (d)
(3) (a) and (c) (4) (a) and (b)

Answer: (4)

Q. 90. Wind pollinated flowers are:

1. small, brightly coloured, producing large number of pollen grains
2. small, producing large number of dry pollen grains
3. large producing abundant nectar and pollen
4. small, producing nectar and dry pollen

Answer: (2)

Q. 91. dB is a standard abbreviation used for the quantitative expression of:

1. the density of bacteria in a medium
2. a particular pollutant
3. the dominant Bacillus in a culture
4. a certain pesticide

Answer: (2)

Q. 92. Which one of the following is one of the characteristics of a biological community?

1. Stratification
2. Natality
3. Mortality
4. Sex-ratio

Answer: (1)

Q. 93. Which one of the following statements about morula in humans is correct?

1. It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA
2. It has far less cytoplasm as well as less DNA than in an uncleaved zygote
3. It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote.
4. It has more cytoplasm and more DNA than an uncleaved zygote

Answer: (1)

Q. 94. Coiling of garden pea tendrils around any support is an example of:

1. Thigmotaxis
2. Thigmonasty
3. Thigmotropism
4. Thermotaxis

Answer: (3)

Q. 95. The two gases making highest relative contribution to the greenhouse gases are:

1. CO_2 and CH_4
2. CH_4 and N_2O
3. $CFC_5$5 and N_2O
4. CO_2 and N_2O

Answer: (1)

Q. 96. Which one of the following is not used in organic farming?

1. Glomus
2. Earthworm
3. Oscillatoria
4. Snail

Answer: (4)

Q. 97. Stirred-tank bioreactors have been designed for:

1. Addition of preservatives to the product
2. Purification of the product
3. Ensuring anaerobic conditions in the culture vessel
4. Availability of oxygen throughout the process

Answer: (4)

Q. 98. The part of Fallopian tube closest to the ovary is:

1. Isthmus
2. Infundibulum
3. Cervix
4. Ampulla

Answer: (2)

Q. 99. An improved variety of transgenic basmati rice:

1. does not require chemical fertilizers and growth hormones
2. gives high yield and is rich in vitamin A
3. is completely resistant to all insect pests and diseases of paddy
4. gives high yield but has no characteristic aroma

Answer: (3)

Q. 100. Infectious proteins are present in:

1. Gemini viruses
2. Prions
3. Viroids
4. Satellite viruses

Answer: (2)

CHEMISTRY

Q. 1. Which one of the following species does not exist under normal conditions?

1. Be_2^+
2. Be_2
3. B_2
4. Li_2

Sol:

Bond order of Be_2 = 0, cannot exit

Answer : (2)

Q. 2. Which of the following complex ion is not expected to absorb visible light?

1. $[Ni(CN)_4]^{2-}$
2. $[Cr(NH_3)_6]^{+3}$
3. $[Fe(H_2O_6)_6]^{2+}$
4. $[Ni(H_2O)_6]^{2+}$

sol.

1. $[Ni(CN)_4]^{2-}$: Number of unpaired electrons − 0
2. $[Cr(NH_3)_6]^{+2}$: Number of unpaired electrons − 3
3. $[Fe(H_2O_6)_6]^{2+}$: Number of unpaired electrons − 4
4. $[Ni(H_2O)_6]^{2+}$: Number of unpaired electrons − 2

Answer : (1)

Q. 3. If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its $K_{(sp)}$ is:

1. $4.00 \times 10^{-6}\ M^3$
2. $4.00 \times 10^{-7}\ M^3$
3. $5.00 \times 10^{-6}\ M^3$
4. $5.00 \times 10^{-7}\ M^3$

Sol.

$$Ba(OH)_{2(S)} \rightarrow Ba^{+2}_{(aq)} + 2\,OH^{-}_{(aq)}$$

$$pH = 12 \text{ or } pOH = 2$$

$$[OH^-] = 10^{-2}\ M$$

$$Ba(OH)_2 \rightarrow Ba^{-2}\ M$$

$$Ba(OH)_2 \rightarrow Ba^{-2} \quad + \quad [OH^-]$$

$$0.5 \times 10^{-2} \quad 10^{-2} \quad i\,0^{-4}$$

$$K_{Sp} = [Ba^{+2}][OH^-]^2$$

$$= [0.5 \times 10^{-2}][1 \times 10^{-2}]^2$$

$$= 0.5 \times 10^{-6} = 5 \times 10^{-7} M^3$$

Answer : (4)

Q. 4. For the reaction

$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + 1/2\,O_{2(g)}$ the value of rate of disappearance of N_2O_5 is given as $6.25 \times 10^{-3}\ mol\ L^{-1}\ s^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as:

1. $6.25\times10^{-3}\ mol\ L^{-1}\ s^{-1}\ and$
   $6.25\times10^{-3}\ mol\ L^{-1}\ s^{-1}$
2. $1.25\times10^{-2}\ mol\ L^{-1}\ s^{-1}\ and$
   $3.125\times10^{-3}\ mol\ L^{-1}\ s^{-1}$
3. $6.25\times10^{-3}\ mol\ L^{-1}\ s^{-1}\ and$
   $3.125\times10^{-3}\ mol\ L^{-1}\ s^{-1}$
4. $1.25\times10^{-2}\ mol\ L^{-1}\ s^{-1}\ and$
   $6.25\times10^{-3}\ mol\ L^{-1}\ s^{-1}$

Sol .

$$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + 1/2\,O_{2(g)}$$

$$\frac{d}{dt}[N_2O_5] = +\frac{1}{2}\frac{d}{dt}[NO_2] = 2\frac{d}{dt}[O_2]$$

$$\frac{d}{dt}[NO_2] = 1.25\times10^{-2}\ mol\ L^{-1}\ S^{-1} and$$

$$\frac{d}{dt}[NO_2] = 1.25\times10^{-2}\ mol\ L^{-1}\ S^{-1} and$$

$$\frac{d}{dt}[O_2] = 3.125\times10^{-3}\ mol\ L^{-1}\ s^{-1}$$

Answer : (2)

Q. 5. Which one of the following does **not** exhibit the phenomenon of mutarotation?

1. (+) Sucrose
2. (+) Lactose
3. (+) Maltose
4. (-) Fructose

Sol:

Sucrose does not have free − CHO and CO groups

Answer : (1)

Q. 6. In which of the following pairs of molecules/ions, the central atoms have sp^2 hybridization?

1. NO_2^- and NH_3
2. BF_3 and NO_2^-
3. NH_2^- and H_2O
4. BF_3 and NH_2^-

Sol .

$$BF_3 : \frac{3+3}{2} = 3, sp^2$$

$$NO_2^- : \frac{5+1}{2} = 3, sp^2$$

Answer : (2)

Q. 7. Liquid hydrocarbons can be converted to a mixture of gaseous hydrocarbons by:

1. Oxidation
2. Cracking
3. Distillation under reduced pressure
4. Hydrolysis

Sol:

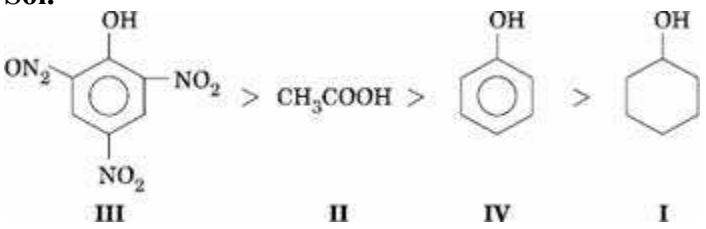
During cracking, lower gaseous hydrocarbons are formed.

Answer : (2)

Q. 8. Given are cyclohexanol (I), acetic acid (II), 2, 4, 6-trinitrophenol (III) and phenol (IV). In these the order of decreasing acidic character will be:

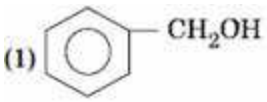
1. III > II > IV> I
2. II > III > I > IV
3. II > III > IV > I
4. III > IV > II > I

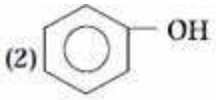
Sol.

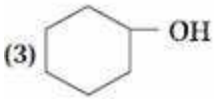


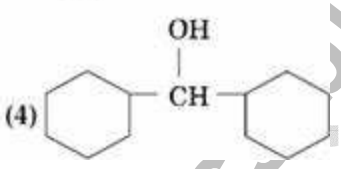
Answer : (1)

Q. 9. Which one of the following compounds has the most acidic nature?









Sol:

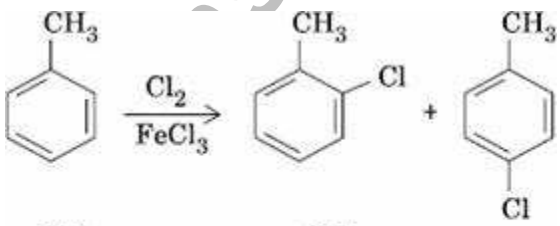
Phenol is most acidic, the other compounds are alcohols.

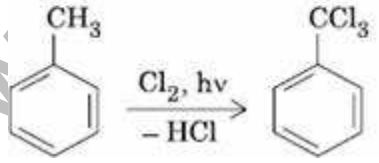
Answer : (2)

Q. 10. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light gives 'Y'. Thus, 'X' and 'Y' are:

1. X = Benzal chloride, Y = o-chlorotoluene
2. X = m-chlorotoluene, Y = p-chlorotoluene
3. X = o-and p-chlorotoluene, Y = Trichloromethyl benzene
4. X = Benzyl chloride, Y = m-chlorotoluene

Sol.



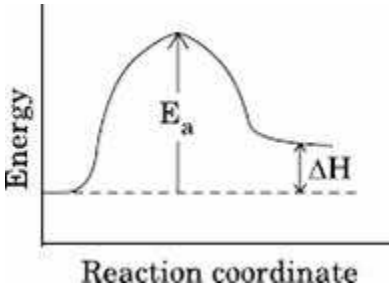


Answer : (3)

Q. 11. For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be:

1. less than ΔH
2. equal to ΔH
3. more than ΔH
4. equal to zero

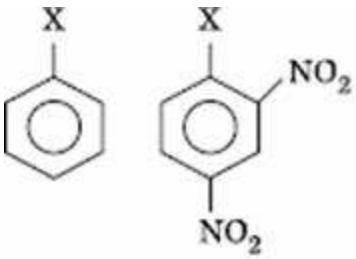
Sol.



$Ea > \Delta H$

Answer : (3)

Q. 12. The correct order of increasing reactivity of C − X bond towards nucleophile in the following compounds is:

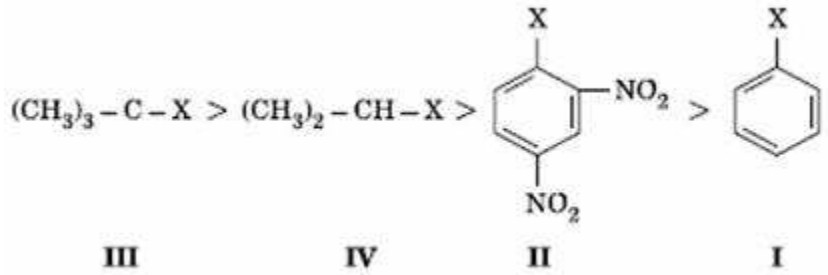


(I) (II) $(CH_3)_3C-X$ (III) $(CH_3)_2CH-X$ (IV)

1. I < II < IV < III
2. II < III < I < IV
3. IV < III < I < II
4. III < II < I < IV

Sol:

Tertiary alkyl halide has the highest rate in nucleophilic substitution. Aryl halide has the least rate due to partial double character. Presence of $-NO_2$ groups in ortho and para positions will increase the reactivity.



or I < II < IV < III

Answer : (1)

Q. 13. Which of the following ions will exhibit colour in aqueous solutions?

1. La^{3+} $(Z = 57)$
2. Ti^{3+} $(Z = 22)$
3. Lu^{3+} $(Z = 71)$
4. Sc^{3+} $(Z = 21)$

Sol:

$La^{+3} : 54e^- = [Xe]$

$Ti^{+3} : 19e^- = [Ar]3d^1$ (colour)

$Lu^{+3} : 68e^- = [Xe]4f^{14}$

$Sc^{+3} : 18e^- = [Ar]$

Answer : (2)

Q. 14. Acetamide is treated with the following reagents separately. Which one of these would yield methylamine?

1. $NaOH - Br_2$
2. Sodalime
3. Hot conc. H_2SO_4

4.

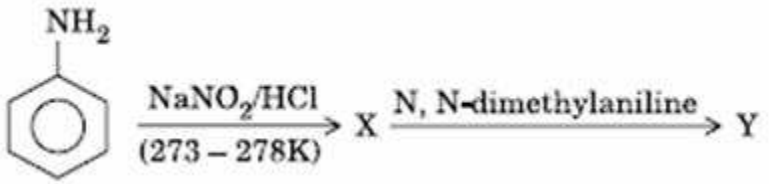
PCl_5

Sol .

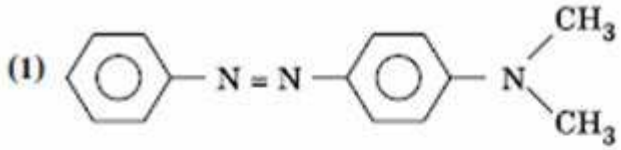
$$CH_3CONH_2 \xrightarrow[Br_2]{NaOH} CH_3NH_2$$

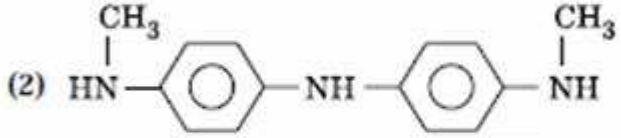
Answer : (1)

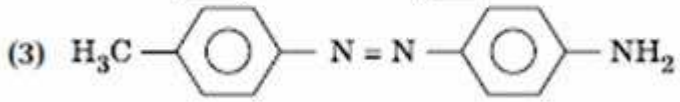
Q. 15. Aniline in a set of the following reactions yielded a coloured product 'Y'.

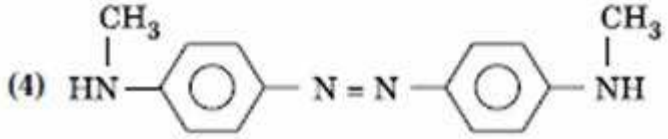


The structure of 'Y' would be:

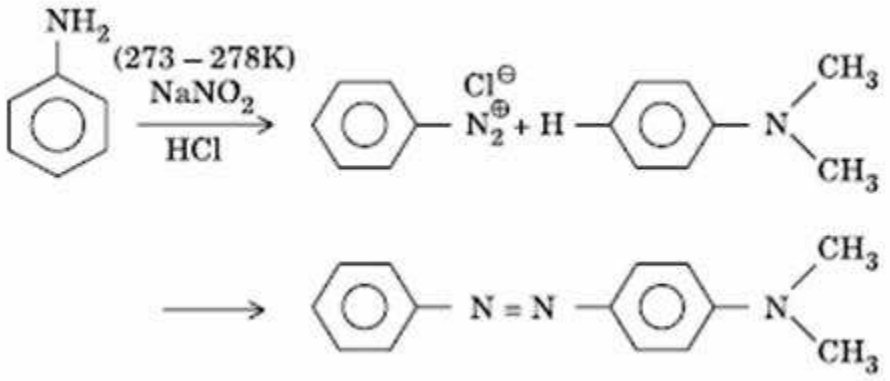
(1) 

(2) 

(3) 

(4) 

Sol.



Answer : (1)

Q. 16. A solution of sucrose (molar mass = 342 g mol^{-1}) has been prepared by dissolving 68.5 g of sucrose in 1000 g of water. The freezing point of the solution obtained will be: (K_f for water = 1.86 K kg mol^{-1})

1. -0.372^oC
2. -0.520^oC
3. $+0.372^oC$
4. -0.570^oC

Sol.

$$\Delta T_f = K_f \frac{1000\, W_2}{M_2\, W_1} = \frac{1.86 \times 1000 \times 68.5}{342 \times 1000} = 0.372$$

$$T_f = -0.372\ ^\circ C$$

Answer: (1)

Q. 17. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to:

1. increase in ionic mobility of ions
2. 100% ionisation of electrolyte at normal dilution
3. increase in both i.e. number of ions and ionic mobility of ions
4. increase in number of ions.

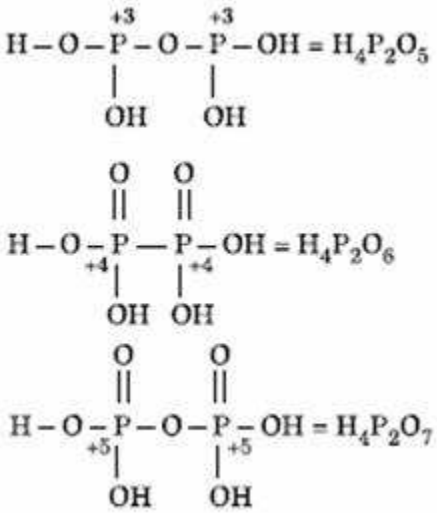
Answer : (1)

Q. 18. Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, $H_4P_2O_7$ are respectively:

1. +3, +5, +4
2. +5, +3, + 4
3. +5, +4, +3

4. +3, +4, +5

Sol.



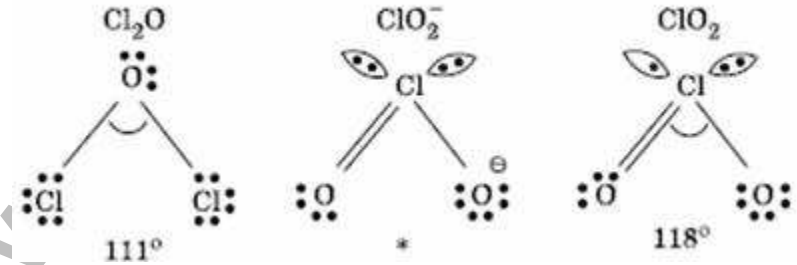
Answer : (4)

Q. 19. The correct order of increasing bond angles in the following species are:

1. $Cl_2O < ClO_2 < ClO_2^-$
2. $ClO_2 < Cl_2O < ClO_2^-$
3. $Cl_2O < ClO_2^- < ClO_2$
4. $ClO_2^- < Cl_2O < ClO_2$

Sol:

The correct order of increasing bond angle is $Cl_2O < ClO_2^- < ClO_2$



* In ClO_2^- there are 2 lone pairs of electrons present on the central chlorine atom. Therefore the bond angle in ClO_2^- _ is less than 118° which is the bond angle in ClO_2 which has less number of electrons on chlorine.

Answer : (3)

Q. 20. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?

1. $CaSO_4$
2. $BeSO_4$
3. $BaSO_4$
4. $SrSO_4$

Sol:

Be^{+2} is very small, hence its hydration enthalpy is greater than its lattice Enthalpy

Correct choice : (2)

Q. 21. Crystal field stabilization energy for high spin d4 octahedral complex is:

1. $-1.8\Delta_0$
2. $-1.6\Delta_0 + P$
3. $-1.2\Delta_0$
4. $-0.6\Delta_0$

Sol:

d4 in high spin octahedral complex

$e_g \uparrow \; -$

$t_{2g} \uparrow \; \uparrow \; \uparrow$

$CFSE = [0.6 \times 1] + [-0.4 \times 3] = -0.6\,\Delta_0$

Answer : (4)

Q. 22. Which one of the following ions has electronic configuration [Ar] $3d^6$?

1. Ni^{3+}
2. Mn^{3+}
3. Fe^{3+}
4. Co^{3+}

(At. Nos. Mn = 25, Fe = 26, Co = 27, Ni = 28)

Sol:

$Ni^{+3} : [Ar]3d^{7}$
$Mn^{+3} : [Ar]3d^{4}$
$Fe^{+3} : [Ar]3d^{5}$
$Co^{+3} : [Ar]3d^{6}$

Answer : (4)

Q. 23. Which of the following statements about primary amines is '**False**'?

1. Alkyl amines are stronger bases than aryl amines
2. Alkyl amines react with nitrous acid to produce alcohols
3. Aryl amines react with nitrous acid to produce phenols
4. Alkyl amines are stronger bases than ammonia

Sol:

Aryl amines will not produce phenol on Treatment with nitrous acid.

Answer : (3)

Q. 24. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase?

1. Addition of NaCl
2. Addition of $Na_2 So_4$
3. Addition of 1.00 molal KI
4. Addition of water

Sol:

When the aqueous solution of one molal KI is diluted with water, concentration decreases, therefore the vapour pressure of the resulting solution increases.

Correct choice : (4)

Q. 25. In which of the following equilibrium Kc and Kp are not equal?

1. $2\,NO_{(g)} \rightleftharpoons N_{2\,(g)} + 0_{2\,(g)}$
2. $SO_{2\,(g)} + NO_{2\,(g)} \rightleftharpoons SO_{3\,(g)} + NO_{(g)}$
3. $H_{2\,(g)} + I_{2\,(g)} \rightleftharpoons 2\,HI(g)$
4. $2C_{(s)} + O_{2\,(g)} \rightleftharpoons 2\,CO_2\,(g)$

Sol .

$2C_{(s)} + O_{2\,(g)} \rightarrow 2\,CO_2\,(g)$

$\Delta n = 2 - 1 = +1$

$\therefore K_c$ *and* K_p *are not equal*

Answer : (4)

Q. 26. For the reduction of silver ions with copper metal, the standard cell potential was found to be + 0.46 V at 25°C. The value of standard Gibbs energy, ΔG^0 will be (F = 96500 C mol^{-1})

1. − 89.0 kJ
2. − 89.0 J
3. − 44.5 kJ
4. − 98.0 kJ

Sol.

$Cu + Ag^{+}_{(aq)} \rightarrow Cu^{+2}_{(aq)} + 2Ag_{(s)}\ n = 2$

$E^0_{Cell} = +0.46\,V$

$\Delta G^0 = -nE^0\ F$

$= \dfrac{-2 \times 0.46 \times 96500}{1000}\ kj$

$= -89\,KJ$

Answer : (1)

Q. 27 What is $[H^+]$ in mol/L of a Solution that is 0.20 M

CH_3COONa and 0.10 M

in CH_3COOH ? K_a for $CH_3COOH = 1.8 \times 10^{-5}$

1. 3.5×10^{-4}
2. 1.1×10^{-5}
3. 1.8×10^{-5}
4. 9.0×10^{-6}

Sol .

$$pH = pk_a + \log\left[\frac{Salt}{Acid}\right]$$

$$Log\ [H^+] = \log K_a - Log\left[\frac{Salt}{Acid}\right]$$

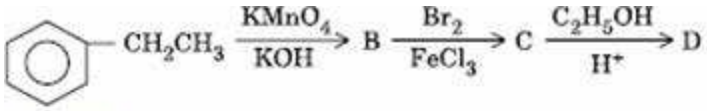
$$Log\ [H^+] = \log K_a - Log\left[\frac{Acid}{Salt}\right]$$

$$[H^+] = K_a\left[\frac{Acid}{Salt}\right]$$

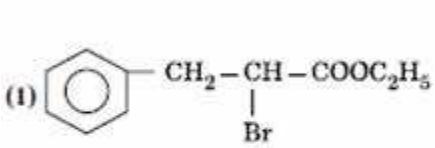
$$= 1.8 \times 10^{-5} \times \frac{0.1}{0.2} = 9 \times 10^{-6}\ M$$

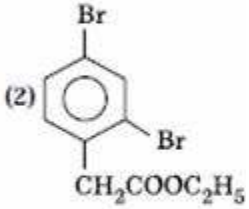
Answer: (4)

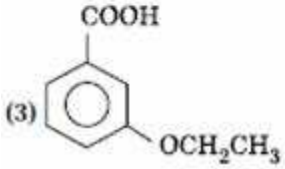
Q. 28. In a set of reactions, ethyl benzene yielded a product D.

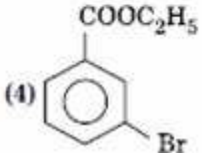


'D' would be:

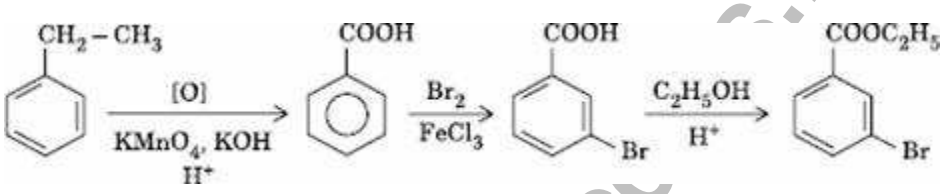








Sol.



Answer : (4)

Q. 29. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, Cl_3^{2-} are respectively (Molar mass of $Na_2CO_3 = 106 g\ mol^{-1}$)

1. 0.955 M and 1.910 M
2. 1.910 M and 0.955 M
3. 1.90 M and 1.910 M
4. 0.477 M and 0.477 M

Sol .

Concentration Of $Na_2CO_3 = \frac{25.5}{106} \times \frac{1000}{250} = 0.955\ M$

$[Na^+] = 2 \times 0.955 = 1.91$

$[CO_3^{-2}] = 0.955\ M$

Answer : (2)

Q. 30. Property of the alkaline earth metals that increases with their atomic number:

1. Solubility of their hydroxides in water
2. Solubility of their sulphates in water
3. Ionization energy
4. Electronegativity

Sol:

Lattice energy decreases more rapidly than hydration energy for alkaline earth metal hydroxides

Answer : (1)

Q. 31. Which of the following pairs has the same size?

1. Fe^{2+} , Ni^{2+}
2. Zr^{4+} , Ti^{4+}
3. Zr^{4+} , Hf^{4+}
4. Zn^{2+} , Hf^{4+}

Sol:

ue to lanthanide contraction, the size of Zr and Hf (atom and ions) remain constant

Answer : (3)

Q. 32. In which one of the following species the central atom has the type of hybridization which is not the same as that present in the other three?

1. SF_4
2. I_3^-
3. $SbCl_5^-$
4. PCl_5

Sol:

$$SbCl_5^{-2} : \frac{5+5+2}{2} = 6, Sp^3d^2$$

I_3^-, SF_4, PCl_5 *all have* sp^3d hybridizat ion.

Answer : (3)

Q. 33. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?

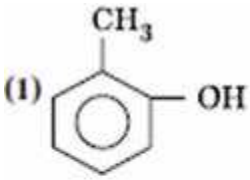
1. Cl < F < O < S
2. O < S < F < Cl
3. F < S < O < Cl
4. S < O < Cl < F

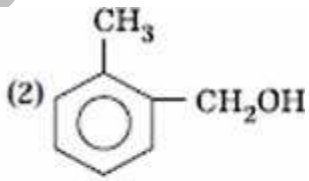
Sol:

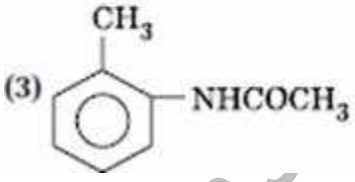
O < S < F < Cl
Electron gain enthalpy − 141 − 200 − 333 − 349 kJ mol^{-1}

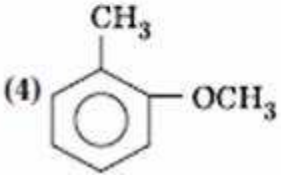
Answer : (2)

Q. 34. Which one is most reactive towards electrophilic reagent?

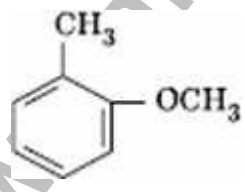
(1) 

(2) 

(3) 

(4) 

Sol.

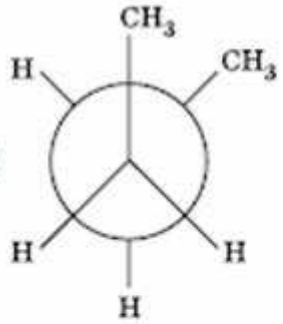


Methoxy group has the highest + M effect.

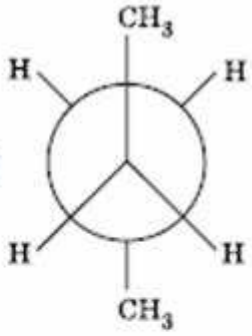
Answer : (4)

Q. 35. In the following the most stable conformation of n-butane is:

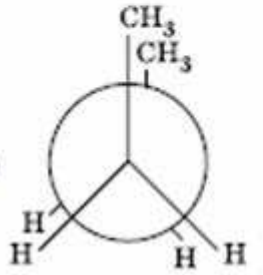
(1)



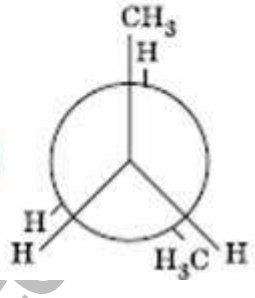
(2)



(3)



(4)



Answer : (2)

Q. 36. Which one is most reactive towards S_N1 reaction?

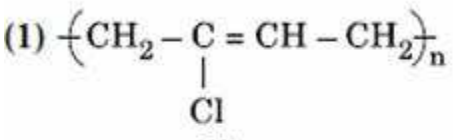
1. $C_6H_5CH(C_6H_5)Br$
2. $C_6H_5CH(CH_3)Br$
3. $C_6H_5C(CH_3)(C_6H_5)Br$
4. $C_6H_5CH_2Br$

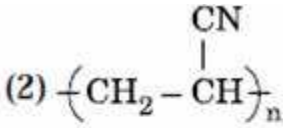
Sol:

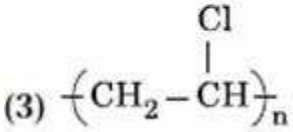
Tertiary carbonium ion formed is stabilized by two phenyl groups and one methyl group.

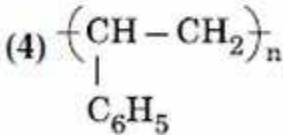
Answer: (3)

Q. 37. Which of the following structures represents Neoprene polymer?

(1) 

(2) 

(3) 

(4) 

Answer : (1)

Q. 38. Which one of the following is employed as a Tranquilizer drug?

1. Promethazine
2. Valium
3. Naproxen
4. Mifepristone.

Answer : (2)

Q. 39. Which of the following reactions will **not** result in the formation of carbon-carbon bonds?

1. Reimer-Tieman reaction
2. Cannizaro reaction
3. Wurtz reaction
4. Friedel-Crafts acylation

Answer: (2)

Q. 40. Which one of the following molecular hydrides acts as a Lewis acid?

1. NH_3
2. H_2O
3. B_2H_6
4. CH_4 BF_3

Answer : (3)

Q. 41. The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence:

1. $BCl_3 > BF_3 > BBr_3$
2. $BBr_3 > BCl_3 > BF_3$
3. $BBr_3 > BF_3 > BCl_3$
4. $BF_3 > BCl_3 > BBr_3$

Sol:

p-p overlap between B and F is maximum due to identical size and energy of porbitals, so electron deficiency in boron of BF_3 is neutralized partially to the maximum extent by back donation. Hence BF_3 is least acidic .

Answer : (2)

Q. 42. The number of atoms in 0.1 mol of a triatomic gas is:

$\left(N_A = 6.02 \times 10^{23}\ mol^{-1}\right)$

1. 6.026×10^{22}
2. 1.806×10^{23}
3. 3.600×10^{23}
4. 1.800×10^{22}

Sol:

The number of atoms in 0.1 mole of a triatomic gas = $0.1 \times 3 \times 6.023 \times 10^{23}$

$= 1.806 \times 10^{23}$

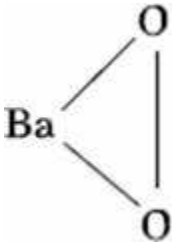
Answer : (2)

Q. 43. Which one of the following compounds is a peroxide?

1. KO_2
2. BaO_2

3. Mn_2O_2
4. NO_2

Sol.



Answer: (2)

Q. 44. Standard entropies of X_2, Y_2 and XY_3 are 60, 40 and 50 JK^{-1} mol^{-1} respectively. For the reaction $\frac{1}{2}X_2+\frac{3}{2}y_2 \quad XY_3\ \Delta H=-30\ KJ$ to be at equilibrium, the temperature should be:

1. 750 K
2. 1000 K
3. 1250 K
4. 500 K

Sol:

ΔS *for the reaction* $\frac{1}{2}\ x_2+\frac{3}{2}Y_2 \quad XY_3$

$\Delta S = 50-(30+60) = -40\ i$

For equilibrium $\Delta G = 0 = \Delta H - T\Delta S$

$T=\frac{\Delta H}{\Delta S}=\frac{-30000}{-40}=750K$

Answer: (1)

Q. 45. The correct order of the decreasing ionic radii among the following is electronic species are:

1. $Ca^{2+} > K^+ > S^{2-} > C^{l-}$
2. $Cl^- > S^{2-} > Ca^{2+} > K^+$
3. $S^{2-} > Cl^- > K^+ > Ca^{2+}$
4. $K^+ > Ca^{2+} > Cl^- > S^{2-}$

Sol:

Among the isoelectronic species S^{2-} has the highest negative charge and hence largest in size followed by Cl^-, K^+ and Ca^{+2}

Answer : (3)

Q. 46. During the kinetic study of the reaction, 2A + B → C + D, following results were obtained:

Run	$[A]/mol\ L^{-1}$	$[B]/mol\ L^{-1}$	Initial rate of formation of D/mol L−1 min−1
i	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data which one of the following is correct?

1. $rate = K[A]^2[B]$
2. $rate = K[A][B]$
3. $rate = K[A]^2[B]^2$
4. $rate = K[A][B]^2$

Sol:

Keeping concentration of [A] constant, when the concentration of [B] is doubled, the rate quadruples. Hence it is second order with respect to B. Keeping the concentration of [B] constant, when the concentration of [A] is increased four times, rate also increases four times. Hence the order with respect to A is one.

$Rate = K[A][B]^2$

Answer: (4)

Q. 47. In a buffer solution containing equal concentration of B^- and HB, the K_b *for* B^- *is* 10^{-10}. The pH of buffer solution is:

1. 10
2. 7
3. 6
4. 4

Sol.

$Kb = 10^{-10}$; $K_a = 10^{-4}$ *or* $pK_a = 4$

For the buffer solution containing equal concentration of B^- and HB

$pH = pK_a + \log 1$

$pH = pK_a = 4$

Answer: (4)

Q. 48. AB crystallizes in a body centred cubic lattice with edge length 'a' equal to 387 pm. The distance between two oppositively charged ions in the lattice is:

1. 335 pm
2. 250 pm
3. 200 pm
4. 300 pm

Sol:

For BCC lattice body diagonal is equal to a $\sqrt{3}$

The distance between the two oppositely charged ions = $\frac{a}{2}\sqrt{3}$

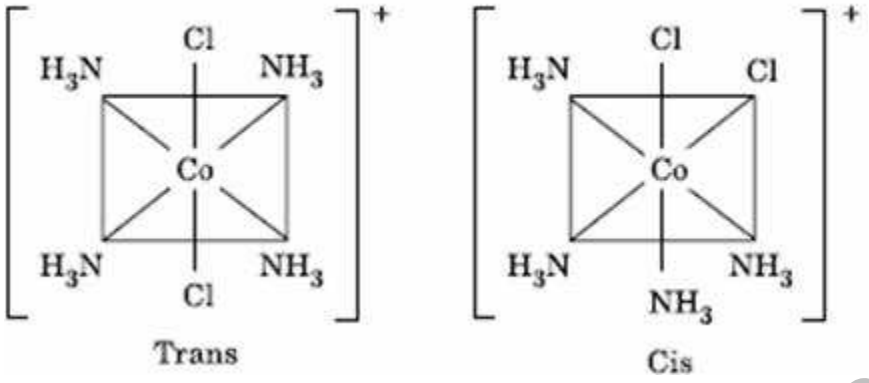
$$= \frac{387 \times 1.732}{2} = 335\ Pm$$

Answer : (1)

Q. 49. The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^+$ *is due to*:

1. linkage isomerism
2. geometrical isomerism
3. coordination isomerism
4. ionization isomerism

Sol.



Answer : (2)

Q. 50. Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is:

1. CH_3COOCH_3
2. CH_3CONH_2
3. $CH_3COOCOCH_3$
4. CH_3COCl

Sol:

Cl^- is the weakest base and hence better leaving group

Answer : (4)

PHYSICS

Q.1. Consider the following two statements:

a. Kirchhoff's junction law follows from the conservation of charge.
b. Kirchhoff's loop law follows from the conservation of energy

Which of the following is correct?

1. Both (A) and (B) are wrong
2. (A) is correct and (B) is wrong
3. (A) is wrong and (B) is correct
4. (4) Both (A) and (B) are correct

Sol:

Junction − conservation of charge Loop − conservation of energy

Answer: (4)

Q. 2. Electromagnets are made of soft iron because soft iron has:

1. low retentivity and high coercive force
2. high retentivity and high coercive force
3. low retentivity and low coercive force
4. high retentivity and low coercive force

Answer : (4)

Q. 3. A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference 4 V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then:

1. $\frac{2C_1}{n_1 n_2}$
2. $16\frac{n_2}{n_1}C_1$
3. $2\frac{n_2}{n_1}C_1$
4. $\frac{16C_1}{n_1 n_2}$

Sol:

1. *Series* $C_{eff} = \frac{C_1}{n_1}$, $Es = \frac{1}{2} C_{eff} V_s^2 = \frac{1}{2} \frac{C_1}{n_1} 16 V^2$

$$= 8V^2 \frac{C_1}{n_1}$$

2. *Parallel* $C_{eff} = n_2 C_2$, $E_P = \frac{1}{2} n_2 C_2 V^2$

$$\therefore \frac{8V^2 C_1}{n_1} = \frac{1}{2} n_2 C_2 V^2$$

$$C_2 = \frac{16 C_1}{n_1 n_2}$$

Answer : (4)

Q. 4. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be:

1. 2.4 V
2. − 1.2 V
3. − 2.4 V
4. 1.2 V

Sol:

$$K_{max} = \frac{hc}{\lambda} - 5.01 = \frac{12375}{\lambda\,(in\ A)} - 5.01$$

$$= \frac{12375}{2000} - 5.01 = 6.1875 - 5.01 = 1.1775 \approx 1.2V$$

Answer : (4)

Q. 5. Two positive ions, each carrying a charge q, are separated by a distance d. If F is the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge of an electron):

1. $\frac{4\pi\varepsilon_0 F d^2}{e^2}$
2. $\sqrt{\frac{4\pi\varepsilon_0 F d^2}{d^2}}$

3. $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$

4. $\frac{4\pi\varepsilon_0 Fd^2}{q^2}$

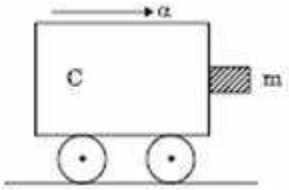
Sol:

$$F = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q^2}{d^2} \Rightarrow q = \sqrt{4\pi\varepsilon_0 Fd^2}\ F = ne$$

$$\therefore n = \sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$$

Answer : (3)

Q. 6. A block of mass m is in contact with the cart C as shown in the Figure.



The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies:

1. $\alpha > \frac{mg}{\mu}$

2. $\alpha > \frac{g}{\mu m}$

3. $\alpha \geq \frac{g}{\mu}$

4. $\alpha < \frac{g}{\mu}$

Sol.

$mg = \mu m a$

$$a \geq \frac{g}{\mu}$$

Answer: (3)

Q. 7. A circular disk of moment of inertia I_t is rotating in a horizontal plane, about its symmetry axis, with a constant angular speed ω_i. Another disk of moment of inertia I_b Ib is dropped coaxially onto the rotating disk. Initially the second disk has zero angular speed. Eventually both the disks rotate with a constant angular speed ω_f. The energy lost by the initially rotating disk to friction is:

1. $\frac{1}{2}\frac{I_b^2}{(I_t + I_b)}\omega_1^2$
2. $\frac{1}{2}\frac{I_t^2}{(I_t + I_b)}\omega_1^2$
3. $\frac{I_b - I_t}{(I_t + I_b)}\omega_1^2$
4. $\frac{1}{2}\frac{I_b - I_t}{(I_t + I_b)}\omega_1^2$

Sol.

$I_t - \omega_i, \qquad \omega_f = \frac{I_t}{I_t + I_b}\omega_i$

$(I_t + I_b) - \omega_f$

$$\Delta K = \frac{1}{2} I_t \omega_1^2 - \frac{1}{2}(I_t + I_b)\frac{I_t^2}{(I_t + I_b)^2}\omega_1^2$$

$$= \frac{1}{2}\omega_1^2 \frac{I_t}{I_t + I_b}(I_t + I_b - I_t) = \frac{1}{2}\omega_i^2 \frac{I_t I_b}{I_t + I_b}$$

Answer : (4)

Q. 8. The displacement of a particle along the x-axis is given by x = a $\sin^2 \omega t$. The motion of the particle corresponds to:

1. Simple harmonic motion of frequency ω/π
2. Simple harmonic motion of frequency $3\omega/2\pi$
3. Non simple harmonic motion
4. Simple harmonic motion of frequency $\omega/2\pi$

Sol.

$$x = a\sin^2 \varpi t = \frac{a}{2}(1-\cos 2\varpi t)$$

$$\frac{dx}{dt} = \frac{a}{2}\, 2\varpi \sin\, 2\varpi t, \frac{d^2}{dt^2} = \frac{4\varpi^2 a}{2}.\cos 2\varpi t$$

$$SHM\ of\ Frequency = \frac{\varpi}{\pi}$$

Answer : (1)

Q. 9. The radii of circular orbits of two satellites A and B of the earth, are 4R and R, respectively. If the speed of satellite A is 3 V, then the speed of satellite B will be:

1. 3 V/4
2. 6 V
3. 12 V
4. 3 V/2

Sol.

$$\frac{V^2}{r} = \frac{K}{r^2} \Rightarrow rV^2 = constant$$

$$r_1 V_1^2 = r_2 V_2^2$$

$$V_2 = V_1\sqrt{\frac{r_1}{r_2}} = V_1\sqrt{\frac{4R}{R}} = 2V_1 = 6V$$

Answer : (2)

Q. 10. A ball is dropped from a high rise platform at t = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 s. What is the value of v?

$(take\ g = 10 m/s^2)$

1. 75 m/s
2. 55 m/s
3. 40 m/s
4. 60 m/s

Sol. Distance moved in 18 s by I ball

$$\frac{1}{2}\times 10\times 18^{2}$$
$$=90\times 18=1620\,\mathrm{m}$$

Distance moved in 12 s by II ball = $ut+\frac{1}{2}gt^{2}$

$$\therefore 1620=12u+5\times 144$$
$$u=135-60=75\,\mathrm{ms}^{-1}$$

Answer : (1)

Q. 11. A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45O. For which of the following value of μ the ray can undergo total internal reflection?

1. μ = 1.33
2. μ = 1.40
3. μ = 1.50
4. μ = 1.25

Sol :

$$\mu \geq \frac{1}{\sin C} \geq \sqrt{2} \geq 1.414 \Rightarrow \mu = 1.50$$

Answer: (3)

Q. 12. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs in time t?

1. $\frac{Q}{4}$
2. $\frac{Q}{16}$
3. 2 Q

4. $\frac{Q}{2}$

Sol.

$$\frac{Q}{t} = K.A\frac{\Delta T}{\ell} \qquad A = \pi R^2 \; ; \; \pi R^2 \ell = \pi\left(\frac{R'}{2}\right)^2 \ell'$$

$$A' = \frac{\pi R^2}{4} \; ; \quad \frac{\ell'}{\ell} = \frac{R^2}{\left(\frac{R'^2}{4}\right)}$$

$$\frac{Q'}{Q} = \frac{A'}{A}\frac{\ell}{\ell'} = \frac{1}{4}.\frac{1}{4} = \frac{1}{16}$$

$$\therefore Q' = \frac{Q}{16}$$

Answer : (2)

Q.13. A transverse wave is represented by y = A sin (ωt − kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

1. $\frac{\pi A}{2}$
2. πA
3. $2\pi A$
4. A

Sol.

$$Y = A\sin(\omega t - kx)$$

$$V_p = \frac{dy}{dt} = A\omega\cos(\omega t - Kx)$$

$$V_p \text{ max} = A\omega = \frac{\omega}{k} \qquad i.e., A = \frac{1}{k}, k = \frac{2\pi}{\lambda}$$

$$\therefore \lambda = 2\pi A$$

Answer : (3)

Q. 14. An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?

1. 400 W
2. 200 W
3. 100 W
4. 800 W

Sol: Amount of water flowing per second.

$$= \frac{m}{time} = \frac{m}{\ell}.\frac{\ell}{t} = \left(\frac{m}{\ell}\right)v$$

$$K.E\ of\ water\ flowing\ per\ second = power = \frac{1}{2}\left(\frac{m}{\ell}\right)v^3$$

$$= \frac{1}{2} \times 100 \times 8 = 400\ w$$

Answer : (1)

Q.15. Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?

1. metallic bonding
2. van der Waal's bonding
3. ionic bonding
4. covalent bonding

Sol:

Metal − conductivity decreases with increase in temperature.

Answer : (1)

Q. 16. A conducting circular loop is placed in a uniform magnetic field, B = 0.025 T with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced e.m.f. when the radius is 2 cm, is:

1. $2\pi\ \mu V$
2. $\pi\mu V$

3. $\frac{\pi}{2}\mu V$
4. $2\mu V$

Sol:

$\phi = B\pi r^2$, $|e| = \frac{d\phi}{dt} = B\pi . 2r\frac{dr}{dt}$

When $r = 2cm$, $\frac{dr}{dt} = 1mm\,s^{-1}$

$e = 0.025 \times \pi \times 2 \times 2 \times 10^{-2} x\, 10^{-3}$

$= 0.100 \times \pi \times 10^{-5} = \pi\mu V$

Answer : (2)

Q. 17. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a $\frac{a}{2}$ distance from the centre, will be:

1. $-\frac{3GM}{a}$
2. $-\frac{2GM}{a}$
3. $-\frac{GM}{a}$
4. $-\frac{4GM}{a}$

Sol : Potential at a point =

$-\frac{GM}{a} - \frac{2GM}{a} = -\frac{3GM}{a}$

Answer : (1)

Q. 18. A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per sec when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was:

1. 510 Hz
2. 514 Hz
3. 516 Hz
4. 508 Hz

Sol.

$\Delta n_1 = 4 , 512 \pm 4$

$\Delta n_2 = 4$, *when tension is increased frequency increases As number of Beats decreased* , the frequency of string $< 512 \Rightarrow 508$ Hz

Answer : (4)

Q. 19. A galvanometer has a coil of resistance 100 ohm and gives a full-scale deflection for 30 mA current. If it is to work as a voltmeter of 30 volt range, the resistance required to be added will be:

1. 900 Ω
2. 1800 Ω
3. 500 Ω
4. 1000 Ω

Sol.

$30 = I_g (r + R)$

$\therefore R = \frac{30}{I_g} - r = \frac{30}{30 \times 10^{-3}} - 100$

$= 1000 - 100 = 900\ \Omega$

Answer : (1)

Q. 20. The energy of a hydrogen atom in the ground state is − 13.6 eV. The energy of a He^+ ion in the first excited state will be:

1. − 13.6 eV
2. − 27.2 eV
3. − 54.4 eV
4. − 6.8 eV

Sol.

$$E_{He^+} = -Z^2 \times \frac{13.6}{n^2}$$

First excited state: $n = 2, Z = 2$ *for Helium*.

$$\therefore E_{He^+} = -\frac{4}{2^2} \times 13.6 = -13.6\,eV$$

Answer : (1)

Q. 21. The dimension of $\frac{1}{2}\varepsilon_0 E^2$, *where* ε_o, where ε0 is permittivity of free space and E is electric field, is:

(1) $ML^2\,T^{-2}$

(2) $ML^{-1}\,T^{-2}$

(3) $ML^2\,T^{-2}$

(4) MLT^{-1}

Sol:

$$\frac{1}{2}\varepsilon_0\,E^2$$

$$\Rightarrow energy\ density = \frac{ML^2\,T^{-2}}{L^3} = ML^{-1}\,T^2$$

Answer : (2)

Q. 22. A man of 50 kg mass is standing in a gravity free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed 2 m/s. When the stone reaches the floor, the distance of the man above the floor will be:

1. 9.9 m
2. 10.1 m
3. 10 m
4. 20 m

Sol: By momentum conservation,

50 u + 0.5 x 2 = 0

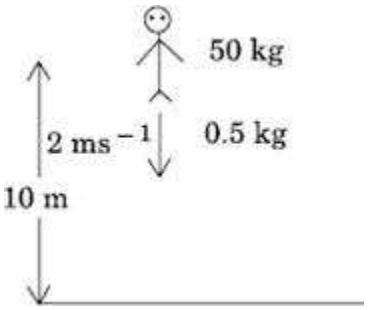
$$u = -\frac{1}{50}\, ms^{-1}$$

$$\left[\frac{1}{50} ms^{-1}\ upward\right]$$

$$Time\ taken\ t = \frac{10}{2} = 5\ s$$

$$Distance\ \ moved\ by\ the\ man = 5 \times \frac{1}{50} = 0.1\ m$$

$\therefore$ *when the stone reaches the floor , the distance of the* **man** *above floor* $= 10.1 m$



Answer : (2)

Q. 23. The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K is given by:

1. $\frac{\sigma r^2 T^4}{R^2}$
2. $\frac{\sigma r^2 T^4}{4\pi R^2}$
3. $\frac{\sigma r^4 T^4}{r^4}$
4. $\frac{4\pi\sigma^2 T^4}{R^2}$

(Where σ is Stefan's constant)

Sol :

Answer : (1)

Q. 24. A common emitter amplifier has a voltage gain of 50, an input impedance of 100 Ω
and an output impedance of 200 Ω. The power gain of the amplifier is:

1. 500
2. 1000
3. 1250

$$E = \frac{S}{S_0}\sigma T^4 = \frac{4\pi r^2}{4\pi R^2}\sigma T^4$$

$$= \varsigma \frac{r^2}{R^2} T^4$$

4. 50

Sol: Power gain

$$V_G . I_G = \frac{V_o}{V_i} . \frac{I_o}{I_i}$$

$$= \frac{V_o^2}{V_i^2} . \frac{R_i}{R_o} = 50 \times 50 \times \frac{100}{200}$$

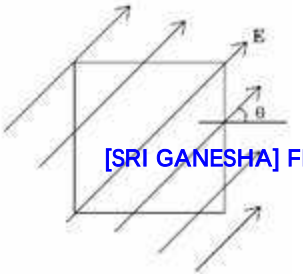
$$= \frac{2500}{2} = 1250$$

Answer : (3)

Q. 25. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current carrying wire, the new time period of magnet will be:

1. 1 s
2. 2 s
3. 3 s
4. 4 s

Sol: Time period,



$$T \propto \frac{1}{\sqrt{B}}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{B_2}{B_1}}, T_2 = T_1 \sqrt{\frac{B_2}{B_1}}$$

$$= 2\sqrt{\frac{24\times10^{-6}}{6\times10^{-6}}} = 4s$$

Answer : (4)

Q. 26. A square surface of side L meter in the plane of the paper is placed in a uniform electric field E (volt/m) acting along the same plane at an angle θ with the horizontal side of the square as shown in **Figure**. The electric flux linked to the surface, in units of volt. m, is:

1. EL^2
2. $EL^2 \cos\theta$
3. $EL^2 \sin\theta$
4. Zero

Sol:

$\phi = EA\cos\theta, \theta -$ angle between E and normal to the surface,

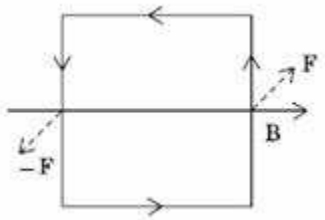
$here\ \theta = \frac{\pi}{2} \Rightarrow \phi = 0$

Answer : (4)

Q. 27. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is F, the net force on the remaining three arms of the loop is:

1. $3\vec{F}$
2. $-\vec{F}$
3. $-3\vec{F}$
4. $\vec{F}$

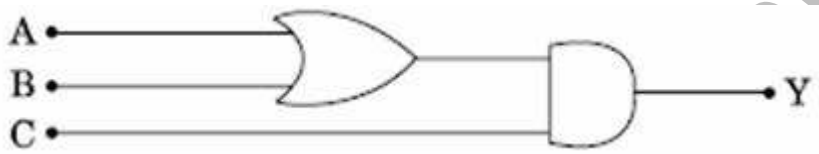
Sol:



Force on remaining arms = − F

Answer : (2)

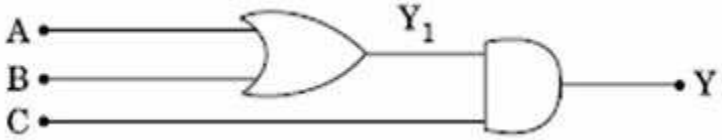
Q. 28. To get an output Y = 1 from the circuit shown below, the input must be:



	A	B	C
1.	0	1	0
2.	0	0	1
3.	1	0	1
4.	1	0	0

Sol:

A	B	C	Y
0	1	0	0
0	0	1	0
1	0	1	1
1	0	0	0



Input: (1 0 1)

Answer : (3)

Q. 29. A 220 volts input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is:

1. 3.6 ampere
2. 2.8 ampere
3. 2.5 ampere
4. 5.0 ampere

Sol.

$$\frac{V_2}{V_1} = 0.8\,\frac{I_1}{I_2} \Rightarrow \frac{V_2\ I_2}{V_1\ I_1} = 0.8$$

$$V_1 = 220\,V, I_2 = 2.0\,A, V_2 = 440V$$

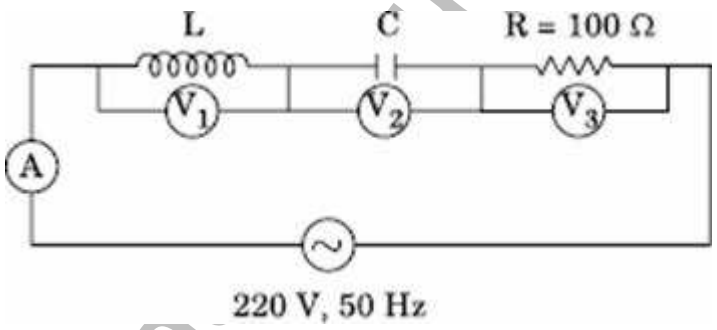
$$I_1 = \frac{V_2\ I_2}{V_1} \times \frac{10}{8}$$

$$= \frac{440 \times 2 \times 100}{220 \times 8}$$

$$= 5A$$

Answer : (4)

Q. 30. In the given circuit the reading of voltmeter V1 and V2 are 300 volts each. The reading of the voltmeter V3 and ammeter A are respectively:



1. 150 V, 2.2 A
2. 220 V, 2.2 A
3. 220 V, 2.0 A
4. 100 V, 2.0 A

Sol.

$$V_L = V_C = 300\,V \Rightarrow resonance$$

$$\therefore V_R = 220\,V, I = \frac{220}{100} = 2.2\,A$$

$$\therefore (220\,V, 2.2\,A)$$

Answer : (2)

Q. 31. A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter d /2 in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively:

1. $F \text{ and } \frac{1}{4}$
2. $\frac{3f}{4} \text{ and } \frac{1}{2}$
3. $F \text{ and } \frac{31}{4}$
4. $\frac{f}{2} \text{ and } \frac{I}{2}$

Sol: By covering aperture, focal length does not change. But intensity is reduced by $\frac{1}{4}$ times.

$I' = \frac{3I}{4}$

$\therefore f, \frac{3I}{4}$

Answer : (3)

Q. 32. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to:

1. $\frac{1}{ze}$
2. v^2
3. $\frac{1}{m}$

4. $\frac{1}{v^4}$

Sol:

$$\frac{1}{2}mv^2 = \frac{1}{4\pi\varepsilon_0}\frac{q_\alpha \, Ze}{r_0} \quad r_0 \propto Ze, \propto q_\alpha$$

$$r_0 = \frac{2}{4\pi\varepsilon_0}\frac{q_\alpha \, Ze}{mv^2} \qquad \propto \frac{1}{m} \Rightarrow (3)$$

$$\propto \frac{1}{V^2}$$

Answer : (3)

Q. 33. The mass of a $^{7}_{3}$Li nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{7}_{3}$Li nucleus is nearly :

1. 46 MeV
2. 5.6 MeV
3. 3.9 MeV
4. 23 MeV

Sol:

$$\Delta n = 0.042 \times 931 \quad 42 \; MeV$$

$$\therefore B.E./\,nucleon = \frac{42}{7} = 6 \; MeV \quad 5.6 \; MeV$$

Answer : (2)

Q. 34. A beam of cathode rays is subjected to crossed Electric (E) and Magnetic fields (B). The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by:

1. $\frac{B^2}{2VE^2}$

2. $\frac{2\ VB^2}{E^2}$
3. $\frac{2\ VE^2}{B^2}$
4. $\frac{E^2}{2\ VB^2}$

(Where V is the potential difference between cathode and anode)

Sol:

eE = eVB $\quad V\frac{E}{B}$

$\frac{1}{2}mv^2 = eV \quad \therefore \quad \frac{e}{m} = \frac{v^2}{2V} = \frac{E^2}{2VB^2}$

Answer : (4)

Q. 35. A particle has initial velocity $(3\hat{i} + 4\hat{j})$ and has acceleration $(0.4\hat{i} + 0.3\hat{j})$. It speed after 10 s is:

1. 7 units
2. $7\sqrt{2}\ units$
3. 8.5 units
4. 10 units

Sol:

$\vec{u} = 3\hat{i} + 4\hat{j}, \vec{a} = 0.4i + 0.3\ j$

$V_x = u_x + a_x \times 10 = 3 + 4 = 7\ ms^{-1}$

$V_y = 4 + 0.3 \times 10 = 4 + 3 = 7\ ms^{-1}$

$\therefore v = \sqrt{v_x^2 + v_y^2} = 7\sqrt{2} ms^{-1}$

Answer : (2)

Q. 36. A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to:

1. (Velocity)$^{3/2}$
2. (distance)^{2}
3. (distance)$^{-2}$
4. (velocity)$^{2/3}$

Sol:

$$x = \frac{1}{t+5}, \frac{dx}{dt} = \frac{-1}{(t+5)^2} = v$$

$$\frac{d^2x}{dt^2} = \frac{2}{(t+5)^3} = 2x^3$$

$$Now \frac{1}{(t+5)} \propto v^{\frac{1}{2}}$$

$$\therefore \frac{1}{(t+5)^3} \propto v\frac{3}{2} \propto \frac{d^2x}{dt^2}$$

Answer : (1)

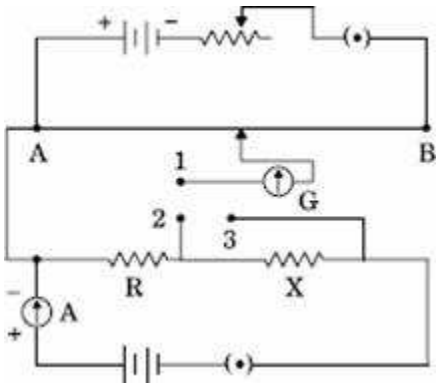
Q. 37. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and 2v at any instant, then the speed of centre of mass of the system will be:

1. 2 v
2. Zero
3. 1.5 v
4. v

Sol: No change in state of motion of COM due to internal forces.
speed of COM = zero

Answer : (2)

Q. 38. A potentiometer circuit is set up as shown. The potential gradient, across the potentiometer wire, is k volt/cm and the ammeter, present in the circuit, reads 1.0 A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3, is plugged in, are found to be at lengths *l*1 cm and *l*2 cm respectively. The magnitudes, of the resistors R and X, in ohms, are then, equal, respectively, to:



1. $K(l_2 - l_1)$ and Kl_2
2. Kl_1 and $K(l_2 - l_1)$
3. $K(l_2 - l_1)$ and Kl_1
4. Kl_1 and Kl_2

Sol :

P.D arross R = IR = $K(l_1 \rightarrow R = K\int_1 \quad I = 1A$

P.D arross

$$(X + R) = I(X + R) = K\int_2 \rightarrow X + R = K\int_2$$

$$X = K(l_2 = l_1)$$

$\therefore R = Kl_1, X = K(l_2 - l_1)$

Answer : (2)

Q. 39. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if:

1. $r = \mu g \omega^2$
2. $r < \frac{\omega^2}{\mu g}$

3.

$$r < \frac{\mu g}{\omega^2}$$

4.

$$r \geq \frac{\mu g}{\omega^2}$$

Sol.

$$mr\omega^2 \leq \mu mg$$

$$r \leq \frac{\mu g}{\omega^2}$$

Answer : (3)

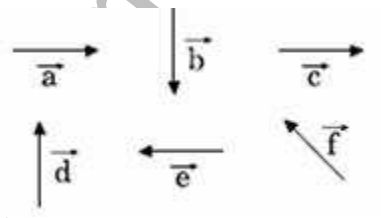
Q. 40. Which of the following statement is **false** for the properties of electromagnetic waves?

1. Both electric and magnetic field vectors attain the maxima and minima at the same place and same time
2. The energy in electromagnetic wave is divided equally between electric and magnetic vectors
3. Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave
4. These waves do not require any material medium for propagation

Answer : (3)

Q. 41. Six vectors, $\hat{a}$ through $\hat{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?

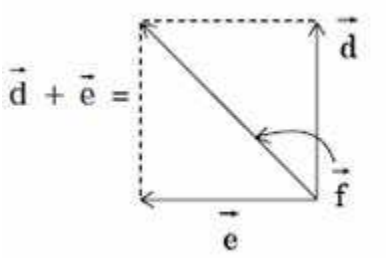
1.



2. $\vec{b} + \vec{c} = \vec{f}$

3. $\vec{d} + \vec{c} = \vec{f}$

4. $\vec{d} + \vec{e} = \vec{f}$
5. $\vec{b} + \vec{e} = \vec{f}$



$\therefore \vec{b} + \vec{e} = \vec{f}$

Answer: (3)

Q. 42. In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated?
(E.C.E of chlorine is 0.367×10^{-6} *Kg/c)*

1. 1.76×10^{-3} *Kg*
2. 9.67×10^{-3} *Kg*
3. 17.61×10^{-3} *Kg*
4. 3.67×10^{-3} *Kg*

Sol.

$$I = \frac{100 \times 10^3}{125} A$$

$$E.C.E = 0.367 \times 10^{-6}\ Kg\ C^{-1}$$

$$Charge\ Per\ minute = \frac{10^5 \times 60}{125} C$$

$$Mass\ liberated = \frac{6 \times 10^6}{125} \times 0.367 \times 10^{-6}$$

$$= \frac{6 \times 1000 \times 0.367 \times 10^{-3}}{125} = 17.616 \times 10^{-3}\ Kg$$

Answer : (3)

Q. 43. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

1. ΔU = − ΔW, in a adiabatic process
2. ΔU = ΔW, in a isothermal process
3. ΔU = ΔW, in a adiabatic process
4. ΔU = − ΔW, in a isothermal process.

Sol:

$\Delta Q = \Delta U + \Delta W$

In adiabatic, $\Delta Q = 0$

$\Delta U = -\Delta W$

In isothermal, $\Delta U = 0$

Answer : (1)

Q. 44. The device that can act as a complete electronic circuit is:

1. Junction diode
2. Integrated circuit
3. Junction transistor
4. Zener diode

Answer : (2)

Q. 45. The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minute at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is:

1. $\log_e 2/5$
2. $\frac{5}{\log_e 2}$
3. $5\log_{10} 2$
4. $5\log_e 2$

Sol.

$$N = N_0 e^{-\lambda t}, t = 5\min . \frac{N_0}{e} = N_0 . e^{-5\lambda}$$

$$5\lambda = 1, \lambda = \frac{1}{5}, T_{1/2} = \frac{\ell n 2}{\lambda} = 5\ell n^2$$

Answer : (4)

Q. 46. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in Wb/m^2 at the centre of the ring is:

1. $\frac{\mu_0 q^f}{2\pi R}$
2. $\frac{\mu_0 q}{2\pi fR}$
3. $\frac{\mu_0 q}{2 fR}$
4. $\frac{\mu_0 qf}{2 R}$

Sol .

$$Current\ I = \frac{q}{T} = \frac{q\omega}{2\pi}$$

$$B = \frac{\mu_0 I}{2R} = \frac{\mu_0}{2R} \frac{9^2 \pi f}{2\pi} = \frac{\mu_0 qf}{2R}$$

Answer : (4)

Q. 47. A ball moving with velocity 2 m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be:

1. 0, 1
2. 1, 1
3. 1, 0.5
4. 0, 2

Sol.

$m-u=2\ ms^{-1}$, $2m-0$

$$e=\frac{V_1'-V_2'}{V_2-V_1}$$

$$2m=mv_1+2mv_2$$

$$0.5=\frac{V_2-V_1}{2} \quad \therefore V_2=1+V_1$$

$$2=V_1+2+2V_1\ ,\ V_1=0,\ V_2=1\ ms^{-1}$$

Answer : (1)

Q. 48. The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass M is also suspended, the period of oscillation will now be:

1. T
2. $T/\sqrt{2}$
3. $2T$
4. $\sqrt{2}\,T$

Sol.

$$T=2\pi\sqrt{\frac{m}{R}}$$

$$\therefore \frac{T_1}{T_2}=\sqrt{\frac{M_1}{M_2}} \therefore T_2=T_1\sqrt{\frac{M_2}{M_1}}=T_1\sqrt{\frac{2M}{M}}$$

$$T_2=T_1=\sqrt{2}\ T\ (where\ T_1=T)$$

Answer : (4)

Q. 50. Which one of the following statement is FALSE?

1. Pure Si doped with trivalent impurities gives a p-type semiconductor
2. Majority carriers in a n-type semiconductor are holes
3. Minority carriers in a p-type semiconductor are electrons
4. The resistance of intrinsic semiconductor decreases with increase of temperature

Answer : (2)

As you are looking for the solved question paper of AIPMT exam , here i am providing list of few questions for your idea.

Q. 1. Biological organisation starts with:
a. Atomic level
b. Submicroscopic molecular level
c. Cellular level
d. Organismic level
Sol. Correct choice: (2)
Q. 2. About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and:
a. calcium and phosphorous
b. phosphorus and sulphur
c. sulphur and magnesium
d. magnesium and sodium
Sol. Correct choice: (1)
Q. 3. Which one of the following is an example of negative feed back loop in humans?
a. Secretion of sweat glands and constriction of skin blood vessels when it is too hot.
b. Constriction of skin blood vessels and contraction of skeletal muscles when it is too cold.
c. Secretion of tears after falling of sand particles in to the eye
d. Salivation of mouth at the sight of delicious food.
Sol. When the set point of hypothalamus is disturbed by high temperature, it stimulates vasodilation and sweating while in low temperature there is vasoconstriction and shivering. Correct choice: (2)
Q. 4. What is common to whale, seal and shark?
a. Homoiothermy
b. Seasonal migration]
c. Thick subcutaneous fat
d. Convergent evolution
Sol. Shark is poikilothermous. All three species show adaptations for aquatic life while these are not closely related. Correct choice: (4)
Q. 5. Which one of the following is not a constituent of cell membrane?
a. Phospholipids
b. Cholesterol
c. Glycolipids
d. Proline
Sol. Correct choice: (4)
Q. 6. Select the wrong statement from the following:
a. The chloroplasts are generally much larger than mitochondria.
b. Both chloroplasts and mitochondria contain and inner and an outer membrane
c. Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane
d. Both chloroplasts and mitochondria contain DNA.
Sol. Correct choice: (3)
Q. 7. The overall goal of glycolysis, Krebs cycle and the electron transport system is the formation of:
a. Nucleic acids
b. ATP is small stepwise units
c. ATP in one large oxidation reaction
d. Sugars
Sol. Correct choice: (2)

Q. 8. If the mean and the median pertaining to a certain character of a population are of the same value, the following is most likely to occur:
a. a skewed curve
b. a normal distribution
c. a bi-modal distribution
d. a T -shaped curve
Sol. Correct choice: (2)
Q. 9. Which one of the following is a slime mould?
a. Anabaena
b. Rhizopus
c. Physarum
d. Thiobacillus
Sol. Physarum is an acellular slime mould. Correct choice: (3)
Q.10. For a critical study of secondary growth in plants, which one of the following pairs is suitable?
a. Wheat and maiden hair fern
b. Sugarcane and sunflower
c. Teak and pine
d. Deodar and fern
Sol. Secondary growth occurs in gymnosperms and dicots. Correct choice: (3)
Q.11. Which one of the following statements about Mycoplasma is wrong?
a. They cause disease in plants
b. They are also called PPLO
c. They are pleomorphic
d. They are sensitive to penicillin
Sol. Mycoplasma is not sensitive to penicillin due to absence of cell wall. Correct choice: (4)
Q.12. In the prothallus of vascular cryptogam, the antherozoids and eggs mature at different times. As a result:
a. self fertilization is prevented
b. there is no change in success rate of fertilization
c. there is high degree of sterility
d. one can conclude that the plant is apomictic
Sol. In vascular cryptogam i.e. in pteridophytes gametophyte is monoecious but protandrous to avoid self fertilization. Correct choice: (1)
Q.13. Two plants can be conclusively said to belong to the same species if they:
a. have same number of chromosomes
b. can reproduce freely with each other and form seeds
c. have more than 90 per cent similar genes
d. look similar and possess identical secondary metabolities.
Sol. The members of a species are inter-fertile and produce fertile offsprings. Correct choice: (2)
Q.14. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?
a. Chemical composition of the cell wall
b. Types of pigments present in the cell
c. Nature of stored food materials in the cell
d. Structural organization of thallus.
Sol. The various algae are classified mainly on the types of pigments present in their cells. Correct choice: (2)
Q.15. Flagellated male gametes are present in all the three of which one of the following sets?

a. Riccia, Dryopteris and Cycas
b. Anthoceros, Funaria and Spirogyra
c. Zygnema, Saprolegnia and Hydrilla
d. Fucus, Marsilea and Calotropis
Sol. The male gametes of bryophytes are biflagellete, and those of pteriodophytes are multiflagellate, except Selaginella having biflagellate gametes. The male gametes of gymnosperms are non motile except those of Cycas having multiciliate gametes. Correct choice: (1)
Q.16. In gymnosperms, the pollen chamber represents:
a. the microsporangium in which pollen grains develop
b. a cell in the pollen grain in which the sperms formed
c. a cavity in the ovule in which pollen grains are stored after pollination
d. an opening in the mega gametophyte through which the pollen tube approaches the egg.
Sol. In gymnosperms, below micropylar beak some of the cells of nucellus of ovule disintigerate to form pollen chamber. Correct choice: (3)
Q.17. Spore dissemination in some liverworts is aided by:
a. peristome teeth
b. elaters
c. indusium
d. calyptra
Sol. In some liverworts like Marchantia spore dispersal is due to hydrochasy and is aided by elaters. Correct choice: (2)
Q.18. Which pair of the following belongs to Basidiomycetes?
a. Morchella and Mushrooms
b. Birds' nest fungi and Pufballs
c. Pufballs and Claviceps
d. Peziza and Stink horns
Sol. Bird's nest fungi – Cyathus, Pufballs – Lycoperdon, Both belong to the class Basidiomycetes. Correct choice: (3)
Q.19. ICBN stands for:
a. Indian Code of Botanical Nomenclature
b. Indian Congress of Biological Names
c. International Code of Botanical Nomenclature
d. International Congress of Biological Names
Sol. ICBN is one of the codes of nomenclature. It stands for International Code of Botanical Nomenclature. Correct choice: (3)
Q. 20. Ergot of rye is caused by a species of:
a. Claviceps
b. Phytophthora
c. Uncinula
d. Ustilago
Sol. Ergot of rye is caused by Claviceps purpurea. Correct choice: (1)
Q. 21. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed:
a. Convergent evolution
b. Divergent evolution
c. Microevolution
d. Co-evolution
Sol. Correct choice: (1)
Q. 22. Adaptive radiation refers to:
a. Power of adaptation in an individual to a variety of environments

b. Adaptations due to Geographical isolation
c. Evolution of different species from a common ancestor
d. Migration of members of a species to different geographical areas
Sol. Correct choice: (3)
Q. 23. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for:
a. growth the movement
b. responsiveness to touch
c. interaction with the environment and progressive evolution
d. reproduction
Sol. Correct choice: (4)
Q. 24. The Finches of Galapogas islands provide an evidence in favour of:
a. Biogeographical Evolution
b. Special Creation
c. Evolution due to Mutation
d. Retrogressive Evolution
Sol. Correct choice: (1)
Q. 25. One of the important consequences of geographical isolation is:
a. Random creation of new species
b. No change in the isolation faunax
c. Preventing Speciation
d. Speciation through reproductive isolation
Sol. Correct choice: (4)
Q. 26. Industrial melanism as observed in peppered moth proves that:
a. Melanism is a pollution-generated feature
b. The true black melanic forms arise by a recurring random mutation
c. The melanic form of the moth has no selective advantage over lighter form in industrial area
d. The lighter-form moth has no selective advantage either in polluted industrial area or non-polluted area.
Sol. It is an example of directional selection. Correct choice: (2)
Q. 27. The concept of chemical evolution is based on:
a. Possible origin of life by combination of chemicals
b. Crystallization of chemicals under suitable environmental conditions
c. Interaction of water, air and clay under
d. Effect of solar radiation of chemicals
Sol. Correct choice: (1)
Q. 28. Among the human ancestors the brain size was more than 1000 CC in:
a. Homo habilis
b. Homo neanderthalensis
c. Homo erectus
d. Ramapithecus
Sol. Homo habilis had a cranial capacity in the range of 680-720 c.c. & that of
Homo erectus erectus 775-990 c.c,
Homo erectus pekinensis 915-1200 c.c.
Homo neanderthalensis 1300-1600 c.c. Correct choice:
Q. 29. Which of the following pairs are correctly matched?
a. Crocodile
b. Sea Urchin
c. Obelia
d. Lemur
- 4-Chambered heart

- Parapodia
– Metagenesis
– Thecodont
(1) Only A and B
(2) A, C and D
(3) B, C and D
(4) Only A and D
Sol. Correct choice: (2)
Q. 30. Select the correct statement from the following:
a. Mutations are random and directional
b. Darwinian variations are small and directionless
c. Fitness is the end result of the ability to adapt and gets selected by nature
d. All mammals except whales and camels have seven cervical vertebrate.
Sol. It explains natural selection. Correct choice: (3)
Q. 31. Which one of the following is a matching pair of a body feature and the animal possessing it?
a. Ventral heart
b. Post-anal tail
c. Ventral Central nervous system
d. Pharyngeal gill slits absent in embryo
- Scorpion
- Octopus
– Leech
– Chamaeleon
Sol. Scorpion has dorsal heart. Post-anal tail is found only in chordates. Pharyngeal gill slits are present in the embryo of chameleon. Correct choice: (3)
Q. 32. What is common between parrot, platypus and kangaroo?
a. Ovoparity
b. Homoiothermy
c. Toothless jaws
d. Functional post -anal tail
Sol. Only birds & mammals are homoiothermous. Correct choice: (2)
Q. 33. What is true about Nereis, Scorpion, Cockroach and Silver fish?
a. They all belong to the same phylum
b. They all have jointed paired appendages
c. They all possess dorsal heart
d. None of them is aquatic
Sol. Correct choice: (3)
Q. 34. Which one of the following statement is correct?
a. Ontogeny repeats phylogeny
b. Stem cells are specialized cells
c. There is no evidence of the existence of gills during embryogenesis of mammals
d. All plant and animal cells are totipotent.
Sol. Correct choice: (1)
Q. 35. "Foolish Seedling" disease of rice led to the discovery of:
a. IAA
b. GA
c. ABA
d. 2, 4 – D
Sol. Foolish seeding disease (Bakane disease) of rice is due to a fungus Giberella

fujikuroi. Yabuta and Sumuki obtained achemical from the fungus and called gibbrellic acid. Correct choice: (2)
Q. 36. Passage cells are thin- walled cells found in:
a. central region of style through which the pollen tube grows towards the ovary.
b. endodermis of roots facilitating rapid transport of water from cortex to pericycle.
c. phloem elements that serve as entry points for substances for transport to other plant parts.
d. testa of seed to enable emergence of growing embryonic axis during seed germination.
Sol. Passage cells also called transfusion tissue are found in the endodermis meant for rapid transport of water from cortex to pericycle. Correct choice: (2)
Q. 37. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is:
a. Quinone
b. Cytochrome
c. Iron-sulphur protein
d. Ferredoxin.
Sol. The first acceptor of electros from an excited chlorophyll is quinone. Correct choice: (1)
Q. 38. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is:
a. succinate dehydrogenase
b. lactate dehydrogenase
c. isocitrate dehydrogenase
d. malate dehydrogenase
Sol. Succinate dehydrogenase is a common enzyme for TCA and ETC. It is located on inner mitochondrial membrane. Rest of the TCA enzymes are present in mitochondrial matrix. Correct choice: (1)
Q. 39. The wavelength of light absorbed by Pr form of phytochrome is:
a. 620 nm
b. 640 nm
c. 680 nm
d. 720 nm
Sol. The Pr form of phytochrome receives red light (600-680 nm) and changes into Pfr. Correct choice: (3)
Q. 40. Opening of floral buds into flowers, is type of:
a. Autonomic movement of growth
b. Autonomic movement of locomotion
c. Autonomic movement of variation
d. Paratonic movement of growth.
Sol. Opening of floral bud into flowers, is due to epinasty, a type of autonomic movement of growth. Correct choice: (1)
Q. 41. Which one of the following pairs, is not correctly matched?
a. IAA - Cell wall elongation
b. Abscissic Acid - Stomatal closure
c. Gibberellic Acid - Leaf fall
d. Cytokinin - Cell division
Sol. Leaf fall is due to interaction of auxin and ethylene. Correct choice: (3)
Q. 42. One gene - one enzyme relationship was established for the first time in:
a. Diploccus pneumoniae
b. Neurospora crassa

c. Salmonella typhimurium
d. Escherichia Coli
Sol. One gene-one enzyme hypothesis was given by Beadle and Tatum in red mould (Neurospora crassa). Correct choice: (2)
Q. 43. Male gametes in angiosperms are formed by the division of:
a. Microspore mother cell
b. Microspore
c. Generative cell
d. Vegetative cell
Sol. During the development of male gametophyte first of all two cells – generative cell and tube nucleus are formed from a pollen. This twocelled stage is called pollen grain. Finally the generative cell divides to form 2-male gametes. Correct choice: (3)
Q. 44. Two cells A and B are contiguous. Cell A has osmotic pressure 10 atm, turgor pressure - 7atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be:
a. Movement of water of Cell A to B
b. Movement of water from Cell B to A
c. No movement of water
d. Equilibrium between the two
Sol. The direction of movement of water is from low to high DPD. Correct choice: (1)
Q. 45. In the leaves of C4 plants, malic acid formation during CO_2 fixation occurs in the cells of:
a. Epidermis
b. Mesophyll
c. Bundle Sheath
d. Phloem
Sol. In C4 plants, C4 cycle occurs in mesophyll cells and C3 cycle in bundle sheath cells. Correct choice: (2)
Q. 46. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganism?
a. Cicer arietinum
b. Casuarina equisetifolia
c. Crotalaria juncea
d. Cycas revolute
Sol. The filamentous nitrogen – fixing microorganism like Frankia occurs in root-nodules of non-leguminous plants like Casuarina and Alnus. Correct choice: (2)
Q. 47. Which one of the following is surrounded by a callose wall?
a. Pollen grain
b. Microspore mother cell
c. Male gamete
d. Egg
Sol. The microspore mother cells develops an internal layer of callose which breaks the plasmodesmatal connections among themselves. Correct choice: (2)
Q. 48. Which one of the following elements is not an essential micronutrient for plant growth?
a. Ca
b. Mn
c. Zn
d. Cu
Sol. Calcium is an essential macronutrient for plant growth. Correct choice: (1)
Q. 49. If you suspect major deficiency of antibodies in person, to which of the following would you look for confirmatory evidence?

a. Haemocytes
b. Serum albumins
c. Serum globulins
d. Fibrinogen in the plasma
Sol. Correct choice: (3)
Q. 50. Which one of the following is a fat -soluble vitamin and its related deficiency disease?
a. Calciferol – Pellagra
b. Ascorbic acid – Scurvy
c. Retinol – Xerophthalmia
d. Cobalamine – Beri-beri
Sol. Correct choice: (3)
Q. 51. Which one of the following mammalian cells is not capable of metabolising glucose to carbon-dioxide aerobically?
a. Red blood cells
b. White blood cells
c. Unstriated muscle cells
d. Liver cells
Sol. RBCs do not have mitochondria & thus can respire only anaerobically. Correct choice: (1)
Q. 52. Compared to a bull a bullock is docile because of:
a. lower levels of adrenalin / noradrenalin in its blood
b. higher levels of thyroxin
c. higher levels of cortisone
d. lower levels of blood testosterone
Sol. The bullock is castrated and therefore secretion of testosterone is not adequate. Correct choice: (4)
Q. 53. In the human female, menstruation can be deferred by the administration of:
a. FSH only
b. LH only
c. Combination of FSH and LH
d. Combination of estrogen and progesterone
Sol. Correct choice: (4)
Q. 54. In human body, which one of the following is anatomically correct?
a. Cranial nerves
b. Floating ribs
c. Collar bones
d. Salivary glands
- 10 pairs
- 2 pairs
– 3 pairs
–1 pair
Sol. Correct choice: (2)
Q. 55. In which one of the following preparations are you likely to come across cell junctions most frequently?
a. Hyaline cartilage
b. Ciliated epithelium
c. Thrombocytes
d. Tendon
Sol. Correct choice: (2)
Q. 56. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate?

a. Whole blood from pulmonary vein
b. Blood plasma
c. Blood serum
d. Sample from the thoracic duct of lymphatic system
Sol. Blood serum does not contain fibrinogen and few other clotting factors, thus it will not coagulate. Correct choice: (3)
Q. 57. Feeling the tremors of an earthquake a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action?
a. Gastrin
b. Thyroxin
c. Adrenaline
d. Glucagon
Sol. Correct choice: (3)
Q. 58. A person who is on a long hunger strike and is surviving only on water, will have:
a. less urea in his urine
b. more sodium in his urine
c. less amino acids in his urine
d. more glucose in his blood.
Sol. Correct choice: (1)
Q. 59. Which one of the following pairs of structures distinguishes a nerve cell from other types of cell?
a. Nucleus and mitochondria
b. Perikaryon and dendrites
c. Vacuoles and fibers
d. Flagellum and medullary sheath
Sol. Correct choice: (2)
Q.60. Which part of ovary in mam mals acts as an endocrine gland after evolution?
a. Vitelline membrane
b. Graafian follicle
c. Stroma
d. Germinal epithelium
Sol. Correct choice: (2)
Q. 61. During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric charge?
a. First positive, then negative and again back to positive
b. First negative, then positive and again back to negative
c. First positive, then negative and continue to be negative
d. First negative, then positive and continue to be positive.
Sol. Correct choice: (2)
Q. 62. A person is having problems with calcium and phosphorous metabolism in his body. Which one of the following glands may not be functioning properly?
a. Thyroid
b. Parathyroid
c. Parotid
d. Pancreas
Sol. Correct choice: (2)
Q. 63. Identify the odd combination of the habitat and the particular animal concerned:
a. Rann of Kutch
b. Dachigam National Park
c. Sunderbans
d. Periyar

- Wild Ass
- Snow Leopard
–Bengal Tiger
–Elephant
Sol. Dachigam National Park is for the conservation of Hangul.
Correct choice: (2)
Q. 64. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order?
a. S < DE < PE < SE
b. SE < S < PE < DE
c. SE < PE < S < DE
d. PE < S < SE < DE
Sol. BOD of distillery effluent is 40,000 mg / l and that of paper mill effluent and sewage is 190 mg/l and 30 mg/l, respectively. Correct choice: (2)
Q. 65. Which one of the following ecosystem types has the highest annual net primary productivity?
a. Temperate deciduous forest
b. Tropical rain forest
c. Tropical deciduous forest
d. Temperate evergreen forest
Sol. Tropical rain forest has highest annual net primary productivity (9000 K cal / m 2 / yr). Correct choice: (2)
Q. 66. Which one of the following is being utilized as a source of biodiesel in the Indian countryside?
a. Pongamia
b. Euphorbia
c. Beetroot
d. Sugarcane
Sol. Pongamia, Jatropa, Euphorbia are petrocrops. However, in the Indian countryside, Pongamia (Kanjar) is being utilized as a source of biodiesel. Correct choice: (1)
Q. 67. In a coal fires power plant electrostatic precipitators are installed to control emission of:
a. CO
b. SO2
c. NOX
d. SPM
Sol. Electrostatic precipitators control emission of suspended particle matter (SPM).
Correct choice: (4)
Q. 68. Which one of the following is not a bioindicator of water pollution?
a. Sewage fungus
b. Sludge-worms
c. Blood-worms
d. Stone flies
Sol. Correct choice: (4)
Q. 69. A high density of elephant population in an area can result in:
a. Predation on one another
b. Mutualism
c. Intra specific competition
d. Inter specific competition
Sol. Intra-specific competition occurs between the members of the same species. Correct choice: (3)

Q. 70. Geometric representation of age structure is a characteristic of:
a. Ecosystem
b. Biotic community
c. Population
d. Landscape
Sol. Age structure is one of the characteristics of population. Correct choice: (3)
Q. 71. Which one of the following pairs of organisms are exotic species introduced in India?
a. Nile perch, Ficus religiosa
b. Ficus religiosa, Lantana camara
c. Lantana camara, Water hyacinth
d. Water hyacinth, Prosopis cineraria
Sol. Lantana camara and Eicchornia czassipes (water hyacinth) are exotic species. Correct choice: (3)
Q. 72. One of endangered species of Indian medicinal plants is that of:
a. Nepenthes
b. Podophyllum
c. Ocimum
d. Garlic
Sol. Podophyllum hexandrum - : (Papri), gives a drug from its rhizome; besides being stimulant and purgative and has destructive action on cancerous tissues. Correct choice: (2)
Q. 73. A genetically engineered micro-organism used successfully in bioremediation of oil spills is a species of:
a. Bacillus
b. Pseudomonas
c. Trichoderma
d. Xanthomonas
Sol. Pseudomonas putida (superbug) developed by genetic engineering by Anand Mohan Chakravorty is used to control oil spills. Correct choice: (2)
Q. 74. A sequential expression of a set of human genes occurs when a steroid molecule binds to the:
a. Ribosome
b. Transfer RNA
c. Messenger RNA
d. DNA sequence
Sol. Correct choice: (4)
Q. 75. The Okazaki fragments in DNA chain growth:
a. polymerize in the direction and explain DNA replication
b. result in transcription
c. polymerize in the direction and forms replication fork
d. prove semi-conservative nature of DNA replication
Sol. Replication occurs always in direction. Okazaki fragments, synthesized on DNA template, join to form lagging strand which grows in direction. Correct choice: (1)
Q. 76. In the hexaploid wheat, the haploid (n) and basic (x) numbers of chromosomes are:
a. n = 21 and x = 7
b. n = 7 and x = 21
c. n = 21 and x = 21
d. n = 21 and x = 14
Sol. The basic number (x) of wheat is 7. Thus the 6x = 2n = 42 and n = 21. Correct

choice: (1)
Q. 77. Molecular basis of organ differentiation depends on the modulation in transcription by:
a. Anticodon
b. RNA polymerase
c. Ribosome
d. Transcription factor
Sol. Correct choice: (4)
Q. 78. Telomere repetitive DNA sequence control the function of eukaryote chromosomes because they:
a. prevent chromosome loss
b. act as replicons
c. are RNA transcription initiator
d. help chromosome pairing
Sol. Telomerase seal the ends of the chromosomes. Correct choice: (1)
Q. 79. Inheritance of skin colour in humans is an example of:
a. codominance
b. chromosomal aberration
c. point mutation
d. polygenic inheritance
Sol. Inheritance of skin colour in human is controlled by three genes, A, B and C. Correct choice: (4)
Q. 80. A common test to find the genotype of a hybrid is by:
a. crossing of one F1progeny with male parent
b. crossing of one F2 progeny with male parent
c. crossing of one F2 progeny with female parent
d. studying the sexual behaviour of F1 progenies.
Sol. To find the genotype of hybrid, it is test crossed. Correct choice: (1)
Q. 81. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle - like structure. What is it's DNA-binding sequence?
a. TATA
b. TTAA
c. AATT
d. CACC
Sol. The DNA binding sequence for RNA polymerase is called TATA box. Correct choice: (1)
Q. 82. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRYY and rryy genotypes are hybridized, the F2 segregation will show:
a. Higher number of the parental types.
b. Higher number of the recombinant types.
c. Segregation in the expected 9: 3: 3: 1 ratio.
d. Segregation in 3:1 ratio.
Sol. When the linked genes are situated quite close, the chances of crossing over are highly reduced. Due to this, large number of parental gametes are formed and only few recombinant gametes are formed. This results in higher number of parental types in F2 generation as compared to recombinants.
Correct choice: (1)
Q. 83. In maize, hybrid vigour is exploited by:
a. Inducing mutations.
b. Bombarding the seeds with DNA.
c. Crossing of two inbred parental lines.

d. Harvesting seeds from the most productive plants.
Sol. Correct choice: (3)
Q. 84. Differentiation of organs and tissues in a developing organism, is associated with:
a. Deletion of genes
b. Developmental mutations
c. Differential expression of genes
d. Lethal mutations
Sol. Correct choice: (3)
Q. 85. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F1 generation?
a. 3 : 1
b. 50 : 50
c. 9 : 1
d. 1 : 3
Sol. This is a monohybrid test cross. Correct choice: (2)
Q. 86. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?
a. Through elimination of repetitive DNA.
b. Deletion of non-essential genes.
c. Super-coiling in nucleosomes.
d. DNAse digestion.
Sol. The nucleosome model explains the packaging of histone proteins and DNA in the chromatin material which forms the chromosome. Correct choice: (3)
Q. 87. In cloning of cattle a fertilized egg is taken out of the mother's womb and:
a. from this upto eight identical twins can be produced
b. the egg is divided into 4 pairs of cells which are implanted into the womb of others cows
c. in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb other cows.
d. in the eight cell stage the individual cells are separated under electrical field for further development in culture media.
Sol. As per the experiment performed by the scientist from Japan. Correct choice: (3)
Q. 88. Which one of the following statements is correct?
a. At present it is not possible to grow maize without chemical fertilizers.
b. Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
c. Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.
d. Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and potassium for plant nutrition in soil.
Sol. The Agricultural run off contains high concentration of chemical fertilizers. Which is discharge in near by lakes causes nutrient enrichment of lakes called eutrophication. Correct choice: (2)
Q. 89. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?
a. The population of its predators increases enormously.
b. S-shaped or sigmoid growth of this insect.
c. The food plants mature and die at the end of the rainy season.
d. Its population growth curve is of J-type.
Sol. A population which grows exponentially and crashes suddenly exhibits J-type growth curve. Correct choice: (4)

Q. 90. The two polynucleotide chains in DNA are:
a. semiconservative
b. parallel
c. discontinuous
d. antiparallel
Sol. The two chains in a dsDNA run in opposite direction one while other in opposite direction.
Correct choice: (4)
Q. 91. A plant requires magnesium for:
a. Cell wall development
b. Holdin g cells together
c. Protein synthesis
d. Chlorophyll synthesis
Q. 92. Probiotics are:
a. Live microbial food supplement
b. Safe antibiotics
c. Cancer inducing microbes
d. New kind of food allergens
Sol. Live microbial food supplements are called probiotics (e.g., curd). Correct choice: (1)
Q. 93. Bowman's glands are located in the:
a. olfactory epithelium of our nose
b. proximal end of uriniferous tubules
c. anterior pituitary
d. female reproductive system of cockroach
Sol. Correct choice: (1)
Q. 94. Increased asthamatic attacks in certain seasons are related to:
a. Low temperature
b. Hot and humid environment
c. Eating fruits preserved in tin containers
d. Inhalation of seasonal pollen
Sol. Correct choice: (4)
Q. 95. A human male produces sperms with genotypes AB, Ab, aB and ab pertaining to two diallelic characters in equal proportions. What is the corresponding genotype of this person?
a. AABB
b. AaBb
c. AaBB
d. AABb
Sol. The formula for gamete formation is 2n where n stands for number of heterozygous pairs. AaBb has 2 heterozygous pairs so it will form 4 types of gametes. Correct choice: (2)
Q. 96. Which one of the following pairs is wrongly matched?
a. Coliforms
b. Methanogens
c. Yeast
d. Streptomycetes
- Vinegar
-Gobar gas
–Ethanol
–Antibiotic
Sol. Coliforms are bacteria found in colon e.g. E. coli. For the preparation of vinegar

Acetobacter aceti is employed. Correct choice: (1)
Q. 97. Which one of the following pairs is mismatched?
a. Bombyx mori
b. Pila globosa
c. Apis indica
d. Kenia lacca
-silk
-pearl
–honey
–lac
Sol. Pinctada vulgaris is a bivalve from which pearl is obtained. Correct choice: (2)
Q. 98. Which one of the following is viral disease of poultry?
a. Pasteurellosis
b. Salmonellosis
c. Coryza
d. New Castle disease
Sol. Correct choice: (4)
Q. 99. Ultrasound of how much frequency is beamed into human body for sonography?
a. 45 - 70 MHz
b. 30 - 45 MHz
c. 15 - 30 MHz
d. 1 - 15 MHz
Sol. Correct choice: (4)
Q. 100. Lysozyme that is present in perspiration, saliva and tears, destroys:
a. most virus-infected cells
b. certain fungi
c. certain types of bacteria
d. all viruses
Sol. Correct choice: (3)

CHEMISTRY
Q. 1. With which of the following configuration an atom has the lowest ionization enthalpy?
a.
b.
c.
d.
Sol. represents the excited state of a Neon atom. The energy needed to knock off an electron from the excited state of neon must be least. Correct choice is: (4)
Q. 2. An element, X has the following isotopic composition; 200X:90% ; 199X:8.0% ; 202X:2.0%
The weighted average atomic mass of the naturally occurring element X is closest to :
a. 199 amu
b. 200 amu
c. 201 amu
d. 202 amu
Sol. The weighted average atomic mass of element (X) = 0.9 (200) + 0.08 (199) + 0.02 (202) = 180 + 15.92 + 4.04 = Correct choice is: (2)
Q. 3. Concentrated aqueous sulphuric acid is 98% H 2SO 4 by mass and has a density of 1.80 g. mL-1 . Volume of acid required to make one litre of 0.1 M H2SO4 is,
a. 5.55 mL
b. 11.10 mL

c. 16.65 mL
d. 22.20 mL
Sol. Density = 1.80 g/ml
Correct choice: (1)
Q.4. Consider the following sets of quantum numbers:
n I M s
(a) 3 0 0 + ½
(b) 2 2 1 + ½
(c) 4 3 -2 - ½
Which of the following sets of quantum number is not possible
a. a and c
b. b, c and d
c. a, b, c and d
d. b, d and e
Sol. Choice (b), (d) and (e) are incorrect. Remember that value of 'l' ranges from (0) to (n – 1) and values of 'm' range from (–l) to (+l). Correct choice: (4)
Q. 5. The number of moles of KMnO4 that will be needed to react with one mole of sulphite ion in acidic solution is:
a. 1
b.
c.
d.
Sol.
Correct choice : (4)
Q. 6. In a first-order reaction , if k is rate constant and initial concentration of the reactant A is 0.5 M then the half-life is :
a.
b.
(d) 1 0 -1 - ½
(e) 3 2 3 +1/2
c.
d.
Sol.
Correct choice: (1)
Q. 7. The reaction of hydrogen and iodine monochloride is given as:
This reaction is of first order with respect to , following mechanisms were proposed :
Mechanism A :
Mechanism B :
Which of the above mechanism (s) can be consistent with the given information about the reaction
a. A only
b. B only
c. 1 and 2 both
d. Neither 1 nor 2
Sol. The rate law is invariably determined from the slowest step of the mechanism. Therefore mechanism (B) is consistent with the data given for order of reaction. Correct choice: (2)
Q. 8. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately :
a. 40 minutes
b. 50 minutes

c. 45 minutes
d. 60 minutes
Sol.
Correct choice: (3)
Q. 9. The equilibrium constant of the reaction :
a.
b.
c.
d.
Sol.
Correct choice: (1)
Q. 10. 0.5 molal aqueous solution of a weak acid (HX) is 20% ionized. If Kf for water is 1.86 K kg mol sup-1 , the lowering in freezing point of the solution is
a. – 0.56 K
b. – 1.12 K
c. 0.56 K
d. 1.12 K
Correct choice: (4)
Q. 11.The efficiency of a fuel cell is given by
a.
b.
c.
d.
Sol. Efficiency of a fuel cell Correct choice: (4)
Q. 12. Consider the following reactions:
a.
b.
c.
d.
Enthalpy of formation of H2O(l) is
a.
b.
c.
d.
Sol. Heat of formation of H2O(l) = -X2 kJ / mol . Correct choice: (2)
Q. 13. Given that bond energies of
a.
b.
c.
d.
Sol.
Correct choice: (4)
Q. 14. The Langmuir adsorption isotherm is deduced using the assumption
a. The adsorbed molecules interact with each other
b. The adsorption takes place in multilayers
c. The adsorption sites are equivalent in their ability to adsorb the particles
d. The heat of adsorption varies with coverage
Sol. angmuir adsorption has the following postulates
a. The isotherm is devised for adsorption equilibrium i.e., when rate of adsorption = rate of desorption
b. Adsorption at all sites is equivalent
c. Adsorption at a site is unaffected by adsorption at neighboring sites.

Correct choice: (3)
Q. 15. The following equilibrium constants are given
The equilibrium constant for the oxidation of NH3 by oxygen to give NO is
a.
b.
c.
d.
Sol.
Correct choice: (2)
Q. 16. Caulate the pOH of a solution at 250C that contains
a. 1.000
b. 7.000
c. 4.000
d. 9.000
Sol. Correct choice : (3)
Q. 17. Aweak acid, mol of this acid is dissolved in
one litre of water, the percentage of acid dissociated at equilibrium is closest to
a. 0.100%
b. 99.0%
c. 1.00%
d. 99.9%
Sol. We know that, Correct choice: (3)
Q. 18. The fraction of total volume occupied by the atoms present in a simple cube is
a.
b.
c.
d.
Sol. Packing fraction for a simple cube Correct choice: (2)
Q. 19. Identify the correct order of the size of the following:
a.
b.
c.
d.
Sol. Anions have the largest sizes followed by neutral atoms and then cations for a respective period. So, the correct order should be
Correct choice: (3)
Q.20. In which of the following pairs, the two species are iso-structural?
a.
b.
c.
d.
Sol. Both -
Q. 21. The correct order of
a.
b.
c.
d.
Sol. The correct order of
Correct choice: (1)
Q. 22. Which one of the following ionic species has the greatest proton affinity to form stable compound?
a. I- b. HS- c.

d. E- Sol. Strongest base would have the highest proton affinity i.e, Correct choice: (3)
Q. 23. In which of the following the hydration energy is higher than the lattice energy?
a. SrSO4
b. BaSO4
c. MgSO4
d. RaSO4
Sol. MgSO4 is the most soluble out of the given alkaline earth metal sulphates. Correct choice: (3)
Q. 24. Which of the following statements, about the advantage of roasting sulphide ore before reduction is not true?
a. Roasting of the sulphide to the oxide is thermodynamically feasible.
b. Carbon and hydrogen are suitable reducing agents for metal sulphides.
c. The of the sulphide is greater than those for CS2 andH2S
d. The is negative for roasting of sulphide ore to oxide
Sol. Carbon and hydrogen are not suitable for reduction of sulphides directly. Correct choice: (2)
Q. 25. The correct order of increasing thermal stability of
a.
b.
c.
d.
Sol. The correct order is
Correct choice: (3)
Q. 26. Sulphides ores of metals are usually concentrated by Froth Flotation process. Which one of the following sulphides oresoffers an exception and is concentrated by chemical leaching?
a. Sphalerite
b. Argentite
c. Galena
d. Copper pyrite
Sol. Argentite ore is leached with NaCN during extraction of silver in the Mc Arthur Forrest Cyanide process. Correct choice: (2)
Q. 27. Which one of the following anions is present in the chain structure of silicates?
a.
b.
c.
d.
Sol. Chain silicates have the general formula Correct choice: (4)
Q. 28. Which one of the following orders correctly represents the increasing acid strengths of the given acids?
a.
b.
c.
d.
Sol. The correct order is
Correct choice: (2)
Q. 29. Which of the following oxidation states are the most characteristic for lead and tin respectively?
a. + 2, + 2
b. + 4, + 2
c. + 2, + 4
d. + 4, + 4

Sol. Among common characteristic states for Pb and Sn, we find +2 and +4 respectively.
Correct choice: (3)
Q. 30. Identify the incorrect statement among the following:
a. Shielding power of 4f electrons is quite weak
b. There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu
c. Lanthanoid contraction is the accumulation of successive shrinkages
d. As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements
Sol. The atomic radii of 4d and 5d elements down the group become quite similar due to lanthanidecontraction. Correct choice: (4)
Q. 31. Which one of the following ions is the most stable in aqueous solution?
a.
b.
c.
d.
(Atomic number. Ti = 22, V = 23, Cr = 24, Mn = 25)
Sol . is the most stable ion in aqueous medium. Correct choice: (2)
Q. 32. The d electron configurations of Cr . Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour?
a.
b.
c.
d.
Sol. will have two unpaired electrons and
will show least paramagnetic character. Correct choice: (4)
Q. 33. Which of the following will give a pair of enantiomorphs?
a.
b.
c.
d.
Sol . The complex ion can show optical isomerism in its cis-isomer, and
will form a pair of enantiomorphs. Its trans-form will be optically inactive (meso).
Correct choice: (4)
Q. 34. If NaCl is doped with
a.
b.
c.
d.
Sol. Number of moles of cationic vacancies
Correct choice: (4)
Q. 35. Which of the following presents the correct order of the acidity in the given compounds?
a.
b.
c.
d.
Sol. Correct choice: (1)
Q. 36. The product formed in Aldol condensation is
a. an alpha, beta unsaturated ester
b. a beta-hydroxy acid
c. a beta-hydroxy aldehyde or a beta-hydroxy ketone
d. an alpha-hydroxy aldehyde or ketone

Sol. Aldol condensation leads to formation of
Correct choice: (3)
Q. 37. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc. HCl is called
a. Wolf- Kishner Reduction
b. Clemmensen Reduction
c. Cope Reduction
d. Dow Reduction
Sol. This is Clemmensen's reduction. Correct choice: (2)
Q. 38. Consider the following compounds
a.
b.
c.
d.
The correct decreasing order of their reactivity towards hydrolysis is
a. (b) > (d) > (a) > (c)
b. (b) > (d) > (c) > (a)
c. (a) > (b) > (c) > (d)
d. (d) > (b) > (a) > (c)
Sol. The attack of the nucleophile onto the carbonyl carbon is the rate-determining step. So, order must be (b) > (d) > (a) > (c) Correct choice: (1)
Q. 39. Which one of the following on treatment with 50% aqueous sodium
a.
b.
c.
d.
Sol. Benzaldehyde has no hydrogen atom, so it can undergo Cannizaro reaction.
Correct choice: (3)
Q. 40. Which one of the following on reduction with lithium aluminium hydride yields a secondary amine?
a. Methyl Cyanide
b. Nitroethane
c. Methylisocyanide
d. Acetamide
Sol. Methyl isocyanide on reduction with LiAlH 4 will give dimethylamine. Correct choice: (3)

Re: AIPMT Solved Question Paper

Q. 41. The order of decreasing reactivity towards an electrophilic reagent, for the following:
a. Benzene
b. Toluene
c. Chlorobenzene
d. Phenol would be
a. d > b > a > c
b. a > b > c > d
c. b > d > a > c

d. d > c > b > a
Sol. The correct order is d > b > a > c. Correct choice: (1)
Q. 42. Predict the product C obtained in the following reaction of
a.
b.
c.
d.
Sol.
Correct choice: (1)
Q. 43. Which of the compounds with molecular formulaC5H10 yields acetone on ozonolysis?
a. 2 – Methyl – 1 – butene
b. 2 – Methyl – 2 – butane
c. 3 – Methyl – 1 – butane
d. Cyclopentane
Sol.
Correct choice: (2)
Q. 44. If there is no rotation of plane polarized light by a compound in a specific solvent, thought to be chiral, it may mean that
a. the compound may be a racemic mixture
b. the compound is certainly a chiral
c. the compound is certainly meso
d. there is no compound in the solvent
Sol. The given compound was thought to be chiral because of a chiral carbon/s. If there is no optical activity, it means the compound must certainly be meso. Correct choice: (3)
Q. 45. For the following
a. I–
b. Cl –
c. Br- the increasing order of nucleophilicity would be:
a.
b.
c.
d.
Sol. The order of nucleophilicities of halides ions in water (default solvent) will be
Correct choice: (3)
Q. 46. has a chiral centre. Which one of the following
represents its R configuration?
a.
b.
c.
d.
Sol.
Q. 47. In the reaction
Which of the following compounds will be formed?
a.
b.
c.
d.
Sol.
Correct choice: (1)
Q. 48. Which one of the following vitamins is water-soluble?
a. Vitamin A

b. Vitamin B
c. Vitamin E
d. Vitam in K
Sol. Vitamin (B) and vitamin (C) are water soluble, while Vitamin (A), (D), (E) and (K) are fat soluble. Correct choice: (2)
Q. 49. RNA and DNA are chiral molecules, their chirality is due to
a. D – sugar component
b. L – sugar component
c. Chiral bases
d. Chiral phosphate ester units
Sol. Deoxyribose and ribose sugars are D -chiral sugars in DNA and RNA. Correct choice: (1)
Q. 50. Which one of the following polymers is prepared by condensation polymerization?
a. Styrene]
b. Nylon – 66
c. Teflon
d. Rubber
Sol. Nylon-66 is a condensation polymer of hexamethylene diamine and adipic acid. \Correct choice: (2)
PHYSICS
Q. 1. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be
a.
b.
c.
d.
Sol. Correct choice: (1)
Q. 2. A particle moving along x-axis has acceleration f, at time t, given
are constant. The particle at t = 0 has zero velocity. In
the time interval between t = 0 and the instant when f = 0 , the particle's velocity (vx) is
a.
b.
c.
d.
Sol.
If they have asked instantaneous velocity when Correct choice: (1)
Q. 3. A car moves from X to Y with a uniform speed vu and returns to Y with a uniform speed vd .The average speed for this round trip is
a.
b.
c.
d.
Sol. In question it must be car moves from X to Y and returns to X.
Correct choice: (2)
Q. 4. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its co-ordinates at a later time are . The path of the particle makes with the x-axis
an angle of
a.
b.
c.
d.
Sol. Correct choice: (4)

Q. 5. A block B is pushed momentarily along a horizontal surface with an initial velocity V. If is the coefficient of sliding friction between B and the surface, block B will come to rest after a time
a.
b.
c.
d.
Sol. Correct choice: (2)
Q. 6. A vertical spring with force constant K is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d . The net work done in the process is
a.
b.
c.
d.
Sol.
Correct choice: (3)
Q. 7. A wheel has angular acceleration of 3.0 rad/sec2 and an initial angular speed of 2.00 rad / sec. In a time of 2 sec it has rotated through an angle (in radian) of
a. 4
b. 6
c. 10
d. 12
Sol. Correct choice:
(3)
Q. 8.
a.
b.
c.
d.
Sol.
Correct
choice: (2)
Q. 9. The position x of a particle with respect to time t along x -axis is given by where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the +x direction?
a. 24 m
b. 32 m
c. 54 m
d. 81 m
Sol.
Correct choice: (3)
Q. 10. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan?
a. 4.0 cm
b. 8.0 cm
c. 10.0 cm
d. any value less than 12.0 cm
Sol. Correct choice: (3)

Q. 11. A particle of mass m moves in the XY plane with a velocity V along the straight line AB. If the angular momentum of the particle with respect to origin O is LA when it is at A and LB when it is at B, then
a.
b.
c.
d. The relationship between LA and LB depends upon the slope of the line AB
Sol. Correct choice: (3)
Q. 12. A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about , the initial angular acceleration of the rod will be
a.
b.
c.
d.
Sol. Correct choice: (1)
Q. 13. Two satellites of earth, are moving in the same orbit. The mass of is four times the mass of . Which one of the following statements is true?
a. The kinetic energies of the two satellites are equal.
b. The time period of is four times that of .
c. The potential energies of earth and satellite in the two cases are equal.
d. are moving with the same speed.
Sol . As orbital velocity it is independent of mass of satellite Correct choice: (4)
Q. 14. Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature , the power received by a unit surface, (normal to the incident rays) at a distance R from the center of the sun is (where is the Stefan's constant).
a.
b.
c.
d.
Sol. Power radiated
Correct choice: (1)
Q. 15. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 620C, its efficiency is doubled. Temperature of the source is
a.
b.
c.
d.
Sol.
Correct choice: (1)
Q. 16. A black body is at . It emits energy at a rate which is proportional to
a.
b.
c.
d.
Sol. Correct choice: (3)
Q. 17. The frequency of a light wave in a material is and wavelength is 5000Å. The refractive index of material will be
a. 1.33
b. 1.40

c. 1.50
d. 3.00
Sol. Correct choice: (4)
Q. 18. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is
a. (1) zero
b.
c.
d.
Sol.
Correct choice: (2)
Q. 19. The particle executing simple harmonic motion has a kinetic energy .
The maximum values of the potential energy and the total energy are respectively
a.
b.
c.
d.
Sol. Correct choice: (1)
Q. 20. A particle executes simple harmonic oscillation with an amplitude a . The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is
a. T / 2
b. T / 4
c. T / 8
d. T /12
Sol. Correct choice: (4)
Q. 21. The electric and magnetic field of an electromagnetic wave are
a. in phase and perpendicular to each other
b. in phase and parallel to each other
c. in opposite phase and perpendicular to each other
d. in opposite phase and parallel to each other
Sol.
Correct choice: (1)
Q. 22. A small coin is resting on the bottom of a beaker filled with a liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface (see figure). How fast is the light traveling in the liquid?
a.
b.
c.
d.
Sol . Correct
choice: (2)
Q. 23. Charges +q and -q are placed at points A and B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is
a.
b.
c.
d.
Sol. At C potential
Correct choice: (1)
Q. 24. A hollow cylinder has a charge q coulomb within it. If f is the electric flux in units

of volt × meter associated with the curved surface B, the flux linked with the plane surface A in units of volt × meter will be
a.
b.
c.
Sol. Correct choice: (2)
Q. 25. Three point charges +q, - 2q and +q are placed at points (x = 0, y = a, z = 0), (x = 0, y = 0, z = 0) and (x = a, y = 0, z = 0) respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are
a.
b.
c.
d.
Sol . Correct choice: (3)
Q. 26. Two condensers, one of capacity C and the other of capacity C/2, are connected to a V-volt battery, as shown. The work done in charging fully both the condensers is
a.
b.
c.
d.
Sol. Correct choice: (4)
Q. 27. The total power dissipated in Watts in the circuit shown here is
a. 4
b. 16
c. 40
d. 54
Sol . Correct choice: (4)
Q. 28. A steady current of 1.5 amp flows through a copper voltameter for 10 minute. If the electrochemical equivalent of copper is 30´10 -5 gm coulomb-1 , the mass of copper deposited on the electrode will be
a. 0.27 gm
b. 0.40 gm
c. 0.50 gm
d. 0.67 gm
Sol . m = Zit; m = 0.27gm Correct choice: (1)
Q. 29. If the cold junction of a thermo-couple is kept at 00C and the hot junction is kept at T0C, then the relation between neutral temperature (Tn) and temperature of inversion (Ti) is
a.
b.
c.
d.
Sol . Correct choice: (2)
Q. 30. Three resistances P, Q, R each of and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of is connected in parallel to S the bridge gets balanced. What is the value of S?
a.
b.
c.
d.
Sol .
Correct choice: (3)

Q. 31. The resistance of an ammeter is and its scale is graduated for a current upto 100 Amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 Amperes by this meter. The value of shuntresistance is
a.
b.
c.
d.
Sol.
Correct choice: (3)
Q. 32. Under the influence of a uniform magnetic field a charge-particle is moving in a circle of radius R with constant speed V. The time period of the motion
a. depends on R and not on V
b. depends on V and not on R
c. depends on both R and V
d. is independent of both R and V
Sol. Correct choice: (4)
Q. 33. A charged particle (charge q) is moving in a circle of radius R with uniform speed v . The associated magnetic moment is given by
a. qvR
b. qv R / 2
c. qv R2
d. qvR2 / 2
Sol. Correct choice: (2)
Q. 33. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move
a. along a straight line
b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path
Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)
Q. 34. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move
a. along a straight line
b. in an elliptical orbit
c. in a circular orbit
d. along a parabolic path
Sol. As velocity, magnetic field and electric field are mutually perpendicular. Correct choice: (3)
Q. 35. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flu f linked with the primary coil is given by
is a constant, the output
voltage across the secondary coil is
a. 30 volts
b. 90 volts
c. 120 volts
d. 220 volts
Sol. Correct choice: (3)
Q. 36. What is the value of inductance L for which the current is a maximum in a series

LCR circuit with
a. 10 mH
b. 100 mH
c. 1 mH
d. cannot be calculated unless R is known
Sol.
Correct choice: (2)
Q. 37. A transformer is used to light a 100W and 110V lamp from a 220V mains. If the main current is 0.5A, the efficiency of the transformer is approximately
a. 10%
b. 30%
c. 50%
d. 90%
Sol. Correct choice: (4)
Q. 38. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature then it will show
a. diamagnetism
b. paramagnetism
c. anti ferromagnetism
d. no magnetic property
Sol . Fact based Correct choice: (2)
Q. 39. A 5 watt source emits monochromatic light of wavelength . When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photoelectrons liberated will
a. be reduced by a factor of 2
b. be reduced by a factor of 4
c. be reduced by a factor of 8
d. be reduced by a factor of 16
Q. 40. Monochromatic light of frequency is produced by a laser. The power emitted is . The number of photons emitted, on the average, by the source per second is
a.
b.
c.
d.
Sol . Correct choice: (2)
Q. 41. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio will be proportional to
a. R
b. 1/R
c. 1/R2
d. R2
Sol . Radius of path
Correct
choice: (3)
Q. 42. If the nucleus 13 has a nuclear radius of about 3.6 fm, then Te would have its radius approximately as
a. 4.8 fm
b. 6.0 fm
c. 9.6 fm

d. 12.0 fm
Sol. Correct choice: (2)
Q. 43. In radioactive decay process, the negatively charged emitted particles are
a. the electrons orbiting around the nucleus
b. the electrons present inside the nucleus
c. the electrons produced as a result of the decay of neutrons inside the nucleus
d. the electrons produced as a result of collisions between atoms
Sol . When neutron decays as given Correct choice: (3)
Q. 44. A nucleus has nucleus A X
Z has mass represented by M (A, Z). If Mp and Mn denote the mass of proton and neutron respectively and B.E the binding energy in Me V then
a.
b.
c.
d.
Sol. Correct choice: (3)
Q. 45. Two radioactive substances A and B have decay constants respectively.
At t = 0 they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be after a time interval
a.
b.
c.
d.
Sol.
Correct choice: (1)
Q. 46. The total energy of electron in the ground state of hydrogen atom is −13.6 eV. The kinetic energy of an electron in the firstm excited state is
a. 1.7 eV
b. 3.4 eV
c. 6.8 eV
d. 13.6 eV
Sol. Total energy in 1st excited state
Correct choice: (2)
Q. 47. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is
a. an n-type semiconductor
b. a p-type semiconductor
c. an insulator
d. a metal
Sol. In diagram acceptor level is near valance band which will happen in p-type semiconductor. Correct choice: (2)
Q. 48. A common emitter amplifier has a voltage gain of 50, an input impedance of and an output impedance of . The power gain of the amplifier is
a. 100
b. 500
c. 1000
d. 1250
Sol.
Correct choice: (4)
Q. 49. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table
(i) A B Y

0 0 0
0 1 1
1 1 1
(ii) A B Y
0 1 0
1 0 0
1 1 1
(iii) A B Y
0 0 1
0 1 1
1 0 1
1 1 0
(iv) A B Y
0 0 1
0 1 0
1 0 0
1 1 0
Q. 50. For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct?
a.
b.
c.
d.
Sol. the cubic system is the most symmetric out of all seven crystal systems. All edges for the unit cell are same i.e., a = b = c and all angles are right angles i.e.,
Correct choice: (1)

PART- A : Physics (Code - P)

भाग - A : भौतिक विज्ञान

1. If force (F), velocity(V) and time (T) are taken as fundamental units, the dimensions of mass are :

(1) $[FVT^{-1}]$ (2) $[FVT^{-2}]$ (3) $[FV^{-1}T^{-1}]$ (4) $[FV^{-1}T]$

यदि बल (F), वेग (V) तथा समय (T) को मूल मात्रक मान लिया जाय तो, द्रव्यमान की विमायें होगी :

(1) $[FVT^{-1}]$ (2) $[FVT^{-2}]$ (3) $[FV^{-1}T^{-1}]$ (4) $[FV^{-1}T]$

Ans. **(4)**

Sol. $F = M \times \frac{L}{T^2} = \frac{ML}{TT}$

$F = \frac{MV}{T}$

$FTV^{-1} = M$

2. A projectile is fired from the surface of the earth with a velocity of $5ms^{-1}$ and angle θ with the horizontal. Another projectile fired from another planet with a velocity of $3ms^{-1}$ at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is : (given = $9.8\ ms^{-2}$)

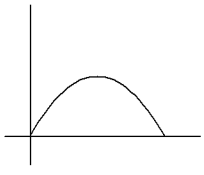
(1) 3.5 (2) 5.9 (3)16.3 (4)110.8

एक प्रक्षेप्य को पृथ्वी की सतह से $5ms^{-1}$ के वेग से तथा क्षैतिज दिशा से θ से कोण पर छोडा जाता है। किसी अन्य ग्रह से $3ms^{-1}$ के वेग तथा इसी कोण (θ)पर छोड़े गये एक प्रक्षेप्य का प्रक्षेप पथ, पृथ्वी से छोड़े गये प्रक्षेप्य पथ के सर्वसम (सर्वथा समान) है। यदि पृथ्वी पर है $g = 9.8\ ms^{-2}$ है तो, इस ग्रह पर गुरूत्वीय त्वरण का मान ms^{-2} में होगा

(1) 3.5 (2) 5.9 (3)16.3 (4)110.8

Ans. **(1)**

Sol.



$\frac{5^2}{g} = \frac{3^2}{a}$

$a = 9.8 \times \frac{9}{25}$

$a = 3.5$

3. A particle is moving such that its position coordinates (x,y) are
(2m, 3m) at time t = 0,
(6m,7m) at time t = 2s and
(13m, 14m) at time t = 5 s,
Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5 s is :

(1) $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$ (2) $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$ (3) $2\left(\hat{i}+\hat{j}\right)$ (4) $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

एक कण इस प्रकार गति करता है कि, इसके स्थिति निर्देशांक (x,y) निम्न प्रकार हैं :
(2m, 3m) समय t = 0, पर
(6m,7m) समय t = 2s पर
(13m, 14m) समय t = 5 s पर

तो t = 0 से t = 5 s तक, औसत वेग सदिश $\left(\vec{V}_{av}\right)$ होगा :

(1) $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$ (2) $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$ (3) $2\left(\hat{i}+\hat{j}\right)$ (4) $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Ans **(4)**

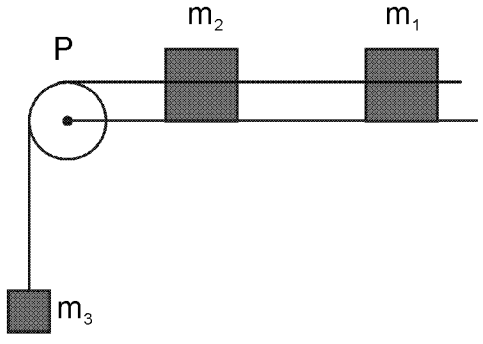
Sol. $\vec{r}_\ell = 2\hat{i} + 3\hat{j}$

$\vec{r}_f = 13\hat{i} + 14\hat{j}$

$\vec{s} = 11\hat{i} + 11\hat{j}$

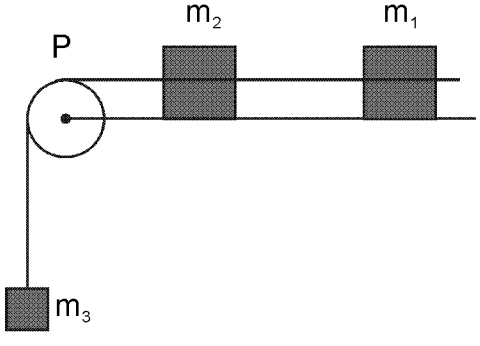
$< \vec{v} > = \dfrac{11\hat{i} + 11\hat{j}}{5}$

4. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is : (Assume $m_1 = m_2 = m_3 = m$)



(1) $\dfrac{g(1-g\mu)}{9}$ (2) $\dfrac{2g\mu}{3}$ (3) $\dfrac{g(1-2\mu)}{3}$ (4) $\dfrac{g(1-2\mu)}{2}$

यहाँ दर्शाये गये निकाय में तीन पिंड m_1, m_2 और m_3 एक रस्सी से जुड़े हैं जो एक घिरनी P के ऊपर होकर गुजरती है। m_1 मुक्त रूप से लटका हैं और m_2 तथा m_3 एक रूक्ष क्षैतिज मेज पर हैं, जिसका घर्षण गुणांक = μ हैं। घिरनी घर्षण रहित है और इसका द्रव्यमान नगण्य है। यदि $m_1 = m_2 = m_3 = m$ है तो, m_1 का अधोमुखी (नीचे की ओर) त्वरण होगा :



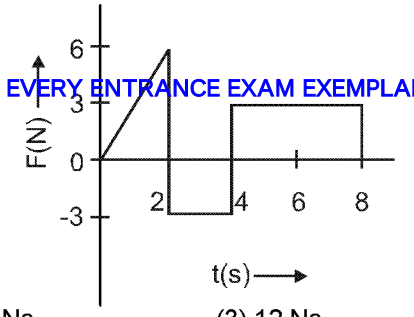
(1) $\dfrac{g(1-g\mu)}{9}$ (2) $\dfrac{2g\mu}{3}$ (3) $\dfrac{g(1-2\mu)}{3}$ (4) $\dfrac{g(1-2\mu)}{2}$)

Ans. **(3)**

Sol. $a = \dfrac{mg - 2\mu mg}{3m}$

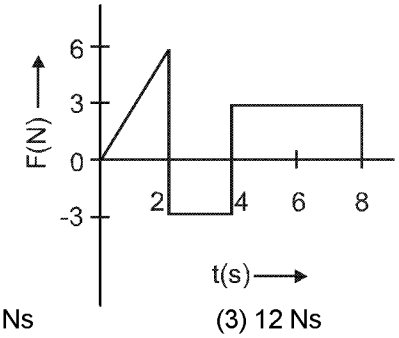
$a = \dfrac{g - 2\mu mg}{3} = g\left(\dfrac{1-2\mu}{3}\right)$

5. The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is :



(1) 24 Ns (2) 20 Ns (3) 12 Ns (4) 6 Ns

'm' द्रव्यमान के किसी कण पर आरोपित बल 'F' को बल समय ग्राफ द्वारा दर्शाया गया है। समय t = 0 से 8 s तक के अंतराल में कण के संवेग में परिवर्तन होगा :



(1) 24 Ns (2) 20 Ns (3) 12 Ns (4) 6 Ns)

Ans. **(3)**

Sol. $\Delta P = \left(\frac{1}{2}\right)(2)(6) - (3)(2) + (4)^2(3)$

$= 6 - 6 + 12$

$= 12$

6. A balloon with mass 'm' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that is starts moving up with an acceleration 'a' ?

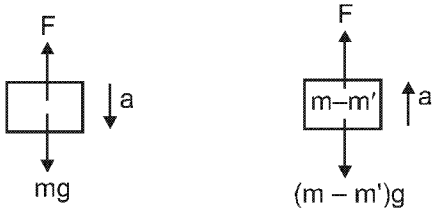
(1) $\frac{2ma}{g+a}$ (2) $\frac{2ma}{g-a}$ (3) $\frac{ma}{g+a}$ (4) $\frac{ma}{g-a}$

'm' द्रव्यमान का एक बैलून (गुब्बारा) 'a' त्वरण से नीचे उतर रहा है। (जहाँ a < g) इसमें से कितने द्रव्यमान का पदार्थ हटा दिया जाये कि यह 'a' त्वरण से ऊपर की ओर जाने लगे ?

(1) $\frac{2ma}{g+a}$ (2) $\frac{2ma}{g-a}$ (3) $\frac{ma}{g+a}$ (4) $\frac{ma}{g-a}$)

Ans. **(1)**

Sol. $mg - F = ma$ .....(1)



$F - (m - m')g = (m - m')a$

from (1)

$F - mg + m'g = ma - m'a$

$mg - ma - mg + m'g = ma - m'a$

$m'(g + a) = 2ma$

$m' = \frac{2ma}{g+a}$

7. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (υ). The total kinetic energy generated due to explosion is :

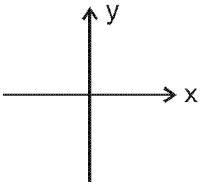
(1) $m\upsilon^2$ (2) $\frac{3}{2}m\upsilon^2$ (3) $2m\upsilon^2$ (4) $4m\upsilon^2$

4m द्रव्यमान का एक पिंड (वस्तु) x-y समतल पर विराम अवस्था में है। इसमें अचानक विस्फोट होने पर, इसके दो भाग, (जिनमें प्रत्येक का द्रव्यमान 'm' है) एक ही वेग 'υ' से एक दूसरे की लम्बवत् दिशा में गति करने लगते हैं। तो, विस्फोट के कारण जनित कुल गतिज ऊर्जा का मान होगा :

(1) $m\upsilon^2$ (2) $\frac{3}{2}m\upsilon^2$ (3) $2m\upsilon^2$ (4) $4m\upsilon^2$)

Ans. **(2)**

Sol.



$p_i = p_f$

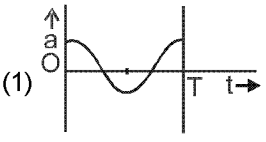
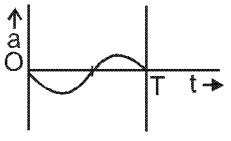
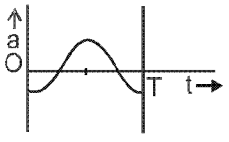
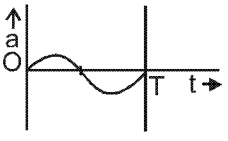
$O = mv\,\hat{i} + mv\,\hat{j} + 2m\vec{v}$

$\vec{v} = -\frac{v}{2}\hat{i} - \frac{v}{2}\hat{j}$

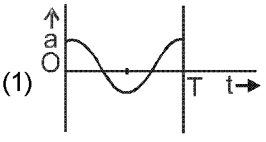
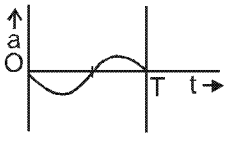
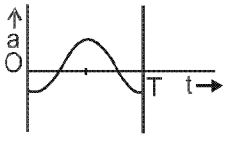
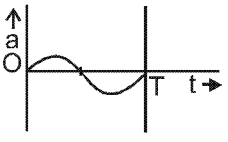
$|\vec{v}| = \frac{v}{\sqrt{2}}$

$KE = \frac{v}{2}mv^2 + \frac{v}{2}mv^2 + \frac{v}{2}2m\left(\frac{v}{\sqrt{2}}\right)^2 = mv^2 + \frac{mv^2}{2} = \frac{3}{2}mv^2$

8. The oscillation of a body on a smooth horizontal surface is represented by the equation,
$X = A\cos(\omega t)$
where X = displacement at time t
ω = frequency of oscillation
Which one of the following graph shows correctly the variation 'a' with 't' ?

(1)  (2)  (3)  (4) 

Here a = acceleration at time t
T = time period
किसी पिंड (वस्तु) के चिकने क्षैतिज पृष्ठ (सतह) पर दोलनों के समीकरण को
$X = A\cos(\omega t)$ द्वारा
निरूपित किया जाता है, जहाँ
X = t समय पर विस्थापन
ω = दोलनों की आवृति
तो 't' के साथ 'a' के विचलन (परिवर्तन) को कौन सा ग्राफ (आलेख) सही रूप में दर्शाता है ?

(1)  (2)  (3)  (4) 

यहाँ a = समय t पर त्वरण
T = आवर्तकाल

Ans. **(3)**

Sol. $X = A\cos\omega t$
$v = A\omega\sin\omega t$
$a = -a\omega^2\cos\omega t$

9. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2}

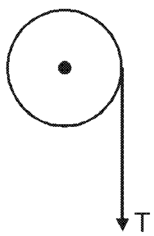
(1) 25 N (2) 50 N (3) 78.5 N (4) 157 N

50 kg द्रव्यमान तथा 0.5 m त्रिज्या का एक ठोस सिलिन्डर (बेलन) अपनी क्षैतिज अक्ष के परितः स्वतंत्र रूप से घूर्णन कर सकता है। इस पर एक भारहीन रस्सी लपेटी गई है, जिसका एक सिरा इस सिलिन्डर से जुडा है और दूसरा सिरा मुक्त सिरा मुक्त रूप से लटक रहा है। रस्सी में कितने तनाव लगाया जाय कि कोणीय त्वरण 2 परिक्रमण से$^{-2}$ हो ?

(1) 25 N (2) 50 N (3) 78.5 N (4) 157 N

Ans. **(4)**

Sol. $(T) \times (R) = \left(\frac{MR^2}{2}\right)(\alpha)$



$T = \left(\frac{MR}{2}\right)(\alpha) = \left(\frac{50 \times 0.5}{2}\right)(2 \times 2\pi) = 157N$

10. The ratio of the acceleration for a solid sphere (mass 'm' and radius 'R') rolling down an incline of angle 'θ' without slipping and slipping down the incline without rolling is :

(1) 5 : 7 (2) 2 : 3 (3) 2 : 5 (4) 7 : 5

किसी नत समतल का आनत कोण 'θ' है इस पर 'm' द्रव्यमान तथा 'R' त्रिज्या का एक ठोस गोला ऊपर से नीचे की ओर इस प्रकार गति करता है कि प्रथम दशा में गति पूर्णत : लोटनिक है और सरकी (फिसलन) नहीं है, तथा दूसरी दिशा में गति केवल सरकी है और लोटनिक नहीं है। तो, इन दोनों दशाओं में गोले के त्वरणों का अनुपात होगा :

(1) 5 : 7 (2) 2 : 3 (3) 2 : 5 (4) 7 : 5

Ans. **(1)**

Sol. $a_1 = \frac{g\sin\theta}{1+\frac{I}{MR^2}}$

$a_1 = \frac{g\sin\theta}{1+\frac{2}{5}MR^2} = \frac{5}{7}g\sin\theta$

$\frac{a_1}{a_2} = \frac{5}{7}$

11. A block hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole ?

(1) 10^{-9} m (2) 10^{-6} m (3) 10^{-2} m (4) 100 m

कृष्ण विवर (ब्लैक होल) एक ऐसा पिंड है, जिसका गुरूत्वीय क्षेत्र इतना प्रबल होता है कि इसमें से प्रकाश भी बाहर नही निकल सकता। पृथ्वी को लगभग कितनी त्रिज्या तक संपीडित किया जाये कि यह कृष्ण विवर बन जाये ?

(पृथ्वी का द्रव्यमान 5.98×10^{24} kg)

(1) 10^{-9} m (2) 10^{-6} m (3) 10^{-2} m (4) 100 m

Ans. **(3)**

Sol. Light is unable to escape so

प्रकाश पलायन न कर सके

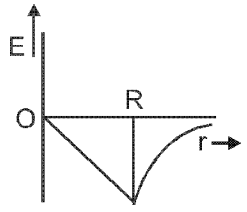
$V_e = C$

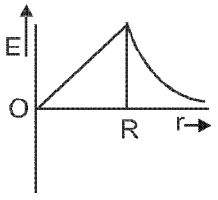
$$\sqrt{\frac{2GM}{R}} = 3 \times 10^8$$

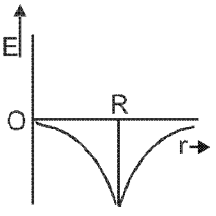
$$\Rightarrow \quad \sqrt{\frac{2\times\left(\frac{20}{3}\times10^{-11}\right)(6\times10^{24})}{R}} = 3\times 10^8$$

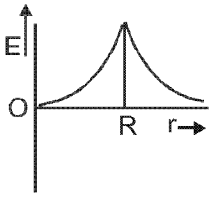
get $R \approx 9$ mm $\approx 10^{-2}$m

12. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by :

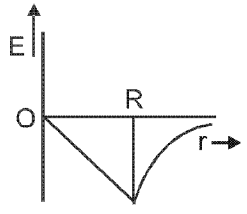
(1) 

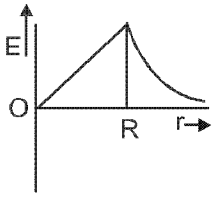
(2) 

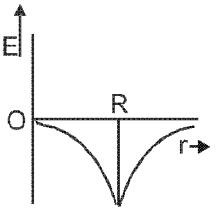
(3) 

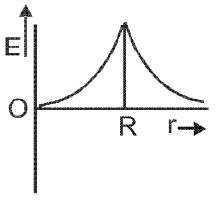
(4) 

पृथ्वी के गुरूत्वीय क्षेत्र की तीव्रता(E) की, पृथ्वी के केन्द्र से दूरी (r) पर, निर्भरता को कौन सा ग्राफ सही प्रकार निरूपित करता है ?

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol. $E = -\frac{GM}{R^3}\times\vec{r}$ (if $r < R$)

$$E = -\frac{GM}{r^3}\times\vec{r} \quad (\text{if } r \geq R)$$

13. Copper of fixed volume 'V' is drawn into wire of length 'ℓ'. When this wire is subjected to a constant force 'F', the extension produced in the wire is '$\Delta\ell$'. Which of the following graph is a straight line ?

(1) $\Delta\ell$ versus $1/\ell$ (2) $\Delta\ell$ versus ℓ^2 (3) $\Delta\ell$ versus $1/\ell^2$ (4) $\Delta\ell$ versus ℓ

नियत आयतन 'V' के ताँबे से 'ℓ' लम्बाई का एक तार बनाया गया है। इस तार पर एक नियत (अचर) बल 'F' लगाने से, इस तार में उत्पन्न विस्तार '$\Delta\ell$' है। निम्न में से कौन-सा ग्राफ एक सरल रेखा है ?

(1) $\Delta\ell$ तथा $1/\ell$ के बीच (2) $\Delta\ell$ तथा ℓ^2 के बीच (3) $\Delta\ell$ तथा $1/\ell^2$ के बीच (4) $\Delta\ell$ तथा ℓ के बीच

Ans. **(2)**

Sol. $V = A\ell$

$$Y = \frac{F/A}{\frac{\Delta\ell}{\ell}}$$

$$\frac{Y\Delta\ell}{\ell} = \frac{F}{A}$$

$$\Delta\ell = \frac{F\ell}{YA} = \frac{F}{Y}\cdot\frac{\ell\ell}{V}$$

$$\Delta\ell = \frac{F}{YV}\ell^2$$

$$\Delta\ell \propto \ell^2$$

14. A certain number of spherical drops of a liquid of radius 'r' coalesce to form a single drop of radius 'R' and volume 'V'. If 'T' is the surface tension of the liquid then:

(1) Energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released. (2) Energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is released.

(3) Energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released. (4) Energy is neither released nor absorbed.

किसी द्रव की 'r' त्रिज्या की गोलाकार कुछ बूँदें मिलकर 'R' त्रिज्या तथा 'V' आयतन की एक बूँद बन जाती है, यदि द्रव का पृष्ठ तनाव 'T' हो तो, इस प्रक्रम में :

(1) $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ ऊर्जा मुक्त होगीं। (2) $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ ऊर्जा अवशोषित होगी।

(3) $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ ऊर्जा मुक्त होगीं। (4) न तो ऊर्जा मुक्त होगी न ही अवशोषित होगी।

Ans. **(3)**

Sol. $\Delta U = (ST)(\Delta A)$

A(initial प्रारम्भिक) = $(4\pi r^2)n$

A(final अन्तिम) = $4\pi R^2$

$\Delta A = (4\pi r^2)n - 4\pi R^2$

$$\left(\frac{4}{3}\pi r^3\right)n = \frac{4}{3}\pi R^3$$

$$n = \frac{R^3}{r^3}$$

$$\Delta A = 4\pi\left[\frac{R^3}{r^3}\cdot r^2 - R^2\right] = 4\pi\left[\frac{R^3}{r} - \frac{R^3}{R}\right] = \left(\frac{4\pi R^3}{3}\right)3\left[\frac{1}{r}-\frac{1}{R}\right]$$

$$\Delta A = 3V\left[\frac{1}{r}-\frac{1}{R}\right]$$

$$\Delta U = 3VT\left[\frac{1}{r}-\frac{1}{R}\right]$$

15. Steam at 100°C is passed into 20g of water at 10°C When water acquires a temperature of 80°C, the mass of water present will be:

[Take specific heat of water = 1 cal g^{-1} $^0C^{-1}$ and latent heat of steam = 540 cal g^{-1}]

10°C ताप के 20g जल में, 100°C की वाष्प गुजरती है जल का ताप 80°C होने पर उपस्थित जल का द्रव्यमान कितना होगा?

[जल की विशिष्ट ऊष्मा = 1 cal g^{-1} $^0C^{-1}$ तथा वाष्प की गुप्त ऊष्मा = 540 cal g^{-1}]

(1) 24 g (2) 31.5 g (3) 42.5 g (4) 22.5 g

Ans. **(4)**

Sol. m(g) steam at 100° → m(g) water at 100°C + 540m .....(1)

m(g) water at 100°C → m(g) water at 80°C + (m)(1) (20) .....(2)

(1) + (2)

m(g) steam at 100°C → m(g) water at 80° + 560m (cal) .....(3)

20 g water at 10°C + (20) (1) 70 → 20 g water at 80°C .....(4)

from (3) and (4)

mix + 1400 cal → (20 + m) g water at 80°C + 560m (cal)

1400 = 560m

2.5 = m

Total mass of water present

= (20 + 2.5)g

= 22.5g

Sol. m(g) भाप 100° पर → 100°C पर m(g) भाप + 540m .....(1)

m(g) भाप 100°C पर → 80°C पर m(g) पानी + (m)(1) (20) .....(2)

(1) + (2)

m(g) भाप 100°C पर → 80° पर m(g) पानी + 560m (cal) .....(3)

10°C पर 20 g पानी + (20) (1) 70 → 80°C पर 20 g पानी .....(4)

(3) तथा (4) से

मिश्रण + 1400 cal → 80°C पर (20 + m) g पानी + 560m (cal)

1400 = 560m

2.5 = m

पानी का कुल उपस्थित द्रव्यमान

= (20 + 2.5)g

= 22.5g

16. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is;

जल की कुछ मात्रा को 70°C से 60°C तक ठंडा होने में 5मिनट तथा 60°C से 54°C तक ठंडा होने में और 5 मिनट लगते हैं। तो जल के आसपास (परिवेश) का ताप होगा।

(1) 45°C (2) 20°C (3) 42°C (4) 10°C

Ans. **(1)**

Sol. $\frac{60-70}{5} = -K(65-T)$

$\frac{54-60}{5} - K(57-T)$

$\frac{-10}{-6} = \frac{65-T}{57-T}$

285 – 5T = 195 – 3T

90 = 2T

T = 45°

17. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16V. The final pressure of the gas is : (take $\gamma = 5/3$)
किसी एक परमाण्विक गैस का दाब P और आयतन V हैं। इसमें पहले समतापीय रूप से 2V आयतन तक और फिर रूद्धोष्म रूप से 16V आयतन तक प्रसार होता है। यदि $\gamma = 5/3$ हो तो, गैंस का अन्तिम दाब होगा।

(1) $\frac{P}{64}$ (2) $\frac{P}{32}$ (3) $\frac{P}{64}$ (4) $\frac{P}{16}$

Ans. **(3)**

Sol. Isothermally समतापीय प्रक्रिया से $PV = P_1 2V$

$$P_1 = \frac{P}{2}$$

Adiabatically रूद्धोष्म प्रक्रिया

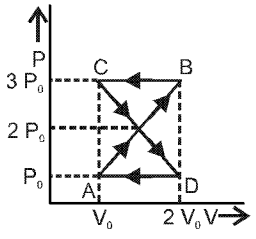
$$\frac{P}{2}(2V)^{\gamma} = P_f (16V)^{\gamma}$$

$$P_f = \frac{P}{2}\left(\frac{1}{2^3}\right)^{\frac{5}{3}}$$

$$P_f = \frac{P}{2}\left(\frac{1}{2^3}\right)^{\frac{5}{3}} = \frac{P}{(2)(2)^5}$$

$$P_f = \frac{p}{64}$$

18. A thermodynamics system undergoes cyclic process ABCDA as shown in Fig. The work done by the system in the cycle is:
कोई ऊष्मागतिक निकाय आरेख में दर्शाये गये अनुसार चक्रिक प्रक्रम ABCDA पर चलता है। तो, निकाय द्वारा इस चक्र में किया गया कार्य होगा:



(1) P_0V_0 (2) $2P_0V_0$ (3) $\frac{P_0V_0}{2}$ (4) Zero शून्य

Ans. **(4)**

Sol. Work done in process ODA = $1/2 \times P_0 \times V_0$
While work done in the process OBC = $-1/2\ P_0V_0$

Sol. ODA प्रक्रिया में किया गया कार्य = $1/2 \times P_0 \times V_0$
OBC प्रक्रिया में किया गया कार्य = $-1/2\ P_0V_0$
कुल कार्य = 0

19. The mean free path of molecules of a gas (radius 'r') is inversely proportional to:
यदि किसी गैस के अणुओं की त्रिज्या 'r' हो तो, उनका माध्य–मुक्त–पथ व्युत्क्रमानुपाती होता हैं:

(1) r^3 (2) r^2 (3) r (4) $\sqrt{r}$

Ans. **(2)**

Sol. Mean free path औसत मुक्त पथ $\ell = \frac{1}{\sqrt{2}\pi d^2}$

So अतः $\ell \propto \frac{1}{d^2} \Rightarrow \ell \propto \frac{1}{r^2}$

20. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by:

यदि किसी रस्सी को तीन खंडों में विभाजित करने पर उन खंडों की मूल आवृत्तियों क्रमशः n_1, n_2 तथा n_3 हों तो इस रस्सी की प्रारंभिक मूल आवृत्ति n के लिए संबंध होगा:

(1) $\frac{1}{n}=\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}$

(2) $\frac{1}{\sqrt{n}}=\frac{1}{\sqrt{n_1}}+\frac{1}{\sqrt{n_2}}+\frac{1}{\sqrt{n_3}}$

(3) $\sqrt{n}=\sqrt{n_1}+\sqrt{n_2}+\sqrt{n_3}$

(4) $n = n_1 + n_2 + n_3$

Sol.

$$n_1 = \frac{1}{2\ell_1}\sqrt{\frac{T}{\mu}}$$

$$n_2 = \frac{1}{2\ell_2}\sqrt{\frac{T}{\mu}}$$

$$n_3 = \frac{1}{2\ell_3}\sqrt{\frac{T}{\mu}}$$

$$n = \frac{1}{2\ell}\sqrt{\frac{T}{\mu}}$$

$$\ell = \ell_1+\ell_2+\ell_3$$

$$\frac{1}{n}=\frac{1}{n_1}+\frac{1}{n_2}+\frac{1}{n_3}$$

21. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lies below 1250 Hz are: (velocity of sound = 340 ms^{-1})

यदि वायु में ध्वनि का वेग 340 ms^{-1} हो तो, 1250 Hz से कम आवृत्ति वाले 85 cm लम्बे एक सिरे पर बन्द नलिका (पाइप) में वायु–स्तम्भ के संभव प्राकृतिक दोलनों की संख्या होगी:

(1) 4 (2) 5 (3) 7 (4) 6

Ans. **(4)**

Sol. Fundamental freuency of a closed organ pipe is $f_1 = \frac{V}{4\ell} = \frac{340}{4\times0.85} = 100$ Hz

The natural freuencies of the organ pipe will be f = 100 Hz, 300 Hz, 500 Hz, 700 Hz, 900 Hz, 1100 Hz which are below 1250 Hz

Sol. बंद ऑर्गन पाइप की मूल प्राकृतिक आवृति $f_1 = \frac{V}{4\ell} = \frac{340}{4\times0.85} = 100$ Hz

अतः इस आर्गन पाइप की वे प्राकृति आवृत्तिया जो 1250 Hz से कम हो f = 100 Hz, 300 Hz, 500 Hz, 700 Hz, 900 Hz, 1100 Hz,

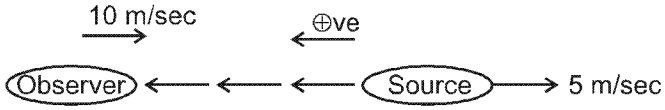
22. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be:

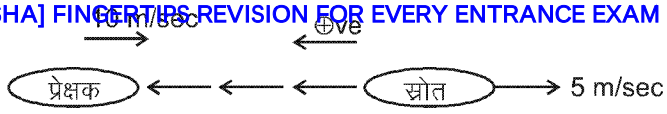
ट्रैफिक [illegible] 36km प्रतिघंटे [illegible] ट्रैफिक [illegible] होने पर, उससे आगे 18 km प्रतिघंटे की चाल से चलती हुई एक कार,1392 Hz आवृत्ति का हॉर्न बजाती है। यदि ध्वनि की चाल 343 m/s हैं तो, मोटर साईकिल चालक को इस हॉर्न की आवृत्ति सुनाई देगी:

(1) 1332 Hz (2) 1372 Hz (3) 1412 Hz (4) 1454 Hz

Ans. **(3)**

Sol.



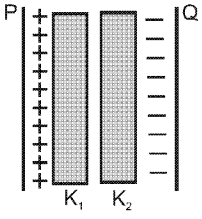


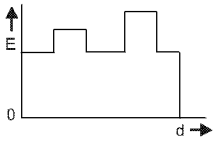
Appearent frequency heard by the observer is
प्रेक्षक द्वारा सुनी गई आभासी आवृति

$$f' = f_0\left(\frac{V - V_0}{V - V_s}\right)$$

$$f' = (1392)\left(\frac{343 - (-10)}{343 - (-5)}\right) = 1412\ Hz$$

23. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by:
एक समान्तर पट्टिका (प्लेट) संधारित्र की दो प्लेटों के बीच में, K_1 तथा K_2 ($K_1 < K_2$) परावैद्युतांक के दो पतले स्लैंब (पट्टिका) चित्र में दर्शाये गये अनुसार रखी गई हैं। संधारित्र की दो पट्टिकाओं के बीच विद्युत क्षेत्र का मान 'E' में, पट्टिका P से दूरी 'd' के साथ परिवर्तन को कौनसा ग्राफ सही रूप से दर्शाता है?



(1)


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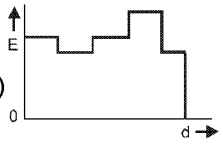

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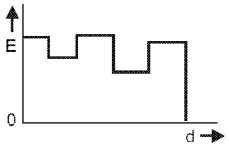

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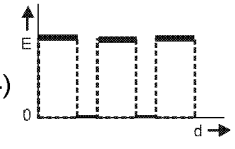
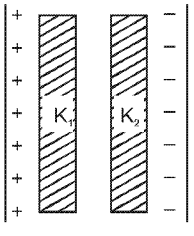
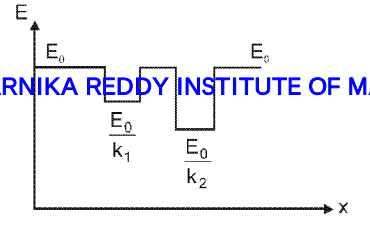


Ans. **(3)**

Sol.





24. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are:
एक चालक गोले की त्रिज्या R है। इस पर Q आवेश है। इस गोले के केन्द्र पर विद्युत विभव तथा विद्युत क्षेत्र क्रमशः होंगेः

(1) Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$ (2) $\frac{Q}{4\pi\varepsilon_0 R}$ and Zero (3) $\frac{Q}{4\pi\varepsilon_0 R}$ and $\frac{Q}{4\pi\varepsilon_0 R^2}$ (4) Both are zero.

Ans. **(2)**

Sol. For a conducting sphere
Electric fidld at centre = 0

Potential at centre = $\frac{KQ}{R} = \frac{Q}{4\pi\varepsilon_0 R}$

Sol. चालक गोले के लिए
केन्द्र पर विद्युत क्षेत्र = 0

केन्द्र पर विभव = $\frac{KQ}{R} = \frac{Q}{4\pi\varepsilon_0 R}$

25. In a region the potential is represented by V(x, y, z) = 6x – 8xy –8y + 6yz, where V is in volts and x, y, z, are in meters. The electric force experienced by a charge of 2 coulomb situated at point (1, 1,1) is :
किसी क्षेत्र में विभव को, V(x, y, z) = 6x – 8xy –8y + 6yz से, निरूपित किया जाता है, जहाँ V, वोल्ट में तथा x, y, z, मीटर में हैं। तो बिन्दु (1, 1,1) पर स्थित 2 कूलॉम आवेश पर लगने वाला विद्युत बल होगा :

(1) $6\sqrt{5}$ N (2) 30N (3) 24N (4) $4\sqrt{35}$ N

Ans. **(4)**

Sol. $V_{(x, y, z)} = 6x – 8xy – 6y + 6yz$

$E_x = -\frac{\partial V}{\partial x} = – 6 + 8y$

$E_y = -\frac{\partial V}{\partial y} = 8x + 8 – 6z$

$E_z = -\frac{\partial V}{\partial z} = – 6y$

$\vec{E} = (–6 + 8y)\,\hat{i} + (8x + 8 – 6z)\,\hat{j} – 6y\,\hat{k}$

$\vec{E}_{(1, 1, 1)} = 2\hat{i} + 10\hat{j} – 6\hat{k}$

$|\vec{E}| = 2\sqrt{35}\ NC^{-1}$

$F = qE = 2 \times 2\sqrt{35} = 4\sqrt{35}$ N

26. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5 Ω The power loss in the wire is:
एक नगर से विद्युत शक्ति को, 150 km दूर स्थित एक अन्य नगर तक, ताँबे के तारों से भेजा जाता है। प्रतिकिलोमीटर विभव–पात 8 वोल्ट तथा प्रतिकिलोमीटर औसत प्रतिरोध 0.5 Ω है, तो तार में शक्ति–क्षय होगाः

(1) 19.2 W (2) 19.2 kW (3) 19.2 J (4) 12.2 kW

Ans. **(2)**

Sol. Total voltage drop = 150 × 8 = V
total resistance of wire R = 0.5 × 150

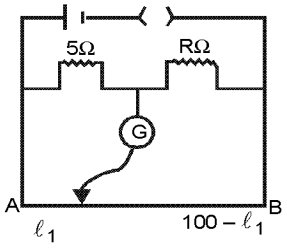
Power loss = $\frac{V^2}{R} = \frac{(150 \times 8)^2}{0.5 \times 150}$ = 19.2 KW

कुल विभव पतन = 150 × 8 = V
तार का कुल प्रतिरोध R = 0.5 × 150

शक्ति हानि = $\frac{V^2}{R} = \frac{(150 \times 8)^2}{0.5 \times 150}$ = 19.2 KW

27. The resistance in the two arms of the meter bridge are $5\,\Omega$ and $R\,\Omega$, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6\,\ell_1$. The resistance 'R' is :

किसी मीटर–सेतु की दो भुजाओं का प्रतिरोध $5\,\Omega$ तथा $R\,\Omega$ हैं। जब प्रतिरोध R से समान्तर (पार्श्व) क्रम में R ओम का एक अन्य प्रतिरोध (शन्ट) लगा दिया जाता है तो नया संतुलन बिन्दु $1.6\,\ell_1$ पर प्राप्त होता है। प्रतिरोध 'R' का मान होगा :



(1) $10\,\Omega$ (2) $15\,\Omega$ (3) $20\,\Omega$ (4) $25\,\Omega$

Ans. **(2)**

Sol. $$\frac{5}{R} = \frac{\ell_1}{100 - \ell_1}$$

$$\frac{5}{R/2} = \frac{1.6\ell_1}{100 - 1.6\ell_1}$$

Solving ℓ_1 = 25 cm and R = $15\,\Omega$

हल करने पर ℓ_1 = 25 cm तथा R = $15\,\Omega$

28. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R, connected acrose the given cell, has values of .

(i) infinity (ii) $9.5\,\Omega$

The 'balancing lengths, on the potentiometer wire are found to be 3m and 2.85 m, respectively.

The value of internal resistance of the cell is :

किसी दिये गये सैल का आन्तरिक प्रतिरोध ज्ञात करने के लिये प्रयुक्त एक विभवमापी के तार की लम्बाई 4m है और इसके सिरों से जुड़ी मुख्य बैंटरी का विद्युत वाहक बल (इ.एम.एफ) 2.0 V है। बैटरी का आन्तरिक प्रतिरोध नगण्य है। दिये गये सेल के सिरों पर जोड़े गये प्रतिरोधक R का प्रतिरोधः

(i) अनन्त (ii) $9.5\,\Omega$

रखने पर विभवमापी की 'संतुलन लम्बाइयाँ क्रमशः 3m तथा 2.85 m हैं।

तो, सेल का आन्तरिक प्रतिरोध होगाः

(1) $0.25\,\Omega$ (2) $0.95\,\Omega$ (3) $0.5\,\Omega$ (4) $0.75\,\Omega$

Ans. **(3)**

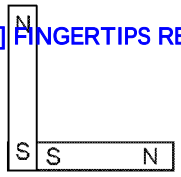
Sol. Internal resistance of the unknown cell is

$$r = \left(\frac{\ell_1}{\ell_2} - 1\right) R = \left(\frac{3}{2.85} - 1\right)(9.5\Omega) = 0.5\Omega$$

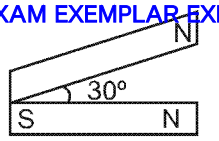
अज्ञात सेल का आन्तरिक प्रतिरोध

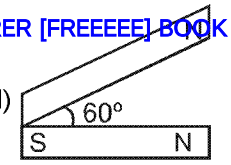
$$r = \left(\frac{\ell_1}{\ell_2} - 1\right) R = \left(\frac{3}{2.85} - 1\right)(9.5\Omega) = 0.5\Omega$$

29. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole $\vec{m}$. Which configuration has highest net magnetic dipole moment ?

(a) 

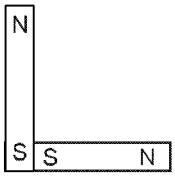
(b) 

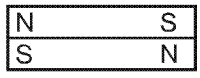
(c) 

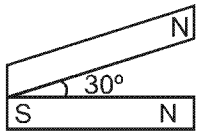
(d) 

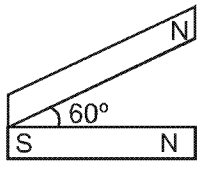
(1) a (2) b (3) c (4) d

आरेख में दंड़ (छड़) चुम्बकों की व्यवस्थाओं के विन्यास दर्शाये गये है। प्रत्येक चुम्बक की द्विध्रुव आघूर्ण $\vec{m}$ है। किस विन्यास में नेट चुम्बकीय द्विध्रुव आघूर्ण का मान अधिकतम होगा?

(a) 

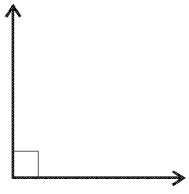
(b) 

(c) 

(d) 

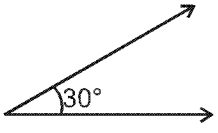
(1) a (2) b (3) c (4) d

Ans. **(3)**

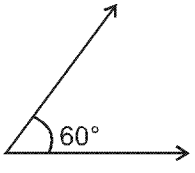
Sol. (a) 

$M_{net} = \sqrt{m^2 + m^2 + 2mm\cos 90^\circ} = \sqrt{2}\,m$

(b) $M_{net} = m - m = 0$

(c) 

$M_{net} = \sqrt{m^2 + m^2 + 2mm\cos 30^\circ} = m\sqrt{2+\sqrt{3}}$

(d) 

$M_{net} = \sqrt{m^2 + m^2 + 2mm\cos 60^\circ} = \sqrt{3}m$

is configuration (c) θ is least so M_{net} is maximum.

विन्यास (c) में θ न्यूनतम है अतः M_{net} अधिकतम होगा।

30. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be :

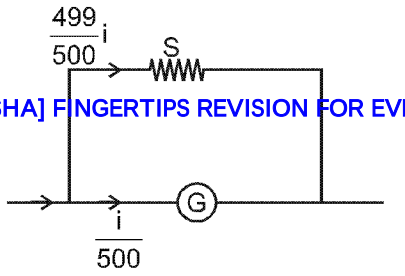
(1) $\frac{1}{499}G$ (2) $\frac{499}{500}G$ (3) $\frac{1}{500}G$ (4) $\frac{500}{499}G$

किसी एमीटर में मुख्य धारा का 0.2% भाग गैल्वेनोमीटर की कुंडली से गुजरता है। यदि गैल्वेनोमीटर की कुंडली का प्रतिरोध G है तो एमीटर का प्रतिरोध होगा :

(1) $\frac{1}{499}G$ (2) $\frac{499}{500}G$ (3) $\frac{1}{500}G$ (4) $\frac{500}{499}G$

Ans. **(3)**

Sol.



as (G) and the shunt are in parallel combination $i_g R_g = i_s R_s \Rightarrow \left(\frac{i}{500}\right)(G) = \left(\frac{499}{500}i\right)(S)$

चूंकि (G) और शंट समानान्तर क्रम में है अतः $i_g R_g = i_s R_s \Rightarrow \left(\frac{i}{500}\right)(G) = \left(\frac{499}{500}i\right)(S)$

$$\Rightarrow \qquad S = \frac{G}{499}$$

Equivalent resitance of the ammeter

अमीटर का तुल्य प्रतिरोध

$$\frac{1}{R_{eq}} = \frac{1}{G} + \frac{1}{\frac{G}{499}} \qquad \Rightarrow \qquad R_{eq} = \frac{G}{500}$$

31. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point 'I' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be :

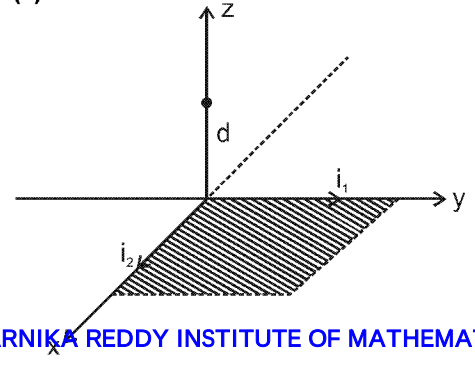
(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$ (3) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$ (4) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$

दो सर्वसम (एक से) लम्बे चालक तार AOB तथा COD एक दूसरे के ऊपर आपस में लम्बवत् रखे गये हैं, और 'O' बिन्दु पर एक दूसरे को काटते हैं। इनसे क्रमशः I_1 तथा I_2 धारायें प्रवाहित हो रही हैं। बिन्दु 'O' तथा 'd' दूरी पर दोनो तारों के तल के लम्बवत् दिशा के अनुदिश स्थित किसी बिन्दु 'P' पर चुम्बकीय क्षेत्र का मान होगा :

(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$ (3) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$ (4) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$

Ans. **(4)**

Sol.



$\vec{B}$ due to wire (1) $\vec{B}_1 = \left(\frac{\mu_0 i_1}{2\pi d}\right)\hat{i}$

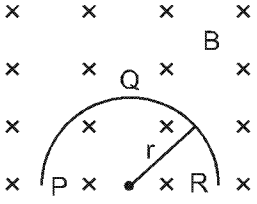
तार (1) के कारण चुम्बकीय क्षेत्र $\vec{B}_1 = \left(\frac{\mu_0 i_1}{2\pi d}\right)\hat{i}$

B due to wire (2) $B_2 = \left(\frac{\mu_0 i_2}{2\pi d}\right)(-\hat{j})$

तार (2) के कारण चुम्बकीय क्षेत्र $\vec{B}_2 = \left(\frac{\mu_0 i_2}{2\pi d}\right)(-\hat{j})$

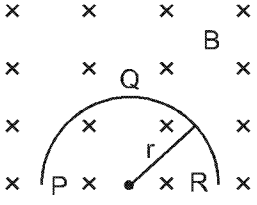
$|B_{net}| = \frac{\mu_0}{2\pi d}\sqrt{i_1^2 + i_2^2}$

32. A thin semicircular conducting the ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. Teh potential difference developed across the ring when its speed is v, is :



(1) Zero
(2) $Bv\pi r^2/2$ and P is at higher potential
(3) πrBv and R is at higher potential
(4) $2rBv$ and R is at higher potential

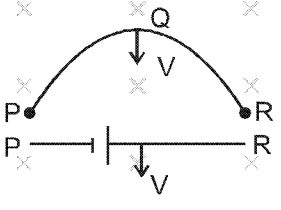
'r' त्रिज्या की एक पतली अर्धवृत्ताकार चालक रिंग (वलय) PQR किसी क्षैतिज चुम्बकीय क्षेत्र B में गिर रही है। गिरते समय इसका समतल आरेख में दर्शाये गये अनुसार ऊर्ध्वाधर रहता है। जब गिरते हुई रिंग की चाल v है तो, इसके दो सिरों के बीच विकसित विभवांतर होगा :



(1) शून्य
(2) $Bv\pi r^2/2$ तथा P उच्च विभव पर होगा।
(3) πrBv तथा R का विभव अधिक (उच्च) होगा।
(4) $2rBv$ तथा R का विभव अधिक (उच्च) होगा।

Ans. **(4)**

Sol.



emf = $VB\ell_{eq}$ = VB(2R) where R is at higher potential and P is at lower potential

emf = $VB\ell_{eq}$ = VB(2R) जहाँ बिन्दु R उच्च विभव तथा P निम्न विभव पर होगा।

33. A transformer having efficiency of 90% is working on 200 V and 3 kW power supply. If the current in the secondary coil is 6 A the voltage across the secondary coil and the current in the primary coil respectively are :

(1) 300 V, 15 A (2) 450 V, 15 A (3) 450 V, 13.5 A (4) 600 V, 15A

एक ट्रांसफार्मर की क्षमता 90% है, जो 200 V तथा 3 kW की विद्युत आपूर्ति पर कार्य कर रहा है। यदि द्वितीयक कुंडली में 6 A की धारा प्रवाहित हो रही है तो, द्वितीयक कुंडली के सिरों के बीच विभवान्तर तथा प्राथमिक कुंडली में विद्युत धारा का मान क्रमशः होगा :

(1) 300 V, 15 A (2) 450 V, 15 A (3) 450 V, 13.5 A (4) 600 V, 15A

Ans. **(2)**

Sol. Current in primary coil = $\frac{P}{V} = \frac{3000}{200} = 15A$

प्राथमिक कुण्डली में धारा = $\frac{P}{V} = \frac{3000}{200} = 15A$

$P_{out} = \eta\%$ of P_{in}

$V_2\ i_2 = \frac{90}{100} \times (3000)$

$(v_2)\ (6) = 2700$

$V_2 = 450$ volt

34. Light with an energy flux of 25×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is :

(1)1.25×10^{-6} N (2) 2.50×10^{-6} N (3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

25×10^4 Wm^{-2} ऊर्जा फ्लक्स का प्रकाश किसी पूर्णतः परावर्तक पृष्ठ (सतह) पर लम्बवत् आपतित होता हैं। यदि इस पृष्ठ का क्षेत्रफल 15 cm^2 हो तो, पृष्ठ पर आरोपित औसत बल होगा :

(1)1.25×10^{-6} N (2) 2.50×10^{-6} N (3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

Ans. **(2)**

Sol. $F = \frac{2IA}{C} = \frac{2(25\times10^4)(15\times10^{-4})}{3\times10^8} = 2.5 \times 10^{-6}$ N

35. A beam of light of λ = 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between first dark fringes on either side of the central bright fringe is :

(1) 1.2 cm (2) 1.2 mm (3) 2.4 cm (4) 2.4 mm

दूर स्थित किसी स्रोत से आता हुआ, λ = 600 nm का प्रकाश पुंज, 1 mm चौड़ी झिरी पर आपतित होता है। इससे उत्पन्न विवर्तन पैटर्न को झिरी से 2 m दूर स्थित पर्दे पर देखा जाता है तो, केन्द्रीय दीप्त फ्रिंज के दोनों ओर की प्रथम अदीप्त फ्रिंजों के बीच की दूरी होगी :

(1) 1.2 cm (2) 1.2 mm (3) 2.4 cm (4) 2.4 mm

Ans. **(4)**

Sol. Angular width of 1st maxima

$2\theta = \frac{2\lambda}{a}$

linear width of 1st maxima = (D) $(2\theta) = \frac{2\lambda D}{a} = \frac{2\times(600\times10^{-9})(2)}{1\times10^{-3}} = 2.4$ mm

Sol. 1st उच्चिष्ठ की कोणीय चौड़ाई

$2\theta = \frac{2\lambda}{a}$

1st उच्चिष्ठ की रेखीय चौड़ाई = (D) $(2\theta) = \frac{2\lambda D}{a} = \frac{2\times(600\times10^{-9})(2)}{1\times10^{-3}} = 2.4$ mm

36. In the Young's double slit experiment the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wave length of light used). The intensity at a point where the path difference is $\lambda/4$, will be :

(1) K (2) K/4 (3) K/2 (4) zero

यंग के द्वि–झिरी प्रयोग में, पर्दे के किसी बिन्दु पर λ पथांतर होने से, वहाँ प्रकाश की तीव्रता K है, (λ प्रयुक्त प्रकाश की तरंग दैर्ध्य है) तो पर्दे के उस बिन्दु पर तीव्रता होगी, जहाँ पथांतर $\lambda/4$ है, तीव्रता होगी

(1) K (2) K/4 (3) K/2 (4) शून्य

Ans. **(3)**

Sol. $I_{max}\ 4I_0 = k$

at the other point, path difference = $\frac{\lambda}{4}$

so phase difference $\theta = k\Delta x = \frac{2\pi}{\lambda} \times \frac{\lambda}{4} = \frac{\pi}{2}$

$I^1 = I_0 + I_0 + 2\sqrt{I_0}\sqrt{I_0}\cos\frac{\pi}{2}$

$I^1 = 2I_0 = \frac{K}{2}$

Sol. $I_{max}\ 4I_0 = k$

दूसरे बिन्दु पर पथान्तर = $\frac{\lambda}{4}$

अतः कलान्तर $\theta = k\Delta x = \frac{2\pi}{\lambda} \times \frac{\lambda}{4} = \frac{\pi}{2}$

$I^1 = I_0 + I_0 + 2\sqrt{I_0}\sqrt{I_0}\cos\frac{\pi}{2}$

$I^1 = 2I_0 = \frac{K}{2}$

37. It the focal length of objective lens is increased then magnifying power of :

(1) microscope will increase but that of telescope decrease
(2) microscope and telescope both will increase
(3) microscope and telescope both will decrease
(4) microscope will decrease but that of telescope will increase.

यदि अभिदृश्यक लेंस की फोकस दूरी को बढ़ दिया जाये तो :

(1) सूक्ष्मदर्शी की आवर्धन क्षमता बढ़ जायेगी तथा दूरदर्शक की कम हो जायेगी।
(2) सूक्ष्मदर्शी तथा दूरदर्शक दोनों की आवर्धन क्षमता बढेगी।
(3) सूक्ष्मदर्शी तथा दूरदर्शक दोनो की आवर्धन क्षमता कम हो जायेगी।
(4) सूक्ष्मदर्शी की आवर्धन क्षमता कम होगी तथा दूरदर्शक की बढ़ जायेगी।

Ans. **(4)**

Sol. M.P. of a microscope = $\left(\frac{L}{f_0}\right)\left(\frac{D}{f_e}\right)$

if $f_0 \uparrow \Rightarrow$ M.P. of the microscope will decrease

M.P. of telescope = $\frac{f_0}{f_e}$

if $f_0 \uparrow \Rightarrow$ M/O. of telescope will increase.

हल. सुक्ष्मदर्शी की आवर्धन क्षमता = $\left(\frac{L}{f_0}\right)\left(\frac{D}{f_e}\right)$

यदि $f_0 \uparrow$ तो सुक्ष्मदर्शी की आवर्धन क्षमता कम होगी

दूरदर्शी की आवर्धन क्षमता = $\frac{f_0}{f_e}$

यदि $f_0 \uparrow \Rightarrow$ दूरदर्शी की आवर्धन क्षमता बढ़ेगी

38. The angle of a prism is 'A'. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2A on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ, of the prism is :

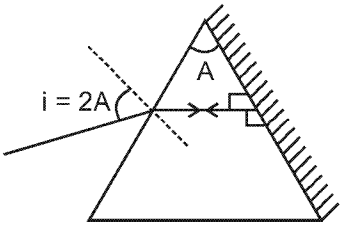
(1) 2sin A (2) 2 cos A (3) $\frac{1}{2}$cos A (4) tan A

किसी प्रिज्म का कोण 'A' है। इस प्रिज्म के एक अपवर्तक पृष्ठ (फलक) रजतित कर परावर्तक बना दियाा गया है, इसके पहले पृष्ठ पर, 2A कोण पर आपतित प्रकाश की किरणें, रजतित पृष्ठ से परवर्तन के पश्चात् अपने मार्ग पर वापस आती हैं। तो, प्रिज्म के पदार्थ का अपवर्तनांक μ होगा :

(1) 2sin A (2) 2 cos A (3) $\frac{1}{2}$cos A (4) tan A

Ans. **(2)**

Sol.



To retrace its path light rays should fall normally on the reflecting surface. So

$r_2 = 0$

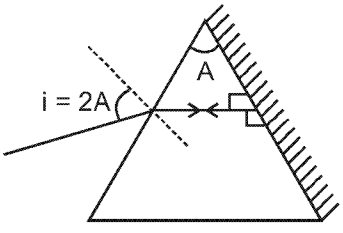
$\Rightarrow$ $r_1 = A - r_2$ $\Rightarrow$ $r_1 = A$

Now applying snell rule between incident ray and refracted ray.

(1) $\sin(2A) = n \sin(A) \Rightarrow 2 \sin A \cos A = n \sin A$

$\Rightarrow$ $n = 2 \cos A$

हल.



पथ को दोहराने के लिए किरण परावर्तक सतह के लम्बवत् टकरानी चाहिए। अतः

$r_2 = 0$

$\Rightarrow$ $r_1 = A - r_2$ $\Rightarrow$ $r_1 = A$

आपतित और परावर्तित किरण के बीच स्नेल (snell) का नियत लगाने पर

(1) $\sin(2A) = n \sin(A) \Rightarrow 2 \sin A \cos A = n \sin A$

$\Rightarrow$ $n = 2 \cos A$

39. When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased fro m emitted 0.5 eV to 0.8eV. The work function of the metal is :

(1) 0.65 eV (2) 1.0 eV (3) 1.3 eV (4) 1.5 eV

धातु के किसी पृष्ठ पर आपतित विकिरणों की ऊर्जा को 20% बढ़ाने पर उससे उत्सर्जित फोटो इलैक्ट्रॉनों (प्रकाश विद्युत इलैक्ट्रॉनों) की गतिज ऊर्जा 0.5 eV से बढ़कर 0.8eV हो जाती है। तो, इस धातु का कार्य फलन है :

(1) 0.65 eV (2) 1.0 eV (3) 1.3 eV (4) 1.5 eV

Ans. **(2)**

Sol. $KE_{max} = h\nu - \psi$

$0.5\text{eV} = h\nu - \psi$ ....(1)

$0.8\text{eV} = 1.2\, h\nu - \psi$ ....(2)

solving हल करने पर $\psi = 1$ eV

40. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :

(1) 25 (2) 75 (3) 60 (4) 50

यदि किसी कण की गतिज ऊर्जा को उसके प्रारम्भिक मान का 16 गुना कर दिया जाय तो, संगत दे–ब्राग्ली तरंगों की तरंगदैर्ध्य में प्रतिशत परिवर्तन होगा :

(1) 25 (2) 75 (3) 60 (4) 50

Ans. **(2)**

Sol. KE = 16 times $\Rightarrow$ V = 4 times

$\Rightarrow$ De-broglie wavelength $\left(\lambda = \frac{h}{mV}\right)$ = one forth $\left(\lambda_0 \rightarrow \frac{\lambda_0}{4}\right)$. So De-Brogli wave will decrease by 75%

हल. KE = 16 गुना $\Rightarrow$ V = 4 गुना

$\Rightarrow$ डी–ब्रोग्ली तरंगदैर्ध्य $\left(\lambda = \frac{h}{mV}\right)$ = एक चौथाई $\left(\lambda_0 \rightarrow \frac{\lambda_0}{4}\right)$ है। अतः डी–ब्रोग्ली तरंगदैर्ध्य 75% कम हो जायेगी।

41. Hydrogen atom in ground state is excited by a monochromatic radiation of λ = 975 Å. Number of spectral lines in the resulting spectrum emitted will be :

(1) 3 (2) 2 (3) 6 (4) 10

निम्नतम ऊर्जा स्थिति में हाइड्रोजन परमाणु को, λ = 975 Å तरंगदैर्ध्य के एकवर्णी प्रकाश से उत्तेजित किया जाता है। तो, परिणाम स्पैक्ट्रम में स्पैक्ट्रमी रेखाओं की संख्या होगी :

(1) 3 (2) 2 (3) 6 (4) 10

Ans. **(3)**

Sol. Energy of the photone E = $\frac{hc}{\lambda} = \frac{1240}{97.5}$ = 12.75 eV

This energy is equal to energy gap between n = 1 (– 13.6) and n = 4(–0.85). So by this energy, the electron will excite from n = 1 to n = 4. When the electron will fall back, numbers of spectral lines emmitted = $\frac{n(n-1)}{2}$

= $\frac{(4)(4-1)}{2} = 6$

हल. फोटॉन की ऊर्जा E = $\frac{hc}{\lambda} = \frac{1240}{97.5}$ = 12.75 eV

यह ऊर्जा n = 1 (– 13.6) तथा n = 4(–0.85) के ऊर्जान्तर के बराबर है। अतः इस ऊर्जा से इलेक्ट्रॉन n = 1 से n = 4 में उत्तेजित होगा जब इलेक्ट्रॉन पुनः n = 1 में आयेगा तब $\frac{n(n-1)}{2}$ स्पेक्ट्रम रेखाऐं उत्सर्जित करेगा

= $\frac{(4)(4-1)}{2} = 6$

42. The Binding energy per nucleon of ^7_3Li and ^4_2He nucleon are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction $^7_3Li + ^1_1H \rightarrow ^4_2He + ^4_2He + Q$, the value of energy Q released is :

(1) 19.6 MeV (2) –2.4 MeV (3) 8.4 MeV (4) 17.3 MeV

^7_3Li तथा ^4_2He की प्रति न्यूक्लिऑन बंधन ऊर्जा क्रमशः 5.60 MeV तथा 7.06 MeV है तो निम्नांकित नाभिकीय अभिक्रिया

$^7_3Li + ^1_1H \rightarrow ^4_2He + ^4_2He + Q$, में मुक्त ऊर्जा Q का मान होगा :

(1) 19.6 MeV (2) –2.4 MeV (3) 8.4 MeV (4) 17.3 MeV

Ans. **(4)**

Sol. $_4Li^7 + {}_1H^1 \longrightarrow {}_2({}_2He^4)$

BE of products = (5.6 MeV) × 7 + 0

उत्पाद की बन्धन ऊर्जा BE = (5.6 MeV) × 7 + 0

= 39.2 MeV

E_i = –39.2 MeV

BE of reactant = (7.06) × 4 × 2

कारकों की बन्धन ऊर्जा BE = (7.06) × 4 × 2

= 56.48 MeV

E_f = – 56.48 MeV

As nuclear energy decreases, so some energy will be released

चुंकि नाभिकीय ऊर्जा घट गई है अतः कुछ ऊर्जा मुक्त होगी

$Q_{release} = E_i - E_f = (-39.2) - (-56.48) = 17.28$ MeV

43. A radio isotope 'X' with a half life 1.4 × 10^9 years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X' and 'Y' in the ratio 1 : 7. The age of the rock is :

(1) 1.96 × 10^9 years (2) 3.92 × 10^9 years (3) 4.20 × 10^9 years (4) 8.40 × 10^9 years

एक रेडियोएक्टिव समस्थानिक 'X' की अर्ध–आयु 1.4 × 10^9 वर्ष है। यह क्षयित होकर 'Y' में रूपान्तरित हो जाता है जो स्थायी है। किसी गुफा की एक चट्टान में 'X' तथा 'Y' का अनुपात 1 : 7 पाया गया। तो, इस चट्टान की आयु होगी :

(1) 1.96 × 10^9 वर्ष (2) 3.92 × 10^9 वर्ष (3) 4.20 × 10^9 वर्ष (4) 8.40 × 10^9 वर्ष

Ans. **(3)**

Sol.

	X	$\longrightarrow$	Y
t = 0	N_0		0
at time t	$N_0 - x$		x

$$\frac{N_0 - x}{x} = \frac{1}{7} \quad \Rightarrow \quad x = \frac{7N_0}{8}$$

So remaining nuclei of X = $N_0 - x = \frac{N_0}{8} = \frac{N_0}{2^3}$

So three half life periods would have been passed

$\Rightarrow \quad t = 3\,t_{1/2} = 3 \times 1.4 \times 10^9 = 4.2 \times 10^9$year

हल.

	X	$\longrightarrow$	Y
t = 0	N_0		0
किसी समय t पर	$N_0 - x$		x

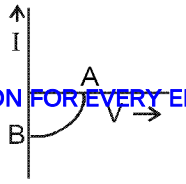
$$\frac{N_0 - x}{x} = \frac{1}{7} \quad \Rightarrow \quad x = \frac{7N_0}{8}$$

अतः X के शेष नाभिक = $N_0 - x = \frac{N_0}{8} = \frac{N_0}{2^3}$

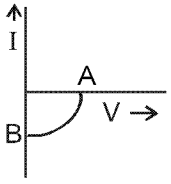
अतः तीन अर्द्धआयु काल लगेगें

$\Rightarrow \quad t = 3\,t_{1/2} = 3 \times 1.4 \times 10^9 = 4.2 \times 10^9$year

44. The given graph represents V – I characteristic for a semiconductor device.



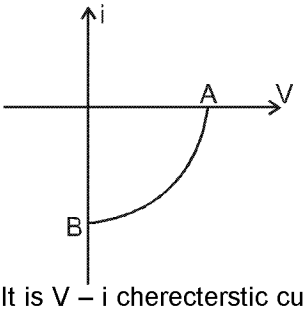
Which of the following statement is correct ?
(1) It is V – I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current.
(2) It is for a solar cell and points A and B represent open circuit voltage and current, respectively.
(3) It is for a photodiode and points A and B represent open circuit voltage and current respectively.
(4) It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively.
यहाँ ग्राफ (आलेख) में एक अर्ध–चालक युक्ति का V – I अभिलक्षण दर्शाया गया है।



इसके लिये निम्नलिखित में से कौनसा कथन सही हैं?
(1) यह 'सौर सेल' का V – I अभिलक्षण है, जहाँ A, खुले परिपथ में वोल्टता तथा B लघु–परिपथन विद्युत धारा को निरूपित करता है।
(2) यह 'सौर सेल' के लिये है तथा A और B खुले परिपथ में क्रमशः वोल्टता तथा विद्युत धारा को निरूपित करते हैं।
(3) यह 'फोटो डायोड' के लिये है तथा A और B खुले परिपथ में क्रमशः वोल्टता तथा विद्युत धारा को निरूपित करते हैं।
(4) यह LED के लिये है और A तथा B खुले परिपथ में क्रमशः वोल्टता तथा लघु–परिपथ में विद्युत धारा को निरूपित करते हैं।

Ans. **(1)**

Sol.



It is V – i cherecterstic curve for a solar cell, where A represent open circuit voltage of solar cell and B represent short circuit current.
यह सौर सेल का अभिलाक्षिणक V – i ग्राफ है, जहाँ पर A सौर सेल का खुला परिपथ विभवान्तर बताता है तथा B लघु परिपथन धारा बताता है।

45. The barrier potential of a p-n junction depends on :
(a) type of semi conductor material
(b) amount of doping
(c) temperature
Which one of the following is correct?
(1) (a) and (b) only (2) (b) only (3) (b) and (c) only (4) (a), (b) and (c)
किसी p-n संधि का रोधक विभव निर्भर करता है :
(a) अर्ध–चालक के पदार्थ पर
(b) अपमिश्रण की मात्रा पर
(c) ताप पर
निम्नांकित में से कौन सा सही है?
(1) केवल (a) तथा (b) (2) केवल (b) (3) केवल (b) तथा (c) (4) (a), (b) तथा (c)

Ans. **(4)**

Sol. The barrier potential depends on type of semiconductor (for Si V_b = 0.7 volt & for Ge V_b = 0.3 volt), amount of doping and also on the temperature.
अवरोधक विभव अर्द्धचालक के प्रकार, अपमिश्रण की मात्रा तथा ताप पर निर्भर करता है।
के लिए = 0.3 वोल्ट)

PART- B : Chemistry (Code - P)

भाग - B : रसायन विज्ञान

46. What is the maximum number of orbitals that can be identified with the following quantum number n = 3, ℓ = 1, m = 0 **(Atomic structure) (XI) (easy)**

(1) 1 (2) 2 (3) 3 (4) 4

निम्न क्वांटम संख्या के लिए अधिकतम अभिनिर्धारित कक्षकों की संख्या क्या होगी ?

n = 3, ℓ = 1, m = 0

(1) 1 (2) 2 (3) 3 (4) 4

Ans. (1)

Sol. It is 3P orbital with magnetic Q.N. = 0

So, it should be $3P_z$

यह 3P कक्षक है जिसकी चुम्बकीय क्वांटम संख्या = 0 है

अतः, यह $3P_z$ होना चाहिए

47. Calculate the energy in corresponding to light of wavelength 45 nm : (Planck's constant h = 6.63×10^{-34} Js : speed of light c = 3×10^8 ms^{-1}) **(Atomic structure) (XI) (Moderate)**

(1) 6.67×10^{15} (2) 6.67×10^{11}

(3) 4.42×10^{-15} (4) 4.42×10^{-18}

45 nm के तरंगदैर्ध्य के प्रकाश के लिए ऊर्जा का मान जूल में निकालें: (प्लांक स्थिरांक h = 6.63×10^{-34} Js : प्रकाश का वेग c = 3×10^8 ms^{-1})

(1) 6.67×10^{15} (2) 6.67×10^{11}

(3) 4.42×10^{-15} (4) 4.42×10^{-18}

Ans. (4)

Sol. $$E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{45 \times 10^{-9}} = 4.4 \times 10^{-18}$$

48. Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27ºC in identical conditions. The ratio of the volumes of gases H_2:O_2 : methane would be - **(Mole concept) (XI) (easy)**

(1) 8 : 16 : 1 (2) 16 : 8 :1 (3) 16 : 1 : 2 (4) 8 : 1 : 2

समान द्रव्यमान में H_2, O_2 और मिथेन को एक आयतन V के पात्र में 27ºC पर समान परिस्थितियों में लिया गया है। H_2:O_2 : मिथेन गैसों के आयतन का अनुपात होगा -

(1) 8 : 16 : 1 (2) 16 : 8 :1 (3) 16 : 1 : 2 (4) 8 : 1 : 2

Ans. (3)

Sol.

H_2	O_2	CH_4
32	32	32
16	1	2 mole ratio

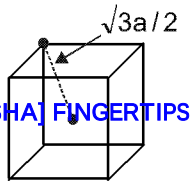
49. If a the length of the side of a cube, the distance between the body centered atom one corner atom in the cube will be - **(Solid state) (XII) (Moderate)**

(1) $\frac{2}{\sqrt{3}}a$ (2) $\frac{4}{\sqrt{3}}a$ (3) $\frac{\sqrt{3}}{4}a$ (4) $\frac{\sqrt{3}}{2}a$

यदि a घन के फलक की लम्बाई है, तो घन के अन्तःकेन्द्रित परमाणु एवं कोने वाले परमाणु के बीच की दूरी होगी -

(1) $\frac{2}{\sqrt{3}}a$ (2) $\frac{4}{\sqrt{3}}a$ (3) $\frac{\sqrt{3}}{4}a$ (4) $\frac{\sqrt{3}}{2}a$

Ans. (4)



Sol.

50. Which property of colloids is not dependent on the charge on colloidal particles ?
(Surface chemistry) (XII) (Easy)

(1) Coagulation (2) Electrophoresis (3) Electro-osmosis (4) Tyndall effect

कोलॉइडो का कौनसा गुण कोलॉइड कण के आवेश पर निर्भर नहीं करता है ?

(1) स्कंदन (2) वैघुत कण संचलन (3) वैद्युत परासरण (4) टिन्डल प्रभाव

Ans. (4)

Sol. Tyndal effect is due to Scattering of light and not due to charge.
टिण्डल प्रभाव प्रकाश के प्रर्कीणन के कारण होता है। (आवेश के कारण नहीं)

51. Which of the following salts will give highest pH in water ? **(Ionic equilibrium) (XI) (easy)**

(1) KCl (2) NaCl (3) Na_2CO_3 (4) $CuSO_4$

निम्नलिखित लवणों में कौन जल में अधिकतम pH देगा ?

(1) KCl (2) NaCl (3) Na_2CO_3 (4) $CuSO_4$

Ans. (3)

Sol. Na_2CO_3 is basic due to hydrolysis of CO_3^{2-} ion (CO_3^{2-} आयन के जल अपघटन के कारण Na_2CO_3 क्षारीय है।)

$$CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$$

52. Of the following 0.10m aqueous solutions, which one will exhibit the largest freezing point depression ?
(Solution & Coligative property) (XII) (Easy)

(1) KCl (2) $C_6H_{12}O_6$ (3) $Al_2(SO_4)_3$ (4) K_2SO_4

निम्न में से किसके 0.10m जलीय विलयन का सबसे ज्यादा हिमांक में अवनमन होगा ?

(1) KCl (2) $C_6H_{12}O_6$ (3) $Al_2(SO_4)_3$ (4) K_2SO_4

Ans. (3)

Sol. $\Delta T_f = iK_fm$
i is highest for $Al_2(SO_4)_3$
$Al_2(SO_4)_3$ के लिये i का मान उच्चतम होगा

53. When 22.4 litres of $H_2(g)$ is mixed with 11.2 litres of $Cl_2(g)$, each at STP, the moles of HCl(g) formed is equal to -
(Mole concept) (XI) (easy)

(1) 1 mol of HCl(g) (2) 2 mol of HCl(g) (3) 0.5 mol of HCl(g) (4) 1.5 mol of HCl(g)

जब 22.4 लीटर $H_2(g)$ को 11.2 लीटर $Cl_2(g)$ के साथ STP पर मिश्रित किया जाता है, तो HCl(g) के मोल बनेंगे -

(1) 1 मोल HCl(g) (2) 2 मोल HCl(g) (3) 0.5 मोल HCl(g) (4) 1.5 मोल HCl(g)

Ans. (1)

Sol. $H_2 + Cl_2 \longrightarrow 2HCl$
22.4 lt 11.2 lt

1 mole $= \frac{1}{2}$ mole

Limiting reagent is Cl_2. So, 1 mole HCl is formed.
Cl_2 सीमान्त अभिकर्मक है अतः 1 mole HCl बनेगा

54. When 0.1 mol MnO_4^{2-} is oxidised the quantity of electricity required to completely MnO_4^{2-} to MnO_4^- is -

(Electro chemistry) (XII) (Moderate)

(1) 96500 C (2) 2 × 96500 C (3) 9650 C (4) 96.50 C

अगर 0.1 mol MnO_4^{2-} को पूर्ण उपचयित (MnO_4^{2-} से MnO_4^-) करते हैं, तो कितनी विद्युत मात्रा की आवश्यकता होगी

(1) 96500 C (2) 2 × 96500 C (3) 9650 C (4) 96.50 C

Ans. (3)

Sol. $MnO_4^{2-} \longrightarrow MnO_4^-$

0.1 mole

v.f. = 1

So, 0.1 mole = 96500 × 0.1

= 9650 C charge is required (आवेश आवश्यक होगा)

55. Using the Gibbs change, $\Delta G^o = +63.3$ kJ, for the following reaction, $Ag_2CO_3(g) \rightleftharpoons 2Ag^+(aq) + CO_3^{2-}(aq)$ the K_{sp} of $Ag_2CO_3(s)$ in water at 25ºC is ($R = 8.314\ JK^{-1}\ mol^{-1}$)

(Therodynamics+Ionic equilibrium) (XI) (Tough)

(1) 3.2×10^{-26} (2) 8.0×10^{-12} (3) 2.9×10^{-3} (4) 7.9×10^{-2}

गिब्ज ऊर्जा परिवर्तन, $\Delta G^o = +63.3$ kJ को प्रयोग में लेते हुए निम्न अभिक्रिया के लिए जल में 25ºC पर

$Ag_2CO_3(g) \rightleftharpoons 2Ag^+(aq) + CO_3^{2-}(aq)$, $Ag_2CO_3(s)$ का K_{sp} होगा ($R = 8.314\ JK^{-1}\ mol^{-1}$)

(1) 3.2×10^{-26} (2) 8.0×10^{-12} (3) 2.9×10^{-3} (4) 7.9×10^{-2}

Ans. (2)

Sol. $\Delta G^o = -2.303\ RT \log K_{sp}$

$63.3 \times 10^3 = -2.303 \times 8.31 \times 298 \log K_{sp}$

$-11.09 = \log K_{sp}$

$8 \times 10^{-12} = K_{sp}$

56. The weight of silver (at.wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O_2 at STP will be - **(Electro chemistry) (XII) (Moderate)**

(1) 5.4 g (2) 10.8 g (3) 54.0 g (4) 108.0 g

सिल्वर (प.भा = 108) का कितना भार विस्थापित होगा उतनी विद्युत से जो कि 5600 mL O_2 को STP पर विस्थापित करता है ?

(1) 5.4 g (2) 10.8 g (3) 54.0 g (4) 108.0 g

Ans. (4)

Sol. $n_{O_2} = \frac{5600}{22400} = \frac{1}{4}$

$\frac{w_{Ag}}{108} \times 1 = \frac{w_{O_2}}{M_{O_2}} \times 4$ ($2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$)

$\frac{w_{Ag}}{108} = \frac{1}{4} \times 4$

$w_{Ag} = 108$ g

57. Which of the following statements is correct for the spontaneous adsorption of a gas ?

(1) ΔS is negative and therefore, ΔH should be highly positive **(surface chemistry) (XII) (Easy)**

(2) ΔS is negative and therefore, ΔH should be highly negative

(3) ΔS is positive and therefore, ΔH should be negative

(4) ΔS is positive and therefore, ΔH should also be highly positive

निम्न में से कौनसा कथन गैस के स्वतः प्रवर्तित अधिशोषण के लिए सही है ?

(1) ΔS ऋणात्मक है, इसलिए, ΔH उच्चतम धनात्मक होना चाहिए

(2) ΔS ऋणात्मक है, इसलिए, ΔH उच्चतम ऋणात्मक होना चाहिए

(3) ΔS धनात्मक है, इसलिए, ΔH उच्चतम ऋणात्मक होना चाहिए

(4) ΔS धनात्मक है, इसलिए, ΔH उच्चतम धनात्मक होना चाहिए

Ans. (2)

Sol. $\Delta G = \Delta H - T\Delta S$

ΔS = –ve for adsorption

So, ΔH must be –ve to make ΔG = –ve

$\Delta G = \Delta H - T\Delta S$

एवं: प्रवीतित अधिशोषण के लिए ΔS = –ve

अतः ΔG का मान ऋणात्मक होने के लिए ΔH का मान अधिक ऋणात्मक होना चाहिए ΔG = –ve

$\Delta G = \Delta H - T\Delta S$

58. For the reversible reaction : **(Chemical equilibrium) (XI) (easy)**

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$$

The equilibrium shifts in forward direction -

(1) by increasing the concentration of $NH_3(g)$

(2) by decreasing the pressure

(3) by decreasing the concentrations of $N_2(g)$ and $H_2(g)$

(4) by increasing pressure and decreasing temperature

इस उत्क्रमणीय अभिक्रिया के लिए :

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$$

साम्यवस्था अग्र दिशा में विस्थापित होगी -

(1) $NH_3(g)$ की सान्द्रता बढ़ाने पर

(2) दाब में कमी करने पर

(3) $N_2(g)$ एवं $H_2(g)$ की सान्द्रता कम करने पर

(4) दाब में वृद्धि एवं ताप में कमी करने पर

Ans. (4)

Sol. According to Le-Chatalier principle. (लीशातेलिए सिद्धान्त के अनुसार)

59. For the reaction : अभिक्रिया के लिये **(Thermodynamics) (XI) (Tough)**

$X_2O_4(l) \rightarrow 2XO_2(g)$

ΔU = 2.1 k cal, Δs = 20 cal K^{-1} at 300 K

300 K पर ΔU = 2.1 k cal, Δs = 20 cal K^{-1}

Hence तो, ΔG is है:

(1) 2.7 k cal (2) –2.7 k cal (3) 9.3 k cal (4) –9.3 k cal

Ans. (2)

Sol. $\Delta H = \Delta U + \Delta ng\, RT$

$$= 2.1 + \frac{2 \times 2 \times 300}{1000} = 1.2$$

$\Delta G = \Delta H - T\Delta s$

$$= 3.3 - 300 \times \frac{26}{1000} = 3.3 - 6 = -2.7 \text{ K cal}$$

60. For a given exothermic reaction, K_p and K_p' are the equilibrium constants at temperatures T_1 and T_2 respectively. Assuming that heat of reaction is constant in temperatures range between T_1 and T_2, it is readily observation that: **(Chemical equilibrium) (XI) (Moderate)**

उष्माक्षेपी अभिक्रिया के लिये तापमान T_1 एवं T_2 पर साम्यावस्था स्थिरांक क्रमशः K_p और K_p है। अगर यह मान लें कि तापमान सीमा T_1 एवं T_2 के बीच अभिक्रिया की ऊष्मा स्थिर है। तो आसानी से प्रेक्षित है :

(1) $K_p > K_p'$ (2) $K_p < K_p'$ (3) $K_p = K_p'$ (4) $K_p = \frac{1}{K_p'}$

Ans. (1)

Sol. $\log\frac{K_2}{K_1} = \frac{\Delta H^0}{2.303R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$

$T_2 > T_1$ So $K_p < K_P'$ (exothermic reaction)

(assuming $T_2 > T_1$, although it is not mentioned, which temprature is higher

If $T_1 > T_2$ then $K_p > K_P'$ then answer should be (2).

$\log\frac{K_2}{K_1} = \frac{\Delta H^0}{2.303R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$

$T_2 > T_1$ So $K_p < K_P'$ (उष्माक्षेपी अभिक्रिया)

(यह मानते हुए कि $T_2 > T_1$ यद्यपि यह नहीं कहा गया है कौनसा तापमान अधिक है

यदि $T_1 > T_2$ तब $K_p > K_P'$ तो उत्तर (2) होना चाहिए

61. Which of the following orders of ionic radii is correctly represented?

निम्न में से किसके द्वारा आयनिक त्रिज्या का क्रम सही रूप से प्रदर्शित है ?

(Periodic table) (XI) (Moderate)

(1) $H^- > H^+ > H$ (2) $Na^+ > F^- > O^{2-}$ (3) $F^- > O^{2-} > Na^+$ (4) $Al^{3+} > Mg^{2+} > N^{3-}$

Ans. **BONUS**

Sol. $F^- = 133\ P_m$

$O^2 = 140\ P_m$

$Na^+ = 102\ P_m$

There is no correct option. (कोई भी विकल्प सही नहीं है)

62. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reaction is left in excess and how much? (At, wt.Mg = 24; O = 16) **(Mole concept) (XI) (Moderate)**

1.0 g मैग्निशियम को 0.56 g O_2 के साथ बंद पात्र में जलाया जाता है। कौन–सा अभिक्रिया शेष रहेगा और कितना?

(Mg का परमाणु भार = 24 एवं O का परमाणु भार = 16)

(1) Mg, 0.16 g (2) O_2, 0.16 g (3) Mg, 0.44 g (4) O_2, 0.28 g

Ans. (1)

Sol. $Mg + \frac{1}{2}O_2 \rightarrow MgO$

$\frac{1.0}{24} \quad \frac{0.56}{32}$

$\frac{0.5}{12} \quad \frac{0.07}{4}$

$\frac{0.5}{12} - x \quad \frac{0.07}{4} - \frac{x}{2}$

Oxygen is limiting reagent so (ऑक्सीजन सीमान्त अभिकर्मक है इसलिए) $\frac{0.07}{4} - \frac{x}{2} = 0$

$x = \frac{0.07}{2}$

excess (आधिक्य) Mg = $\frac{0.5}{12} - \frac{0.07}{2}$ mole

mass of Mg is (Mg का द्रव्यमान है) = $1 - 0.7 \times 12 = 0.16$ gram

63. The pair of compounds that can exist together is:
यौगिकों का युग्म जो एक साथ विद्यमान रह सकता है, है: **(Redox reaction) (XI) (Moderate)**

(1) $FeCl_3$, $SnCl_2$ (2) $HgCl_2$, $SnCl_2$ (3) $FeCl_2$, $SnCl_2$ (4) $FeCl_3$ KI

Ans. (3)

Sol. $FeCl_2$ and $SnCl_2$ (both are reducing agent and have lower oxidation no.)
$FeCl_2$ तथा $SnCl_2$ (दोनों ही अपचायक है तथा निम्नतर ऑक्सीकरण अवस्था में है।)

64. Be^{2+} is isoelectronic with which of the following ions? **(Atomic structure) (XI) (Easy)**
निम्न आयन में से Be^{2+} किसके समइलेक्ट्रॉनिक है ?

(1) H^+ (2) Li^+ (3) Na^+ (4) Mg^{2+}

Ans. (2)

Sol. $Be^2 = 1s^2 = Li^+$

65. Which of the following molecules has the maximum dipole moment ?
निम्न में से किस अणु का द्विध्रुव आघूर्ण सर्वाधिक है ? **(Chemical bonding) (XI) (Easy)**

(1) CO_2 (2) CH_4 (3) NH_3 (4) NF_3

Ans. (3)

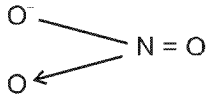
Sol. CO_2 CH_4 NH_3 NF_3
$\mu = 0$ $\mu = 0$ $\mu = 1.47D$ $\mu = 0.23D$

66. Which one of the following species has plane triangular shape ?
निम्न स्पीशीज में से किसका आकार समतल त्रिकोणीय है? **(Chemical bonding) (XI) (Moderate)**

(1) N_3 (2) NO_3^- (3) NO_2 (4) CO_2

Ans. (2)

Sol.



sp^2 (triangular planer) (समतल त्रिकोणीय)

67. Acidity of diprotic acids in aqueous solutions increases in the order:
जलीय विलयनों में डाइप्रोटिक अम्लों की अम्लता का बढ़ता हुआ क्रम है : **(p-block) (XII) (Easy)**

(1) $H_2S < H_2Se < H_2Te$ (2) $H_2Se < H_2S < H_2Te$
(3) $H_2Te < H_2S < H_2Se$ (4) $H_2Se < H_2Te < H_2S$

Ans. (1)

Sol. $H_2O < H_2S < H_2Se < H_2Te$ (acidic strength) (अम्लीय सामर्थ्य)

68. (a) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$ **(p-block) (XII) (Easy)**
(b) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$
Role of hydrogen peroxide in the above reactions is respectively:
ऊपर दी गई अभिक्रियाओं में हाइड्रोजन परॉक्साइड का कार्य है:

(1) oxidizing in (a) and reducing in (b) (a) में उपचायक एवं (b) में अपचायक
(2) reducing in (a) and oxidizing in (b) (a) में अपचायक एवं (b) में उपचायक
(3) reducing in (a) and (b) (a) एवं (b) में अपचायक
(4) oxidizing in (a) and (b) (a) एवं (b) में उपचायक

Ans. (3)

Sol. O_3 is reduced into O^{-2} ion and
Ag_2O is reduced to Ag so
H_2O_2 is reducing agent in both (a) and (b)
O_3 का अपचयन O^{-2} आयन तथा
Ag_2O का अपचयन Ag में होता है इसलिए
H_2O_2 दोनों (a) तथा (b) में अपचायक है।

69. Artificial sweetner which is stable under cold conditions only is :

(1) Saccharine (2) Sucralose (3) Aspartame (4) Alitame

कृत्रिम मधुरक जो केवल ठंडी परिस्थिति में ही स्थायी है : **(Chemistry in everyday life) [Class XII] (easy)**

(1) सैकरीन (2) सूक्रालोस (3) ऐस्पार्टेम (4) ऐलिटेम

Ans **(3)**

Sol. Aspartame is stable at cold conditions but unstable at cooking temperature.

एसपार्टेम शीत परिस्थिति में स्थाई होता है लेकिन खाना पकाने वाले तापमान पर अस्थायी होता है।

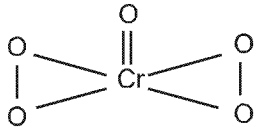
70. In acidic medium, H_2O_2 changes $Cr_2O_7^{-2}$ to CrO_5 which has two (–O – O–) bonds Oxidation state of Cr in CrO_5 is : **(Redox) (XI) (Easy)**

अम्लीय माध्यम में H_2O_2 ,$Cr_2O_7^{-2}$ को CrO_5 जिसमें कि दो (–O – O–) आबंध है में परिवर्तित करता है। CrO_5 में Cr की आक्सीजन अवस्था है।

(1) +5 (2) +3 (3) +6 (4) –10

Ans. (3)

Sol.



71. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives : **(Redox/d-block) (XI) (Easy)**

जलीय $KMnO_4$ की अभिक्रिया अम्लीय परिस्थिति में H_2O_2 से करवाने पर देता है:

(1) Mn^{4+} and O_2 (2) Mn^{2+} and O_2 (3) Mn^{2+} and O_3 (4) Mn^{4+} and MnO_2

Ans. (2)

Sol. $3H_2SO_4 + 2KMnO_4 + 5H_2O_2 \rightarrow 5O_2 + 2MnSO_4 + 8H_2O + K_2SO_4$

72. Among the following complexes the one which shows Zero crystal field stabilizations energy (CFSE)

निम्न संकुलों में से एक जो शून्य क्रिस्टल क्षेत्र स्थायीकरण ऊर्जा (CFSE) प्रदर्शित करता है : **(Co-ordination compounds) (XII) (Moderate)**

(1) $[Nn(H_2O)_6]^{3+}$ (2) $[Fe(H_2O)_6]^{3+}$ (3) $[Co(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{3+}$

Ans. (2)

Sol. $[Fe(H_2O)_6]^{3+}$

$Fe^{+2} = 3d^5$ ($t_{2g}^{1,1,1}\, e_g^{1,1}$)

so C.F.S.E. is = $[-0.4 \times 3 + 0.6 \times 2]\ \Delta_0 = 0$

73. Magnetic moment 2.83 BM is given by which of the following ions? **(d-block) (XII) (easy)**

(At.nos.Ti=22,Cr=24, Mn=25, Ni=28)

निम्नांकित आयनों में से किसका चुम्बकीय आघूर्ण 2.83 BM है ?

(प.सं: Ti=22,Cr=24, Mn=25, Ni=28)

(1) Ti^{3+} (2*)Ni^{2+} (3) Cr^{3+} (4) Mn^{2+}

Ans. (2)

Sol. $\mu = 2.83$, $n = 2$

so (इसलिए) Ni^{2+} ($3d^8 4s^0$)

74. Which of the following complexes is used to be as an anticancer agent ? **(Co-ordination compounds) (XII) (Moderate)**

निम्न में से कौन –से संकुल का उपयोग प्रति कैन्सर कर्मक रूप में होता है ?

(1) mer-$[Co(NH_3)_3Cl]$ (2*) Cis - $[Pt\,Cl_2(NH_3)_2]$ (3) cis - $K_2[Pt\,Cl_2Br_2]$ (4) Na_2CoCl_4

Ans. (2)

Sol. Cis - $[Pt\,Cl_2(NH_3)_2]$ known as cis platin is used as an anticancer agent.

सिस - $[Pt\,Cl_2(NH_3)_2]$ को सिस प्लेटिन कहते हैं जिसका उपयोग प्रतिकेन्सर कर्मक के रूप में होता है।

75. Reason of lanthanoid contraction is : **(Periodic table) (XI) (easy)**

(1) Negligible screening effect of 'f' orbitals (2) Increasing nuclear charge

(3) Decreasing nuclear charge (4) Decreasing screening effect

लैन्थैनोइड संकुचन का कारण है :

(1) 'f' कक्षकों का नगण्य आवरण प्रभाव (2) नाभिकीय आवेश में वृद्धि

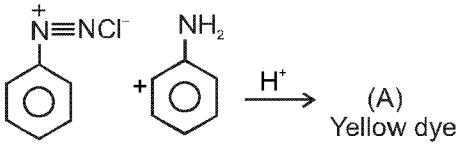
(3) नाभिकीय आवेश में कमी (4) आवरण प्रभाव में कमी

Ans. (1)

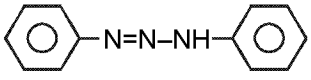
Sol. Poor screening effect of *f*-orbital. (f-कक्षकों का दुर्बल आवरण प्रभाव)

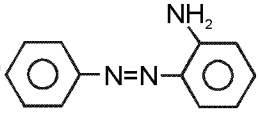
76. In the following reaction, the product (A) **(Topic-Aromatic[O]) (Class-XII) (Moderate)**

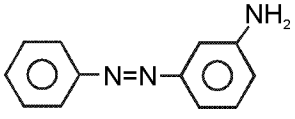
निम्न अभिक्रिया में उत्पाद (A) है :

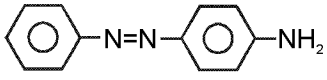


is :

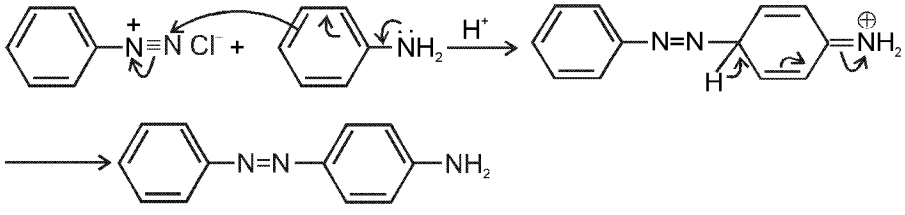
(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. 

It is an electrophilic substitution reaction.

Coupling reaction of aniline takes place at the para-position to NH_2 group in benzene nucleus gives azodye.

यह एक इलेक्ट्रॉनस्नेही प्रतिस्थापन अभिक्रिया है।

एनिलीन में NH_2 की पेरा स्थिति पर युग्मन अभिक्रिया द्वारा ऐजो रंजक प्राप्त होता है।

77. Which of the following will be most stable diazonium salt $RN_2^+X^-$? **(Aromatic[O]) (Class-XII) (easy)**

निम्न में से कौन सर्वाधिक स्थायी डाईऐजोनियम लवण $RN_2^+X^-$ होगा?

(1) $CH_3N_2^+X^-$ (2*) $C_6H_5N_2^+X^-$ (3) $CH_3CH_2N_2^+X^-$ (4) $C_6H_5CH_2N_2^+X^-$

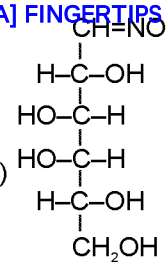
Ans. (2)

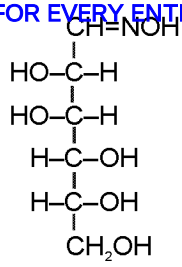
Sol. Benzene diazonium chloride is most stable due to conjugation

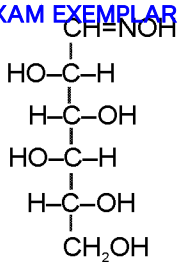
बेन्जीन डाईएजोनियम क्लोराइड संयुग्मन के कारण स्थायी होता है।

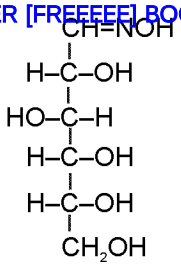
78. D(+) glucose reacts with hydroxyl amine and yield an oxime. The structure of the oxime would be :
(Topic-Biomolecules/Carbohydrate[O]) (Class-XII) (easy)

D(+) ग्लूकोस हाइड्रोक्सिल एमीन के साथ क्रिया करके ऑक्जाइम देता है। ऑक्जाइम की सही संरचना है :

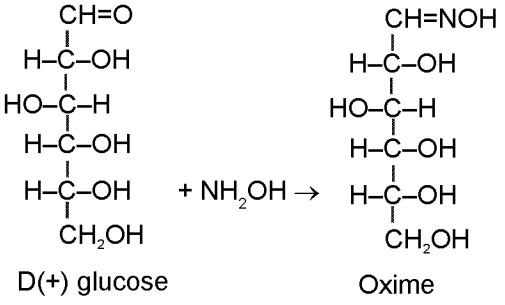
(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. 

D(+) glucose Oxime

79. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human being ? **(Topic-Biomolecules/Harmones[O]) (Class-XII) (easy)**

(1) Thyroxin (2) Insulin (3) Adrenaline (4) Estradiol

निम्न में से कौन–सा हार्मोन तनाव की स्थिति में मानव यकृत में ग्लाइकोजेनेसिस उद्दीपित करता है ?

(1) थाईरोक्सिन (2) इन्सुलिन (3) ऐड्रीनिलिन (4) ऐस्ट्रोडाइओल

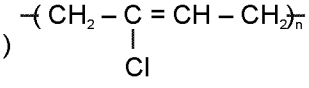
Ans. (3)

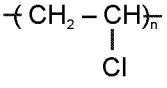
Sol. Adrenaline hormone is produced by adrenal glands after receiving a massage from the brain that a stressfull situation has presented itself. It is commonly known as ***fight or flight*** hormone.

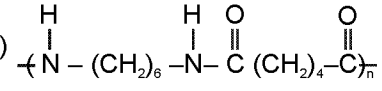
तनाव की स्थिति में विमान द्वारा संदेश प्राप्त होने पर एड्रिनलिन ग्रन्थि से एड्रिनिलिन हार्मोन का उत्सर्जन होता है इस हार्मोन का सामान्य नाम ***fight*** और ***flight*** हार्मोन है

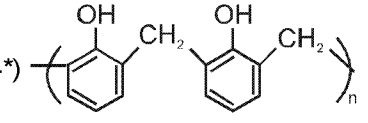
80. Which one of the following is an example of a thermosetting polymer?

निम्न में से कौन तापदृढ़ बहुलक का उदाहरण है ? **(Topic-Polymer[O]) (Class-XII) (Moderate)**

(1) 

(2) 

(3) 

(4*) 

Ans. (4)

Sol. (1) Neoprene rubber (नियोप्रीन रबर)

(2) PVC is a thermoplastic (PVC थर्मोप्लास्टिक होता है)

(3) Nylon-6,6 is a fibre (नायलॉन-6,6 रेशे है)

(4) Bakelite is a thermosetting polymer (बेकेलाइट तापदृढ बहुलक है।)

81. Which of the following organic compounds polymerizes to form the polyester Dacron? **(Topic-Polymer[O]) (Class-XII) (Moderate)**

(1) Propylene and paraHO – (C_6H_4) – OH

(2) Benzolic acid and ethanol

(3) Terepthalic acid and ethylene glycol

(4) Benzolic acid and para HO – (C_6H_4) – OH

निम्न में से कौन–से कार्बनिक यौगिक बहुलीकृत होकर पॉलिएस्टर डेक्रॉन देते हैं ?

(1) प्रोपीलिन और पैरा HO – (C_6H_4) – OH

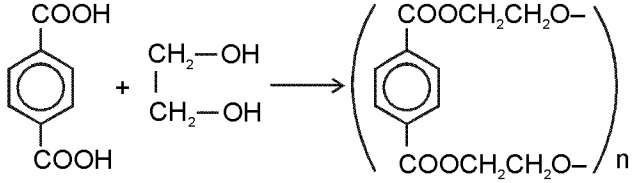
(2) बेन्जॉइक अम्ल एंव ईथेनॉल

(3) टेरेफ्थैलिक अम्ल एंव एथिलीन ग्लाईकोल

(4) बेन्जॉइक अम्ल एंव पैरा HO – (C_6H_4) – OH

Ans. (3)

Sol. Polyester Dacron



82. Which one of the following is not a common component of Photochemical Smog? **(Topic-Environmental chemistry[O]) (Class-XI) (easy)**

(1) Ozone (2) Acrolein (3) Peroxyacetyl nitrate (4) Chloroflurocarbons

निम्न में से कौन प्रकाश रासायनिक धुऐं का सामान्य घटक नहीं है ?

(1) ओजोन (2) एक्रोलिन (3) परोक्सीऐसीटिल नाइट्रेट (4) क्लोरो–फ्लोरोकार्बन

Ans. (4)

Sol.

83. In the Kjedahl's method for estimation of nitrogen present in soil sample, ammonia evolved from 0.75g of sample neutralized 10ml. of 1M H_2SO_4 The percentage of nitrogen in the soil is: **(Topic-POC[O]) (Class-XI) (easy)**

रेत के नमूने में से नाइट्रोजन की उपस्थिति आकलन करने की केल्डाल विधि में 0.75g नमूने से उत्सर्जित अमोनिया को 10ml. 1M H_2SO_4 से उदासीन किया जाता है। रेत में नाइट्रोजन का प्रतिशत है :

(1) 37.33 (2) 45.33 (3) 35.33 (4) 43.33

Ans. (1)

Sol. Volume of 1M H_2SO_4 = 10 m mol

Volume of NH_3 consumed = 20 m mol

$$\text{Weight of N} = \frac{14 \times 20}{1000}\text{ g} = 0.280\text{ g}$$

$$\% \text{ N} = \frac{0.280}{0.75} \times 100 = 37.33\%$$

1M H_2SO_4 का आयतन = 10 m mol

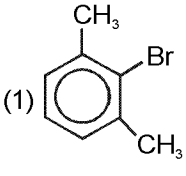
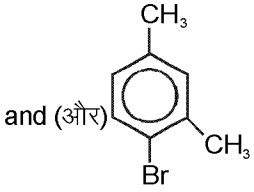
अभिकृत NH_3 का आयतन consumed = 20 m mol

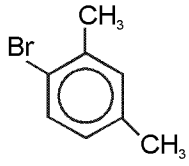
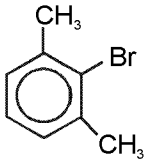
$$\text{N का द्रव्यमान} = \frac{14 \times 20}{1000}\text{ g} = 0.280\text{ g}$$

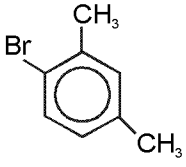
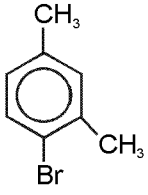
$$\% \text{ N} = \frac{0.280}{0.75} \times 100 = 37.33\%$$

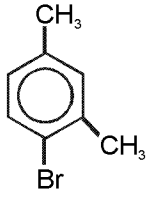
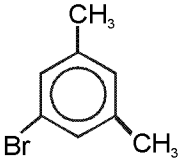
84. What product are formed when the following compound is treated with Br_2 in the presence of $FeBr_3$?
निम्न यौगिक की क्रिया Br_2 के साथ $FeBr_3$ की उपस्थिति में करवाने पर क्या उत्पाद बनेगा?

(Topic-Aromatic[O]) (Class-XII) (easy)

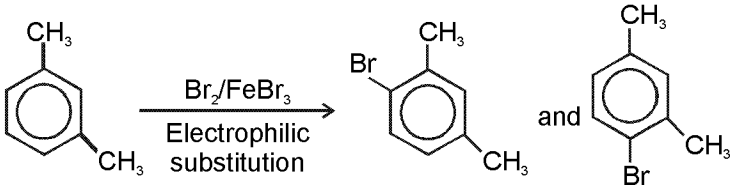
(1)  and (और) 

(2)  and (और) 

(3)  and (और) 

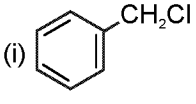
(4)  and (और) 

Ans. (3)

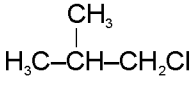
Sol. 

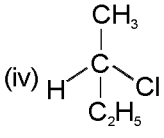
85. Which of the following compoundds will undergo racemisation when solution of KOH hydrolysis?
निम्न में से कौनसे यौगिकों का KOH के विलयन से जल अपघटन के दौरान रेसेमीकरण होता है:

(Topic-Reaction Mechanism[O]) (Class-XII) (Moderate)

(i) 

(ii) $CH_3CH_2CH_2Cl$

(iii) 

(iv) 

(1) (i) and (ii) (2) (ii) and (i)v (3) (iii) and (iv) (4) (i) and (iv)

(1) (i) और (ii) (2) (ii) और (i)v (3) (iii) और (iv) (4) (i) और (iv)

Ans. (BONUS)

Sol. Answer is only (iv) but there is no correct option.
उत्तर केवल (iv) है लेकिन सही विकल्प नहीं दिया गया है।

86. Among the following sets of reaction which one produces anisole? **(Topic-Reaction Mechanism[O])**
निम्न में से कौनसा अभिकारक समूह ऐनिसोल देता है? **(Class-XII) (Moderate)**

(1) CH_3CHO ; RMgX (2) C_6H_5OH ; NaOH ; CH_3I

(3) C_6H_5OH ; neutral (उदासीन)$FeCl_3$ (4) $C_6H_5 - CH_3$; CH_3COCl ; $AlCl_3$

Ans. (2)

Sol. (1) $CH_3 - CH = O + RMgx \rightarrow CH_3 - \underset{\text{alcohol}}{\overset{\overset{R}{|}}{CH}} - OH$

(2) $C_6H_5 - OH + NaOH \rightarrow C_6H_5 - ONa \xrightarrow[S_N^2]{CH_3I} C_6H_5 - OCH_3$ (Anisole) (Williamson's synthesis) (विलियमसन संश्लेषण)

(3) C_6H_5OH + neutral $FeCl_3 \rightarrow$ Violet colour complex (बैंगनी रंग का संकुल)

(4) $C_6H_5 - CH_3 + CH_3COCl + AlCl_3 \rightarrow$ Para–methyl acetophenone (पेरा–मेथिलऐसीटोफिनोन)

87. Which of the following will not be soluble in sodium hydrogen carbonate ? **(Topic-GOC[O]) (Class-XII) (Moderate)**

(1) 2, 4, 6-trinitrophenol (2) Benzoic acid

(3*) o-Nitrophenol (4) Benzenesulphonic acid

निम्न में से कौन सोडियम हाइड्रोजन कार्बोनेट में विलेय नहीं है ?

(1) 2, 4, 6-ट्राईनाइट्रोफिनॉल (2) बेन्जोइक अम्ल

(3) o-नाईट्रोफिनॉल (4) बेन्जीनसल्फोनिक अम्ल

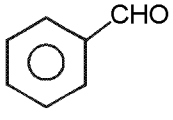
Ans. (3)

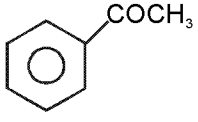
Sol. Acids stronger than H_2CO_3 give CO_2 gas with sodium hydrogen carbonate and also soluble in it.

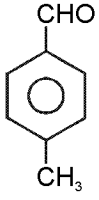
H_2CO_3 से प्रबल अम्ल सोडियम हाइड्रोजन कार्बोनेट के साथ CO_2 गैस देते हैं तथा इसमें विलेय भी होते हैं।

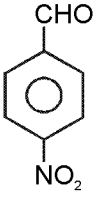
88. Which one is most reactive towards Nucleophilic addition reaction ? **(Topic-Carbonyl compounds[O]) (Class-XII) (easy)**

निम्न में से कौन नाभिकस्नेही योगात्मक अभिक्रिया के प्रति सबसे अधिक सक्रिय है ?

(1) 

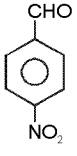
(2) 

(3) 

(4) 

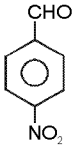
Ans. (4)

Sol. Electron withdrawing (–I, –M) groups increases reactivity towards nucleophilic addition reaction.

In 

NO_2 (–I, –M) group increases the reactivity towards nucleophilic addition reaction at CHO group.

इलेक्ट्रॉनआकर्षी (–I, –M) समूह नाभिकस्नेही योगात्मक अभिक्रिया के प्रति क्रियाशीलता बढ़ा देते हैं।



में NO_2 (–I, –M) समूह CHO समूह पर नाभिकस्नेही योगात्मक अभिक्रिया के प्रति क्रियाशीलता को बढ़ा देता हैं।

89. Identify Z in the sequence of reactions : **(Topic-Alkene/Reaction mechanism[O])(Class-XII) (Moderate)**
अभिक्रिया अनुक्रम में Z पहचाने :

$$CH_3CH_2CH=CH_2 \xrightarrow[H_2O_2]{HBr} Y \xrightarrow{C_2H_5ONa} Z$$

(1) $CH_3–(CH_2)_3–O–CH_2CH_3$ (2) $(CH_3)_2CH_2–O–CH_2CH_3$
(3) $CH_3(CH_2)_4–O–CH_3$ (4) $CH_3CH_2–CH(CH_3)–O–CH_2CH_3$

Ans. (1)

Sol.
$$CH_3CH_2CH=CH_2 \xrightarrow[H_2O_2]{HBr} CH_3CH_2\underset{H}{\underset{|}{C}}H–\overset{Br}{\overset{|}{C}}H_2 \xrightarrow{C_2H_5ONa} CH_3–(CH_2)_3–OCH_2CH_3$$

HBr in presence of peroxide gives anti Markovnikoff addition product.
1°alkyl halide on reaction with C_2H_5ONa gives S_N2 reaction.

$$CH_3CH_2CH=CH_2 \xrightarrow[H_2O_2]{HBr} CH_3CH_2\underset{H}{\underset{|}{C}}H–\overset{Br}{\overset{|}{C}}H_2 \xrightarrow{C_2H_5ONa} CH_3–(CH_2)_3–OCH_2CH_3$$

HBr का परऑक्साइड की उपस्थिति में योग द्वारा एन्टीमार्कोनिकॉफ उत्पाद प्राप्त होता है।
1° एल्किल हेलाइड C_2H_5ONa के साथ S_N2 अभिक्रिया देता है।

90. Which of the following organic compounds has same hybridization as its combustion product –(CO_2) ?
(Topic-GOC[O])(Class-XI) (easy)

(1) Ethane (2) Ethyne (3) Ethene (4) Ethanol

निम्न में से किस कार्बनिक यौगिक का संकरण उसके दहन उत्पाद (CO_2) जैसा है ?

(1) ईथेन (2) ईथाइन (3) ईथीन (4) ईथेनॉल

Ans. (2)

Sol. In Ethyne (CH≡CH) both carbon atoms are sp hybrid as the hybridisation of combustion product, carbon atom of O=C=O (CO_2).
एथाइन (CH≡CH) के दोनों कार्बन का संकरण sp है जैसा की उसके दहन उत्पाद O=C=O (CO_2) का संकरण होता है।

PART- C : BIOLOGY
भाग - C : जीव विज्ञान

91. Which one of the following shows isogamy with non-flagellated gametes?

(1) Sargassum (2) Ectocarpus (3) Ulothrix (4) Spirogyra

निम्नलिखित में से कौन, अकाशाभिक युग्मकों की सहायता से समयुग्मकता दर्शाता है?

(1) सारगासम (2) एक्टोकार्पस (3) यूलोथ्रिक्स (4) स्पाइरोगायरा

Ans. **(4)**

92. Five kingdom system of classification suggested by R.H. Whittaker is not based on:

(1) Presence or absence of a well defined nucleus (2) Mode of reproduction
(3) Mode of nutrition. (4) Complexity of body organisation

आर. एच. ह्विटेकर द्वारा प्रस्तावित पांच जगत वर्गीकरण निम्नलिखित में से किस पर आधारित नहीं है?

(1) सुपरिभाषित केन्द्रक की उपस्थिति और अनुपस्थिति (2) प्रजनन का ढंग
(3) पोषण का ढंग (4) काय संगठन की जटिलता

Ans. **(1)**

93. Which one of the following fungi contains hallucinogens ?

(1) *Morchella esculenta* (2) *Amanita muscaria*

(3) *Neurospora sp.* (4) *Ustilago sp.*

निम्नलिखित में से कौन से कवक में हैलोसिनोजन हैं ?

(1) *मॉरकेला एस्कुलेन्टा* (2) *अमानीटा मस्कारिया*

(3) *न्यूरोस्पोरा जाति* (4) *अस्टीलेगो जाति*

Ans. **(2)**

Sol. *Amanita muscaria* is a species of poisonous mushroom. It contains a psychoactive compound known as **muscimol** having hallucinogenic properties.

ऐमेनिटा मस्केरिया मशरूम की एक विषैली प्रजाति है। इसमें एक मनोसक्रिय यौगिक मस्कीमोल उपस्थित होता है जिसकी प्रवृति मतिभ्रम करने वाली होती है।

94. Archaebacteria differ from eubacteria in:

(1) Cell membrane structure (2) Mode of nutrition

(3) Cell shape (4) Mode of reproduction

आद्यजीवाणु (आर्कीबैक्टीरिया), सुजीवाणुओं (यूबैक्टिरिया) से किसमें भिन्न होते हैं ?

(1) कोशिका कला संरचना (2) पोषण का ढंग

(3) कोशिका आकार (4) प्रजनन का ढंग

Ans. **(1)**

Sol. Archaebacteria show the presence of branched chain lipids in cell membrane than eubacteria. That increases tolerance against adverse conditions.

यूबैक्टिरिया की तुलना में ऑर्किबैक्टिरिया की कोशिका कला में शाखित श्रृंखला लिपिड्स होते है, जो कि प्रतिकूल परिस्थितियों के प्रति प्रतिरोधकता प्रदान करते हैं

95. Which one of the following is wrong about *Chara*?

(1) Upper oogonium and lower round antheridium

(2) Globule and nucule present on the same plant

(3) Upper antheridium and lower oogonium

(4) Globule is male reproductive structure

कारा के विषय में निम्नलिखित में से कौनसा गलत है ?

(1) ऊपरी अण्डधानी और निचली गोल पुंधानी।

(2) ग्लोब्यूल और न्यूक्यूल की एक ही पौधे में उपस्थिति।

(3) ऊपरी पुंधानी और निचली अंडधानी

(4) ग्लोब्यूल नर प्रजनन संरचना है।

Ans. **(3)**

96. Which of the following is responsible for peat formation?

(1) *Marchantia* (2) *Riccia* (3) *Funaria* (4) *Sphagnum*

पीट बनने के लिये कौनसा उत्तरदायी है ?

(1) *मार्केन्शिया* (2) *रिक्सीया* (3) *फ्यूनेरिया* (4) *स्फेग्नम*

Ans. **(4)**

97. Placenta and pericarp are both edible portions in :

(1) Apple (2) Banana (3) Tomato (4) Potato

बीजाण्डासन और फलभित्ति, दोनों खाने योग्य भाग किसमें हैं ?

(1) सेब (2) केला (3) टमाटर (4) आलू

Ans. **(3)**

Sol. Tomato has berry fruit in which all the parts of fruit including placenta and pericarp are edible.

टमाटर में बेरी फल होता है जिसमें फल के सभी भाग जिसमें बीजाण्डसन तथा पेरीकॉर्प शामिल हैं, खाने योग्य होते हैं

98. When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as:

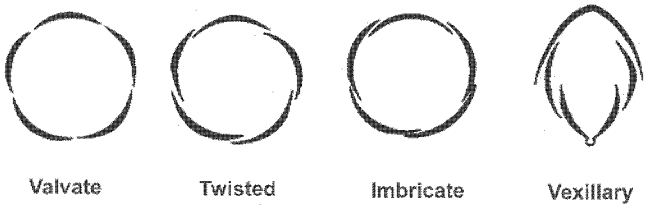
(1) Vexillary (2) Imbricate (3) Twisted (4) Valvate

जब बाह्यदल पुंज या दल पुंज की किनारें, बिना किसी विशेष दिशा से एक दूसरे को अतिछादित करती हैं तो इस दशा को कहा जाता है:

(1) वैक्जीलरी (2) कोरछादी (3) व्यावर्तित (4) कोरस्पर्शी

Ans. **(2)**

Sol.



99. You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will your use to distinguish between the two?

(1) Secondary xylem (2) Secondary phloem (3) Protoxylem (4) Cortical cells

आपको एक द्विबीजपत्री तने और एक द्विबीजपत्री जड़ के काफी पुराने टुकड़े दिये गये हैं। आप उन दोनों में प्रभेद करने के लिए निम्नलिखित में कौन सी शारीरिक संरचनाओं का इस्तेमाल करेंगे ?

(1) द्वितीयक दारू (2) द्वितियक पोषवाह (3) आदिदारू (4) वल्कुट कोशिकायें

Ans. **(3)**

100. Which one of the following statements is correct ?

(1) The seed in grasses is not endospermic.

(2) Mango is a parthenocarpic fruit

(3) A proteinaceous aleurone layer is present in maize grain.

(4) A sterile pistil is called a staminode.

निम्नलिखित कथनों में से कौन सा सही है ?

(1) घासों के बीज भ्रूणपोषी नहीं हैं।

(2) आम एक अनिषेकफली फल है।

(3) मक्का के दाने में एक प्रोटीनकृत एल्युरोन परत उपस्थित होती है।

(4) एक बंध्य स्त्रीकेसर को बंध्य पुंकेसर कहा जाता है।

Ans. **(3)**

101. Tracheids differ from the tracheary elements in :

(1) Having casparian strips (2) Being imperforate

(3) Lacking nucleus (4) Being lignified

वाहिनिकी, अन्य वाहिकीय तत्वों से कैसे भिन्न होती हैं ?

(1) कैसपेरी पट्टियों का होना (2) अछिद्री होना

(3) केन्द्रक का अभाव (4) लिग्निन युक्त होना

Ans. **(2)**

102. An example of edible underground stem is:

(1) Carrot (2) Groundnut (3) Sweet potato (4) Potato

खाने योग्य भूमिगत तने का एक उदाहरण कौनसा है ?

(1) गाजर (2) मूँगफली (3) शकरकन्दी (4) आलू

Ans. **(4)**

Sol. In potato, Edible part is underground branch that is modification of underground stem. In carrot and sweet potato the edible parts are conincal root and tuberous root respectively while in groundnut edible part is cotyledons.

आलू में खाने योग्य भाग भूमिगत कंद होता है जो भूमिगत तने का रूपान्तरण है। गाजर तथा मीठे आलू में भाग शंकुरूपी मूल तथा कंदिल मूल होती है जबकि मूंगफली में खाने योग्य भाग बीजपत्र होते हैं।

103. Which structures perform the function of mitochondria in bacteria ?

(1) Nucleoid (2) Ribosomes (3) Cell wall (4) Mesosomes

जीवाणुओं में सूत्रकणिका का कार्य कौन निभाता है ?

(1) केन्द्रकाभ (2) राइबोसोम (3) कोशिका भित्ति (4) मध्यकाय

Ans. **(4)**

Mesosome of Bacteria is analogous organ of Mitochondria. Both has respiratory enzymes.

जीवाणु का मीजोसोम, माइटोकॉण्ड्रिया का समवृत्ति अंग है। इन दोनों में श्वसनीय एन्जाइम्स होते हैं।

104. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as :

(1) Microtubules (2) Microfilaments

(3) Intermediate filaments (4) Lamins

एक ठोस रैखिक साइटोपंजर जिसका व्यास 6 nm है और जो एकल प्रकार के एकलक से बना है, किस नाम से जाना जाता है ?

(1) सूक्ष्मनलिका (2) सूक्ष्मतंतु

(3) अन्तस्थः तन्तु (4) लैमिन्स

Ans. **(2)**

105. The osmotic expansion of a cell kept in water is chiefly regulated by :

(1) Mitochondria (2) Vacuoles (3) Plastids (4) Ribosomes

जल में रखी एक कोशिका का परासरणीय फैलाव मुख्यतः किसके द्वारा नियंत्रित होता है ?

(1) सूत्रकणिका (2) रसधानी (3) लवक (4) राइबोसोम

Ans. **(2)**

106. During which phase(s) of cell cycle, amount of DNA in a cell remains at 4 C level if the initial amount is denoted as 2C ?

(1) G_0 and G_1 (2) G_1 and S (3) Only G_2 (4) G_2 and M

यदि डी.एन.ए. की प्रारम्भिक मात्रा 2C हो, तो कोशिका चक्र की किस प्रावस्था में, कोशिका में डी.एन.ए. की मात्रा 4 C स्तर पर रहती है ?

(1) G_0 और G_1 (2) G_1 और S (3) केवल G_2 (4) G_2 और M

Ans. **(3)**

107. Match the following and select the correct answer :

(a)	Centriole	(i)	Infoldings in mitochondria
(b)	Chlorophyll	(ii)	Thylakoids
(c)	Cristae	(iii)	Nucleic acids
(d)	Ribozymes	(iv)	Basal body cilia or flagella

	A	B	C	D
(1)	(iv)	(ii)	(i)	(iii)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(iv)	(iii)	(i)	(ii)

निम्नलिखित को सुमेलित कीजिए और सही उत्तर चुनिएः

(a)	तारक केन्द्र	(i)	सूत्रकणिका में अन्तःवलन
(b)	पर्णहरित	(ii)	थाइलेकॉइड
(c)	अंतः कटक	(iii)	न्यूक्लिक अम्ल
(d)	राइबोजाइम	(iv)	पक्षाभ या कशाभ की आधार काय

	A	B	C	D
(1)	(iv)	(ii)	(i)	(iii)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(iv)	(iii)	(i)	(ii)

Ans. **(1)**

108. Dr F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly - cut coleoptile stumps. Of what significance is this experiment ?

(1) It made possible the isolation and exact identification of auxin.

(2) It is the basis for quantitative determination of small amounts of growth- promoting substances.

(3) It supports the hypothesis that IAA is auxin.

(4) It demonstrated polar movements of auxins

डॉ. एफ. वेन्ट ने निरिक्षण किया कि यदि प्रांकुर चोल को अलग कर उसे एक घंटे के लिए अगार में रखा जाये तो अगार एक झुकाव उत्पन्न करेगा, यदि उसे ताजे कटे हुए प्रांकुर चोल ठूंठ के एक ओर स्थापित किया जाय। इस प्रयोग का क्या महत्व है ?

(1) इससे ऑक्जीन का पृथक्करण और सही पहचान सम्भव हुआ।

(2) यह वृद्धिप्रोत्साहक पदार्थों की कम मात्रा के मात्रात्मक निर्धारण का आधार है।

(3) यह इस परिकल्पना का समर्थन करता है कि आई.ए.ए. ऑक्जीन है।

(4) यह ऑक्सजीन का ध्रुवीय गमन को दर्शाता है।

Ans. **(1)**

109. Deficiency symptoms of nitrogen and potassium are visible first in :

(1) Senescent leaves (2) Young leaves (3) Roots (4) Buds

नाइट्रोजन और पोटेशियम की कमी के लक्षण सबसे पहले कहाँ दिखते हैं ?

(1) जीर्णमान पत्तियों में (2) तरूण पत्तियों में (3) जड़ों में (4) कलियों में

Ans. **(1)**

Nitrogen and Potassium are mobile elements.

नाइट्रोजन तथा पोटेशियम चलायमान तत्व हैं

110. In which one of the following processes CO_2 is not released ?

(1) Aerobic respiration in plants (2) Aerobic respiration in animals

(3) Alcoholic fermentation (4) Lactate fermentation

निम्नलिखित में से किस प्रक्रिया में CO_2 मुक्त नहीं होती ?

(1) पादपों में वायु श्वसन (2) प्राणियों में वायु श्वसन

(3) एल्कोहली किण्वन (4) लैक्टेट किण्वन

Ans. **(4)**

In lactate fermentation neither CO_2 releases nor $NADH.H^+$ forms.

$$2CH_3CO\,COOH + 2NA\,D\,H.H^+ \xrightarrow[\text{FMN, } Zn^{++}]{\text{Lactate dehydrogenase,}} 2CH_3CHOHCOOH + 2NAD^+$$

(Pyruvic acid) (Lactic acid)

लेक्टेट किण्वन में न तो CO_2 निकलती है और न ही $NADH.H^+$ बनता है

$$2CH_3CO\,COOH + 2NA\,D\,H.H^+ \xrightarrow[\text{FMN, } Zn^{++}]{\text{Lactate dehydrogenase,}} 2CH_3CHOHCOOH + 2NAD^+$$

(Pyruvic acid) (Lactic acid)

111. Anoxygenic photosynthesis is characteristic of:

(1) *Rhodospirillum* (2) *Spirogyra* (3) *Chlamydomonas* (4) *Ulva*

अनॉक्सी प्रकाश संश्लेषण किसका अभिलक्षण है ?

(1) *रोडोस्पाइरिलम* (2) *स्पाइरोगायरा* (3) *क्लेमाइडोमोनास* (4) *अल्वा*

Ans. **(1)**

Sol. Rhodospirillum is Anoxygenic Nitrogen fixing photosynthetic bacteria.

रोडोस्पाइरिलम अवायवीय, नाइट्रोजन स्थिरीकारी, प्रकाश संश्लेषी जीवाणु है।

112. A few normal seedling of tomato were kept in a dark room.After few days they were found to have become white- coloured like albions , Which of the following terms will you use to describe them ?

(1) Mutated (2) Embolised (3) Etiolated (4) Defoliated

टमाटर के कुछ सामान्य नवोद्भिदों को अंधरे कक्ष में रखा गया। कुछ दिनों के बाद वे वर्णकहीन के जैसे सफेद हुए पाये गए । उनका वर्णन करने के लिए आप निम्नलिखित में से किस शब्द का प्रयोग करेंगे ?

(1) उत्परिवर्तित (2) अन्तरारोहित (3) पांडुरित (4) निष्पत्रित

Ans. **(3)**

113. Which one of the following growth regulators is known as stress hormone ?

(1) Abscissic acid (2) Ethylene

(3) GA_3 (4) Indole acetic acid

निम्नलिखित में से कौन–सा वृद्धि नियत्रक प्रतिबल हार्मोन के नाम से जाना जाता है ?

(1) एब्सीसिक अम्ल (2) एथिलिन

(3) GA_3 (4) इंडोल एसीटिक अम्ल

Ans. **(1)**

114. Geitonogamy involves

(1) Fertilization of a flower by the pollen from another flower of the same plant

(2) Fertilization of a flower by the pollen from another same flower.

(3) Fertilization of a flower by the pollen from a flower of another plant in the same population

(4) Fertilization of a flower by the pollen from a flower of another plant belonging to a distant population

सजात पुष्पी परागण में क्या होता है ?

(1) एक पुष्प का निषेचन उसी पादप के दूसरे पुष्प के पराग से

(2) एक पुष्प का निषेचन उसी पुष्प के पराग से

(3) एक पुष्प का निषेचन उसी समष्टि के दूसरे पादप के पुष्प के पराग से

(4) एक पुष्प का निषेचन दूरस्थ समष्टि के दूसरे पादप के पुष्प के पराग से

Ans. **(1)**

115. Male gametophyte with least number of cells is present in :

(1) Pteris (2) Funaria (3) Lilium (4) Pinus

कोशिकाओं की न्यूनतम संख्या वाला नर युग्मकोद्भिद् किसमें होता है ?

(1) टेरिस (2) फ्यूनेरिया (3) लिलियम (4) पाइनस

Ans. **(3)**

Sol. Lilium is angiospermic plant, in which male gametophyte is 3 - celled and most reduced gametophyte as compared to Funaria (Bryophyte). Pinus (Gymnosperm), Pteris (Pteridophyte)

लिलियम आवृत्तबीजीय पादप है जिसमें नर गेमिटोफाइट 3 - कोशिकीय होता है तथा फ्यूनेरिया (Bryophyte), पाइनस (Gymnosperm), टेरिस (Pteridophyte) के गेमिटोफाइट की तुलना में अत्यधिक ह्रासित होता है।

116. An aggregate fruit is one which devloped from

(1) Multicarpellary syncarppous gynoecium

(2) Multicarpellary apocarups gynoecium

(3) Complete inflorescence

(4) Multicarpellary superior ovary

एक पुंज फल वह है जो विकसित होता है:

(1) बहुअण्डपी युक्तांडपी जायांग से

(2) बहुअण्डपी वियुक्तांडपी जायांग से

(3) पूर्ण पुष्पक्रम से

(4) बहुअण्डपी उर्ध्ववर्ती अण्डाशय से

Ans. **(2)**

117. Pollen tablets are avalable in the market for:

(1) In vitro fertilization (2) Breeding programmes

(3) Supplementing food (4) Ex situ conservation

पराग टिकिया बाजार में किस लिए उपलब्ध हैं ?

(1) पात्र निषेचन के लिए (2) प्रजनन योजनाओं के लिए

(3) खाद्य सम्पूरण के लिए (4) बाह्यस्थाने संरक्षण के लिए

Ans. **(3)**

118. Function of filiform apparutus is to :

(1) Recognize the suitable pollen at stigma (2) Stimulate division of genrative cell

(3) Producer nector (4) Guide the entry of pollen tube

तन्तुरूप समुच्य का क्या कार्य हैं ?

(1) वर्तिकाग्र पर उपयुक्त पराग को पहचानना (2) जनन कोशिका के विभाजन को प्रेरित करना

(3) मकरंद का उत्पादन (4) पराग नली के प्रवेश का मार्गदर्शन

Ans. **(4)**

Sol. Filiform apparatus finger like projections of synergids of embryo sac that guide the entry of pollen tube in embryo sac

तंतुरूपी उपकरण, सिनरजिड की अंगुली सदृश्य अतिवृद्धियाँ हैं जो भ्रूणकोष में परागनली के प्रवेश को निर्देशित करती है

119. Non- albuminous seed is produced in:

(1) Maize (2) Castor (3) Wheat (4) Pea

एल्ब्यूमिन रहित बीज किसमें उत्पादित होते हैं?

(1) मक्का (2) अरंडी (3) गेंहूँ (4) मटर

Ans. **(4)**

120. Which of the following showns coiled RNA strand and capsomeres ?

(1) Polio virus (2) Tobacco mosaic virus

(3) Measles virus (4) Retro virus

कुंडलित आर एन ए रज्जुक और पेटिकांशक निम्नलिखित में स कौन दर्शाता है ?

(1) पोलिओ विषाणु (2) तंबाकू मोजेक विषाणु

(3) खसरा विषाणु (4) पश्च विषाणु

Ans. **(2)**

121. Which one of the following is wrongly matched ?

(1) Transcription - Writing information from DNA to - RNA

(2) Transcription - Using information in m - RNA to make protein

(3) Repressor protein - Binds to a operatore to stop enzyme synthes

(4) Operon - Structural genes, operator and promoter.

निमलिखित मे से कौन गलत सुमेलित हैं ?

(1) अनुलेखन – डी एन ए से टी आर एन ए को सूचना लिखना ।

(2) अनुवादन – प्रोटीन निर्माण के लिए एम–आर एन ए में सूचना का इस्तेमाल करना ।

(3) दमकारी प्रोटीन – प्रकिण्व संश्लेषण को रोकने के लिए प्रचालक को बंधित करता है।

(4) ओपेरॉन – संरचनात्मक जीन, प्रचालक और उन्नायक ।

Ans. **(1)**

Sol. Transcription - writing information from DNA to m-RNA.

अनुलेखन – डी.एन.ए. से एम – आर.एन.ए. को सूचना लिखना

122. Transformation was discovered by :

(1) Meseson and stahl (2) Hershey and chase

(3) Griffith (4) Waston and crick

रूपांतरण की खोज किसके द्वारा की गई ?

(1) मेसल्सन और स्टाल (2) हर्शे और चेस

(3) ग्रिफिथ (4) वाट्सन और क्रिक

Ans. **(3)**

123. Fruit colour in squash is an example of :

(1) Recessive epistasis (2) Dominant epistasis

(3) Complementary genes (4) Inhibitory genes

कुम्हड़ा के फल का रंग किसका उदाहरण है ?

(1) अप्रभावी प्रबलता (2) प्रभावी प्रबलता

(3) पूरक जीन (4) निरोधी जीन

Ans. **(2)**

124. Viruses have :

(1) DNA enclosed in a protein coat (2) Prokaryotic nucleus

(3) Single Chromosome (4) Both DNA and RNA

विषाणुओं में क्या होता है ?

(1) प्रोटीन आवरण में परिबद्ध डी एन ए (2) प्राक्केन्द्रकी केन्द्रक

(3) अकेला गुणसूत्र (4) डी एन ए और आर एन ए दोनों

Ans. **(4)**

125. The first human hormone produced by recombinant DNA tecnology is :

(1) Insulin (2) Estrogen (3) Thyroxin (4) Progesterone

पुनर्योगज डी एन ए प्रौद्योगिकी द्वारा उत्पादित पहला मानव हार्मोन कौनसा है ?

(1) इन्सुलिन (2) एस्ट्रोजन (3) थाइरोक्सीन (4) प्रोजेस्टोरॉन

125. (1)

Sol. The first hormone to be genetically engineered i.e. insulin is commercially available as **humulin**.

जेनेटिक इन्जिनियरिंग द्वारा बनाया जाने वाला प्रथम हार्मोन इन्सुलिन, व्यवसायिक रूप में ह्यूमेलिन के रूप में उपलब्ध है।

126. An analysis of chromosomal DNA using the Southern hybrization technique does not use:

(1) Electrophoresis (2) Blotting (3) Autoradiography (4) PCR

गुण सूत्रीय डी एन ए के विश्लेषण मे सदर्न संकरण तकनीक मे क्या प्रयुक्त नहीं होता ?

(1) वैद्युत कण संचलन (2) शोषण (3) स्वविकिरणी चित्रण (4) पी सी आर

Ans. **(4)**

127. In vitro clonal propagation in plants in characterized by :

(1) PCR and RAPD (2) Northern blootting

(3) Electrophoresis and HPLC (4) Microscopy

पादपों में पात्रे क्लोनी प्रवर्धन किसके द्वारा चित्रित होता है ?

(1) पी. सी. आर. और आर. ए. पी. डी. (2) नार्दर्न शोषण

(3) वैद्युत कण संचलन और एच पी एल सी (4) सूक्ष्मदर्शिकी

Ans. **(4)**

128. An alga which can be employed as food for human beings :

(1) Ulothrix (2) Chlorella (3) Spirogyra (4) Polysiphonia

वह कौनसा शैवाल है जिसे मानव के लिए खाद्य के रूप में नियोजित किया जाता है ?

(1) यूलोथ्रिक्स (2) क्लोरेला (3) स्पाइरोगायरा (4) पॉलिसाइफोनिया

Ans. **(2)**

129. Which vector can clone only a small fragment of DNA ?

(1) Bactrial artifical chromosome (2) Yeast artificial chromosome

(3) Plasmid (4) Comid

कौनसा संवाहक डी एन ए के केवल एक छोटे टुकड़े को क्लोन कर सकता है ?

(1) जीवाणु का कृत्रिम गुणसूत्र (2) यीष्ट का कृत्रिम गुणसूत्र

(3) प्लैज्मिड (4) कॉस्मिड

Ans. **(3)**

Sol. Length of DNA in cloning vectors.

Plasmid - 5-10 kb

Cosmid - 40 - 45 kb

Bacterial -

Artificial Chromosome - 200 - 350 kb

Yeast artificial chromosome - 1 Mb

क्लोनिंग संवाहकों में DNA की लम्बाई

Plasmid - 5-10 kb

Cosmid - 40 - 45 kb

Bacterial -

Artificial chromosome - 200 - 350 kb

Yeast artificial chromosome - 1 Mb

130. An example of ex situ conservation is :

(1) National Park (2) Seed Bank

(3) Wildlife santuary (4) Sacred Grove

बाह्यस्थान संरक्षण का एक उदाहरण कौनसा है ?

(1) राष्ट्रीय उद्यान (2) बीज बैंक

(3) वन्य प्राणी अभयारण्य (4) पवित्र उपवन

Ans. **(2)**

131. A location with luxuriant growth of lichens on the trees indicates that the :

(1) Trees are very healthy (2) Trees are heavily infested

(3) Location is highly polluted (4) Location is not polluted

किसी स्थान पर वृक्षों पर लाइकेनों की प्रचुर मात्रा में वृद्धि क्या संकेत देता है ?

(1) वृक्ष अत्याधिक स्वस्थ हैं (2) वृक्ष भारी पीड़ा से ग्रस्त हैं

(3) वह स्थान अत्याधिक प्रदूषित है (4) वह स्थान प्रदूषित नहीं है

Ans. **(4)**

Sol. Lichens are indicators of SO_2 pollution. If location is not polluted by SO_2 than growth of lichen will enhance.

लाइकेन्स SO_2 प्रदूषण के सूचक हैं, यदि कोई स्थान SO_2 द्वारा प्रदूषित नहीं है तो वहां लाइकेन की वृद्धि अधिक होगी ।

132. Match the following and select the correct option :

(a) Earthworm (i) Pioneer species

(b) Succession (ii) Detrivore

(c) Ecosystem service (iii) Natality

(d) Population growth (iv) Pollination

	a	b	c	d
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(i)	(iii)	(ii)
(3)	(iii)	(ii)	(iv)	(i)
(4)	(ii)	(i)	(iv)	(iii)

निम्नलिखित को सुमेलित कीजिए और सही विकल्प चुनिये

(a) केंचूआ (i) अग्रगामी जातियाँ

(b) अनुक्रमण (ii) अपरदाहारी

(c) पारिस्थिकीय तंत्र सेवा (iii) जन्मदर

(d) जनसंख्या वृद्धि (iv) परागण

	a	b	c	d
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(i)	(iii)	(ii)
(3)	(iii)	(ii)	(iv)	(i)
(4)	(ii)	(i)	(iv)	(iii)

Ans. **(4)**

133. A species facing extremely high risk of extinction in the immediate future is called :

(1) Vulnerable (2) Endemic

(3) Critically Endangered (4) Extinct

एक जाति, जो निकट भविष्य में विलोपन के उच्च जोखिम की चरमता का सामना कर रही हैं उसे क्या कहा जाता है ?

(1) सुभेद्य (2) स्थानिक

(3) क्रांतिक संकटापन्न (4) विलोप

Ans. **(3)**

134. The zone of atmosphere in which the ozone layer is :

(1) Ionosphere (2) Mesosphere (3) Stratosphere (4) Troposphere

वायुमण्डल का वह क्षेत्र जिसमें ओजोन परत उपस्थित है, उसे क्या कहते हैं?

(1) आयनमण्डल (2) मध्यमण्डल (3) समतापमण्डल (4) क्षोभमण्डल

Ans. **(3)**

135. The orgatnization which published the Red List of species is :

(1) ICFRE (2) IUCN (3) UNEP (4) WWF

कौन सा संगठन जातियों की रेड सूची प्रकाशित करता हैं ?

(1) आई. सी. एफ. आर. ई. (2) आई. यू. सी. एन.

(3) यु. एन. ई. पी. (4) डब्ल्यु. डब्ल्यु. एफ.

Ans. **(2)**

136. Select the Taxon mentioned that represents both marine and fresh water species :

(1) Echionoderms (2) Ctenophroa

(3) Cephalocoradata (4) Cnidaria

बताये गए टेक्सोनों में उसका चुनाव कीजिए जिसमें दोंनों समुद्री और स्वच्छ जलीय जातियाँ होती हैं ।

(1) एकाइनोडर्मस (2) टेनोफोरा

(3) सिफेलोकार्डेटा (4) निडेरिया

Ans. (4)

Sol. Echinoderms, Ctenophores and Cephalochordates are exclusively marine. However, Cnidarians live in both marine as well as fresh water habitats.

इकाईनोडर्म्स, टिनोफोर्स तथा सिफेलोकार्डेट्स पूर्णतया समुद्री होते हैं। जबकि निडेरियन्स समुद्री तथा स्वच्छ जल दोनों ही आवासों में पाये जाते हैं।

137. Which one of the following living organisms completely lacks a cell wall?

(1) Cyanobacteria (2) Sea- fan (*Gorgonia*)

(3) Saccharomyces (4) Blue- green algae

निम्नलिखित में से किस जीवित प्राणी में कोशिका भित्ती का पूर्ण अभाव है ?

(1) सायनोबैक्टीरिया (2) समुद्री फेन (*गोर्गोनिया*)

(3) सेक्रोमाइसीज (4) नील हरित शैवाल

Ans. **(2)**

Sol. Sea fan (*Gorgonia*) is an animal belonging to Phylum Cnidaria. The animal cells are devoid of cellulosic cell wall.

समुद्री पंखा (*गोर्गोनिया*) संघ निडेरिया से संबंधित एक जन्तु है। जन्तु कोशिकाओं में सेल्यूलोज निर्मित कोशिका भित्ति का अभाव होता है।

138. *Planaria* possess high capacity of:

(1) metamorphosis (2) regeneration

(3) alternation of generation (4) bioluminescence

प्लेनेरिया में किसकी अधिक क्षमता होती है?

(1) कायांतरण (2) पुररूद्भवन

(3) पीढ़ी एकांतरण (4) जैव–संदीप्ति

Ans. **(2)**

Sol. Lower animals such as sponges, cnidarians and flat worms like *Planaria* are known to exhibit high degree of regeneration.

निम्नतर जन्तु जैसे स्पंज, निडेरियन्स तथा चपटे कृमि जैसे *प्लेनेरिया* उच्च कोटि की पुनरूद्भवन क्षमता प्रदर्शित करते हैं।

139. A marine cartilaginous fish that can produce electric current is:

(1) Pristis (2) Torpedo (3) Trygon (4) Scoliodon

एक समुद्री उपास्थिल मछली जो विद्युत धारा उत्पन्न कर सकती है :

(1) प्रिस्टिस (2) टोरपिडो (3) ट्राईगान (4) स्कोलियोडान

Ans. **(2)**

Sol. *Torpedo* (electric ray) possesses modified muscles acting as electric organs.

टोरपीडो (इलेक्ट्रिक रे) में रूपांतरित पेशियां वैद्युत अंगों का कार्य करती हैं।

140. Choose the correctly matched pair:

(1) Tendon-Specialized connective tissue (2) Adipose tissue-Dense connective tissue

(3) Areolar tissue- Loose connective tissue (4) Cartilage-Loose connective tissue

सही–सही मिलान वाले जोड़े का चुनाव कीजिये :

(1) कंडरा (टेंन्डन)– विशिष्टीकृत संयोजी ऊतक (2) वसा ऊतक– घना संयोजी ऊतक

(3) त्वचा गर्तिका ऊतक– शिथिल संयोजी ऊतक (4) उपास्थि–शिथिल संयोजी ऊतक

Ans. **(3)**

Sol. Areolar connective tissue is a type of loose connective tissue and is most widely distributed in human body.

त्वचा गर्तिका संयोजी ऊतक एक प्रकार का शिथिल संयोजी ऊतक है तथा यह मानव शरीर में सर्वाधिक बिखरा हुआ होता है।

141. Choose the correctly matched pair:

(1) Inner lining of salivary ducts - Ciliated epithelium

(2) Moist surface of buccal cavity - Glandular epithelium

(3) Tubular parts of nephrons- Cuboidal epithelium

(4) Inner surface of bronchioles - Squamous epithelium

सही मिलान वाले जोड़े का चुनाव कीजिये :

(1) लार नाल का आन्तरिक स्तर–पक्ष्माभ उपकला

(2) मुख गुहिका की नम सतह–ग्रंथिल उपकला

(3) नेफ्रोन के नलिकाकार भाग–घनाकार उपकला

(4) श्वसनिका की आन्तरिक सतह–शल्की उपकला

Ans. **(3)**

Sol. The tubular parts of nephron (except Bowman's capsule and thin limbs of Henle's loop) are lined by cuboidal epithelium

नेफ्रॉन के नलिकीय भाग (बोमेन संपुट तथा हेन्ले की चाप के पतली भुजाओं को छोड़कर) घनाकार उपकला से स्तरित होते हैं।

142. In 'S' phase of the cell cycle:

(1) amount of DNA doubles in each cell. (2) amount of DNA remains same in each cell.

(3) chromosome number is increased (4) amount of DNA is reduced to half in each cell.

कोशिका चक्र के 'एस' प्रावस्था में क्या होता है ?

(1) प्रत्येक कोशिका में डी. एन. ए. की मात्रा दुगनी हो जाती है।

(2) प्रत्येक कोशिका में डी.एन. ए. की मात्रा वही रहती है

(3) गुणसूत्र की संख्या अधिक हो जाती है।

(4) प्रत्येक कोशिका में डी.एन.ए. की मात्रा आधी रह जाती है।

Sol. Repliction of DNA takes place in S-phase of interphase.
इन्टरफेज अवस्था की S-प्रावस्था में DNA का प्रतिकृतियन होता है

143. The motile bacteria are able to move by:

(1) fimbriae (2) flagella (3) cilia (4) pili
गतिमान जीवाणु किस के द्वारा गति करते हैं ?
(1) फिमब्रि (2) कशाभिका (3) पक्ष्माभ (4) पिल्ली

Ans. **(2)**

144. Select the option which is not correct with respect to enzyme action:
(1) Substrate binds with enzyme at its active site.
(2) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate
(3) A non- competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate
(4) Malonate is a competitive inhibitor of succinic dehydrogenase
एन्जाइम क्रिया के संदर्भ में उस विकल्प को चुनिये जो गलत है :
(1) क्रियाधार एन्जाइम के सक्रिय स्थल से जुड़ जाता है।
(2) बहुत सा सक्सीनेट डालने से सक्सीनिक डीहाइड्रोजनेज का मेलोनेट द्वारा संदमन खत्म नहीं होता।
(3) एक अप्रतिस्पर्धात्मक संदमन एन्जाइम के उस स्थल से जुड़ता है जो क्रियाधार के जुड़ने के स्थल के भिन्न है।
(4) मेलोनेट सक्सीनिक डीहाइड्रोजनेज का एक प्रतिस्पर्धात्मक संदमन है।

Ans. **(2)**

Sol. Inhibition of the enzyme, succinate dehydrogenase by malonate is an example of competitive inhibition. Such inhibition is overcome by edition of excess substrate (succinate) in the medium.
मेलोनेट (प्रतिस्पर्धी संदमक) के द्वारा सक्सीनेट डीहाइड्रोजिनेज विकर का संदमन, प्रतिस्पर्धात्मक संदमन का एक उदाहरण है। माध्यम में अत्यधिक मात्रा में क्रियाधार (सक्सीनेट) डालकर इस प्रकार के संदमन से मुक्ति पाई जा सकती है।

145. Which one of the following is a non-reducing carbohydrate?
(1) Maltose (2) Sucrose (3) Lactose (4) Ribose 5-phosphate
निम्नलिखित में से कौन सा एक अन–अपचायक कार्बोहाइड्रेट है ?
(1) माल्टोज (2) सुक्रोज (3) लेक्टोज (4) राइबोज–5फॉस्फेट

Ans. **(2)**

Sol. Sucrose is a disaccharide. It is composed of each one of the glucose and fructose molecules joined together by α–1, 2 glycosidic bond. It is an example of nonreducing sugars.
सुक्रोज एक डाइसेकेराइड है। यह ग्लूकोज तथा फ्रॅक्टोज प्रत्येक के एक अणु से मिलकर बना होता है जो α–1, 2 ग्लाइकोसिडिक बंध द्वारा जुड़े होते हैं।

146. The enzyme recombinase is required at which stage of meiosis:
(1) Pachytene (2) Zygotene (3) Diplotene (4) Diakinesis
रिकम्बिनेज एन्जाइम अर्धसूत्री विभाजन की किस अवस्था में आवश्यक है ?
(1) पेचीटिन (स्थूलपट्ट) (2) जाईगोटीन (युग्मपट्ट) (3) डिप्लोटिन(द्विपट्ट) (4) डाइकाइनेसिस (पारगतिक्रम)

Ans. **(1)**

Sol. Replection of DNA takes place in S-phase of interphase stage.
इन्टरफेज अवस्था की S-प्रावस्था में DNA का प्रतिकृतियन होता है

147. The initial step in the digestion of milk in human is carried out by ?
(1) Lipase (2) Trypsin (3) Rennin (4) Pepsin
मानवों में दूध के पाचन की आंरम्भिक क्रिया किस के द्वारा की जाती है ?
(1) लाइपेज (2) ट्रिप्सिन (3) रेनिन (4) पेप्सिन

Ans. **(3)**

Sol. The enzyme rennin is responsible for the coagulation of milk by converting soluble milk protein (casein) to insoluble milk protein (paracasien). This is the initial step of digestion of milk.
रेनिन विकर, घुलनशील दुग्ध प्रोटीन (कैसिन) को अघुलनशील दुग्ध प्रोटीन (पैराकैसिन) में बदलकर दुग्ध के स्कंदन हेतु उत्तरदायी

148. Fructose is absorbed into the blood through mucosa cells of intestine by the process called
(1) active transport (2) facilitated transport (3) simple diffusion (4) co-transport mechanism
फ्रक्टोज का अवशोषण आंत के श्लेष्मा कोशिकाओं में से होकर रक्त में किस क्रियाविधि के द्वारा होता है ?
(1) सक्रिय परिवहन (2) सुसाध्य परिवहन (3) सामान्य विसरण (4) सह परिवहन क्रियाविधि

Ans. **(2)**

Sol. Passive transport of fructose involves a carrier protein without utilisation of ATP. Hence it is also called facilitated transport.
फ्रक्टोज का असक्रिय परिवहन बिना ATP खर्च किये एक वाहक प्रोटीन के द्वारा संपन्न होता है। अतः इसे सुसाध्य परिवहन भी कहा जाता है।

149. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs:
(1) as bicarbonate ions (2) in the form of dissolved gas molecules
(3) by binding to R.B.C. (4) as carbamino-haemoglobin
रक्त द्वारा अवशोषित कार्बन डाइऑक्साइड का लगभग 70 प्रतिशत भाग फेफड़ों तक परिवहन कैसे होता है?
(1) बाइकार्बोनेट आयन के रूप में (2) गैस के अणुओं की घुली हुई अवस्था में
(3) लाल रक्त कणिकाओं से बंधन करके (4) कार्बामीनो– हीमोग्लोबिन की तरह

Ans. **(1)**

Sol. About 70% of CO_2 is converted into bicarbonates inside RBCs in presence of an enzyme carbonic anhydrase. The bicarbonates are transported as salts of sodium and potassium in blood plasma as well as RBCs.
लगभग 70% CO_2 लाल रूधिर कणिकाओं में कार्बोनिक एनहाइड्रेज विकर द्वारा बाइकार्बोनेट्स में परिवर्तित हो जाता है। बाइकार्बोनेट्स का सोडियम तथा पोटैशियम लवणों के रूप में रूधिर प्लाज्मा तथा रूधिर कणिकाओं में सवंहन होता है।

150. Person with blood group AB is considered as universal recipient because he has:
(1) both A and B antigens on RBC but no antibodies in the plasma.
(2) both A and B antibodies in the plasma.
(3) no antigen on RBC and no antibody in the plasma
(4) both A and B antigens in the plasma but no antibodies
AB रक्त समूह वाला व्यक्ति क्यों सार्व आदाता (ग्राही) माना जाता है?
(1) लाल रूधिर कोशिकाओं पर A और B दोनों प्रतिजन होते हैं तथा प्लाज्मा में प्रतिरक्षी अनुपस्थित होती हैं
(2) प्लाज्मा में A और B दोनों प्रतिरक्षी होती हैं
(3) लाल रूधिर कोशिकाओं में कोई प्रतिजन नहीं होते और प्लाज्मा में प्रतिरक्षी नहीं होती।
(4) प्लाज्मा में A और B दोनों प्रतिजन होते हैं पर प्रतिरक्षी नहीं होती।

Ans. **(3)**

Sol. Person with blood group AB is considered as universal recipient because he has no antigen on RBC and no antibody in the plasma.
AB रूधिर वर्ग वाले व्यक्ति सार्वत्रिक ग्राही माने जाते है क्योंकि उनके रूधिर प्लाज्मा में कोई भी प्रतिरक्षी नहीं होता है।

151. How do parasympathetic neural signals affect the working of the heart.
(1) Reduce both heart rate and cardiac output
(2) Heart rate is increased without affecting the cardiac output.
(3) Both heart rate and cardiac output increase
(4) Heart rate decreases but cardiac output increases.
परानुकंपी तंत्रिकाय संकेत हृदय के कार्य–संचालन की कैसे प्रभावित करते हैं ?
(1) हृदय स्पंदन गति, हृदय निकास पर बिना प्रभाव किये, बढ़ जाती हैं।
(2) हृदय स्पंदन गति, हृदय निकास पर बिना प्रभाव किये, बढ़ जाती हैं।
(3) हृदय स्पंदन गति और हृदय निकास दोनों बढ़ जाते हैं।
(4) हृदय स्पंदन गति कम हो जाती है लेकिन हृदय निकास बढ़ जाता है।

Ans. **(1)**

Sol. Parasympathetic signals reduce both heart rate and cardiac output.
परानुकंपी संकेत हृदय गति की दर तथा हृदयी लब्धि दोनों को घटाते हैं।

152. Which of the following causes an increase in sodium reabsorption in distal convoluted tubule?

(1) Increase in aldosterone levels
(2) Decrease in antidiuretic hormone levels
(3) Decrease in aldosterone levels
(4) Decrease in antidiuretic hormone levels

निम्नलिखित में से किसके द्वारा दूरस्थ संवालित नलिका में सोडियम का पुनरावशोषण बढ़ जाता है ?

(1) ऐलडोस्टेरोन के स्तर के बढ़ने से
(2) एंटीडाइयूरेटिक हार्मोन के स्तर के बढ़ने से
(3) ऐलडोस्टेरोन के स्तर के घटने से
(4) एंटीडाइयूरेटिक हार्मोन के स्तर के घटने से

Ans. **(1)**

Sol. Aldosterone is secreted by zona glomerulosa of adrenal cortex and also known as salt retaining hormone.

एल्डोस्टीरॉन एड्रीनल कॉर्टेक्स के जोना ग्लोमेरूलोसा से स्रावित होता है तथा लवण प्रतिधारक हार्मोन के रूप में जाना जाता है।

153. Select the correct matching of the types of the joint with the example in human skeletal system:

	Types of joint	**Examples**
(1)	Cartilaginous joint	between frontal and pariental
(2)	Pivot joint	between third and fourth cervical vertebrae
(3)	Hinge joint	between humerus and pectoral girdle
(4)	Gliding joint	between carpals

मानव के कंकाल तंत्र में जोड़ के प्रकार ओर उसकी उदाहरण के सही मेल का चयन कीजिये :

	जोड़ की प्रकार	**उदाहरण**
(1)	उपास्थि युक्त जोड़	फ्रंटल और पैराइटल के बीच
(2)	धुराग्र (पाइवट) जोड़	तीसरे और चौथे ग्रीवा कशेरूकल्पों के बीच
(3)	कब्जा (हींन्ज) जोड़	ह्यूमरस और अंस मेखला के बीच
(4)	विसर्पी (ग्लाइडिंग) जोड़	कार्पल्स के बीच

Ans. **(4)**

Sol. Gliding joint occurs between carpals.

कार्पल्स की बीच में ग्लाइडिंग संधि पायी जाती है।

154. Stimulation of a muscle fiber by a motor neuron occurs at:

(1) the neuromuscular junction
(2) the transverse tubules
(3) the myofibril
(4) the sacroplasmic reticulum

प्रेरक न्यूरॉन द्वारा पेशी तंतु का उद्दीपन कहाँ पर होता है?

(1) तंत्रिका पेशी जंक्शन
(2) अनुप्रस्थ नलिकाएँ
(3) पेशीरेशक
(4) पेशीद्रव्य जालिका

Ans. **(1)**

Sol. Stimulation of a muscle fiber, by a motor neuron, occurs at the sarcolemma of neuro muscular junction due to the release of a neurotransmitter(acetylcholine).

चालक तंत्रिका द्वारा तंत्रिक तंतु का उद्दीपन तंत्रिका–पेशी संधि के सार्कोलेमा पर एक तंत्रिका संचारी (एसेटिल्कोलिन) के मुक्त होने से होता है।

155. Injury localized to the hypothalamus would most likely disrupt:

(1) short - term memory
(2) co - ordination during locomotion
(3) executive functions, such as decision making.
(4) regulation of body temperature

हाइपोथेलेमस तक सीमित क्षति संभवतः निम्न लिखित में से किस एक को बाधित करेगी ?

(1) लघु– कालिक स्मृति
(2) चलन में समन्वयन
(3) कार्यकारी प्रकार्य, जैसे कि निर्णय लेना
(4) शरीर के तापमान का नियमन

Ans. **(4)**

Sol. Thermoregulatory centre is present in the hypothalamus.

156. Which one of the following statements is not correct?
(1) Retinal is the light absorbing portion of visual photo pigments.
(2) In retina the rods have the photopigments rhodopsin while cones have three different photopigments.
(3) Retinal is a derivative of Vitamin C.
(4) Rhodopsin is the purplish red protein present in rods only.

निम्नलिखित कथनों में से कौन सा एक सही नहीं है ?
(1) रेटिनल दृष्टि प्रकाश वर्णक का प्रकाश अवशोषण करने वाला भाग है।
(2) रेटिना में प्रकाश वर्णक रोडोप्सिन शलाकाओं में होता है
(3) रेटिनल विटामिन C का व्युत्पन्न है।
(4) रोडोप्सिन बैंगनी लाल प्रोटीन है जो केवल शलाकाओं में ही उपस्थित होता है।

Ans. **(3)**

Sol. Retinal is derivative of vitamin A.
रेटिनल विटामिन A का व्युत्पन्न है।

157. Identify the hormone with its correct matching of source and function:
(1) Oxytocin - posterior pituitary, growth and maintenance of mammary glands.
(2) Melatonin - pineal gland, regulates the normal rhythm of sleepwake cycle.
(3) Progesterone - corpus-luteum, stimulation of growth and activities of female secondary sex organs.
(4) atrial natriuretic factor- ventricular wall increases the blood pressure.
होर्मोन की पहचान के साथ उसके सही स्त्रोत ओर उकसे कार्य के सही मिलान को चुनिये :
(1) ओक्सीटोसिन – पश्च पीयुष ग्रंथि–दुग्ध ग्रंथियों का विकास और रख रखाव।
(2) मेलेटोनिन–पिनियल ग्रंथि– शरीर के दैनिक लय का नियमन।
(3) प्रोजेस्टेरान–कॉर्पसल्यूटियम–स्त्रियों में द्वितीयक लैंगिक अंगों की वृद्धि तथा क्रियाओं की प्रेरणा।
(4) एट्रियल नेट्रियुरेटिक कारक– हृदय की निलय भित्ति रक्त दाब को बढ़ाता है

Ans. **(2)**

Sol. Melatonin is secreted by the pineal gland and regulates the normal rhythm of sleepwake cycle.
मेलेटोनिन पिनियल ग्रंथि द्वारा स्रावित होता है और सामान्य दैनिक लय को नियमित करता है।

158. Fight - or - flight reaction cause activation of :
(1) the parathyroid glands, leading to increased metabolic rate.
(2) the kidney, leading to suppression of renin angiotensin-aldosterone pathway.
(3) the adrenal medulla, leading to increased secretion of epinephrine and norepinephrene
(4) the pancreas leading to a reduction in the blood sugar levels.
फाईट या फ्लाइट अभिक्रियाओं के कारण किस का सक्रियण होता है?
(1) पैराथाइरॉइड ग्रंथियों का जिसके कारण उपापचयी दर बढ़ जाता है।
(2) वृक्क का जिसके कारण रेनिन–एनजियोटेनसिन ऐलडोस्टिरोन पथ में कमी हो जाती है।
(3) अधिवृक्क का जिसके कारण एपिनेफ्रीन और नारएपिनेफ्रीन का स्त्रावण बढ़ जाता है।
(4) अग्न्याशय का जिसके कारण रूधिर शर्करा का स्तर घट जाता है।

Ans. **(3)**

Sol. The secretion of epinephrine and norepinephrene are secreted by adrenal medulla and are associated with fight are flight reactions.
एपीनेफ्रीन तथा नॉरएपीनेफ्रीन अधिवृक्क मज्जा से स्रावित होते हैं तथा फाइट एवं फ्लाइट क्रियाओं से संबंधित होते है।

159. The shared terminal duct of the reproductive and urinary system in the human male is:
(1) Urethra (2) Ureter (3) Vas deferens (4) Vasa efferentia
मानव नर में जनन और मूत्र प्रणाली की साझी अंत्य वाहिका है:
(1) मूत्र मार्ग (2) मूत्र वाहिनी (3) शुक्र वाहक (4) शुक्रवाहिक

Ans. **(1)**

Sol. The ejaculatory duct opens into the urethra which is a common passage both, for urine and semen.
स्खलन नलिका का अंतिम भाग मूत्रमार्ग में खुलता है जो मूत्र तथा वीर्य दोनों के लिये उभनिष्ठ मार्ग है।

160. The main function of mammalian corpus luteum is to produce:

(1) estrogen only (2) progesterone

(3) human chorionic gonadotropin (4) relaxin only

स्तनपायी कार्पस लूटियम का मुख्य कार्य निम्नलिखित को ही पैदा करना होता है :

(1) केवल एस्ट्रोजन (2) प्रोजेस्ट्रोन

(3) मानव कोरियोनिक गोनेडोट्रोपिन (4) केवल रिलेक्सिन

Ans. **(2)**

Sol. After successful fertilization the ruptured graafian follicle converts into corpus luteum. It cheifly secretes progesterone.

सफल निषेचन के बाद टूटी हुई ग्राफियन पुटिका कार्पलस लूटियम में रूपांतरित हो जाती है। यह मुख्यतः प्रोजेस्टेरॉन का स्रावण करती है।

161. Select the correct option describing gonadotropin activity in a normal pregnant female:

(1) High level of FSH and LH stimulates the thickening of endometrium

(2) High level of FSH and LH facilitate implantation of the embryo.

(3) high level of hCG stimulates the synthesize of estrogen and progesterone

(4) High level of hCG stimulates the thickening of endometrium.

एक सामान्य गर्भवती स्त्री में गोनेडोट्रोपिन की सही सक्रियता का वर्णन करने वाले विकल्प का चयन कीजिये–

(1) एफ एस एच और एच एच के उच्च स्तर द्वारा एन्डोमेट्रियम के स्थूलन का उद्दीपन।

(2) एफ एस एच और एल एच के उच्च स्तर द्वारा भ्रूण के अंतरोपण को सुविधा जनक बनाना।

(3) एच सी जी का उच्च स्तर ऐट्रोजन और प्रोजेस्ट्रोन के संश्लेषण का उद्दीपन करता है।

(4) एच सी जी का उच्च स्तर एन्डोमेट्रियम के स्थूलन का उदृदीपन करता है।

Ans. **(3)**

Sol. Human chorionic gonadotorpin(hCG) is secreted by placenta. It maintains the corpus luteum and thereby stimulate the synthesis of estrogen and progesterone.

मानव कोरिऑनिक गोनेडोट्रोपिन (hCG) ऑवल से स्रावित होता है। यह कॉर्पस लूटियम को बनाये रखता है तथा इस प्रकार एस्ट्रोजन तथा प्रोजेस्टेरोन के संश्लेषण को उद्दीपित करता है।

162. Tubectomy is method of sterilization in which:

(1) small part of the fallopian tube is removed or tied up.

(2) ovaries are removed surgically

(3) small part of vas deferens is removed or tied up.

(4) uterus is removed surgically

टयूबक्टोमी बंध्यकरण के एक विधि है जिसमें :

(1) डिंबवाहिनी नली का छोटा भाग निकाल या बांध दिया जाता है।

(2) अंडाशय की शल्यक्रिया विधि से निकाल दिया जाता है।

(3) वास डेफरेन्स का छोटा भाग निकाल दिया जाता है या बांध दिया जाता है।

(4) गर्भाशय शल्यक्रिया विधि द्वारा निकाल दिया जाता है।

Ans. **(1)**

Sol. Tubectomy is a sterlization method of birth control in which small part of the fallopian tube is removed or tied up.

ट्यूबेक्टॉमी जन्म नियंत्रण की एक बंध्यकरण विधि है जिसमें डिंबवाहिनी का एक छोटा सा भाग निकाल दिया जाता है या बांध दिया जाता है।

163. Which of the following is a hormone releasing intra Uterine Device (IUD) ?

(1) Multiload 375 (2) LNG - 20

(3) Cervical cap (4) Vault

निम्नलिखित में से कौन एक हार्मोन मोचित करने वाली इंट्रायूटेराइन युक्ति (आइ यू डी) है :

(1) मल्टीलोड–375 (2) एल एन जी– 20

(3) ग्रीवा टोपी (4) वाल्ट

Ans. **(2)**

Sol. Multiload- 375 and LNG-20 are copper releasing and hormone releasing IUDs.

164. Assisted reproductive technology, IVF involves transfer of:

(1) Ovum into the fallopian tube.

(2) Zygote into the fallopian tube.

(3) Zygote into the uterus

(4) Embryo with 16 blastomeres into the fallopian tube.

सहायक जनक प्रोद्योगिकी, IVF के अर्न्तगत किसका स्थानान्तण होता है ?

(1) अण्डाणु का फेलोपी नलिका में

(2) युग्मज का फेलोपी नलिका में

(3) युग्मज का गर्भाशय में

(4) 16 ब्लास्टोमीयर्स वाले भ्रूण का फेलोपी नलिका में

Ans. (2)

Sol. The transfer of zygote and early embryo upto eight blastomere stage is carried out into the fallopian tube. It is known as Zygote Intra Fallopian Transfer (ZIFT) and is a type of IVF.

युग्मनज तथा आठ कोरकखण्डों वाले प्रारंभिक भ्रूण का स्थानान्तरण डिम्बवाहिनी में किया जाता है। यह युग्मनज अंतराडिम्बवाहिनी स्थानान्तरण (ZIFT) कहलाता है तथा IVF का एक प्रकार है।

165. A man whose father was colour blind marries a woman who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind ?

(1) 25% (2) 0% (3) 50% (4) 75%

एक मनुष्य जिसका पिता वर्णान्धता से ग्रसित था एक ऐसी स्त्री से विवाह करता है जिसकी माता वर्णान्धता से ग्रसित और पिता सामान्य है। इस युगल के नर बच्चों का कितना प्रतिशत वर्णान्ध होगा ?

(1) 25% (2) 0% (3) 50% (4) 75%

Ans. **(3)**

Sol. X^cX Female (Normal & Carrier) XY Male (Normal eyed)

♀ \ ♂	X	Y
X^c	X^cX	X^cY
X	X^cX	XY

Male children 50% will be coleublind of this couple.

इस दम्पत्ति के 50% नर बच्चे वर्णांध होगें

166. In a population of 1000 individuals 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa, Based on this data, the frequency of allele A in the population is :

(1) 0.4 (2) 0.5 (3) 0.6 (4) 0.7

1000 व्यष्टियों की समष्टि में 360 जीनप्ररूप AA, 480 Aa और शेष 160 aa के अर्न्तगत आते हैं। इस आंकड़े के आधार पर A एलील की आवृत्ति इस समष्टि में होगी :

(1) 0.4 (2) 0.5 (3) 0.6 (4) 0.7

Ans. **(3)**

167. A human female with Turner's syndrome:

(1) has 45 chromosomes with XO (2) has one additional X chromosome.

(3) exhibits male characters (4) is able to produce children with normal husband.

एक नारी जो टर्नर सिंड्रोम से ग्रस्त है:

(1) उसमें 45 गुणसूत्र XO के साथ हैं। (2) उसमें एक अधिक X गुणसूत्र है।

(3) वह नर के लक्षण दर्शाती है। (4) एक सामान्य पति के साथ बच्चे पैदा कर सकती है।

Ans. **(1)**

168. Select the correct option:

	Directionof RNA synthesis	Direction of reading of the template DNA strand
(1)	5' - 3'	3' - 5'
(2)	3' - 5'	5' - 3'
(3)	5' - 3'	5' - 3'
(4)	3' - 5'	3' - 5'

सही विकल्प का चयन कीजिए–

	आर.एन.ए. के संश्लेषण की दिशा	टेम्पलेट डी.एन.ए. लड़ी के रीड़िग की दिशा
(1)	5' - 3'	3' - 5'
(2)	3' - 5'	5' - 3'
(3)	5' - 3'	5' - 3'
(4)	3' - 5'	3' - 5'

Ans. **(1)**

169. Commonly used vectors for human genome sequencing are:

(1) T - DNA (2) BAC and YAC

(3) Expression Vectors (4) T/A Cloning Vectors

मानव जीनोम अनुक्रमण के लिए आमतौर पर प्रयुक्त वैक्टर है :

(1) T - डी.एन.ए. (2) बी.ए.सी. और वाइ.ए.सी.

(3) अभिव्यक्ति वैक्टर (4) T/A क्लोनिंग वैक्टर

Ans. **(2)**

170. Forelimbs of cat, lizard used in walking ; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of :

(1) Analogous organs (2) Adaptive radiation

(3) Homologous organs (4) Convergent evolution

बिल्ली और छिपकली के अग्रपाद चलने ; व्हेल के अग्रपाद तैरने और चमगादड़ के अग्रपाद उड़ने के लिए होते हैं , ये किसके उदाहरण हैं ?

(1) समवृत्तिय अंग (2) अनुकूली विकिरण

(3) समजात अंग (4) अभिसारी विकास

Sol. (3)

Forelimbs of cat, lizard, whale and bats are structurally similar and functionliy different. Such organs are called as homologous organs.

बिल्ली, लिजर्ड, व्हेल तथा चमगादड़ के अग्रबाहु संरचनात्मक रूप से समान परन्तु कार्यात्मक रूप से भिन्न होते है। ऐसे अंग समजात अंग कहलाते है।

171. Which one of the following are analogous structures ?

(1) Wings of Bat and Wings of Pigeon

(2) Gills of Prawn and Lungs of Man

(3) Thorns of Bougainvillea and Tendrils of Cucurbita

(4) Flippers of Dolphin and legs of Horse.

निम्नलिखित में से कौन सी समवृत्ति संरचनाएँ हैं ?

(1) चमगादड़ के पंख और कबूतर के पंख

(2) झींगा के गिल और मनुष्य के फेफड़े

(3) बोगनविलिया के कांटे और कुकुरबिटा के तंतु

(4) डाल्फिन के फ्लिपर्स और घोड़े के पैर

Ans. (1)

Sol. The structurally different but functionally similar organs are called as analogus organs.
कार्यात्मक रूप से समान तथा संरचनात्मक रूप से असमान अंग समवृत्त अंग कहलाते हैं।

172. Which is the particular type of drug that is obtained from the plants whose one flowering branch is shown below ?

(1) Hallucinogen (2) Depressant (3) Stimulant (4) Pain - Killer
वह कौन सा विशेष प्रकार का मादक द्रव्य है जो उस पौधे से प्राप्त होती है जिसकी एक पुष्पित शाखा नीचे दिखाई गयी है ?

(1) हेलूसिनोजन (2) अवनमक (3) उद्दीपक (4) दर्द - निवारक

Ans. **(1)**

Sol. The branch of the plant given above is of *Datura*. It is a source of psychoactive compound which causes hallocinations.
ऊपर दिये हुए पौधें की शाखा *धतूरा* की है। यह मतिभ्रम पैदा करने वाले एक मनोसक्रिय यौगिक का स्त्रोत है।

173. At which stage of HIV infection does one usually show symptoms of AIDS ?
(1) With in 15 days of sexual contact with an infected person.
(2) When the infected retro virus enters host cells.
(3) When HIV damages large number of helper T - Lymphocytes.
(4) When the viral DNA is produced by reverse transcriptase.
एच. आई. वी. संक्रमण की किस अवस्था पर एड्स के लक्षण प्रायः दिखायी देते है।
(1) संक्रमित व्यक्ति के साथ लैंगिक सम्पर्क बनाने के 15 दिनों के भीतर हो।
(2) जब संक्रमित रेट्रोवायरस पोषक कोशिका में प्रवेश करता है।
(3) जब एच.आई.वी. विशाल संख्या में हेल्पर टी–लिम्फोसाइटों को क्षतिग्रस्त करता है।
(4) जब उत्क्रम ट्रांसक्रिप्टेज द्वारा वायरल डी.एन.ए. उत्पन्ना होता है।

Ans. **(3)**

Sol. HIV selectively destroys helper T- lymphocytes. It therefore causes symptoms of immuno deficiency due to critically low number of helper T-lymphocytes.
HIV, चयनात्मक रूप से सहायक T- लिम्फोसाइट्स को क्षतिग्रस्त करता है। इस प्रकार सहायक T- लिम्फोसाइट्स की संख्या में असामान्य गिरावट से प्रतिरक्षा न्यूनता के लक्षण प्रकट होते है।

174. To obtain virus - free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken ?

(1) Apical meristem only (2) Palisade parenchyma

(3) Both apical and axillary meristems (4) Epidermis only

ऊतक संवर्धन तकनीक द्वारा रोगी पौधे से विषाणु - मुक्त स्वस्थ पौधों को प्राप्त करने के लिए रोगी पौधे के किन भाग / भागों को लिया जाएगा ?

(1) केवल शीर्ष विभज्योतक (2) पेलीसेड पेरेन्काइमा

(3) शीर्ष और अक्षीय विभज्योतक दोनों ही (4) केवल अधिचर्म

Ans. **(3)**

175. What gases are produced in anaerobic sludge digesters ?

(1) Methane and CO_2

(2) Methane, Hydrogen Sulphide and CO_2

(3) Methane, Hydrogen Sulphide and CO_2

(4) Hydrogen Sulphide and CO_2

कौनसी गैसें अवायवीय आपंक संपाचित्र में उत्पन्न होती है ?

(1) केवल मीथेन और CO_2

(2) मीथेन, हाइड्रोजन सल्फाइड और CO_2

(3) मीथेन, हाइड्रोजन सल्फाइड और CO_2

(4) हाइड्रोजन सल्फाइड और CO_2

Ans. **(2)**

Sol. During sludge digestion, bacteria (sludge digesters) produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas which can be used as source of energy.

कचड़ा के दौरान जीवाणु (कचड़ा पचाने वाले) मिथेन, हाइड्रोजन सल्फाइड तथा कार्बन डाईऑक्साइड गैसों का एक मिश्रण उत्पन्न करते हैं। ये बायोगैस बनाती है जो ऊर्जा के स्रोत के रूप में प्रयुक्त की जा सकती है।

176. Just as a person moving from Delhi to Shimla to escape the heat for the duration of hot summer, thousands of migratory birds from Siberia and other extremely cold northern regions move to:

(1) Western Ghat (2) Meghalaya

(3) Corbett National Park (4) Keolado National Park

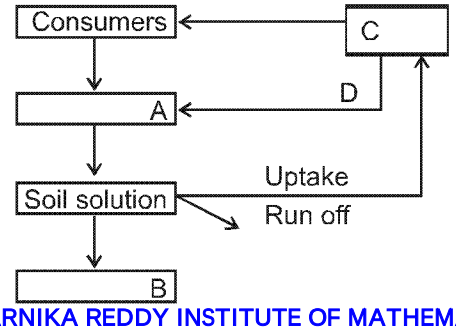
जिस प्रकार एक व्यक्ति गर्मी के मौसम में गर्मी से बचने के लिए दिल्ली से शिमला जाता है उसी प्रकार साइबेरिया और अन्य अत्यधिक ठंडे उत्तरी प्रदेशों से हजारों प्रवासी पक्षी किस ओर जाते हैं ?

(1) पश्चिमी घाट (2) मेघालय

(3) कार्बेट राष्ट्रीय उद्यान (4) कियोलादी राष्ट्रीय उद्यान

Ans. **(4)**

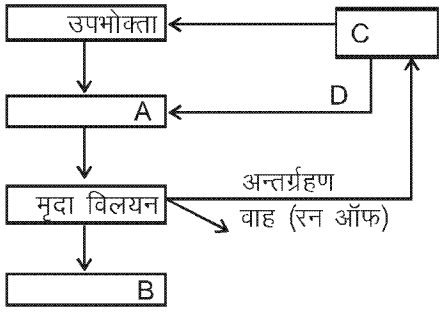
177. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



Options :

	A	B	C	D
(1)	Rock minerals	Detritus	Litter fall	Producers
(2)	Litter	Producers	Rock minerals	Detritus
(3)	Detritus	Rock minerals	Producer	Litter fall
(4)	Producers	Litter fall	Rock minerals	Detritus

एक स्थलीय पारिस्थितिकी तंत्र में फॉस्फोरस चक्र का सरलीकृत मॉडल नीचे दिया गया है जिसमें चार खाली स्थान (A-D) है।. इन्हें पहचानिए:

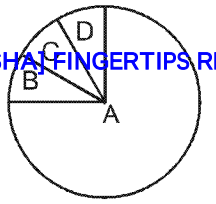


Options :

	A	B	C	D
(1)	चट्टानी खनिज	अपरद	लिट्टरफाल (करकट)	उत्पादक
(2)	करकट	उत्पादक	चट्टानी खनिज	अपरद
(3)	अपरद	चट्टानी खनिज	उत्पादक	करकट
(4)	उत्पादक	करकट	चट्टानी खनिज	अपरद

Ans. **(3)**

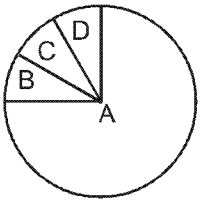
178. Given below is the representation of the extent of global diversity of *invertebrates.* What groups the four portions (A-D) represent respectively ?



Option

	A	B	C	D
(1)	Insects	Crustaceans	Other animal groups	Molluscs
(2)	Crustaceans	Insects	Molluscs	Other animal groups
(3)	Molluscs	Other animals groups	Crustaceans	Insects
(4)	Insects	Molluscs	Crustaceans	Other animal groups

अकशेरूकी की वैश्विक जीव विविधता का अनुपातिक विस्तार नीचे दिये गया है। चार समूह(A-D) किस का प्रतिनिधित्व करते है?



Option

	A	B	C	D
(1)	कीट	क्रस्टैशिया	अन्य प्राणी समूह	मोलस्क
(2)	क्रस्टैशिया	कीट	मोलस्क	अन्य प्राणी समूह
(3)	मोलस्क	अन्य प्राणी समूह	क्रस्टैशिया	कीट
(4)	कीट	मोलस्क	क्रस्टैशिया	अन्य प्राणी समूह

Ans. **(4)**

Sol. The insects comprise largest number of species in the animal kingdom while Mollusca is the second largest animal phylum.

जन्तु जगत में जातियों की सर्वाधिक संख्या कीटों की हैं जबकि मोलस्का दूसरा सर्वाधिक बड़ा जन्तु संघ है।

179. A scrubber in the exhaust of a chemical industrial plant removes :

(1) Gases like sulphur dioxide

(2) Particulate matter of the size 5 micrometer or above

(3) Gases like ozone and methane

(4) Particulate matter of the size 2.5 micrometer or less

एक रासायनिक प्रोद्योगिक संस्थान के निकास में लगा हुआ स्क्रबर क्या हटाता है ?

(1) सल्फर डाईऑक्साइड जैसी गैस

(2) 5 माइक्रोमीटर के या उससे बड़े कणकीय पदार्थ।

(3) ओजोन और मीथेन जैसी गैस

(4) 2.5 माइक्रोमीटर के या इससे छोटे कणकीय पदार्थ

Ans. **(4)**

180. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain ?

plant → mice → snake → peacock

(1) 0.02 J (2) 0.002 J (3) 0.2 J (4) 0.0002 J

यदि 20 J ऊर्जा उत्पादक स्तर पर पर रोक ली जाती है तो, कितनी ऊर्जा भोजन के तौर पर निम्नलिखित श्रृंखला के अन्तर्गत मोर को उपलब्ध होगी ?

पौधा → माइस → सांप → मोर

(1) 0.02 J (2) 0.002 J (3) 0.2 J (4) 0.0002 J

Ans. **(1)**

Sol. **10% rule of Lindman is applicable**

plant → mice → snake → peacock

20J 2J 0.2J 0.02J

यहाँ लिण्डमेन का **10%** नियम लागू होता है

पौधा → चूहा → सांप → मोर

20J 2J 0.2J 0.02J

AIPMT
SAMPLE PAPERS WITH SOLUTIONS

1. Which two of the following five physical parameters have the same dimensions?

(a) energy density (b) refractive index

(c) dielectric constant (d) Young's modulus

(e) magnetic field

(1) (a) and (e) (2) (b) and (d)

(3) (c) and (e) (4) (a) and (d)

Sol. Answer (4)

Energy density and Young's modulus have same dimensional formula.

2. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

(1) 2% (2) 4%

(3) 6% (4) 8%

Sol. Answer (3)

$$\frac{\Delta V}{V} = \frac{3\Delta R}{R}$$

3. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}$ ms^{-2}, in the third second is

(1) $\frac{19}{3}$m (2) 6 m

(3) 4 m (4) $\frac{10}{3}$m

Sol. Answer (4)

$$S_{n^{th}} = u + \frac{a}{2}(2n-1)$$

4. A particle moves in a straight line with a constant acceleration. It changes its velocity from 10 ms^{-1} to 20 ms^{-1} while passing through a distance 135 m in t second. The value of t is

(1) 9 (2) 10

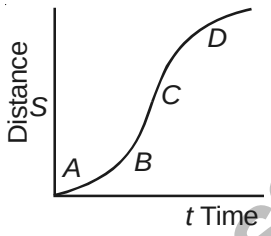
(3) 1.8 (4) 12

Sol. Answer (1)

$$a = \frac{V_f^2 - V_i^2}{2S}, \; t = \frac{V_f - V_i}{a}$$

or $S = \frac{1}{2}(u + v)\, t$

5. A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point



(1) A (2) B

(3) C (4) D

Sol. Answer (3)

Maximum slope is at C.

6. A particle of mass m is projected with velocity v making an angle of 45° with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be

(1) zero (2) 2 mv

(3) $mv/\sqrt{2}$ (4) $mv\sqrt{2}$

Sol. Answer (4)

Momentum change = 2 mv sinθ

7. Sand is being dropped on a conveyor belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be

(1) Zero

(2) Mv newton

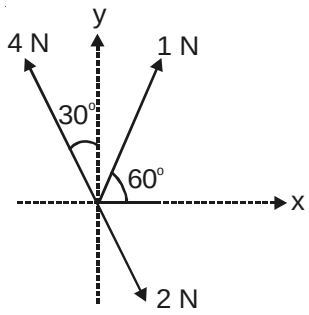
(3) 2 Mv newton

(4) $\frac{Mv}{2}$ newton

Sol. Answer (2)

Force $= \frac{du}{dt} = Mv$

8. Three forces acting on a body are shown in the figure. To have the resultant force only along the y-direction, the magnitude of the force that is needed is



(1) $\sqrt{3}$ N

(2) 0.5 N

(3) 1.5 N

(4) $\frac{\sqrt{3}}{4}$N

Sol. Answer (2)

Net force along x-axis zero.

Let the unknown force be F along x-axis

$\therefore F + 1 \sin 30^o + 2 \sin 30° - 4 \sin 30° = 0$

$\therefore |F| = 0.5\ N$

9. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine? (g = 10 m/s^2)

(1) 7.0 kW

(2) 8.1 kW

(3) 10.2 kW

(4) 12.3 kW

Sol. Answer (2)

$P = 0.9\ gH\ \frac{dm}{dt}$

10. A shell of mass 200 gm is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is

(1) 120 ms^{-1}

(2) 100 ms^{-1}

(3) 80 ms^{-1}

(4) 40 ms^{-1}

Sol. Answer (2)

Let the initial velocity of the shell be v, then velocity of gun is $\left(\frac{0.2v}{4}\right)$. (from conservation of linear moment)

Now $1.05 \times 10^3 = \frac{1}{2}(0.2)v^2 + \frac{1}{2}(4)\left(\frac{0.2v}{4}\right)^2 \Rightarrow v = 100$ m/s

11. The ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and radius, around their respective axes is

(1) $\sqrt{2} : \sqrt{3}$ (2) $\sqrt{3} : \sqrt{2}$

(3) $1 : \sqrt{2}$ (4) $\sqrt{2} : 1$

Sol. Answer (3)

$$\frac{I_{disc}}{I_{ring}} = \frac{MR^2/2}{MR^2} = \frac{MK^2_{disc}}{MK^2_{ring}}$$

$$\Rightarrow \quad \frac{K_{disc}}{K_{ring}} = \frac{1}{\sqrt{2}}$$

12. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90^o. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is

(1) $\frac{\sqrt{2}ML^2}{24}$ (2) $\frac{ML^2}{24}$

(3) $\frac{ML^2}{12}$ (4) $\frac{ML^2}{6}$

Sol. Answer (3)

Distribution of masses about axis of rotation remain unchanged wheather it is straight or bend.

$$I = \frac{ML^2}{12}$$

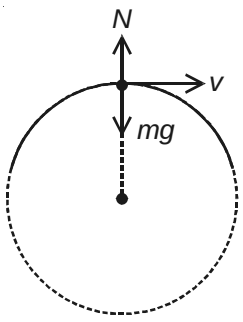
13. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between

(1) 13 m/s and 14 m/s (2) 14 m/s and 15 m/s

(3) 15 ms/ and 16 m/s (4) 16 m/s and 17 m/s

Sol. Answer (2)

Actually, $mg - N = \frac{mv^2}{r}$



For weightlessness, $N = 0$

$\therefore \quad mg = \frac{mv^2}{r}$

$v = \sqrt{gr}$

$= \sqrt{10 \times 20}\ ms^{-1} = 14.14\ ms^{-1}$

14. If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then

(1) Q = 0 (2) W = 0

(3) Q = W = 0 (4) E = 0

Sol. Answer (4)

From the 1st law of thermodynamics,

$Q = E + W$

For cyclic process, $E = 0$, $\therefore Q = W \neq 0$

15. On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39° W and 239° W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39° C on the Celsius scale?

(1) 139° W (2) 78° W

(3) 117° W (4) 200° W

Sol. Answer (3)

$$\frac{39-0}{100-0} = \frac{x-39}{239-39}$$

$$\Rightarrow \quad x = 117^\circ\ W$$

16. At 10°C the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At 110°C this ratio is

(1) $\frac{283}{383}x$ (2) x

(3) $\frac{383}{283}x$ (4) $\frac{10}{110}x$

Sol. Answer (1)

$PV = nRT$

$$\Rightarrow \quad P.\frac{m}{\rho} = \frac{m}{M}RT$$

$$\Rightarrow \quad \frac{\left(\frac{\rho}{P}\right)_f}{\left(\frac{\rho}{P}\right)_i} = \frac{T_i}{T_f} = \frac{10+273}{110+273} = \frac{283}{383}$$

$$\Rightarrow \quad \frac{\left(\frac{\rho}{P}\right)_f}{x} = \frac{283}{383}$$

$$\therefore \quad \left(\frac{\rho}{P}\right)_f = \frac{283}{383}x$$

17. Two Simple Harmonic Motions of angular frequency 100 and 1000 rad s^{-1} have the same displacement amplitude. The ratio of their maximum accelerations is

(1) $1 : 10^4$ (2) $1 : 10$

(3) $1 : 10^2$ (4) $1 : 10^3$

Sol. Answer (3)

$$\frac{(a_{max})_1}{(a_{max})_2} = \frac{\omega_1^2 A}{\omega_2^2 A} = \left(\frac{100}{1000}\right)^2 = \frac{1}{10^2}$$

18. The wave described by $y = 0.25 \sin(10\pi x - 2\pi t)$, where x and y are in meters and t in seconds, is a wave travelling along the

(1) –ve x direction with amplitude 0.25 m and wavelength $\lambda = 0.2$ m

(2) –ve x direction with frequency 1 Hz

(3) +ve x direction with frequency π Hz and wavelength $\lambda = 0.2$ m

(4) +ve x direction with frequency 1 Hz and wavelength $\lambda = 0.2$ m

Sol. Answer (4)

Give, $y = 0.25 \sin (10\pi x - 2\pi t)$

Comparing with $y = A \sin\left(\frac{2\pi}{\lambda}. x - 2\pi nt\right)$, we get,

$\lambda = 0.2$ m

$n = 1$ Hz, –ve sign indicates, the x direction.

19. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = a sin(wt + π/6). After the elapse of what fraction of the time period the velocity of the point will be equal to half of its maximum velocity?

(1) $\frac{T}{12}$ (2) $\frac{T}{8}$

(3) $\frac{T}{6}$ (4) $\frac{T}{3}$

Sol. Answer (1)

$$v = \omega a \cos\left(\omega t + \frac{\pi}{6}\right)$$

$$\Rightarrow \frac{\omega a}{2} = \omega a \cos\left(\frac{2\pi}{T} t + \frac{\pi}{6}\right)$$

$$\Rightarrow \frac{\pi}{3} = \frac{2\pi}{T} t + \frac{\pi}{6}$$

$$\Rightarrow t = \frac{T}{12}$$

20. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 sec and the velocity of the wave is 300 m/sec. What is the phase difference between the oscillations of two points?

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{3}$

(3) $\frac{2\pi}{3}$ (4) π

Sol. Answer (3)

Phase difference $\phi = \frac{2\pi}{\lambda} \times$ path difference

$= \frac{2\pi}{15} \times (15 - 10)$ $\{\lambda = vT = 300 \times 0.05 \text{ m}\}$

$= \frac{2\pi}{5}$

21. The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by

(1) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$ (2) $\sqrt{\frac{\varepsilon_0}{\mu_0}}$

(3) $\sqrt{\mu_0 \varepsilon_0}$ (4) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

Sol. Answer (4)

$v = \frac{1}{\sqrt{\mu_0 \in_0}}$

22. Two periodic waves of intensities I_1 and I_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

(1) $2(I_1 + I_2)$ (2) $I_1 + I_2$

(3) $(\sqrt{I_1} + \sqrt{I_2})^2$ (4) $(\sqrt{I_1} - \sqrt{I_2})^2$

Sol. Answer (1)

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2$

$\therefore \quad I_{max} + I_{min} = 2\,(I_1 + I_2)$

23. Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combinations is

(1) $\frac{f_1 + f_2}{f_1 f_2}$ (2) $\sqrt{\frac{f_1}{f_2}}$

(3) $\sqrt{\frac{f_2}{f_1}}$ (4) $\frac{f_1 + f_2}{2}$

Sol. Answer (1)

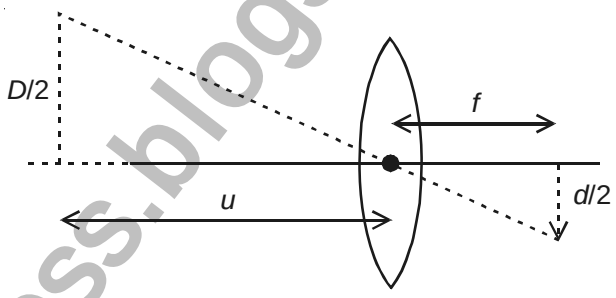
$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\Rightarrow \quad P = \frac{f_1 + f_2}{f_1 f_2}$$

24. A boy is trying to start a fire by focusing Sunlight on a piece of paper using an equiconvex lens of focal length 10 cm. The diameter of the Sun is 1.39×10^9 m and its mean distance from the earth is 1.5×10^{11} m. What is the diameter of the Sun's image on the paper?

(1) 12.4×10^{-4} m
(2) 9.2×10^{-4} m
(3) 6.5×10^{-4} m
(4) 6.5×10^{-5} m

Sol. Answer (2)



Here, $\frac{D/2}{u} = \frac{d/2}{f}$

$$\Rightarrow \quad d = \frac{Df}{u}$$

$$= \frac{1.39 \times 10^9 \times 10 \times 10^{-2}}{1.5 \times 10^{11}} = 9.2 \times 10^{-4} \text{ m}$$

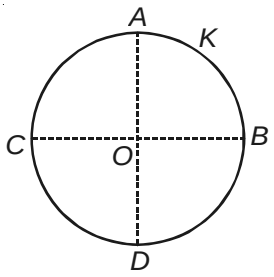
25. The energy required to charge a parallel plate condenser of plate separation d and plate area of cross-section A such that the uniform electric field between the plates is E, is

(1) $\frac{1}{2}\varepsilon_0 E^2 Ad$
(2) $\frac{1}{2}\varepsilon_0 E^2 / A.d$
(3) $\varepsilon_0 E^2 / Ad$
(4) $\varepsilon_0 E^2 Ad$

Sol. Answer (1)

Energy required = $\frac{1}{2}CV^2 = \frac{1}{2}\varepsilon_0 E^2 \text{Ad}$

26. A thin conducting ring of radius R is given a charge +Q. The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part $ACDB$ of the ring is



(1) 3 E along OK
(2) 3 E along KO
(3) E along OK
(4) E along KO

Sol. Answer (3)

$$E_0 = 0$$

$$\vec{E}_{AKB} + \vec{E}_{ACDB} = 0$$

$$\Rightarrow \quad \vec{E}_{ACDB} = {}^{(-)}\vec{E}_{AKB}$$

$$= -E \text{ (along } KO)$$

$$= E \text{ (along } OK)$$

27. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is

(1) $12\pi\varepsilon_0 Q \times 10^{22}$ volt/m (2) $4\pi\varepsilon_0 Q \times 10^{22}$ volt/m

(3) $12\pi\varepsilon_0 Q \times 10^{20}$ volt/m (4) $4\pi\varepsilon_0 Q \times 10^{20}$ volt/m

Sol. Answer (2)

$$V = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{R} = Q \times 10^{11} \text{ volt} \qquad \text{...(i)}$$

$$E = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{R^2} = \frac{V}{R} = Q \times 10^{11} \times 4\pi\varepsilon_0 \times 10^{11} \text{ [from ...(i)]}$$

$$= 4\pi\varepsilon_0 Q \times 10^{22} \text{ volt/m}$$

28. A cell can be balanced against 110 cm and 100 cm of potentiometer wire, respectively with and without being short circuited through a resistance of 10Ω. Its internal resistance is

(1) Zero (2) 1.0 ohm

(3) 0.5 ohm (4) 2.0 ohm

Sol. Answer (2)

$$\text{Internal resistance} = \left(\frac{110}{100} - 1\right) \times 10\Omega$$

29. A wire of a certain material is stretched slowly by ten per cent. It new resistance and specific resistance become respectively

(1) 1.1 times, 1.1 times (2) 1.2 times, 1.1 times

(3) 1.21 times, same (4) Both remain the same

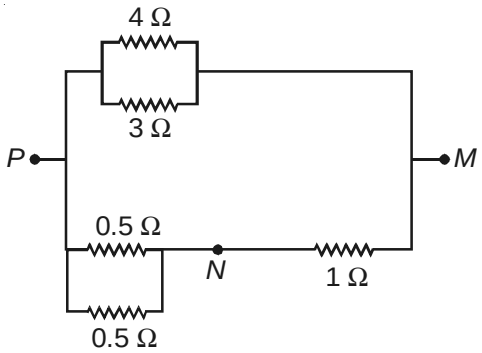
Sol. Answer (3)

$$\frac{R_2}{R_1} = \left(\frac{l_2}{l_1}\right)^2 = \left(\frac{1.1 l_1}{l_1}\right)^2 = 1.21$$

$$R_2 = 1.21 R_1$$

specific resistance is material property which remains unchanged here.

30. In the circuit shown, the current through the 4Ω resistor is 1 amp when the points *P* and *M* are connected to a d.c. voltage source. The potential difference between the points *M* and *N* is



(1) 3.2 volt (2) 1.5 volt

(3) 1.0 volt (4) 0.5 volt

Sol. Answer (1)

Potential difference between *P* and *M* = 1 × 4 = 4 volt

Potential drop between points *M* and *N* = $\frac{4\times1}{1+0.25}$ = 3.2 V

31. An electric kettle takes 4A current at 220 V. How much time will it take to boil 1 kg of water from temperature 20°C? The temperature of boiling water is 100°C.

(1) 4.2 min (2) 6.3 min

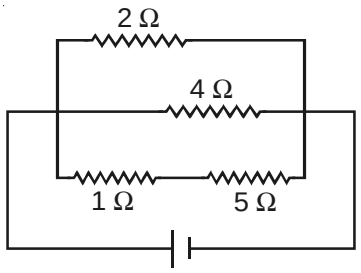
(3) 8.4 min (4) 12.6 min

Sol. Answer (2)

$Vi\,t = mc\Delta\theta$

$t = \frac{1\times4200\times80}{220\times4}$ = 381.8 s = 6.36 min

32. A current of 3 amp. flows through the 2 Ω resistor shown in the circuit. The power dissipated in the 5 Ω resistor is



(1) 5 watt (2) 4 watt

(3) 2 watt (4) 1 watt

Sol. Answer (1)

Potential difference across 2Ω = 6V

Current through 5Ω = $\frac{6}{6}$ = 1A

Power dissipated in 5Ω = $(1)^2 \times 5$ = 5 Watt

33. A particle of mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction $\vec{B}$. After 2 seconds the kinetic energy of the particle will be

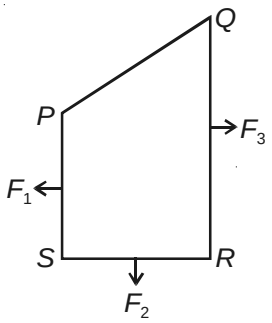
(1) 4 T (2) 3 T

(3) 2 T (4) T

Sol. Answer (4)

Work done by magnetic field on charge particle is zero. Therefore its kinetic energy will be same i.e. T

34.

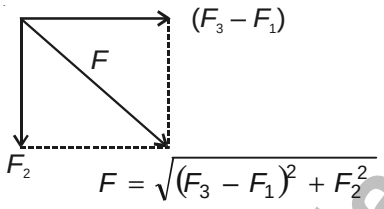


A closed loop $PQRS$ carrying a current is placed in a uniform magnetic field. If the magnetic forces on segments PS, SR and RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown, the force on the segment QP is

(1) $F_3 - F_1 + F_2$ (2) $F_3 - F_1 - F_2$

(3) $\sqrt{(F_3 - F_1)^2 + F_2^2}$ (4) $\sqrt{(F_3 - F_1)^2 - F_2^2}$

Sol. Answer (3)



Since net force on current carrying loop in uniform magnetic field is zero therefore force on remaining segment will be equal and opposite to F.

35. A circular disc of radius 0.2 meter is placed in a uniform magnetic field of induction $\frac{1}{\pi}\left(\frac{\omega b}{m^2}\right)$ in such a way that its axis makes an angle of 60° with $\vec{B}$. The magnetic flux linked with the disc is

(1) 0.01 ωb (2) 0.02 ωb

(3) 0.06 ωb (4) 0.08 ωb

Sol. Answer (2)

Magnetic flux = $BA\cos\theta = \frac{1}{\pi} \times \pi(0.2)^2 \times \cos 60°$

$= 0.04 \times \frac{1}{2} = 0.02$ ωb

36. A galvanometer of resistance 50 Ω is connected to a battery of 3 V along with a resistance of 2950 Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 divisions, the resistance in series should be

(1) 4450 Ω (2) 5050 Ω

(3) 5550 Ω (4) 6050 Ω

Sol. Answer (1)

$30\ i_0 = \dfrac{V}{R_g + 2950}$; $R_g = 50\Omega$

$20\ i_0 = \dfrac{V}{R_g + R} \Rightarrow R = 4450\Omega$

37. Curie temperature is the temperature above which

(1) Ferromagnetic material becomes diamagnetic material

(2) Ferromagnetic material becomes paramagnetic material

(3) Paramagnetic material becomes diamagnetic material

(4) Paramagnetic material becomes ferromagnetic material

Sol. Answer (2)

Above curie temperature domains break down, hence ferromagnetic substances become paramagnetic.

38. A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is 4×10^{-3} ωb. The self-inductance of the solenoid is

(1) 4.0 henry (2) 2.5 henry

(3) 2.0 henry (4) 1.0 henry

$N\phi = Li$

$500 \times 4 \times 10^{-3} = 2L$

$L = 1.0$ henry

Sol. Answer (4)

39. In an a.c. circuit the e.m.f. (e) and the current (i) at any instant are given respectively by

$e = E_0 \sin\omega t$

$i = I_0 \sin(\omega t - \phi)$

The average power in the circuit over one cycle of a.c. is

(1) $E_0 I_0$ (2) $\dfrac{E_0 I_0}{2}$

(3) $\dfrac{E_0 I_0}{2}\sin\phi$ (4) $\dfrac{E_0 I_0}{2}\cos\phi$

Sol. Answer (4)

Since phase difference between current and e.m.f is ϕ

$\therefore\ P_{av} = \dfrac{E_0 I_0}{2}\cos\phi$

40. In the phenomenon of electric discharge through gases at low pressure, the coloured glow in the tube appears as a result of

(1) Collision between different electrons of the atoms of the gas

(2) Excitation of electrons in the atoms

(3) Collision between the atoms of the gas

(4) Collisions between the charged particles emitted from the cathode and the atoms of the gas

Sol. Answer (2)

Due to excitation of electrons in atoms.

41. The work function of a surface of a photosensitive material is 6.2 eV. The wavelength of the incident radiation for which the stopping potential is 5 V lies in the

(1) X-ray region

(2) Ultraviolet region

(3) Visible region

(4) Infrared region

Sol. Answer (2)

$eV_0 = E - \phi$

$E = eV_0 + \phi$

$= 5eV + 6.2\ eV$

$= 11.2\ eV$

$\therefore \quad \lambda = \left(\frac{12400}{11.2}\right) Å \approx 1000\ Å$

$\Rightarrow$ hence lies in ultraviolet region.

42. A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of 3×10^6 ms^{-1}. The velocity of the particle is (mass of electron = 9.1×10^{-31} kg)

(1) 2.7×10^{-21} ms^{-1}

(2) 2.7×10^{-18} ms^{-1}

(3) 9×10^{-2} ms^{-1}

(4) 3×10^{-31} ms^{-1}

Sol. Answer (2)

Same momentum of both particles

$1 \times 10^{-3} \times v = 9 \times 10^{-31} \times 3 \times 10^6$

$v = 2.7 \times 10^{-18}$ m/s

43. The ground state energy of hydrogen atom is –13.6 eV. When its electron is in the first excited state, its excitation energy is

(1) 0

(2) 3.4 eV

(3) 6.8 eV

(4) 10.2 eV

Sol. Answer (4)

Excitation energy = $E_f - E_i$

$= -3.4 - (-13.6) = 10.2$ eV

44. Two radioactive materials X_1 and X_2 have decay constants 5λ and λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time

(1) $\frac{e}{\lambda}$ (2) λ

(3) $\frac{1}{2}\lambda$ (4) $\frac{1}{4\lambda}$

Sol. Answer (4)

$$\frac{N_{x_1}}{N_{x_2}} = \frac{e^{-5\lambda t}}{e^{-\lambda t}} = \frac{1}{e}$$

$$\Rightarrow \quad t = \frac{1}{4\lambda}$$

45. Two nuclei have their mass numbers in the ratio of 1:3. The ratio of their nuclear densities would be

(1) 1 : 1 (2) 1 : 3

(3) 3 : 1 (4) $(3)^{1/3}$: 1

Sol. Answer (1)

Density is independent of mass number of nuclei.

46. If $M(A; Z)$, M_p and M_n denote the masses of the nucleus ${}^{A}_{Z}X$, proton and neutron respectively in units of u (1u = 931.5 MeV / C^2) and BE represents its bonding energy in MeV, then

(1) $M(A, Z) = ZM_p + (A - Z)\, M_n + BE / C^2$ (2) $M(A, Z) = ZM_p + (A - Z)\, M_n - BE / C^2$

(3) $M(A, Z) = ZM_p + (A - Z)\, M_n + BE$ (4) $M(A, Z) = ZM_p + (A - Z)\, M_n - BE$

Sol. Answer (2)

$$BE = \left[ZM_p + (A - Z)\, M_n - M(A, Z)\right]C^2$$

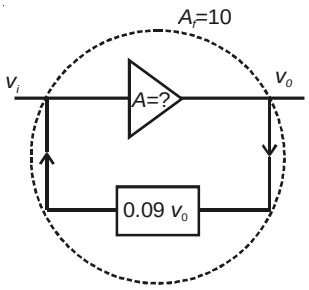
47. The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be

(1) 100 (2) 90

(3) 10 (4) 1.25

Sol. Answer (1)

Given $\frac{v_0}{v_i} = 10$



and $(v_i - 0.09\, v_0)\, A = v_0$

$\Rightarrow \quad A = 100$

48. If the lattice parameter for a crystalline structure is 3.6 Å, then the atomic radius in fcc crystal is

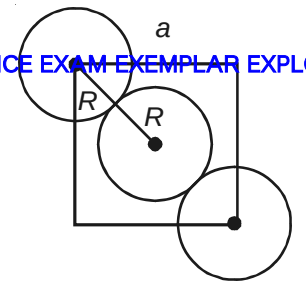
(1) 1.27 Å (2) 1.81 Å

(3) 2.10 Å (4) 2.92 Å

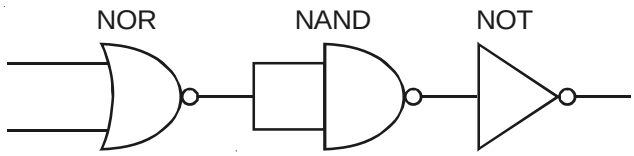
Sol. Answer (1)

$2R = \frac{a}{\sqrt{2}}$

$\therefore\ R = \frac{a}{2\sqrt{2}}$



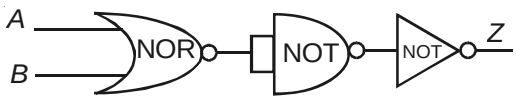
49. The circuit



is equivalent to

(1) OR gate
(2) AND gate
(3) NAND gate
(4) NOR gate

Sol. Answer (4)



A	B	Z
0	0	1
0	1	0
1	0	0
1	1	0

Hence NOR gate

50. A *p-n* photodiode is made of a material with a band gap of 2.0 eV. The minimum frequency of the radiation that can be absorbed by the material is nearly

(1) 20×10^{14} Hz
(2) 10×10^{14} Hz
(3) 5×10^{14} Hz
(4) 1×10^{14} Hz

Sol. Answer (3)

$\nu = \frac{E}{h} = 5 \times 10^{14}$ Hz

51. If uncertainty in position and momentum are equal, then uncertainty in velocity is

(1) $\sqrt{\frac{h}{\pi}}$
(2) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$
(3) $\sqrt{\frac{h}{2\pi}}$
(4) $\frac{1}{m}\sqrt{\frac{h}{\pi}}$

Sol. Answer (2)

$\Delta x = \Delta p$

$\Delta p^2 = \frac{h}{4\pi}$

or $\Delta p = \frac{1}{2}\sqrt{\frac{h}{\pi}}$

or $m\Delta v = \frac{1}{2}\sqrt{\frac{h}{\pi}}$

or $\Delta v = \frac{1}{2m}\sqrt{\frac{h}{\pi}}$

52. If a gas expands at constant temperature, it indicates that

(1) Number of the molecules of gas increases
(2) Kinetic energy of molecules decreases
(3) Pressure of the gas increases
(4) Kinetic energy of molecules remains the same

Sol. Answer (4)

Kinetic energy of gaseous molecules depends on temperature only.

53. The value of equilibrium constant of the reaction

$HI(g) \rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_2$ is 8.0

The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ will be

(1) $\frac{1}{8}$
(2) $\frac{1}{16}$
(3) $\frac{1}{64}$
(4) 16

Sol. Answer (3)

$HI \rightleftharpoons \frac{1}{2}H_2 + \frac{1}{2}I_2, K_1 = 8.0$

or $2HI \rightleftharpoons H_2 + I_2, K_2 = 64$

or $H_2 + I_2 \rightleftharpoons 2HI, K_3 = \frac{1}{64}$

54. If 'a' stands for the edge length of the cubic systems : simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively

(1) $1a : \sqrt{3}a : \sqrt{2}a$
(2) $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$
(3) $\frac{1}{2}a : \sqrt{3}a : \frac{1}{\sqrt{2}}a$
(4) $\frac{1}{2}a : \frac{\sqrt{3}}{2}a : \frac{\sqrt{2}}{2}a$

Sol. Answer (2)

For simple cubic, $a = 2r$

or $r = \frac{a}{2}$

For BCC, $4r = \sqrt{3}a$

or $r = \frac{\sqrt{3}}{4}a$

For FCC, $4r = \sqrt{2}a$

or $r = \frac{a}{2\sqrt{2}}$

Thus, the ratio is $\frac{1}{2}a : \frac{\sqrt{3}}{4}a : \frac{1}{2\sqrt{2}}a$

55. Kohlrausch's law states that at

(1) Infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte

(2) Finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte

(3) Infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte

(4) Infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte

Sol. Answer (1)

Kohlrausch's law states, "at infinite dilution each ion contributes its fixed value towards equivalent conductance irrespective of the other ion in combination with it at fixed temperature."

56. The measurement of the electron position is associated with an uncertainty in momentum, which is equal to 1×10^{-18} g cm s^{-1}. The uncertainty in electron velocity is, (mass of an electron is 9×10^{-28} g)

(1) 1×10^{11} cm s^{-1} (2) 1×10^{9} cm s^{-1}

(3) 1×10^{6} cm s^{-1} (4) 1×10^{5} cm s^{-1}

Sol. Answer (2)

$\Delta p = 1 \times 10^{-18}$ g cm s^{-1}

or $\Delta p = m\Delta v$

or $\Delta v = \frac{\Delta p}{m} = \frac{1 \times 10^{-18}}{9 \times 10^{-28}} \simeq 1 \times 10^{9}$ cm/second

57. Which of the following are not state functions?

(I) q + w (II) q

(III) w (IV) H-TS

(1) (II) and (III) (2) (I) and (IV)

(3) (II), (III) and (IV) (4) (I), (II) and (III)

Sol. Answer (1)

$\Delta U = q + w$

$\Delta G = \Delta H - T\Delta S$

ΔU and ΔG are state functions but q and w are not state functions.

58. The bromination of acetone that occurs in acid solution is represented by this equation

$$CH_3COCH_3(aq) + Br_2(aq) \rightarrow CH_3COCH_2Br(aq) + H^+(aq) + Br^-(aq)$$

These kinetic data were obtained for given reaction concentrations

Initial concentrations, M			Initial rate, disappearance of Br_2, M s^{-1}
$[CH_3COCH_3]$	$[Br_2]$	$[H^+]$	
0.30	0.05	0.05	5.7×10^{-5}
0.30	0.10	0.05	5.7×10^{-5}
0.30	0.10	0.10	1.2×10^{-4}
0.40	0.05	0.20	3.1×10^{-4}

Based on these data, the rate equation is

(1) Rate = $k[CH_3COCH_3][Br_2][H^+]$ (2) Rate = $k[CH_3COCH_3][H^+]$

(3) Rate = $k[CH = COCH_3][Br_2]$ (4) Rate = $k[CH_3COCH_3][Br_2][H^+]^2$

Sol. Answer (2)

In experiment (1) and (2), rate doesn't depend on the concentration of Br_2. So, rate expression will not include $[Br_2]$.

59. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?

(1) 10 L (2) 7 L

(3) 6 L (4) 5 L

Sol. Answer (4)

$$\underset{22.4L\text{ at STP}}{C_3H_8(g)} + \underset{5\times22.4L\text{ at STP}}{5O_2(g)} \rightarrow 3CO_2(g) + 4H_2O(l)$$

$\because$ 22.4 L C_3H_8 at STP $\equiv$ 5 × 22.4 L of O_2 at STP

$\therefore$ 1 L C_3H_8 at STP $\equiv \frac{5 \times 22.4}{22.4}$ of O_2 at STP

= 5 L of O_2 at NTP

60. Bond dissociation enthalpy of H_2, Cl_2 and HCl are 434, 242 and 431 kJmol^{-1} respectively. Enthalpy of formation of HCl is

(1) 245 kJmol^{-1} (2) 93 kJmol^{-1}

(3) –245 kJmol^{-1} (4) –93 kJmol^{-1}

Sol. Answer (4)

$2[H] + 2[Cl] \longrightarrow 2HCl,\ \Delta H = -862\ kJ\ mol^{-1}$

$H_2 \longrightarrow 2[H],\ \Delta H = 434\ kJ$

$Cl_2 \longrightarrow 2[Cl],\ \Delta H = 242\ kJ$

$H_2 + Cl_2 \longrightarrow 2HCl,\ \Delta H = -186\ kJ$

$\therefore\ \Delta H_f$ of $HCl = \dfrac{-186}{2} = -93\ kJ\ mol^{-1}$

61. Which of the following statements is not correct?

(1) The number of Bravais lattices in which a crystal can be categorized is 14

(2) The fraction of the total volume occupied by the atoms in a primitive cell is 0.48

(3) Molecular solids are generally volatile

(4) The number of carbon atoms in an unit cell of diamond is 4

Sol. Answer (4)

Diamond has ZnS type structure. So, no. of atoms in a unit cell of diamond is 8.

Note : But option (2) is also incorrect because the fraction of the total volume occupied by the atoms in a cubic primitive cells is 0.524.

62. Equal volumes of three acid solutions of pH 3, 4 and 5 are mixed in a vessel. What will be the H^+ ion concentration in the mixture?

(1) 1.11×10^{-3} M (2) 1.11×10^{-4} M

(3) 3.7×10^{-4} M (4) 3.7×10^{-3} M

Sol. Answer (3)

$N_1V_1 + N_2V_2 + N_3V_3 = N_mV_m$

or $10^{-3} \times 1 + 10^{-4} \times 1 + 10^{-5} \times 1 = N_m \times 3$

or $1.11 \times 10^{-3} = N_m \times 3$

or $N_m = 0.37 \times 10^{-3}$

$[H^+] = 3.7 \times 10^{-4}$ M

63. The values of K_{p_1} and K_{p_2} for the reactions

$X \rightleftharpoons Y + Z$.....(1) and

$A \rightleftharpoons 2B$.....(2)

are in ratio of 9:1. If degree of dissociation of X and A be equal, then total pressure at equilibrium (1) and (2) are in the ratio

(1) 1 : 1 (2) 3 : 1

(3) 1 : 9 (4) 36 : 1

Sol. Answer (4)

$$\underset{1}{N_2} + \underset{0}{3H_2} \rightleftharpoons \underset{1}{2NH_3}$$

$$\underset{1-x}{\quad} \quad \underset{x}{\quad} \quad \underset{x}{\quad} \quad \underset{1-x}{\quad} \quad \underset{2x}{\quad}$$

$$\frac{K_{p_1}}{K_{p_2}} = \frac{\left(\frac{x}{1+x}\times P\right)^2}{\frac{1-x}{1+x}\times P} \Bigg/ \frac{\left(\frac{2x}{1+x}\times P'\right)^2}{\frac{1-x}{1+x}\times P'}$$

or $\frac{K_{p_1}}{K_{p_2}} = \frac{P}{4P'}$ or $\frac{9}{1} = \frac{P}{4P'}$

or $\frac{P'}{P} = 36:1$

64. If the concentration of OH^- ions in the reaction $Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq) + 3OH^-(aq)$ is decreased by $\frac{1}{4}$ times, then equilibrium concentration of Fe^{3+} will increase by

(1) 4 times (2) 8 times

(3) 16 times (4) 64 times

Sol. Answer (4)

To maintain the constant value of K_c, the concentration of Fe^{3+} ion will increase by 64 times.

65. For the gas phase reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ Which of the following conditions is correct?

(1) $\Delta H > 0$ and $\Delta S < 0$ (2) $\Delta H = 0$ and $\Delta S < 0$

(3) $\Delta H > 0$ and $\Delta S > 0$ (4) $\Delta H < 0$ and $\Delta S < 0$

Sol. Answer (3)

This is an endothermic reaction,

So, $\Delta H > 0$

Since, number of mole in the product side is more

So $\Delta S > 0$.

66. The rate constants k_1 and k_2 for two different reactions are $10^{16} \cdot e^{-2000/T}$ and $10^{15} \cdot e^{-1000/T}$ respectively. The temperature at which $k_1 = k_2$ is

(1) $\frac{1000}{2.303}$K (2) 1000 K

(3) $\frac{2000}{2.303}$K (4) 2000 K

Sol. Answer (1)

$K_1 = 10^{16} e^{-\frac{2000}{T}}$

or $\log K_1 = 16 - \frac{2000}{2.303T}$

$K_2 = 10^{15} e^{-\frac{1000}{T}}$

or $\log K_2 = 15 - \frac{1000}{2.303T}$

If $T = \frac{1000}{2.303} K$, then $K_1 = K_2$

67. Standard free energies of formation (in kJ/mol) at 298 K are –237.2, –394.4 and –8.2 for H_2O (l), CO_2 (g) and pentane (g) respectively. The value of E°_{cell} for the pentane-oxygen fuel cell is

(1) 0.0968 V (2) 1.968 V

(3) 2.0968 V (4) 1.0968 V

Sol. Answer (4)

After calculation ΔG^o, use the formula, $\Delta G^o = -nFE^o$

Here, n = 32 is taken because balanced equation is

$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

68. The dissociation equilibrium of a gas AB_2 can be represented as, $2AB_2$ (g) $\rightleftharpoons$ 2AB (g) + B_2 (g). The degree of dissociation is 'x' and is small compared to 1. The expression relating the degree of dissociation (x) with equilibrium constant K_P and total pressure P is

(1) $\left(\frac{K_P}{P}\right)$ (2) $\left(\frac{2K_P}{P}\right)$

(3) $\left(\frac{2K_P}{P}\right)^{1/3}$ (4) $\left(\frac{2K_P}{P}\right)^{1/2}$

Sol. Answer (3)

$2AB_2$	$\rightleftharpoons$	2AB	+	B_2
1		0		0
1 – x		x		x/2

Total mole at equi. = $1 + \frac{x}{2}$

$\therefore K_P = \frac{\left(\frac{x}{1+x/2} \times P\right)^2 \left(\frac{x/2}{1+x/2} \times P\right)}{\left(\frac{1-x}{1+x/2} \times P\right)^2}$ (Here x is degree of dissociation)

or $K_P = \frac{x^3 P}{2}$

or $x^3 = \frac{2K_P}{P}$

or $x = \left(\frac{2K_P}{P}\right)^{1/3}$

69. The sequence of ionic mobility in aqueous solution is

(1) $Na^+ > K^+ > Rb^+ > Cs^+$ (2) $K^+ > Na^+ > Rb^+ > Cs^+$

(3) $Cs^+ > Rb^+ > K^+ > Na^+$ (4) $Rb^+ > K^+ > Cs^+ > Na^+$

Sol. Answer (3)

More the charge density of ion, more will be the ion-dipole interaction, so more will be hydration of ion and hence less will be the ionic mobility.

70. Percentage of free space in a body centred cubic unit cell is

(1) 28% (2) 30%

(3) 32% (4) 34%

Sol. Answer (3)

32%

In BCC, packing fraction is 68%.

71. The correct order of decreasing second ionisation enthalpy of Ti (22), V (23), Cr (24) and Mn (25) is

(1) Ti > V > Cr > Mn (2) Cr > Mn > V > Ti

(3) V > Mn > Cr > Ti (4) Mn > Cr > Ti > V

Sol. Answer (2)

$Cr\ (24) \rightarrow [Ar]\ 3d^5\ 4s^1$

After removing one electron from chromium, the resulting structure becomes more stable. Hence Cr has higher second ionisation enthalpy.

Thus, the correct order is

$Cr > Mn > V > Ti$

72. How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g of HCl?

(1) 0.029 (2) 0.044

(3) 0.333 (4) 0.011

Sol. Answer (1)

$$\underset{224\ g}{PbO} + \underset{73\ g}{2HCl} \longrightarrow PbCl_2 + H_2O$$

Here, HCl is in excess, hence, PbO is the limiting reactant.

$\because$ 224 g PbO $\equiv$ 1 mole $PbCl_2$

$\therefore$ 6.5 g PbO = $\frac{6.5}{224}$ mole $PbCl_2$

= 0.029 mole

73. Which of the following complexes exhibits the highest paramagnetic behaviour? Where gly = glycine, en = ethylenediamine and bpy = bipyridyl moities). (At. number Ti = 22, V = 23, Fe = 26, Co = 27)

(1) $[Ti(NH_3)_6]^{3+}$ (2) $[V(gly)_2(OH)_2(NH_3)_2]^{+}$

(3) $[Fe(en)(bpy)(NH_3)_2]^{2+}$ (4) $[Co(OX)_2(OH)_2]^{-}$

Sol. Answer (4)

74. Volume occupied by one molecule of water (density = 1 g cm^{-3}) is

(1) 5.5×10^{-23} cm^3 (2) 9.0×10^{-23} cm^3

(3) 6.023×10^{-23} cm^3 (4) 3.0×10^{-23} cm^3

Sol. Answer (4)

Volume of 1 molecule of H_2O = $\frac{18\text{ g}}{6.02\times10^{23}\times1\text{ g/cc}}$

$\cong 3.0\times10^{-23}\text{cm}^3$

75. Number of moles of MnO_4^- required to oxidize one mole of ferrous oxalate completely in acidic medium will be

(1) 0.2 moles (2) 0.6 moles

(3) 0.4 moles (4) 7.5 moles

Sol. Answer (2)

$FeC_2O_4 \longrightarrow Fe^{2+} + 2CO_2 + 3e^-] \times 5$

$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O] \times 3$

$5FeC_2O_4 + 3MnO_4^- + 24H^+ \longrightarrow 5Fe^{3+} + 10CO_2 + 3Mn^{2+} + 12H_2O$

5 mol $FeC_2O_4 \equiv 3$ mol MnO_4^-

$\therefore$ 1 mol $FeC_2O_4 \equiv \frac{3}{5}$ mol MnO_4^-

= 0.6 mol MnO_4^-

76. On the basis of the following E° values, the strongest oxidizing agent is

$[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-} + e^{-1}$; E° = – 0.35 V

$Fe^{2+} \rightarrow Fe^{3+} + e^{-1}$; E° = – 0.77 V

(1) $[Fe(CN)_6]^{3-}$ (2) $[Fe(CN)_6]^{4-}$

(3) Fe^{2+} (4) Fe^{3+}

Sol. Answer (4)

Higher the reduction potential higher will be the oxidising power.

77. The alkali metals from salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders?

(1) LiH > NaH > KH > RbH > CsH
(2) CsH > RbH > KH > NaH > LiH
(3) KH > NaH > LiH > CsH > RbH
(4) NaH > LiH > KH > RbH > CsH

Sol. Answer (1)

Thermal stability of ionic hydrides decreases down the group due to increase in difference in size.

78. Which one of the following arrangements does not give the correct picture of the trends indicated against it?

(1) $F_2 > Cl_2 > Br_2 > I_2$: Electronegativity
(2) $F_2 > Cl_2 > Br_2 > I_2$: Oxidizing power
(3) $F_2 > Cl_2 > Br_2 > I_2$: Electron gain enthalpy
(4) $F_2 > Cl_2 > Br_2 > I_2$: Bond dissociation energy

Sol. Answer (4)

Due to high electron density on F the bond dissociation energy of F_2 is lower and the correct order is

$Cl_2 > Br_2 > F_2 > I_2$.

Note : Electron gain enthalpy is concerned with atoms and not the molecules.

79. With which one of the following elements silicon should be doped so as to give p-type of semiconductor?

(1) Boron
(2) Germanium
(3) Arsenic
(4) Selenium

Sol. Answer (1)

Doping of group 14 elements with elements of group 13 gives p-type semiconductor due to generation of holes.

80. In which of the following coordination entities the magnitude of ΔO (CFSE in octahedral field) will be maximum (at. no. Co = 27)?

(1) $[Co(C_2O_4)_3]^{3-}$
(2) $[Co(H_2O)_6]^{3+}$
(3) $[Co(NH_3)_6]^{3+}$
(4) $[Co(CN)_6]^{3-}$

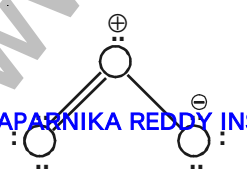
Sol. Answer (4)

$CN^{\ominus}$ is very strong field ligand.

81. The angular shape of molecule (O_3) consists of

(1) 2 singma and 1 pi bond
(2) 1 sigma and 2 pi bonds
(3) 2 sigma and 2 pi bonds
(4) 1 sigma and 1 pi bond

Sol. Answer (1)

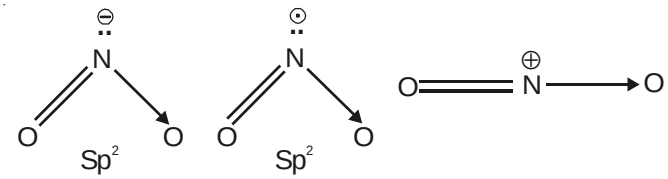


82. The correct order of increasing bond angles in the following triatomic species is

(1) $NO_2^- < NO_2^+ < NO_2$ (2) $NO_2 < NO_2^+ < NO_2^-$

(3) $NO_2^- < NO_2 < NO_2^+$ (4) $NO_2^+ < NO_2 < NO_2^-$

Sol. Answer (3)



(One lone pair) (One odd electron) (No lone pair)

83. Four diatomic species are listed below the different sequences. Which of these presents the correct order of their increasing bond order?

(1) $He_2^+ < O_2^- < NO < C_2^{2-}$ (2) $O_2^- < NO < C_2^{2-} < He_2^+$

(3) $NO < C_2^{2-} < O_2^- < He_2^+$ (4) $C_2^{2-} < He_2^+ < NO < O_2^-$

Sol. Answer (1)

Bond orders of different species are

He^+_2 – 0.5

O^-_2 – 1.5

NO – 2.5

C^{2-}_2 – 3.0

84. Equimolar solutions of the following were prepared in water separately. Which one of the solutions will record the highest pH?

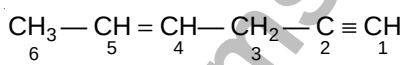
(1) $CaCl_2$ (2) $SrCl_2$

(3) $BaCl_2$ (4) $MgCl_2$

Sol. Answer (3)

pH increases with increase in basicity of aqueous solution. Basicity of halides of s-block in aqueous solution increases down the group.

85. In the hydrocarbon

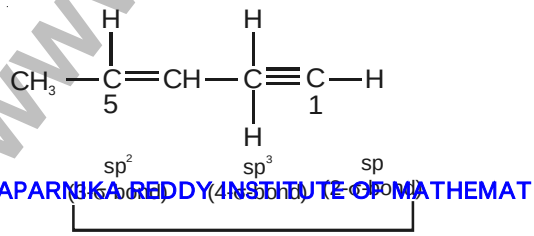


The state of hybridization of carbons 1, 3 and 5 are in the following sequence

(1) sp^3, sp^2, sp (2) sp^2, sp, sp^3

(3) sp, sp^3, sp^2 (4) sp, sp^2, sp^3

Sol. Answer (3)



86. Green chemistry means such reactions which

(1) Study the reactions in plants

(2) Produce colour during reactions

(3) Reduce the use and production of hazardous chemicals

(4) Are related to the depletion of ozone layer

Sol. Answer (3)

Factual

87. A strong base an abstract an α-hydrogen from

(1) Alkane (2) Alkene

(3) Amine (4) Ketone

Sol. Answer (4)

α-hydrogen in ketone is very acidic since its removal gives resonance stabilised carbanions.

88. How many stereoisomers does the molecules have?

$CH_3CH = CHCH_2CHBrCH_3$

(1) 2 (2) 4

(3) 6 (4) 8

Sol. Answer (2)

There is one geometrical and one chiral centre in the molecule. Thus isomers will be

(1) Cis-d form

(2) Trans-d form

(3) Cis-l form

(4) Trans-l form

89. The stability of carbanions in the following

a. $RC{=}C^{\ominus}$ b. 

c. $R_2C{=}\overset{\ominus}{C}H$ d. $R_3C{=}\overset{\ominus}{C}H_2$

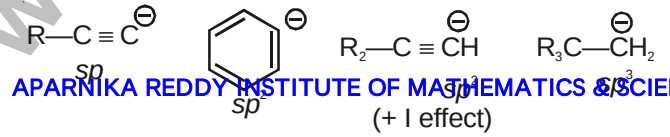
is in the order of

(1) a > c > b > d (2) a > b > c > d

(3) b > c > d > a (4) d > b > c > a

Sol. Answer (2)

Higher is the electronegativity of atom higher will be stability of carbanion on it. Higher is the s-character, higher will be the electronegativity of atom.



90. The relative reactivities of acyl compounds towards nucleophilic substitution are in the order of

(1) Acyl chloride > Ester > Acid anhydride > Amide

(2) Acyl chloride > Acid anhydride > Ester > Amide

(3) Ester > Acyl chloride > Amide > Acid anhydride

(4) Acid anhydride > Amide > Ester > Acyl chloride

Sol. Answer (2)

Better is the leaving group higher will be the reactivity of acyl compounds towards nucleophilic acyl substitution. Weaker is the base, better is the leaving group. Weaker bases are derived from stronger acids.

91. Base strength of

a. $H_3C\overset{\ominus}{C}H_2$

b. $H_2C=\overset{\ominus}{C}H$

c. $H-C\equiv C^{\ominus}$

is in the order of

(1) a > b > c (2) b > a > c

(3) c > b > a (4) a > c > b

Sol. Answer (1)

Stronger is the conjugate acid weaker will be corresponding conjugate base. Acidity of conjugate acids of given carbanions is ⓒ < ⓑ < ⓐ

Thus order of basicity of given carbanions will be ⓐ > ⓑ > ⓒ

92. $H_3C-\underset{\underset{CH_3}{|}}{CH}-CH=CH_2 + HBr \rightarrow A$

A (predominantly) is

(1) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{Br}{|}}{CH}-CH_3$

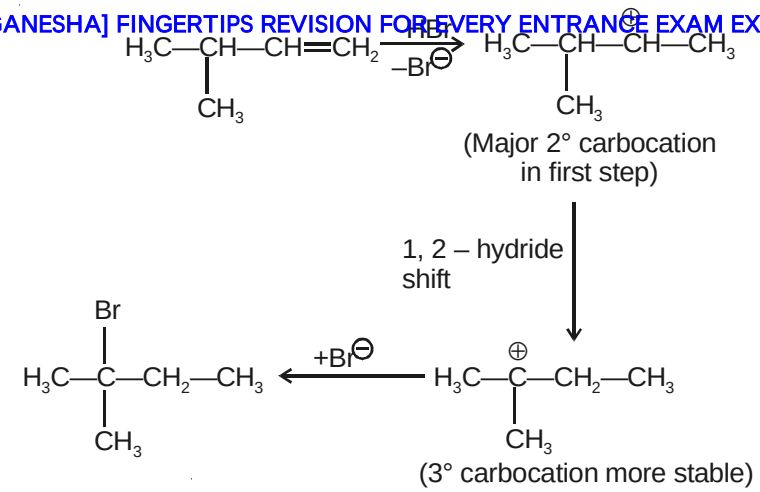
(2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2Br$

(3) $CH_3-\overset{\overset{Br}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2CH_3$

(4) $CH_3-\underset{\underset{Br}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3$

Sol. Answer (3)

Reaction is electrophilic addition which proceeds through carbocation reaction intermediate which undergo hydride shift.



93. In DNA, the complimentary bases are

(1) Uracil and adenine; cytosine and guanine

(2) Adenine and thymine; guanine and cytosine

(3) Adenine and thymine; guanine and uracil

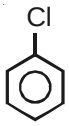
(4) Adenine and guanine; thymine and cytosine

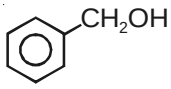
Sol. Answer (2)

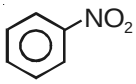
A = = = T

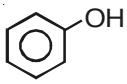
G ≡ ≡ ≡ C

94. Which one the following is most reactive towards electrophilic attack?

(1) 

(2) 

(3) 

(4) 

Sol. Answer (4)

Hydroxy group is most activating group among given options, towards electrophilic attack.

95. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be

(1) CH_4O (2) CH_3O

(3) CH_2O (4) CHO

Sol. Answer (2)

Element	Percentage	Molar ratio	Simple molar rati0
C	38.71	3.22	1
H	9.67	9.67	3
O	51.62	3.22	1

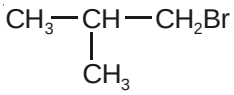
96. In a S_N2 substitution reaction of the type

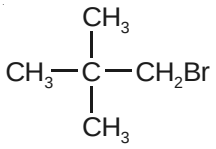
$$R-Br + Cl^{\ominus} \xrightarrow{DMF} R-Cl + Br^{\ominus}$$

Which one of the following has the highest relative rate?

(1) CH_3CH_2Br

(2) $CH_3-CH_2-CH_2Br$

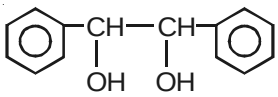
(3) 

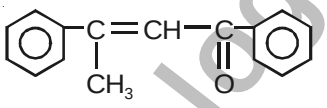
(4) 

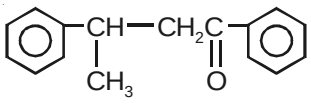
Sol. Answer (1)

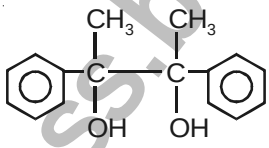
For S_{N^2} reaction, there should be low steric hinderance for better reactivity.

97. Acetophenone when reacted with a base, C_2H_5ONa, yields a stable compound which has the structure?

(1) 

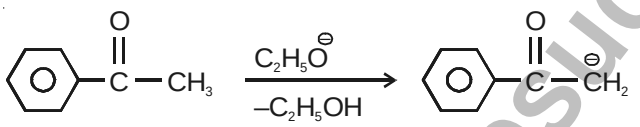
(2) 

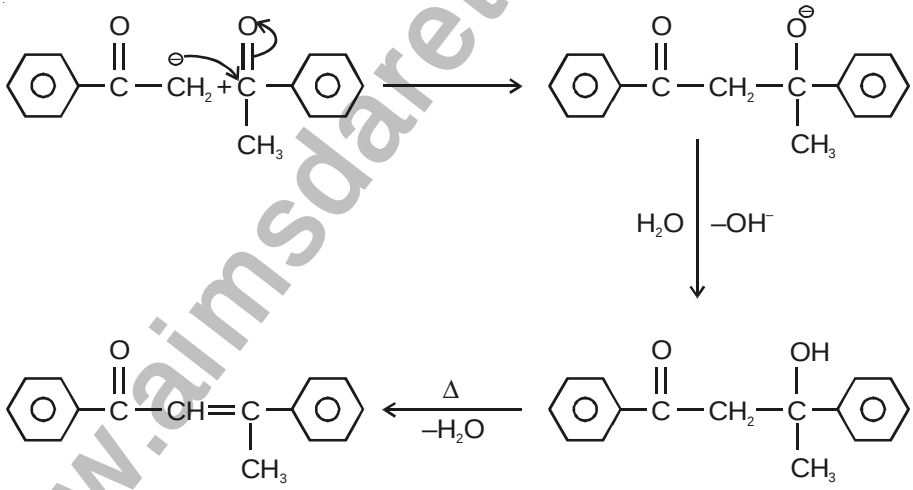
(3) 

(4) 

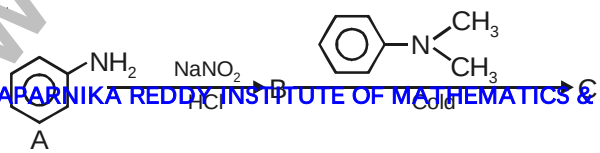
Sol. Answer (2)

It show condensation reaction

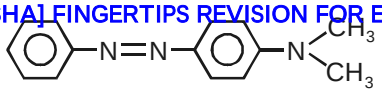


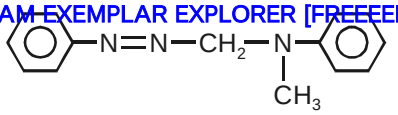


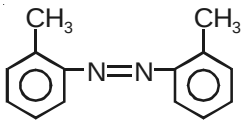
98. In a reaction of aniline a coloured product C was obtained.

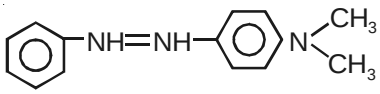


The structure of C would be

(1) 

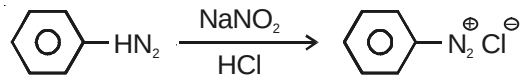
(2) 

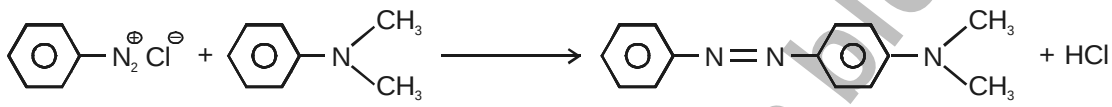
(3) 

(4) 

Sol. Answer (1)

Diazotisation followed electrophillic substitution at para position.





99. Which of the following statements is not true?

(1) Natural rubber is a 1, 4 - polymer of isoprene

(2) In vulcanization, the formation of sulphur bridges between different chains make rubber harder and stronger

(3) Natural rubber has the trans-configuration at every double bond

(4) Buna-S is a copolymer of butadiene and styrene

Sol. Answer (3)

Natural rubber has cis-configuration at each double bond.

Gutta-Percha has trans-configuration of each double bond.

100. Which one of the following is an amine hormone?

(1) Progesterone (2) Thyroxine

(3) Oxypurin (4) Insulin

Sol. Answer (2)

Thyroxine-derived from tyrosine amino acid.

Insulin - Polypeptide.

Progesterone - Steroid hormone.

101. Select one of the following of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms

(1) Embryo development and apical meristem

(2) Absence of resin duct and leaf venation

(3) Presence of vessel elements and absence of archegonia

(4) Perianth and two integuments

Sol. Answer (3)

Members of order Gnetales possess vessels and show absence of archegonia.

102. *Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify

(1) Bacteria that contain cytoskeleton and ribosomes

(2) Archaebacteria that contain protein homologous to eukaryotic core histones

(3) Archaebacteria that lack any histones resembling those found in eukaryoties but whose DNA is negatively supercoiled

(4) Bacteria whose DNA is relaxed or positively supercoiled but which have a cytoskeleton as well as mitochondria

Sol. Answer (3)

Archaebacteria have –ve supercoiled DNA but histones are chemically different in composition from eukaryotes.

103. Which one of the following is heterosporous?

(1) *Equisetum* (2) *Dryopteris*

(3) *Salvinia* (4) *Adiantum*

Sol. Answer (3)

Others are homosporous pteridophytes.

104. In which one of the following male and female gametophytes do not have free living independent existence?

(1) *Cedrus* (2) *Pteris*

(3) *Funaria* (4) *Polytrichum*

Sol. Answer (1)

Cedrus is gymnosperm having reduced dependent gametophytes as pollen and endosperm.

105. Which one of the following groups of three animals each is **correctly** matched with their one characteristic morphological feature?

	Animals		**Morphological feature**
(1)	Cockroach, Locust, *Taenia*	-	Metameric segmentation
(2)	Liver fluke, Sea anemone, Sea cucumber	-	Bilateral symmetry
(3)	Centipede, Prawn, Sea urchin	-	Jointed appendages
(4)	Scorpion, Spider, Cockroach	-	Ventral solid central nervous system

Sol. Answer (4)

106. Which one of the following phyla is correctly matched with its two general characteristics?

(1)	Mollusca	-	Normally oviparous and development through a trochophore or veligerlarva
(2)	Arthropoda	-	Body divided into head, thorax and abdomen and respiration by tracheae
(3)	Chordata	-	Notochord at some stage and separate anal and urinary openings to the outside
(4)	Echinodermata	-	Pentamerous radial symmetry and mostly internal fertilization

Sol. Answer (1)

107. Which one of the following in birds, indicates their reptilian ancestry?

(1) Eggs with a calcareous shell

(2) Scales on their hind limbs

(3) Four-chambered heart

(4) Two special chambers crop and gizzard in their digestive tract

Sol. Answer (2)

108. *Ascaris* is characterized by

(1) Presence of pseudocoelom and metamerism (metamerization)

(2) Absence of true coelom but presence of metamerism

(3) Presence of neither true coelom nor metamerism

(4) Presence of true coelom but absence of metamerism

Sol. Answer (3)

109. Which one of the following is **not** a characteristic of phylum Annelida?

(1) Ventral nerve cord

(2) Closed circulatory system

(3) Segmentation

(4) Pseudocoelom

Sol. Answer (4)

110. Cellulose is the major component of cell walls of

(1) *Saccharomyces*

(2) *Pythium*

(3) *Xanthomonas*

(4) *Pseudomonas*

Sol. Answer (2)

Pythium is a phycomycetes member having cellulosic cell wall.

Xanthomonas and *Pseudomonas* are Eubacteria having peptidogycan cell wall. *Saccharomyces* – Chitinous cell wall.

111. Vacuole in a plant cell

(1) Lacks membrane and contains water and excretory substances

(2) Is membrane-bound and contains storage proteins and lipids

(3) Is membrane-bound and contains water and excretory substances

(4) Lacks membrane and contains air

Sol. Answer (3)

It is having tonoplast as membrane and stores water and excretory substances.

112. A competitive inhibitor of succinic dehydrogenase is

(1) Malate

(2) Malonate

(3) Oxaloacetate

(4) α-ketoglutarate

Sol. Answer (2)

Malonate competes with succinate for active sites of succinate dehydrogenase.

113. Polysome is formed by

(1) Ribosomes attached to each other in a linear arrangement

(2) Several ribosomes attached to a single mRNA

(3) Many ribosomes attached to a strand of endoplasmic reticulum

(4) A ribosome with several subunits

Sol. Answer (2)

This structure appears during protein synthesis in cytoplasm to translate different parts of a polypeptide.

114. Carbohydrates are commonly found as starch in plant storage organs. Which of the following five properties of starch (a - e) make it useful as a storage material?

a. Easily translocated

b. Chemical non-reactive

c. Easily digested by animals

d. Osmotically inactive

e. Synthesized during photosynthesis

The useful properties are

(1) Both a & e
(2) Both b & c
(3) Both b & d
(4) a, c & e

Sol. Answer (3)

Starch is nonreducing and water insoluble so is preferred as storage material.

115. In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea?

(1) Archaea completely differ from prokaryotes

(2) Archaea resemble eukarya in all respects

(3) Archaea have some novel features that are absent in other prokaryotes and eukaryotes

(4) Archaea completely differ from both prokaryotes and eukaryotes

Sol. Answer (3)

Archaea have primitive forms with histones, no organized nucleus, membrane bound organelles absent and proteinous and noncellulosic carbohydrate nature of cell wall.

116. Keeping in view the 'fluid mosaic model' for the structure of cell membrane, which one of the following statements is **correct** w.r.t. the movement of lipids and proteins from one lipid monolayer to the other (described as flip-flop movement)?

(1) Neither lipids nor proteins can flip-flop

(2) Both lipids and proteins can flip-flop

(3) While lipids can rarely flip-flop, proteins cannot

(4) While proteins can flip-flop, lipids cannot

Sol. Answer (3)

It is exclusive property of lipids shown during changing temperature of cellular environment.

117. In germinating seeds fatty acids are degraded exclusively in the

(1) Mitochondria
(2) Proplastids
(3) Glyoxysomes
(4) Peroxisomes

Sol. Answer (3)

It is regulated by glyoxylate cycle.

118. The two sub-units of ribosome remain united at a critical ion level of

(1) Calcium
(2) Copper
(3) Manganese
(4) Magnesium

Sol. Answer (4)

Mangesium concentration is 0.0001 M.

119. Thron of *Bougainvillea* and tendril of *cucurbita* are example of

(1) Retrogressive evolution (2) Analogous organs

(3) Homologous organs (4) Vestigial organs

Sol. Answer (3)

120. Haploids are more suitable for mutation studies than the diploids. This is because

(1) All mutations, whether dominant or recessive are expressed in haploids

(2) Haploids are reproductively more stable than diploids

(3) Mutagens penetrate in haploids more effectively than diploids

(4) Haploids are more abundant in nature than diploids

Sol. Answer (1)

Haploids have only one set of chromosome hence alleles.

121. Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?

(1) Adenine, Thymine – *Purines* (2) Thymine, Uracil – *Pyrimidines*

(3) Uracil, Cytosine – *Pyrimidines* (4) Guanine, Adenine – *Purines*

Sol. Answer (1)

Adenine and guanine are purines, whereas, Uracil, Thymine, Cytosine are pyrimidines.

122. Which one of the following conditions in humans is correctly matched with its chromosomal abnormality/ linkage?

(1) Down syndrome – 44 autosomes + XO

(2) Klinefelter syndrome – 44 autosomes + XXY

(3) Colour blindness – Y-linked

(4) Erythroblastosis foetalis – X-linked

Sol. Answer (2)

Downs syndrome – 45 + XX or 45 + XY

123. In the DNA molecules

(1) There are two strands which run antiparallel-one in 5′ $\rightarrow$ 3′ direction and other in 3′ $\rightarrow$ 5′

(2) The total amount of purine nucleotides and pyrimidine nucleotides is not always equal

(3) There are two strands which run parallel in the 5′ $\rightarrow$ 3′ direction

(4) The proportion of Adenine in relation to thymine varies with the organism

Sol. Answer (1)

The 2 strands of DNA are antiparallel one in 5’ – 3’ direction and the other in 3’ – 5’ direction.

124. What is true about the isolated small tribal populations?

(1) There is no change in population size as they have a large gene pool

(2) There is a decline in population as boys marry girls only from their own tribe

(3) Hereditary diseases like colour blindness do not spread in the isolated population

(4) Wrestlers who develop strong body muscles in their life time pass this character on to their progeny

Sol. Answer (2)

The acquired character such as strong muscles of a wrestler obtained by regular exercise will not be transmitted to the next generation. Gene pool of a population will consist of a large number of genes which will vary in their frequencies. These frequencies also depend on proportion of various genotypes in the total population. Small tribal population will have small gene pool.

Hereditary diseases like colour blindness will spread in isolated population due to inbreeding.

There is a decline in population as boys marry girls only from their own tribe, this is due to absence of gene migration/gene flow.

125. Which one of the following scientist's name is correctly matched with the theory put forth by him?

(1) Mendel – Theory of Pangenesis

(2) Weismann – Theory of continuity of Germplasm

(3) Pasteur – Inheritance of acquired characters

(4) de Vries – Natural selection

Sol. Answer (2)

Following are the right matching pairs.

de Vries - Mutation theory

Darwin - Theory of pangenesis and Natural selection

Pasteur - Discarded the theory of spontaneous generation of life and proved that life arises from pre-existing life.

126. Which one of the following is incorrect about the characteristics of protobionts (coacervates and micropheres) as envisaged in the abiogenic origin of life?

(1) They could maintain an internal environment

(2) They were able to reproduce

(3) They could separate combinations of molecules from the surroundings

(4) They were partially isolated from the surroundings

Sol. Answer (2)

According to recent literature, coacervates and microsphere do not reproduce.

127. Darwin's Finches are an excellent example of

(1) Connecting links (2) Adaptive radiation

(3) Seasonal migration (4) Brood parasitism

Sol. Answer (2)

Darwins Finches are examples of evolutionary divergence giving rise to new species, arising from one commmon ancestor, depending upon the habitat.

128. Which one of the following pairs of items correctly belongs to the category of organs mentioned against it?

(1) Wings of honey-bee and wings of crow – Homologous organs

(2) Thorn of *Bougainvillea* and tendrils of *Cucurbita* – Analogous organs

(3) Nictitating membrane and blind spot in human eye – Vestigial organs

(4) Nephridia of earthworm and malpighian tubules of cockroach – Excretory organs

Sol. Answer (4)

Wings of honey bee and the wings of crow are analogous.

Thorn of **Bougaivillea** and tendrils of Cucurbita are homologous.

Blind spot in humans represent the point where the optic nerve will leave the eye ball so it is not vestigeal.

129. The fruit is chambered, developed from inferior ovary and has seeds with succulent testa in

(1) Cucumber
(2) Pomegranate
(3) Orange
(4) Guava

Sol. Answer (2)

This forms edible part of pomegranate.

130. The C_4 plants are phoptosynthetically more efficient than C_3 plants because

(1) They have more chloroplasts

(2) The CO_2 compensation point is more

(3) CO_2 generated during photorespiration is trapped and recycled through PEP carboxylase

(4) The CO_2 efflux is not prevented

Sol. Answer (1)

C_4 plants do not show photorespiration and have more chloroplast in bundle sheath.

131. The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that adenosine triphosphate (ATP) is formed because

(1) There is a change in the permeability of the inner mitochondiral membrane toward adenosine diphosphate (ADP)

(2) High energy bonds are formed in mitochondrial proteins

(3) ADP is pumped out of the matrix into the intermembrane space

(4) A proton gradient forms across the inner membrane

Sol. Answer (4)

Proton motive force develop between perimitochondrial space and matrix across inner mitochondrial membrane.

132. Dry indehiscent single-seeded fruit formed bicarpellary syncarpous inferior ovary is

(1) Cremocarp
(2) Caryopsis
(3) Cypsela
(4) Berry

Sol. Answer (3)

Cypsela — Asteraceae.

Cremocarp — Shizocarpic fruit, as in umbelliferae.

Caryopsis — Indehiscent fruit formed from monocarpellary and superior ovary with basal placentation.

133. The rupture and fractionation do not usually occur in the water column in vessel/tracheids during the ascent of sap because of

(1) Transpiration pull
(2) Lignified thick walls
(3) Cohesion and adhesion
(4) Weak gravitational pull

Sol. Answer (3)

Continuity of water column is maintained by cohesion and adhesion.

134. Senescence as an active developmental cellular process in the growth and functioning of a flowering plant, is indicated in

(1) Floral parts
(2) Vessels and tracheid differentiation
(3) Leaf abscission
(4) Annual plants

Sol. Answer (3)

Abscission provides nutrient movement and rejuvenation of plant.

135. Vascular tissues in flowering plants develop from

(1) Dermatogen
(2) Phellogen
(3) Plerome
(4) Periblem

Sol. Answer (3)

Periblem — Ground tissue

Phellogen — Cork cambium

Dermatogen — Epidermis

136. In leaves of C_4 plants malic acid synthesis during CO_2 fixation occurs in

(1) Guard cells
(2) Epidermal cells
(3) Mesophyll cells
(4) Bundle sheath

Sol. Answer (3)

Bundle sheath malic acid is transported from mesophylls.

137. Importance of day length in flowering of plants was first shown in

(1) *Petunia*
(2) *Lemna*
(3) Tobacco
(4) Cotton

Sol. Answer (3)

Discovered by Garnar & Allard in a maryland mammoth variety of tobacco.

138. Endosperm is consumed by developing embryo in the seed of

(1) Maize
(2) Coconut
(3) Castor
(4) Pea

Sol. Answer (4)

Other three are endospermic/albuminous seeds.

139. Nitrogen fixation in root nodules of *Alnus* is brought about by

(1) *Azorhizobium*
(2) *Bradyhizobium*
(3) *Clostridium*
(4) *Frankia*

Sol. Answer (4)

Frankia is actinomycete.

Bradyrhizobium — Root nodules in soyabean.

140. The energy releasing process in which the substrate is oxidised without an external electron acceptor is called

(1) Glycolysis (2) Fermentation

(3) Photorespiration (4) Aerobic respiration

Sol. Answer (2)

Fermentation consumes $NADH_2$ and e^- acceptor is released as NAD^+ not used. While glycolysis uses external e^- acceptor as NAD^+.

141. Replum is present in the ovary of flower of

(1) Pea (2) Lemon

(3) Mustard (4) Sunflower

Sol. Answer (3)

Mustard (Brassicaceae) possess false septum in ovary having parietal placentation.

142. The fleshy receptacle of syconus of fig encloses a number of

(1) Mericarps (2) Achenes

(3) Samaras (4) Berries

Sol. Answer (2)

Syconus is fruit type in fig which is composed of many acheneal fruitlets.

143. Electrons from excited chlorophyll molecule of photosystem II are accepted first by

(1) Ferredoxin (2) Cytochrome - b

(3) Cytochrome - f (4) Quinone

Sol. Answer (4)

Plastoquinone is used as mobile carrier and primary electron acceptor from PS II.

144. Which type of white blood cells are concerned with the release of histamine and the natural anticoagulant heparin?

(1) Monocytes (2) Neutrophils

(3) Basophils (4) Eosinophils

Sol. Answer (3)

Basophils have a function similar to mast cells. So both basophils and mast cells contain *heparin*, *histamine* and serotonin.

145. Which one of the following is the true description about an animal concerned?

(1) Cockroach – 10 pairs of spiracles (2 pairs on thorax and 8 pairs on abdomen)

(2) Earthworm – The alimentary canal consists of a sequence of pharynx, oesophagus, stomach, gizzard and intestine

(3) Frog – Body divisible into three regions - head, neck and trunk

(4) Rat – Left kidney is slightly higher in position than the right one

Sol. Answer (1)

In rat right kidney is sligtly higher than left because all the organs are concentrated towards left, only in human beings left kidney is higher. In earthworm, the organs of alimentary canal are pharynx, oesophagus, gizzard, stomach and intestine. In Frog, neck is absent.

146. Which one of the following is the correct matching of the site of action on the given substrate, the enzyme acting upon it and the end product?

(1) *Stomach* : Fats $\xrightarrow{\text{Lipase}}$ micelles

(2) *Duodenum* : Triglycerides $\xrightarrow{\text{Trypsin}}$ monoglycerides

(3) *Small intestine* : Starch $\xrightarrow{\alpha\text{ Amylase}}$ Disaccharide (Maltose)

(4) *Small intestine* : Proteins $\xrightarrow{\text{Pepsin}}$ Amino acids

Sol. Answer (3)

Pancreatic juice is released in intestine & contains, Pancreatic α-amylase, also called as Amylopsin, it digets 70% of the starch converting it into Maltose, Isomaltose and limit dextrins.

147. What is vital capacity of our lungs?

(1) Total lungs capacity minus residual volume

(2) Inspiratory reserve volume plus tidal volume

(3) Total lungs capacity minus expiratory reserve volume

(4) Inspiratory reserve volume plus expiratory reserve volume

Sol. Answer (1)

Vital capacity = TV + IRV + ERV

Total lung capacity = VC + RV

So we can say that VC = Total lung capacity – Residual volume.

148. Which one of the following is the correct difference between *Rod Cells* and *Cone Cells* of our retina?

	Rod Cells	***Cone Cells***
(1) Distribution	More concentrated in centre of retina	Evenly distributed all over retina
(2) Visual acuity	High	Low
(3) Visual pigment contained	Iodopsin	Rhodopsin
(4) Overall function	Vision in poor light	Colour vision and detailed vision in bright light

Sol. Answer (4)

Rod cells are more concentrated towards the periphery. Visual **acuity** is highest in fovea centralis which contains only cones. Visual pigment in rods cells is rhodopsin, whereas in the cone cells it is **iodopsin**.

149. Which one of the following items gives its correct total number?

(1) Cervical vertebrae in humans – 8

(2) Floating ribs in humans – 4

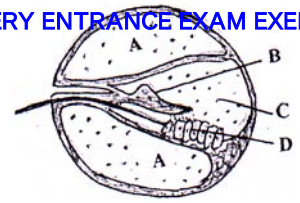
(3) Amino acids found in proteins – 16

(4) Types of diabetes – 3

Sol. Answer (2)

In human beings floatings ribs are 2 pairs (4), i.e. 11^{th} and 12^{th} ribs.

150. Given below is a diagrammatic cross section of a single loop of human cochlea



Which one of the following options correctly represents the names of three different parts?

(1) A : Perilymph, B : Tectorial membrane, C : Endolymph

(2) B : Tectorial membrane, C : Perilymph, D : Secretory cells

(3) C : Endolymph, D : Sensory hair cells, A : Serum

(4) D : Sensory hair cells, A : Endolymph, B : Tectorial membrane

Sol. Answer (1)

In the diagram of human cochlea.

A. represents - Perilymph

B. represents - Tectorial membrane

C. represents - Endolymph

D. represents - Sensory cells

151. Given below are four methods (A - D) and their modes of action (a - d) in achieving contraception. Select their correct matching from the four options that follow

Method	***Mode of Action***
A. The pill	(a) Prevents sperms reaching cervix
B. Condom	(b) Prevents implantation
C. Vasectomy	(c) Prevents ovulation
D. Copper T	(d) Semen contains no sperms

Matching

(1) A-(b), B-(c), C-(a), D-(d)

(2) A-(c), B-(a), C-(d), D-(b)

(3) A-(d), B-(a), C-(b), D-(c)

(4) A-(c) B-(d), C-(a), D-(b)

Sol. Answer (2)

Oral contraceptive pills contain estrogen and progesterone hormones, so they alter the ovulatory cycle and mainly prevent ovulation. Condoms are physical barrier, they prevent the sperms reaching cervix. Vasectomy is the surgical and terminal method of birth control in males. They do not prevent sperm production, but hinder sperm transport so the semen will not contain any sperms. IUDS e.g. Copper-T prevent fertilization and mainly **implantation**.

152. What will happen if the secretion of parietal cells of gastric glands is blocked with an inhibitor?

(1) Enterokinase will not be released from the duodenal mucosa and so trypsinogen is not converted to trypsin

(2) Gastric juice will be deficient in chymosin

(3) Gastric juice will be deficient in pepsinogen

(4) In the absence of HCl secretion, inactive pepsinogen is not converted into the active enzyme pepsin.

Sol. Answer (4)

Parietal cells/oxyntic cells, their function is to secrete HCl and **Castle's intrinsic factor**. Pepsinogen, is converted into active pepsin by HCl, i.e. by change in pH.

153. During the propagation of a nerve impulse, the action potential results from the movement of

(1) Na^+ ions from extracellular fluid to intracellular fluid

(2) Ka^+ ions from extracellular fluid to intracellular fluid

(3) Na^+ ions from intracellular fluid to extracellular fluid

(4) Ka^+ ions from intracellular fluid to extracellular fluid

Sol. Answer (1)

When the threshold stimulus is applied, the permeability of the membrane for sodium ions will change. Voltage gated sodium ion channels open and Na^+ ion flows form extra-cellular fluid to intracellular fluid, the outside becomes negative and inside positive. The membrane is depolarised & when the two ends of this membrane is connected to oscilloscope a potential difference of + 30 mv, called as action potential is generated.

154. The blood calcium level is lowered by the deficiency of

(1) Calcitonin

(2) Parathormone

(3) Thyroxine

(4) Both Calcitonin and Parathormone

Sol. Answer (2)

155. The most active phagocytic white blood cells are

(1) Neutrophils and monocytes

(2) Neutrophils and eosinophils

(3) Lymphocytes and macrophages

(4) Eosinophils and lymphocytes

Sol. Answer (1)

Neutrophils and monocytes have phagocytic function.

156. Earthworms have no skeleton but during burrowing, the anterior end becomes turgid and acts as a hydraulic skeleton. It is due to

(1) Setae

(2) Coelomic fluid

(3) Blood

(4) Gut peristalsis

Sol. Answer (2)

Setae help in attachment, but turgidity and hydraulic skeleton is due to coelomic fluid.

157. In humans, blood passes from the post caval to the diastolic right atrium of heart due to

(1) Pressure difference between the post caval and atrium

(2) Pushing open of the venous valves

(3) Suction pull

(4) Stimulation of the sino auricular node

Sol. Answer (1)

Blood always flows from higher pressure towards the lower pressure.

158. In humans, at the end of the first meiotic division, the male germ cells differentiate into the

(1) Spermatozonia

(2) Primary spermatocytes

(3) Secondary spermatocytes

(4) Spermatids

164. Which extraembryonic membrane in humans prevents desiccation of the embryo inside the utrerus?

(1) Amnion (2) Chorion

(3) Allantois (4) Yolk sac

Sol. Answer (1)

Amnion encloses amniotic fluid which prevents dessication of embryo, that's why present in all true land vertebrates.

165. Which one of the following statements is incorrect about menstruation?

(1) The beginning of the cycle of menstruation is called menarche

(2) During normal menstruation about 40 ml blood is lost

(3) The menstrual fluid can easily clot

(4) At menopause in the female, there is especially abrupt increase in gonadotropic hormones

Sol. Answer (3)

Menopause is a senile change in ovaries. After menopause the level of pituitary gonadotropins remain same or slightly increase. FSH is more than LH; but the ovaries are not responding to these hormone, because all the ovarian follicles are converted into follicular atresia. There is decline in the level of progesterone and estrogen.

Initially the blood inside the uterus clots, but it is liquefied by the enzyme plasmin released by uterus. Menstrual fluid which is discharged cannot clot again.

166. The haemoglobin of a human foetus

(1) Has a higher affinity for oxygen than that of an adult

(2) Has a lower affinity for oxygen than that of the adult

(3) Its affinity for oxygen is the same as that of an adult

(4) Has only 2 protein subunits instead of 4

Sol. Answer (1)

The haemoglobin of human foetus (HbF) has 4 Heme group and 1 globin. In HbF the globin protein is made up of 2α and 2β polypeptide chains. Each α has 141 amino acids and each β-has 146 amino acids but 37 amino acids in each β are different from that of HbA. It has higher affinity for O_2 even at low PO_2 and the oxygen –Hb dissociation curve remains towards the left of normal.

167. Consider the statements given below regarding contraception and answer as directed thereafter

(a) Medical Termination of Pregnancy (MTP) during first trimester is generally safe

(b) Generally chances of conception are nil until mother breast-feeds the infant upto two years

(c) Intrauterine devices like copper-T are effective contraceptives

(d) Contraception pills may be taken upto one week after coitus to prevent conception

Which two of the above statements are correct?

(1) a, b (2) b, c

(3) c, d (4) a, c

Sol. Answer (4)

During intense lactational period the chances of conception are almost nil, maximum upto six months and not two years.

After unwanted sexual intercourse, conception can be avoided by taking contraceptive pills within 72 hrs.

168. In human adult females oxytocin

(1) Causes strong uterine contractions during parturition

(2) Is secreted by anterior pituitary

(3) Stimulates growth of mammary glands

(4) Stimulates pituitary to secrete vasopressin

Sol. Answer (1)

Oxytocin is called as Birth Hormone as it causes the contraction of smooth muscles of the uterus leading to the birth of the child.

169. Which one of the following is the correct percentage of the two (out of the total of 4) green house gases that contribute to the total global warming?

(1) Methane 20%, N_2O 18%

(2) CFCs14%, Methane 20%

(3) CO_2 40%, CFSs 30%

(4) N_2O 6%, CO_2 86%

Sol. Answer (2)

CFC 14%, methane 20% : For CO_2 it is 60% and for N_2O it is 6%

170. *Quercus* species are the dominant component in

(1) Tropical rain forests

(2) Temperate deciduous forests

(3) Alpine forests

(4) Scrub forests

Sol. Answer (2)

Temperate deciduous forest

Tropical rain forest – *Dipterocarpus*, *Hopea*

Scrub forest – Oak, *Eucalyptus*

Alpine forest – *Rhododendron*, *Juniperus*

171. About 70% of total global carbon is found in

(1) Forests

(2) Grasslands

(3) Agroecosystems

(4) Oceans

Sol. Answer (4)

Oceans : For the C, cycling pool consists of 6×10^{14} kg (29%) of free CO_2 in the atmosphere and 1.45×10^{15} kg (71%) dissolved CO_2 in hydrosphere.

172. Which one of the following is not observed in biodiversity hotspots?

(1) Species richness

(2) Endemism

(3) Accelerated species loss

(4) Lesser inter-specific competition

Sol. Answer (4)

Lesser inter-specific competition : Due to the presence of high species diversity the inter specific competition will be more enhanced.

173. World summit on Sustainable Development (2002) was held in

(1) South Africa

(2) Brazil

(3) Sweden

(4) Argentina

Sol. Answer (1)

It was held in South Africa (Johnnesberg)

174. The slow rate of decomposition of fallen logs in nature is due to their

(1) Low soil temperature (2) Low moisture content

(3) Poor nitrogen content (4) Anaerobic environment around them

Sol. Answer (2)

Low moisture content will lead to decrease in number of decomposers, because decomposers require an optimum moisture for their proper growth and functioning.

175. Consider the following statements concerning food chains

(a) Removal of 80% tigers from an area resulted in greatly increased growth of vegetation

(b) Removal of most of the carnivores resulted in an increased population of deers

(c) The length of food chains is generally limited to 3-4 trophic levels due to energy loss

(d) The length of food chains may vary from 2 to 8 trophic levels.

Which two of the above statements are correct?

(1) a, b (2) b, c

(3) c, d (4) a, d

Sol. Answer (2)

Removal of tigers from an area will lead to an increase in number of herbivores and hence there will be decreased growth of vegetation in that particular area.

The number of trophic levels in a food chain does not reach 8 rather there are 3 or 4 trophic levels.

176. According to Central Pollution Control Board (CPCB), which particulate size in diameter (in micrometers) of the air pollutants is responsible for greatest harm to human health?

(1) 5.2 - 2.5 (2) 2.5 or less

(3) 1.5 or less (4) 1.0 or less

Sol. Answer (2)

This is the report of Central Pollution Control Board.

177. The table below gives the populations (in thousands) of ten species (A - J) in four areas (a - d) consisting of the number of habitats given within brackets against each. Study the table and answer the question which follows

Area and Number of habitats	Species, and their populations (in thousands) in the areas									
	A	B	C	D	E	F	G	H	I	J
a (11)	2.3	1.2	0.52	6.0	–	3.1	1.1	9.0	–	10.3
b (11)	10.2	–	0.62	–	1.5	3.0	–	8.2	1.1	11.2
c (13)	11.3	0.9	0.48	2.4	1.4	4.2	0.8	8.4	2.2	4.1
d (12)	3.2	10.2	11.1	4.8	0.4	3.3	0.8	7.3	11.3	2.1

Which area out of a to d shows maximum species diversity?

(1) a (2) b

(3) c (4) d

Sol. Answer (4)

In areas 'c' and 'd' all the 10 species are present but number of habitats is lesser in area d.

178. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this

(a) Lots of urea and phosphate fertilizers were used in the crops in the vicinity

(b) The area was sprayed with DDT by an aircraft

(c) The lake water turned green and stinky

(d) Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis

Which two of the above were the main causes of fish mortality in the lake?

(1) a, b (2) b, c

(3) c, d (4) a, c

Sol. Answer (4)

Lots of urea and phosphate fertilizers used in crops in the vicinity of lake will lead to eutrophication that means the lake will turn green and stinky.

179. Consider the following four statements (a - d) about certain desert animals such as kangaroo rat.

(a) They have dark colour and high rate of reproduction and excrete solid urine

(b) They do not drink water, breathe at a slow rate to conserve water and have their body covered with thick hairs

(c) They feed on dry seeds and do not require drinking water

(d) They excrete very concentrated urine and do not use water to regulate body temperature

Which two of the above statements for such animals are true?

(1) a and b (2) c and d

(3) b and c (4) c and a

Sol. Answer (2)

Kangaroo rat is the only mammal which does not ingest any water and reamains only on metabolic water which it can utilize due to nasal counter current mechanism. It feeds on dry castor seeds. Sweat glands are absent and secrete concentrated urine with nitrogenous waste as urea.

180. A transgeneic food crop which may help in solving the problem of night blindness in developing countries is

(1) Golden rice (2) Flavr Savr tomatoes

(3) Starlink maize (4) Bt Soybean

Sol. Answer (1)

Golden rice is transgenic rice in which the genes for synthesis of enzymes involved in β-carotene formation are transferred. So golden rice is rich in vitamin A, preventing night blindness.

181. Bacterial leaf blight of rice is caused by a species of

(1) *Erwinia* (2) *Xanthomonas*

(3) *Pseudomonas* (4) *Alternaria*

Sol. Answer (2)

Xanthomonas oryzae.

182. Which one of the following is linked to the discovery of Bordeaux mixture as a popular fungicide?

(1) Black rust of wheat (2) Bacterial leaf blight of rice

(3) Downy mildew of grapes (4) Loose smut of wheat

Sol. Answer (3)

It was discovered by Professor Millardet of Bordeaux University of France.

183. Which one of the following is being tried in India as a biofuel substitute for fossil fuels?

(1) *Jatropha* (2) *Jatropha*

(3) *Azadirachta* (4) *Musa*

Sol. Answer (2)

It is a petroplant and the source of fuel is latex.

184. *Trichoderma harzianum* has proved a useful microorganism for

(1) Biological control of soi-borne plant pathogens (2) Bioremediation of contaminated soils

(3) Reclamation of wastelands (4) Gene transfer in higher plants

Sol. Answer (1)

It secretes chitinase enzyme which is responsible for antifungal activities.

185. Gel electrophoresis is used for

(1) Isolation of DNA molecule

(2) Cutting of DNA into fragments

(3) Separation of DNA fragments according to their size

(4) Construction of recombinant DNA by joining with cloning vectors

Sol. Answer (3)

After the action of restriction endonuclease the fragments of DNA so formed are separated by gel electrophoresis. This technique is based upon the principle of separation of molecules on the basis of charge and mass.

186. To which type of barriers under innate immunity, do the saliva in the mouth and the tears from the eyes, belong?

(1) Physical barriers (2) Cytokine barriers

(3) Cellular barriers (4) Physiological barriers

Sol. Answer (4)

Acid in stomach, saliva in mouth, tears from eyes all prevent microbial growth. They are part of innate immunity and grouped under physiological barriers.

187. Match the disease in Column I with the appropriate items (pathogen/prevention/treatment) in Column II

Column I	Column II
(a) Amoebiasis	(i) Treponema palladium
(b) Diphtheria	(ii) Use only sterilized food and water
(c) Cholera	(iii) DPT Vaccine
(d) Syphilis	(iv) Use oval rehydration therapy

(1) a-(ii), b-(iii), c-(iv), d-(i) (2) a-(i), b-(ii), c-(iii), d-(iv)

(3) a-(ii), b-(iv), c-(i), d-(iii) (4) a-(ii), b-(i), c-(iii), d-(iv)

Sol. Answer (1)

188. Consider the following statements about biomedical technologies

(a) During open heart surgery blood is circulated in the heart-lung machine

(b) Blockage in coronary arteries is removed by angiography

(c) Computerised Axial Tomography (CAT) gives detailed internal structures as cross-section of body

(d) X-ray provides clear and detailed images or organs like prostate glands and lungs

Which two of the above statements are correct?

(1) a and b (2) b and d

(3) c and d (4) a and c

Sol. Answer (4)

Angioplasty not **angiography** is unblocking of blocked arteries. Radiograph produced by x-rays is just a shadow of the dense body parts.

189. Which one of the following pairs of codons is correctly matched with their function or the signal for the particular amino acid?

(1) UUA, UCA - Leucine

(2) GUU, GCU - Alanine

(3) UAG, UGA - Stop

(4) AUG, ACG - Start / Methionine

Sol. Answer (3)

UAA, UAG and UGA are nonsense or terminating or stop codons as these are responsible for the termination of translation.

190. Which one of the following is the correct statement regarding the particular psychotropic drug specified?

(1) *Barbiturates* cause relation and temporary euphoria

(2) *Hashish* causes after thought perceptions and hallucinations

(3) *Opium* stimulates nervous system and causes hallucinations

(4) *Morphine* leads to delusions and disturbed emotions

Sol. Answer (2)

Morphine is both a sedative as well as analgesic drug. Barbiturates are sedatives and have hypnotic effect. Opium is also a narcotic drug which has a depressing effect on CNS.

191. Cry 1 endotoxins obtained from *Bacillus Thuringiensis* are effective against

(1) Boll worms (2) Mosquitoes

(3) Flies (4) Nematodes

Sol. Answer (1)

Proteins encoded by the genes cry I Ac and cry II Ab control cotton bolloworm.

192. Modern detergents contain enzyme preparations of

(1) Thermophiles (2) Acidophiles

(3) Alkaliphiles (4) Thermoacidophiles

Sol. Answer (2)

Enzymes used in detergents are proteases and lipases, which are obtained from fungi. Fungi grows properly in acidic medium.

193. The linking of antibiotic resistance gene with the plasmid vector became possible with

(1) Exonucleases (2) DNA ligase

(3) Endouncleases (4) DNA polymerase

Sol. Answer (2)

Restriction endonucleases act as molecular scissors; but DNA ligases help in linking foreign DNA to plasmid.

194. Which one of the following proved effective for biological control of nematodal disease in plants?

(1) *Paecilomyces lilacinus*

(2) *Pisolithus tinctorius*

(3) *Pseudomonas cepacia*

(4) *Gliocladium virens*

Sol. Answer (3)

195. Main objective of production/use of herbicide resistant GM crops is to

(1) Reduce herbicide accumulation in food articles for health safety

(2) Eliminate weeds from the field without the use of manual labour

(3) eliminate weeds from the field without the use of herbicides

(4) Encourage eco-friendly herbicides

Sol. Answer (2)

As herbicide resistant GM crops will remain unaffected to the herbicide used, while the weeds will get killed.

196. Consider the following four measures (a - d) that could be taken to successfully grow chick-pea in an area where bacterial blight disease is common

(a) Spray with Bordeaux mixture

(b) Control of the insect vector of the disease pathogen

(c) Use of only disease-free seeds

(d) Use of varieties resistant to the disease

Which two of the above measures can control the disease?

(1) (a) and (d)
(2) (b) and (c)
(3) (a) and (b)
(4) (c) and (d)

Sol. Answer (4)

Bordeaux is used to control fungal diseases and no insect vector is reported for bacterial blight disease. Thus use of disease free seeds and disease resistant varieties can control disease.

197. Human insulin is being commercially produced from a transgenic species of

(1) *Saccharomyces*
(2) *Escherichia*
(3) *Mycobacterium*
(4) *Rhizobium*

Sol. Answer (2)

Eli Lilly was the first American Company to launch genetically engineered insulin called as **humulin**. They prepared two DNA sequences by reverse transcription of their m-RNA and linked them separately with the modified plasmid of *Escherichia coli*.

198. Cornea transplant in humans is almost never rejected. This is because

(1) It is a non-living layer

(2) Its cells are least penetrable by bacteria

(3) It has no blood supply

(4) It is composed of enucleated cells

Sol. Answer (3)

Cornea can be easily transplanted because it has no blood supply & therefore, does not involve immune response.

199. Which of the following pairs of organs includes only the endocrine glands?

(1) Pituitary and Ovary

(2) Parathyroid and Adrenal

(3) Pancreas and Parathyroid

(4) Thymus and Testes

Sol. Answer (2)

Testes, Ovaries and Pancreas have both exocrine and endocrine functions; but Parathyroid and Adrenals have only endocrine function.

200. What is antisense technology?

(1) RNA polymerase producing DNA

(2) A cell displaying a foreign antigen used for synthesis of antigens

(3) Production of somaclonal variants in tissue cultures

(4) When a piece of RNA that is complementary in sequence is used to stop expression of a specific gene

Sol. Answer (4)

Antisense technology is the translational control of protein synthesis which involves use of RNA which is complemantry to m-RNA, inhibiting the expression of genes.

AIPMT
SAMPLE PAPERS WITH SOLUTIONS

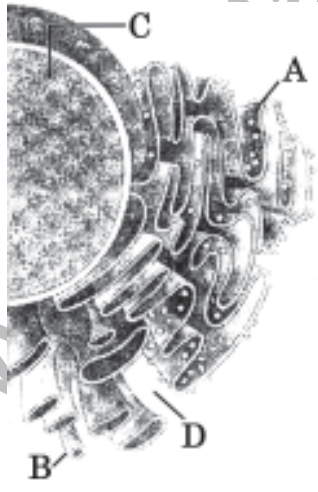
1. Which one of the following pairs of structures is correctly matched with their correct description?

	Structures		Description
(1)	Tibia and fibula	–	Both form parts of knee joint
(2)	Cartilage and cornea	–	No blood supply but do require oxygen for respiratory need
(3)	Shoulder joint and elbow joint	–	Ball and socket type of joint
(4)	Premolars and molars	–	20 in all and 3– rooted

Ans. (2)

Sol. Cartilage is avascular, as the blood vessels innervate only perichondrium. In the formation of knee joint, tibia is involved with femur.

2. Identify the components labelled A, B, C and D in the diagram below from the list (i) to (viii) given along with



Components:

(i) Cristae of mitochondria

(ii) Inner membrane of mitochondria

(iii) Cytoplasm

(iv) Smooth endoplasmic reticulum

(v) Rough endoplasmic reticulum

(vi) Mitochondrial matrix

(vii) Cell vacuole

(viii) Nucleus

The correct components are :

	A	B	C	D
(1)	(v)	(iv)	(viii)	(iii)
(2)	(i)	(iv)	(viii)	(vi)
(3)	(vi)	(v)	(iv)	(vii)
(4)	(v)	(i)	(iii)	(ii)

Ans. (1)

Sol. Golgi and ER are often found associated to nuclear membrane.

3. Fastest distribution of some injectible material/ medicine and with no risk of any kind can be achieved by injecting it into the

(1) Muscles (2) Arteries

(3) Veins (4) Lymph vessels

Ans. (3)

Sol. Intravenous injection is given for rapid distribution of drugs/substance. Intramuscular injection is given for producing local effect.

4. Which one of the following statements about the particular entity is true?

(1) *Centromere* is found in animal cells, which produces aster during cell division

(2) The *gene for producing insulin* is present in every body cell

(3) *Nucleosome* is formed of nucleotides

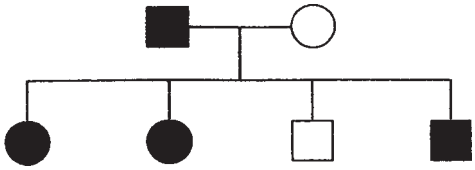
(4) *DNA* consists of a core of eight histones

Ans. (2)

Sol. 'Centromere' is found in chromosomes where two chromatids are attached.

'Insulin' gene is found in every body cell but is not expressed in all cells.

5. Study the pedigree chart of a certain family given below and select the **correct** conclusion which can be drawn for the character



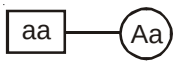
(1) The female parent is heterozygous

(2) The parents could not have had a normal daughter for this character

(3) The trait under study could not be colour-blindness

(4) The male parent is homozygous dominant

Ans. (1)

Sol. 

6. Leguminous plants are able to fix atmospheric nitrogen through the process of symbiotic nitrogen fixation. Which one of the following statements is **not** correct during this process of nitrogen fixation?

(1) Leghae moglobin scavenges oxygen and is pinkish in colour

(2) Nodules act as sites for nitrogen fixation

(3) The enzyme nitrogenase catalyses the conversion of atmospheric N_2 to NH_3

(4) Nitrogenase is insensitive to oxygen

Ans. (4)

Sol. Nitrogenase is sensitive against O_2.

7. Which one of the following is a xerophytic plant in which the stem is modified into the flat green and succulent structure?

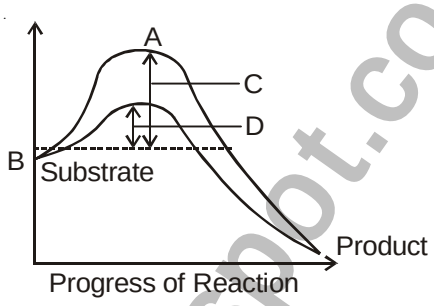
(1) *Opuntia* (2) *Casuarina*

(3) *Hydrilla* (4) *Acacia*

Ans. (1)

Sol. *Opuntia* – Phylloclade

8. The figure given below shows the conversion of a substrate into product by an enzyme. In which one of the four options (1–4) the components of reaction labelled as A, B, C and D are identified correctly?



Options:

	A	B	C	D
(1)	Potential energy	Transition state	Activation energy with enzyme	Activation energy *without* enzyme
(2)	Transition state	Potential energy	Activation energy *without* enzyme	Activation energy *with* enzyme
(3)	Potential energy	Transition state	Activation energy *with* enzyme	Activation energy *without* enzyme
(4)	Activation energy *with* enzyme	Transition state	Activation energy *without* enzyme	Potential energy

Ans. (2)

Sol. Activation energy is required for overcoming the energy barrier which gets reduced in the presence of enzyme.

9. Which of the following are used in gene cloning?

(1) Nucleoids (2) Lomasomes

(3) Mesosomes (4) Plasmids

Ans. (4)

Sol. Plasmids are used as the vector in gene cloning.

10. When domestic sewage mixes with river water

(1) Small animals like rats will die after drinking river water

(2) The increased microbial activity releases micro-nutrients such as iron

(3) The increased microbial activity uses up dissolved oxygen

(4) The river water is still suitable for drinking as impurities are only about 0.1%

Ans. (3)

Sol. Any mixing of sewage will increase BOD and decrease of DO due to decomposing activity of microbes.

11. Given below are four statements (A-D) each with one or two blanks. Select the option which **correctly** fills up the blanks in two statements

Statements:

(A) Wings of butterfly and birds look alike and are the results of __(i)__, evolution.

(B) Miller showed that CH_4, H_2, NH_3 and __(i)__, when exposed to electric discharge in a flask resulted in formation of __(ii)__.

(C) Vermiform appendix is a __(i)__ organ and an __(ii)__ evidence of evolution.

(D) According to Darwin evolution took place due to __(i)__ and __(ii)__ of the fittest.

Options :

(1) (D) – (i) Small variations, (ii) Survival,
(A) – (i) Convergent

(2) (A) – (i) Convergent,
(B) – (i) Oxygen, (ii) nucleosides

(2) (B) – (i) Water vapour, (ii) Amino acids
(C) – (i) Rudimentary, (ii) Anatomical

(4) (C) – (i) Vestigial, (ii) Anatomical
(D) – (i) Mutations, (ii) Multiplication

Ans. (1)

Sol. According to Darwin, evolution took place due to small variations & survival of the fittest. Wings of butterfly & birds are analogous or convergent. Vermiform appendix is vestigial organ.

12. Aestivation of petals in the flower of cotton is correctly shown in1

(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. Lady's finger, cotton and china rose, all shows twisted aestivation.

13. In which one of the following organisms its *excretory organs* are **correctly** stated?

(1) Humans – Kidneys, sebaceous glands and tear glands

(2) Earthworm – Pharyngeal, integumentary and septal nephridia

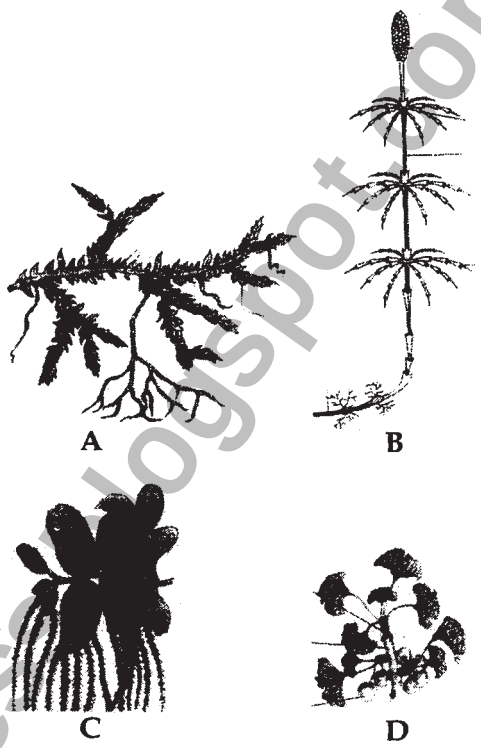
(3) Cockroach – Malpighian tubules and enteric caeca

(4) Frog – Kidneys, skin and buccal epithelium

Ans. (2)

Sol. Earthworm has 3 types of nephridia.

14. Examine the figures A, B, C and D. In which one of the four options all the items A, B, C and D are correct?



Options:

	A	B	C	D
(1)	*Chara*	*Marchantia*	*Fucus*	*Pinus*
(2)	*Equisetum*	*Ginkgo*	*Selaginella*	*Lycopodium*
(3)	*Selaginella*	*Equisetum*	*Salvinia*	*Ginkgo*
(4)	*Funaria*	*Adiantum*	*Salvinia*	*Riccia*

Ans. (3)

Sol. A – *Selaginella*, B – *Equisetum*, C – *Salvinia*, D – *Ginkgo*

15. The most apparent change during the evolutionary history of *Homo sapiens* is traced in

(1) Loss of body hair

(2) Walking upright

(3) Shortening of the jaws

(4) Remarkable increase in the brain size

Ans. (4)

Sol. Brain size or cranial capacity shows gradual increases in history of *Homo sapiens.*

16. Which one of the following is now being commercially produced by biotechnological procedures?

(1) Nicotine (2) Morphine

(3) Quinine (4) Insulin

Ans. (4)

Sol. Insulin is produced by synthesizing the polypeptide A and polypeptide B separately and then linking them.

17. The correct floral formula of soybean is

(1) $\% \, ♀♂ \, K_{(5)} \, C_{1+(2)+2} \, A_{(9)+1} \, \underline{G_1}$

(2) $\% \, ♀♂ \, K_5 \, C_{1+(2)+2} \, A_{(9)+1} \, \underline{G_1}$

(3) $\% \, ♀♂ \, K_{(5)} \, C_{1+2+(2)} \, A_{(9)+1} \, \underline{G_1}$

(4) $\% \, ♀♂ \, K_{(5)} \, C_{1+2+(2)} \, A_{1+(9)} \, \underline{G_1}$

Ans. (3)

Sol. $\% \, ♀♂ \, K_{(5)} \, C_{1+2+(2)} \, A_{(9)+1} \, \underline{G_1}$ (w.r.t. NCERT)

18. If for some reason the parietal cells of the gut epithelium become partially non-functional, what is likely to happen?

(1) The pancreatic enzymes and specially the trypsin and lipase will not work efficiently

(2) The pH of stomach will fall abruptly

(3) Steapsin will be more effective

(4) Proteins will not be adequately hydrolysed by pepsin into proteoses and peptones

Ans. (4)

Sol. Parietal or oxyntic cells release HCl required for the activation of pepsin.

19. Which one of the following is *most appropriately* defined?

(1) Host is an organism which provides food to another organism

(2) *Amensalism* is a relationship in which one species is benefited whereas the other is unaffected

(3) *Predator* is an organism that catches and kills other organism for food

(4) *Parasite* is an organism which always lives inside the body of other organism and may kill it

Ans. (3)

Sol. Term 'Host' is specific to parasitic relation only.

20. Read the following four statements, A, B, C and D and select the right option having both correct statements.

STATEMENTS :

(A) Z scheme of light reaction takes place in presence of PSI only.

(B) Only PS I is functional in cyclic photophosphorylation.

(C) Cyclic photophosphorylation results into synthesis of ATP and $NADPH_2$

(D) Stroma lamellae lack PS II as well as NADP.

Options :

(1) B and D (2) A and B

(3) B and C (4) C and D

Ans. (1)

Sol. It requires both PS-II and PS-I, where PS-II is more important. Stroma lamella contains PS-I only.

21. Which one of the following techniques is safest for the detection of cancers?

(1) Magnetic resonance imaging (MRI)

(2) Radiography (X-ray)

(3) Computed tomography (CT)

(4) Histopathological studies

Ans. (1)

Sol. Histopathological study is the invasive technique. Radiography and CT involves X-rays which are harmful.

22. Signals from fully developed foetus and placenta ultimately lead to parturition which requires the release of

(1) Estrogen from placenta

(2) Oxytocin from maternal pituitary

(3) Oxytocin from foetal pituitary

(4) Relaxin from placenta

Ans. (2)

Sol. Oxytocin or Pitocin released from maternal pituitary causes contractions in the uterine muscles to help in parturition.

23. Select the *correct* matching of a hormone, its source and function.

	Hormone	**Source**	**Function**
(1)	Vasopressin	Posterior pituitary	Increases loss of water through urine
(2)	Norepinephrine	Adrenal medulla	Increases heart beat, rate of respiration and alertness
(3)	Glucagon	Beta-cells of Islets of langerhans	Stimulates glycogenolysis
(4)	Prolactin	Posterior Pituitary	Regulates growth of mammary glands and milk formation in females

Ans. (2)

Sol. Vasopressin decreases loss of water through urine. Glucagon is released from α-cells. Prolactin is released from anterior pituitary.

24. In eukaryotic cell transcription, RNA splicing and RNA capping take place inside the

(1) Ribosomes (2) Nucleus

(3) Dictyosomes (4) ER

Ans. (2)

Sol. Mature mRNA comes out in cytoplasm only after completion of splicing, capping and tailing.

25. Given below are four statements (a-d) regarding human blood circulatory system

(a) Arteries are thick-walled and have narrow lumen as compared to veins

(b) Angina is acute chest pain when the blood circulation to the brain is reduced

(c) Persons with blood group AB can donate blood to any person with any blood group under ABO system

(d) Calcium ions play a very important role in blood clotting

Which two of the above statements are correct?

(1) (a) & (d) (2) (a) & (b)

(3) (b) & (c) (4) (c) & (d)

Ans. (1)

Sol. Angina is due to reduced blood supply to heart wall. Person with blood group AB is universal recepient.

26. In human female the *blastocyst*

(1) Forms placenta even before implantation

(2) Gets implanted into uterus 3 days after ovulation

(3) Gets nutrition from uterine endometrial secretion only after implantation

(4) Gets implanted in endometrium by the trophoblast cells

Ans. (4)

Sol. Blastocyst starts getting nutrition before implantation.

27. The haemoglobin content per 100 ml of blood of a normal healthy human adult is

(1) 5 - 11 g (2) 25 - 30 g

(3) 17 - 20 g (4) 12 - 16 g

Ans. (4)

28. An example of endomycorrhiza is

(1) *Nostoc* (2) *Glomus*

(3) *Agaricus* (4) *Rhizobium*

Ans. (2)

Sol. *Nostoc* -BGA, *Agaricus*- Basidiomycetes, *Rhizobium* - Eubacteria

29. One of the commonly used plant growth hormone is tea plantations is

(1) Ethylene

(2) Abscisic acid

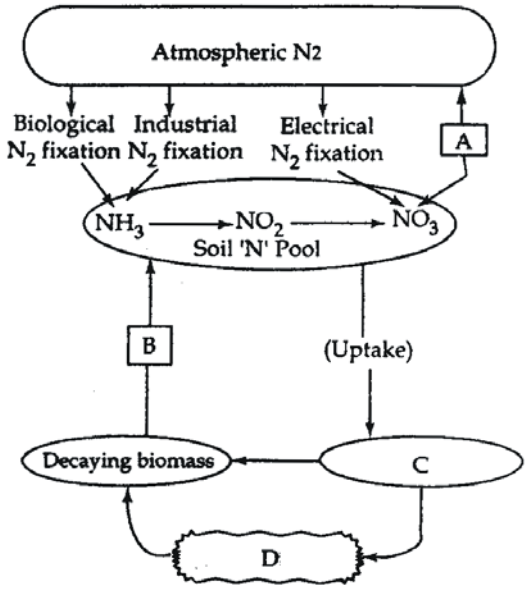
(3) Zeatin

(4) Indole - 3 - acetic acid

Ans. (4)

Sol. Auxins are commonly used in stem cutting.

30. Study the cycle shown below and select the option which gives correct words for all the four blanks A, B, C and D.



Options:

	A	B	C	D
(1)	Nitrification	Ammonification	Animals	Plants
(2)	Denitrification	Ammonification	Plants	Animals
(3)	Nitrification	Denitrification	Animals	Plants
(4)	Denitrification	Nitrification	Plants	Animals

Ans. (2)

Sol. A – Denitrification, B – Ammonification, C – Plants, D-Animals

31. Jaundice is a disorder of

(1) Excretory system

(2) Skin and eyes

(3) Digestive system

(4) Circulatoy system

Ans. (3)

Sol. Jaundice can be due to blockage/inflammation of bile duct.

32. Kranz anatomy is one of the characteristics of the leaves of

(1) Potato (2) Wheat

(3) Sugarcane (4) Mustard

Ans. (3)

Sol. Sugarcane – C_4 plant

33. In *Antirrhinum* two plants with pink flowers were hybridized. The F_1 plants produced red, pink and white flowers in the proportion of 1 red, 2 pink and 1 white. What could be the genotype of the two plants used for hybridization? Red flower colour is determined by *RR*, and white by *rr* genes.

(1) *rrrr* (2) *RR*

(3) *Rr* (4) *rr*

Ans. (3)

Sol. Parents (Pink) Rr ♀ × Rr ♂ (Pink)

Gametes R r R r

	R	r
R	RR	Rr
r	Rr	rr

1 : 2 : 1
Red : Pink : White

34. Transport of food material in higher plants takes place through

(1) Companion cells (2) Transfusion tissue

(3) Tracheids (4) Sieve elements

Ans. (4)

Sol. Sieve elements – Major transporting element of food.

Transfusion tissue – In place of lateral viens in gymnosperm leaves.

35. Which one of the following is manoecious?

(1) *Marchantia* (2) *Cycas*

(3) *Pinus* (4) *Date palm*

Ans. (3)

Sol. Both male and female cones occur or same plant in *Pinus*.

36. A cross in which an organism showing a dominant phenotype in crossed with the recessive parent in order to know its genotype is called :

(1) Monohybrid cross (2) Back cross

(3) Test cross (4) Dihybrid cross

Ans. (3)

Sol. Back cross include cross of F_1 with any of the parents *i.e.,* (Tt × tt) or (Tt × TT).

37. The Indian Rhinoceros is a natural inhabitant of which one of the Indian states?

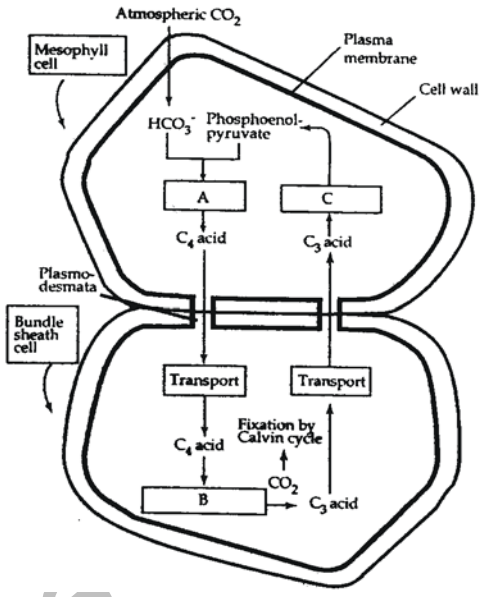
(1) Uttarakhand (2) Uttar Pradesh

(3) Himachal Pradesh (4) Assam

Ans. (4)

Sol. Kaziranga National Park is famous for rhinoceros.

38. Study the pathway given below :



In which of the following options correct words for all the three blanks A, B and C are indicated?

	A	B	C
(1)	Decarboxylation	Reduction	Regeneration
(2)	Fixation	Transamination	Regencration
(3)	Fixation	Decarboxylation	Regeneration
(4)	Carboxylation	Decarboxylation	Reduction

Ans. (3)

Sol. A – Fixation of CO_2 by PEPCO

B – Decarboxylation

C – Regeneration

39. Black (stem) rust of wheat is caused by :

(1) *Alternaria solani* (2) *Ustilago nuda*

(3) *Puccinia graminis* (4) *Xanthomonas oryzae*

Ans. (3)

Sol. *Puccinia graminis tritici* - Black stem rust of wheat.

40. Secretions from which one of the following are rich in fructose, calcium and some enzymes?

(1) Male accessory glands

(2) Liver

(3) Pancreas

(4) Salivary glands

Ans. (1)

Sol. Male accessory glands include a pair of seminal vesicles, a prostate gland, and pair of bulbourethral glands. Their secretions is called as seminal plasma, which is rich in fructose, has calcium and some enzymes.

41. A person suffering from a disease caused by *Plasmodium*, experiences recurring chill and fever at the time when?

(1) The sporozoites released from RBCs are being rapidly killed and broken down inside spleen

(2) The trophozoites reach maximum growth and give out certain toxins

(3) The parasite after its rapid multiplication inside RBCs ruptures them, releasing the stage to enter fresh RBCs

(4) The microgametocytes and megagametocytes are being destroyed by the WBCs

Ans. (3)

Sol. In malaria chill and fever is due to the release of haemozoin, a toxic substance formed by breakdown of haemoglobin present in RBC. It will be released after the rupture of RBC, in erythrocytic schizogamy.

42. ABO blood grouping is controlled by gene I which has three alleles and show co-dominance. There are six genotypes. How many phenotypes in all are possible?

(1) Six (2) Three

(3) Four (4) Five

Ans. (3)

Sol. A, B, AB and O.

43. Three of the following statements about enzymes are correct and one is wrong. Which one is wrong?

(1) Enzymes require optimum pH for maximal activity

(2) Enzymes are denatured at high temperature but in certain exceptional organisms they are effective even at temperatures 80°-90°C

(3) Enzymes are highly specific

(4) Most enzymes are proteins but some are lipids

Ans. (4)

Sol. Most enzymes are proteins but some are RNA enzymes.

44. An elaborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cell shape is called :

(1) Thylakoid

(2) Endoplasmic Reticulum

(3) Plasmalemma

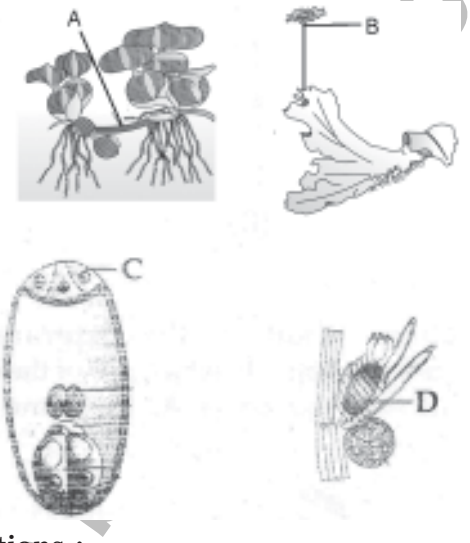
(4) Cytoskeleton

Ans. (4)

Sol. Cytoskelcton-Microtubule, Microfilament and Intermediate filaments.

45. Examine the figures (A-D) given below and select the right option out of 1-4, in which all the four structures A, B, C and D are identified correctly

Structures :



Options :

	A	B	C	D
(1)	Rhizome	Sporangiophore	Polar cell	Globule
(2)	Runner	Archegoniophore	Synergid	Antheridium
(3)	Offset	Antheridiophore	Antipodals	Oogonium
(4)	Sucker	Seta	Megaspore mother cell	Gemma cup

Ans. (3)

Sol. A – Offset of Eichhornia

B – Antheridiophore of *Marchantia*

C – Antipodals

D – Oogonium (Nucule) of *Chara*

46. Root development is promoted by

(1) Abscisic acid

(2) Auxin

(3) Gibberellin

(4) Ethylene

Ans. (4)

Sol. Root development and root hair formation C_2H_4.

47. Consider the following four statements A, B, C and D and select the right option for two **correct** statements.

Statements

(A) In vexillary aestivation, the large posterior petal is called - *standard*, two lateral ones are *wings* and two small anterior petals are termed *keel*

(B) The floral formula for Liliaceae is

$$\oplus ⚥ P_{3+3} A_{3+3} + G_{\underline{3}}$$

(C) In pea flower the stamens are monadelphous

(D) The floral formula for Solanaceae is

$$\oplus ⚥ K_{(3)} C_{(3)} A_{(4)} + G_{(2)}$$

The correct statements are

(1) (A) and (C)

(2) (A) and (B)

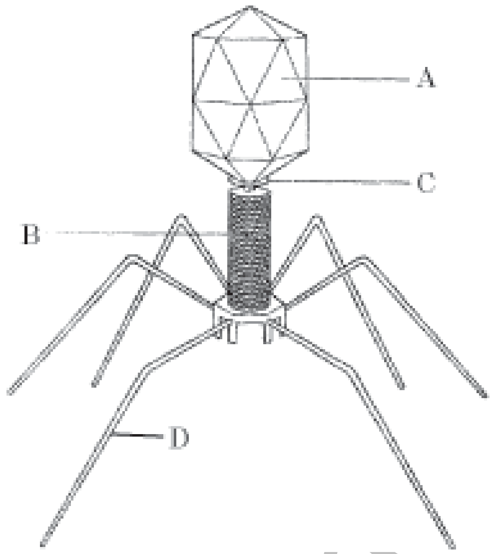
(3) (B) and (C)

(4) (C) and (D)

Ans. (2)

Sol. Pea-Diadelphous.

48. Given below is the diagram of a bacteriophage. In which one of the options all the four parts A, B, C and D are correct?



Options :

	A	B	C	D
(1)	Tail fibres	Head	Sheath	Collar
(2)	Sheath	Collar	Head	Tail fibres
(3)	Head	Sheath	Collar	Tail fibres
(4)	Collar	Tail fibres	Head	Sheath

Ans. (3)

Sol. A - Head

B - Sheath

C - Collar

D - Tail fibre

49. In genetic engineering, a DNA segment (gene) of interest, is transferred to the host cell through a vector. Consider the following four agents (A-D) in this regard and select the correct option about which one or more of these can be used as a vector/ vectors

Statements

(A) A bacterium (B) Plasmid

(C) Plasmodium (D) Bacteriophage

Options :

(1) (A), (B) and (D) only (2) (A) only

(3) (A) and (C) only (4) (B) and (D) only

Ans. (4)

Sol. Plasmids and bacteriophages are used as vectors in genetic engineering.

50. Which one of the following can **not** be used for preparation of vaccines against plague?

(1) Formalin-inactivated suspensions of virulent bacteria

(2) Avirulent live bacteria

(3) Synthetic capsular polysaccharide material

(4) Heat-killed suspensions of virulent bacteria

Ans. (3)

Sol. Synthetic capsular polysaccharide vaccines are available for treatment of pneumonia caused by

Streptococcus pneumoniae

Hemophilus influenza

and for meningtidis caused by *Neisseria meningitids.*

They are not available for plague.

51. The fruit fly *Drosophila melanogaster* was found to be very suitable for experimental verification of chromosomal theory of inheritance by Morgan and his colleagues because :

(1) It reproduces parthenogenetically

(2) A single mating produces two young flies

(3) Smaller female is easily recognisable from larger male

(4) It completes life cycle in about two weeks

Ans. (4)

Sol. Female is larger. Many offsprings are produced from single mating.

52. The *lac* operon consists of

(1) Four regulatory genes only

(2) One regulatory gene and three structural genes

(3) Two regulatory genes and two structural genes

(4) Three regulatory genes and three structural genes

Ans. (2)

Sol. Regulatory gene - 'i', structural genes - z, y, a

53. Crocodile and penguin are similar to Whale and Dogfish in which one of the following features?

(1) Possess a solid single stranded central nervous system

(2) Lay eggs and guard them till they hatch

(3) Possess bony skeleton.

(4) Have gill slits at some stage

Ans. (4)

Sol. Crocodile, Penguin, Whale and Dogfish all are chordates. So, all have gill slits at some stage of development.

54. Select the answer with *correct matching* of the structure, its location and function

	Structure	Location	Function
(1)	Eustachian tube	Anterior part of internal ear	Equalizes air pressure on either sides of tympanic membrane
(2)	Cerebellum	Mid brain	Controls respiration and gastric secretions
(3)	Hypothalamus	Fore brain	Controls body temperature, urge for eating and drinking
(4)	Blind spot	Near the place where optic nerve leaves the eye	Rods and cones are present but inactive here

Ans. (3)

Sol. Hypothalamus is the floor of diencephalon which is the part of fore brain. It has thermoregulatory centre, hunger and thirst centre.

55. Select the correct combination of the statements (*a-d*) regarding the *characteristics* of certain organisms

(a) Methanogens are Archaebacteria which produce methane in marshy areas

(b) *Nostoc* is a filamentous blue-green alga which fixes atmospheric nitrogen

(c) Chemosynthetic autotrophic bacteria synthesize cellulose from glucose

(d) Mycoplasma lack a cell wall and can survive without oxygen

The correct statement are

(1) (b), (c) (2) (a), (b), (c)

(3) (b), (c), (d) (4) (a), (b), (d)

Ans. (4)

Sol. Chemosynthetic autotrophs oxidize inorganic substances to produce energy and helps cycling of minerals.

56. Which one of the following is the *correct description* of a certain part of a normal human skeleton?

(1) Parietal bone and the temporal bone of the skull are joined by fibrous joint

(2) First vertebra is axis which articulates with the occipital condyles

(3) The 9^{th} and 10^{th} pairs of ribs are called the floating ribs

(4) Glenoid cavity is a depression to which the thigh bone articulates

Ans. (1)

Sol. Immovable/fixed/fibrous joint are present between the skull bones. So, between parietal bone and the temporal bone of the skull are joined by fibrous joint.

57. Vegetative propagation is *Pistia* occurs by

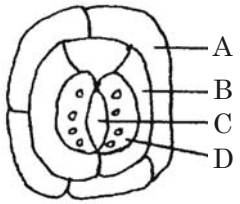
(1) Stolen (2) Offset

(3) Runner (4) Sucker

Ans. (2)

Sol. *Lemna, Pistia, Eichhornia* - Offset

58. Given below is the diagram of a stomatal apparatus. In which of the following all the four parts labelled as A, B, C and D are correctly identified?

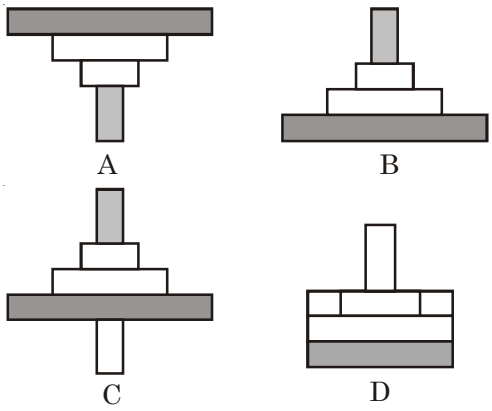


	A	B	C	D
(1)	Subsidiary cell	Epidermal cell	Guard cell	Stomatal aperture
(2)	Guard cell	Stomatal aperture	Subsidiary cell	Epidermal cell
(3)	Epidermal cell	Guard cell	Stomatal aperture	Subsidiary cell
(4)	Epidermal cell	Subsidiary cell	Stomatal aperture	Guard cell

Ans. (4)

Sol. A-Epidermal cell, B-Subsidiary cell, C-Stomatal aperture, D-Guard cell

59. Which of the following representations shows the pyramid of numbers in a forest ecosystem?



(1) D (2) A

(3) B (4) C

Ans. (3)

Sol. Pyramid of number is inverted in single tree ecosystem only.

60. The 3′-5′ phosphodiester linkages inside a polynucleotide chain serve to join

(1) One DNA strand with the other DNA strand

(2) One nucleoside with another nucleoside

(3) One nucleotide with another nucleotide

(4) One nitrogenous base with pentose sugar

Ans. (3)

Sol. 3′-5′ phosphodiester bond is formed between carbon 3 of one nucleotide and carbon 5 of the other nucleotide.

61. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i. The resultant magnetic field due to the two semicircular parts at their common centre is

(1) $\frac{\mu_0 i}{2\sqrt{2}R}$ (2) $\frac{\mu_0 i}{2R}$

(3) $\frac{\mu_0 i}{4R}$ (4) $\frac{\mu_0 i}{\sqrt{2}R}$

Ans. (1)

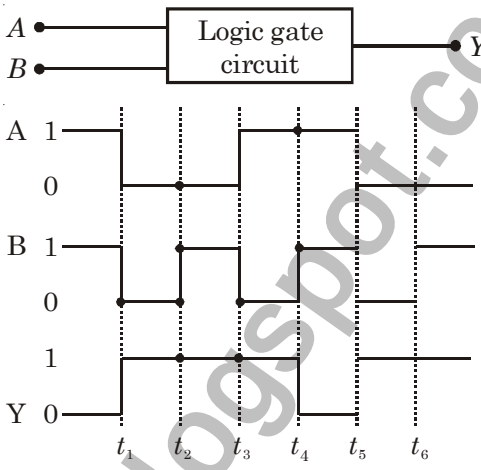
Sol. $\vec{B} = \vec{B_1} + \vec{B_2}$

$|\vec{B_1}| = |\vec{B_2}| = \frac{\mu_0 i}{4R}$

$|\vec{B}| = \sqrt{B_1^2 + B_2^2}$

$|\vec{B}| = \frac{\mu_0 i}{4R}\sqrt{2} = \frac{\mu_0 i}{2\sqrt{2}\,R}$

62. The following figure shows a logic gate circuit with two inputs A and B and the output Y. The voltage waveforms of A, B and Y are as given



The logic gate is

(1) NOR gate (2) OR gate

(3) AND gate (4) NAND gate

Ans. (4)

Sol.

A	B	Y
1	1	0
0	0	1
0	1	1
1	0	1

63. Two parallel metal plates having charges $+Q$ and $-Q$ face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will

(1) Become zero (2) Increase

(3) Decrease (4) Remain same

Ans. (3)

Sol. Electric field in vacuum

$$E_0 = \frac{\sigma}{\varepsilon_0}$$

In medium

$$E = \frac{\sigma}{\varepsilon_0 K}$$

$K > 1$

$E < E_0$

64. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is

(1) Zero (2) E

(3) $\frac{E}{2}$ (4) $\frac{E}{3}$

Ans. (1)

Sol. Electric field inside shell is zero.

65. A student measures the distance traversed in free fall of a body, initially at rest in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is

(1) $e_2 - e_1$ (2) $e_1 + 2e_2$

(3) $e_1 + e_2$ (4) $e_1 - 2e_2$

Ans. (2)

Sol. $\ln g = \ln h - 2 \ln t$

$$\left(\frac{\Delta g}{g} \times 100\right)_{\max} = \frac{\Delta h}{h} \times 100 + 2\frac{\Delta t}{t} \times 100$$

$$= e_1 + 2e_2$$

66. When monochromatic radiation of intensity I falls on a metal surface, the number of photoelectron and their maximum kinetic energy are N and T respectively. If the intensity of radiation is $2I$, the number of emitted electrons and their maximum kinetic energy are respectively

(1) N and $2T$ (2) $2N$ and T

(3) $2N$ and $2T$ (4) N and T

Ans. (2)

Sol. Number of photoelectrons ∝ Intensity

Maximum kinetic energy is independent of intensity

67. The electric field of an electromagnetic wave in free space is given by

$\vec{E} = 10\cos\left(10^7 t + kx\right)\hat{j}$ V/m, where t and x are in seconds and metres respectively. It can be inferred that

(a) The wavelength λ is 188.4 m

(b) The wave number k is 0.33 rad/m

(c) The wave amplitude is 10 V/m

(d) The wave is propagating along $+x$ direction

Which one of the following pairs of statements is correct?

(1) (c) & (d) (2) (a) and (b)

(3) (b) & (c) (4) (a) & (c)

Ans. (4)

Sol. Amplitude = $10\frac{V}{m}$

$$C = \frac{\omega}{k}$$

$$3 \times 10^8 = \frac{10^7}{k}$$

$$k = \frac{1}{30}$$

$$\frac{2\pi}{\lambda} = \frac{1}{30}$$

λ = 188.4 m

68. The speed of light in media M_1 and M_2 is 1.5×10^8 m/s and 2.0×10^8 m/s respectively. A ray of light enters from medium M_1 to M_2 at an incidence angle i. If the ray suffers total internal reflection, the value of i is

(1) Equal to $\sin^{-1}\left(\frac{2}{3}\right)$

(2) Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$

(3) Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$

(4) Less than $\sin^{-1}\left(\frac{2}{3}\right)$

Ans. (3)

Sol. $\mu_1 = 2$

$$\mu_2 = \frac{3}{2}$$

$$2\sin i \geq \frac{3}{2}\sin 90$$

$$\sin i \geq \frac{3}{4}$$

$$i \geq \sin^{-1}\left(\frac{3}{4}\right)$$

69. A ray of light is incident on a 60° prism at the minimum deviation position. The angle of refraction at the first face (i.e., incident face) of the prism is

(1) Zero (2) 30°

(3) 45° (4) 60°

Ans. (2)

Sol. In minimum deviation

$r_1 = r_2 = r$

$A = 2r$

$$r = \frac{60}{2} = 30^\circ$$

70. For transistor action

(a) Base, emitter and collector regions should have similar size and doping concentrations.

(b) The base region must be very thin and lightly doped.

(c) The emitter-base junction is forward biased and base-collector junction is reverse baised.

(d) Both the emitter-base junction as well as the base collector junction are forward biased.

Which one of the following pairs of statements is correct?

(1) (d), (a) (2) (a), (b)

(3) (b), (c) (4) (c), (d)

Ans. (3)

71. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius R_2 $(R_2 > R_1)$ is

(1) $GmM\left(\frac{1}{R_1^2} - \frac{1}{R_2^2}\right)$ (2) $GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

(3) $2GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ (4) $\frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Ans. (4)

Sol. $$-\frac{GMm}{2R_1} + \text{KE} = -\frac{GMm}{2R_2}$$

$$\text{KE} = \frac{GMm}{2}\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

72. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is

(1) 60° (2) 15°

(3) 30° (4) 45°

Ans. (1)

Sol. $v' = v_0\cos\theta$

$$\frac{v_0}{2} = v_0\cos\theta$$

$$\cos\theta = \frac{1}{2}$$

$\theta = 60^\circ$

73. From a circular disc of radius R and mass $9M$, a small disc of mass M and radius $\frac{R}{3}$ is removed concentrically. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through its centre is

(1) $\frac{40}{9}MR^2$ (2) MR^2

(3) $4MR^2$ (4) $\frac{4}{9}MR^2$

Ans. (1)

Sol. $I = I_1 - I_2$

$$= \frac{9MR^2}{2} - \frac{MR^2}{18}$$

$$= \frac{81MR^2 - MR^2}{18}$$

$$= \frac{40\ MR^2}{9}$$

74. A particle moves in x-y plane according to rule $x = a\sin\omega t$ and $y = a\cos\omega t$. The particle follows

(1) An elliptical path

(2) A circular path

(3) A parabolic path

(4) A straight line path inclined equally to x and y-axes

Ans. (2)

Sol. $$\frac{x}{a} = \sin\omega t$$

$$\frac{y}{a} = \cos\omega t$$

$$\frac{y^2}{a^2} + \frac{x^2}{a^2} = 1$$

$y^2 + x^2 = a^2$

75. A closely wound solenoid of 2000 turns and area of cross-section 1.5×10^{-4} m^2 carries a current of 2.0 A. It is suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} tesla making an angle of 30° with the axis of the solenoid. The torque on the solenoid will be

(1) 3×10^{-3} N.m (2) 1.5×10^{-3} N.m

(3) 1.5×10^{-2} N.m (4) 3×10^{-2} N.m

Ans. (3)

Sol. $M = 2000 \times 1.5 \times 10^{-4} \times 2$

$= 6 \times 10^{-1}$

$\tau = MB\sin 30$

$= 0.6 \times 5 \times 10^{-2} \times \frac{1}{2}$

$\tau = 1.5 \times 10^{-2}$ Nm

76. The decay constant of a radio isotope is λ. If A_1 and A_2 are its activities at times t_1 and t_2 respectively, the number of nuclei which have decayed during the time $(t_1 - t_2)$

(1) $A_1t_1 - A_2t_2$ (2) $A_1 - A_2$

(3) $(A_1 - A_2)/\lambda$ (4) $\lambda(A_1 - A_2)$

Ans. (3)

Sol. $A_1 = \lambda N_1$

$A_2 = \lambda N_2$

$N_1 - N_2 = \left[\frac{A_1 - A_2}{\lambda}\right]$

77. A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8} C. The particle is given an initial horizontal velocity of 10^5 ms^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that

(a) $\vec{B}$ should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity

(b) Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity

(c) Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity

(d) $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicular to the direction of velocity

Which one of the following pairs of statements is possible?

(1) (a) and (c) (2) (c) and (d)

(3) (b) and (c) (4) (b) and (d)

Ans. (3)

78. The binding energy per nucleon in deuterium and helium nuclei are 1.1 MeV and 7.0 MeV, respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is

(1) 23.6 MeV (2) 2.2 MeV

(3) 28.0 MeV (4) 30.2 MeV

Ans. (1)

Sol. $\Delta E = (28 - 4.4)$ MeV

$\Delta E = 23.6$ MeV

79. The electron in the hydrogen atom jumps from excited state ($n = 3$) to its ground state ($n = 1$) and the photons thus emitted irradiate a photosensitive material. If the work function of the material is 5.1 eV, the stopping potential is estimated to be (the energy of the electron in n^{th} state $E_n = -\frac{13.6}{n^2} eV$)

(1) 5.1 V (2) 12.1 V

(3) 17.2 V (4) 7 V

Ans. (4)

Sol. $V = (12.1 - 5.1)$ volt

$V_{stopping} = 7$ V

80. If c_p and c_v denote the specific heats (per unit mass) of an ideal gas of molecular weight M

(1) $C_p - C_v = R/M^2$ (2) $C_p - C_v = R$

(3) $C_p - C_v = R/M$ (4) $C_p - C_v = MR$

where R is the molar gas constant

Ans. (3)

Sol. $C_p - C_v = R$

$MC_p - MC_v = R$

$C_p - C_v = \frac{R}{M}$

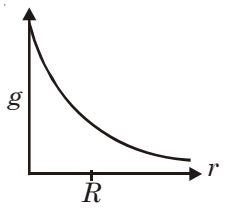
81. A condenser of capacity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is

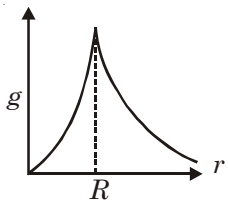
(1) $\left(\frac{C(V_1 - V_2)^2}{L}\right)^{\frac{1}{2}}$ (2) $\frac{C(V_1^2 - V_2^2)}{L}$

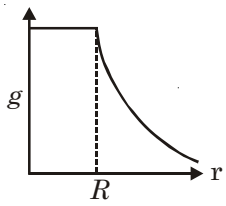
(3) $\frac{C(V_1^2 + V_2^2)}{L}$ (4) $\left(\frac{C(V_1^2 - V_2^2)}{L}\right)^{\frac{1}{2}}$

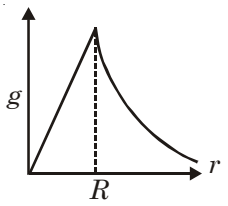
Ans. (4)

82. The dependence of acceleration due to gravity g on the distance r from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in figures below

(a) 

(b) 

(c) 

(d) 

The correct figure is

(1) (d) (2) (a)

(3) (b) (4) (c)

Ans. (1)

83. A solid cylinder and a hollow cylinder, both of the same mass and same external diameter are released from the same height at the same time on a inclined plane. Both roll down without slipping. Which one will reach the bottom first?

(1) Both together only when angle of inclination of plane is 45^{o}

(2) Both together

(3) Hollow cylinder

(4) Solid cylinder

Ans. (4)

Sol. $t = \sqrt{\dfrac{2\ell\left(1+\dfrac{k^2}{R^2}\right)}{g\sin\theta}}$

ℓ = length of incline plane

84. The thermo e.m.f. E in volts of a certain thermo-couple is found to vary with temperature difference θ in °C between the two junctions according to the relation

$$E = 30\theta - \frac{\theta^2}{15}$$

The neutral temperature for the thermo-couple will be

(1) 450°C (2) 400°C

(3) 225°C (4) 30°C

Ans. (3)

Sol. At neutral temperature

$$\frac{dE}{d\theta} = 0$$

$$30 - \frac{2\theta}{15} = 0$$

θ = 225 °C

85. (a) Centre of gravity (C.G.) of a body is the point at which the weight of the body acts

(b) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius

(c) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its C.G.

(d) The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the C.G. of the body to the axis

Which one of the following pairs of statements is **correct**?

(1) (d) and (a) (2) (a) and (b)

(3) (b) and (c) (4) (c) and (d)

Ans. (1)

86. The magnetic moment of a diamagnetic atom is

(1) Much greater than one

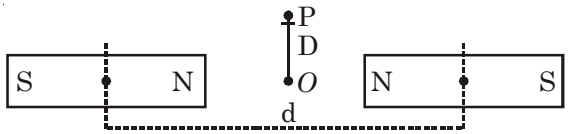
(2) 1

(3) Between zero and one

(4) Equal to zero

Ans. (4)

87. Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure



The force on the charge Q is

(1) Zero

(2) Directed along OP

(3) Directed along PO

(4) Directed perpendicular to the plane of paper

Ans. (1)

88. A particle of mass M starting from rest undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is

(1) $\frac{MV^2}{T}$ (2) $\frac{1}{2}\frac{MV^2}{T^2}$

(3) $\frac{MV^2}{T^2}$ (4) $\frac{1}{2}\frac{MV^2}{T}$

Ans. (4)

89. A thin circular ring of mass M and radius r is rotating about its axis with constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with angular velocity given by

(1) $\frac{(M+2m)\omega}{2m}$ (2) $\frac{2M\omega}{M+2m}$

(3) $\frac{(M+2m)\omega}{M}$ (4) $\frac{M\omega}{M+2m}$

Ans. (4)

Sol. $MR^2\omega = (M + 2m)R^2\omega'$

$$\boxed{\omega' = \frac{m\omega}{(M+2m)}}$$

90. A monoatomic gas at pressure P_1 and V_1 is compressed adiabatically to $\frac{1}{8}$th its original volume. What is the final pressure of the gas?

(1) 64 P_1 (2) P_1

(3) 16 P_1 (4) 32 P_1

Ans. (4)

Sol. $PV^{5/3} = P'\left(\frac{V}{8}\right)^{5/3}$

$P' = P(8)^{5/3}$

$= P \times 2^5$

$P' = 32P$

91. Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is

(1) Mg < Ca < Cl < P (2) Cl < P < Mg < Ca

(3) P < Cl < Ca < Mg (4) Ca < Mg < P < Cl

Ans. (2)

Sol. In a period size decreases from left to right.

92. The reaction

$$2A(g) + B(g) \rightleftharpoons 3C(g) + D(g)$$

is begun with the concentrations of A and B both at an initial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression

(1) $[(0.75)^3(0.25)] \div [(1.00)^2(1.00)]$

(2) $[(0.75)^3(0.25)] \div [(0.50)^2(0.75)]$

(3) $[(0.75)^3(0.25)] \div [(0.50)^2(0.25)]$

(4) $[(0.75)^3(0.25)] \div [(0.75)^2(0.25)]$

Ans. (2)

Sol.

	$2A$	+	$B \rightleftharpoons$	$3C$	+	D
Initial	1		1	0		0
Eq.	1 – 0.50		1 – 0.25	0.75		0.25

$$K = \frac{(0.75)^3(0.25)}{(0.50)^2(0.75)}$$

93. Which of the following expressions correctly represents the equivalent conductance at infinite dilution of $Al_2(SO_4)_3$. Given that $\Lambda^o_{Al^{3+}}$ and $\Lambda^o_{SO_4^{2-}}$ are the equivalent conductances at infinite dilution of the respective ions?

(1) $2\Lambda^o_{Al^{3+}} + 3\Lambda^o_{SO_4^{2-}}$ (2) $\Lambda^o_{Al^{3+}} + \Lambda^o_{SO_4^{2-}}$

(3) $(\Lambda^o_{Al^{3+}} + \Lambda^o_{SO_4^{2-}}) \times 6$ (4) $\frac{1}{3}^{\Lambda^o} Al^{3+} + \frac{1}{2}^{\Lambda^o} SO_4^{2-}$

Ans. (2)

Sol. As equivalent conductance are given for ions.

94. The pressure exerted by 6.0 g of methane gas in a 0.03 m^3 vessel at 129°C is (Atomic masses : C = 12.01, H = 1.01 and R = 8.314 JK^{-1} mol^{-1})

(1) 215216 Pa (2) 13409 Pa

(3) 41648 Pa (4) 31684 Pa

Ans. (3)

Sol. PV = nRT

$$P = \frac{6}{16.05} \times \frac{8.314 \times 402}{0.03} \simeq 41648 \text{ Pa}$$

95. Match List-I (Equations) with List-II (Type of process) and select the correct option

List-I Equations	List-II Type of processes
a. $K_p > Q$	(i) Non-spontaneous
b. $\Delta G° < RT \ln Q$	(ii) Equilibrium
c. $K_p = Q$	(iii) Spontaneous and endothermic
d. $T > \frac{\Delta H}{\Delta S}$	(iv) Spontaneous

(1) a(i), b(ii), c(iii), d(iv) (2) a(iii), b(iv), c(ii), d(i)

(3) a(iv), b(i), c(ii), d(iii) (4) a(ii), b(i), c(iv), d(iii)

Ans. (3)

Sol. $K_p > Q \rightarrow$ Reaction moves in forward direction.

$\Delta G < RT\ln Q$, ΔG = +ve = reaction non-spontaneous

$K_p = Q$ = Reaction is equilibrium

$T > \frac{\Delta H}{\Delta S} = \Delta H$ = +ve, endothermic

Thus, $\Delta H < T\Delta S$ spontaneous

96. Among the following four compounds

a. Phenol b. Methyl phenol

c. Metanitrophenol d. Paranitrophenol

The acidity order is

(1) d > c > a > b (2) c > d > a > b

(3) a > d > c > b (4) b > a > c > d

Ans. (1)

Sol. Withdrawing group increasing the acidic character and electron donating group decreases the acidic characters.

97. Among the following which one has the highest cation to anion size ratio?

(1) CsI (2) CsF

(3) LiF (4) NaF

Ans. (2)

Sol. $Cs^+ > Li^+ \rightarrow$ atomic radii

$I^- > F^- \rightarrow$ atomic radii

$\therefore$ CsF has highest cation to anion size ratio

98. Three moles of an ideal gas expanded spontaneously into vacuum. The work done will be

(1) Infinite (2) 3 Joules

(3) 9 Joules (4) Zero

Ans. (4)

Sol. In vacuum, $P_{ext} = 0$

$W = 0$

99. Which of the following species is not electrophilic in nature?

(1) $\overset{\oplus}{C}l$ (2) BH_3

(3) $H_3\overset{\oplus}{O}$ (4) $\overset{\oplus}{N}O_2$

Ans. (3)

Sol. Cl^+, BH_3, $\overset{\oplus}{N}O_2$ are electron deficient.

100. A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be

(h = 6.6 × 10^{-34} Js)

(1) 6.6×10^{-32} m (2) 6.6×10^{-34} m

(3) 1.0×10^{-35} m (4) 1.0×10^{-32} m

Ans. (3)

Sol. $\lambda = \frac{h}{mv}$

$= \frac{6.6\times10^{-34}}{0.66\times100} = 10^{-35}$ m

101. Consider the following relations for emf of a electrochemical cell

(a) emf of cell = (Oxidation potential of anode) – (Reduction potential of cathode)

(b) emf of cell = (Oxidation potential of anode) + (Reduction potential of cathode)

(c) emf of cell = (Reductional potential of anode) + (Reduction potential of cathode)

(d) emf of cell = (Oxidation potential of anode) – (Oxidation potential of cathode)

Which of the above relations are correct?

Options:

(1) (c) and (a) (2) (a) and (b)

(3) (c) and (d) (4) (b) and (d)

Ans. (4)

Sol. $E_{cell} = E^o_{\underset{(Red)}{cathode}} - E^o_{\underset{(Red)}{Anode}}$

or

$E_{cell} = E^o_{\underset{(Red)}{cathode}} - E^o_{\underset{(oxid)}{Anode}}$

or

$E_{cell} = E^o_{\underset{(oxid)}{Anode}} - E^o_{\underset{(oxid)}{cathode}}$

102. In which of the following molecules the central atom does not have sp^3 hybridization?

(1) CH_4 (2) SF_4

(3) BF_4^- (4) NH_4^+

Ans. (2)

Sol. $SF_4 = sp^3d$

103. For vaporization of water at 1 atmospheric pressure, the values of ΔH and ΔS are 40.63 kJ mol^{-1} and 108.8 JK^{-1} mol^{-1}, respectively. The temperature when Gibbs energy change (ΔG) for this transformation will be zero, is

(1) 273.4 K (2) 393.4 K

(3) 373.4 K (4) 293.4 K

Ans. (3)

Sol. $\Delta G = \Delta H - T\Delta S$

$\Delta G = 0$

$\Delta H = T\Delta S,$

$$T = \frac{40.63 \times 10^3}{108.8} = 373.4\,K$$

104. Match List-I (substances) with List-II (process) employed in the manufacture of the substances and select the correct option

	List-I		**List-II**
	Substances		**Processes**
a.	Sulphuric acid	(i)	Haber's Process
b.	Steel	(ii)	Bessemer's Process
c.	Sodium hydroxide	(iii)	Leblanc Process
d.	Ammonia	(iv)	Contact Process

(1) a(i), b(iv), c(ii), d(iii) (2) a(i), b(ii), c(iii), d(iv)

(3) a(iv), b(iii), c(ii), d(i) (4) a(iv), b(ii), c(iii), d(i)

Ans. (4)

Sol. Fact.

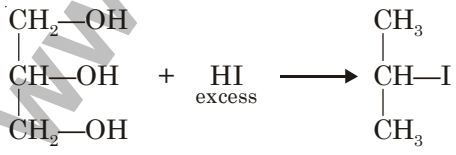
105. When glycerol is treated with excess of HI, it produces

(1) 2-iodopropane (2) Allyl iodide

(3) Propene (4) Glycerol triiodide

Ans. (1)

Sol.



106. Some statements about heavy water are given below

a. Heavy water is used as a moderator in nuclear reactors

b. Heavy water is more associated than ordinary water

c. Heavy water is more effective solvent than ordinary water

Which of the above statements are correct?

(1) a and b (2) a, b and c

(3) b and c (4) a and c

Ans. (1)

Sol. Dielectric constant of H_2O > D_2O. Therefore, H_2O is more effective solvent.

B.P. of D_2O > B.P. of H_2O.

107. The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO_2 is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A. The compound is

(1) $CaCO_3$ (2) Na_2CO_3

(3) K_2CO_3 (4) $CaSO_4.2H_2O$

Ans. (1)

Sol. A → $CaCO_3$

B → $Ca(OH)_2$

C → $Ca(HCO_3)_2$

108. Match the compounds given in List-I with their characteristic reactions given in List-II. Select the correct option

List-I	**List-II**
(Compounds)	**(Reactions)**
a. $CH_3CH_2CH_2CH_2NH_2$	(i) Alkaline hydrolysis
b. $CH_3C{\equiv}CH$	(ii) With KOH (alcohol) and $CHCl_3$ produces bad smell
c. $CH_3CH_2COOCH_3$	(iii) Gives white ppt. with ammoniacal $AgNO_3$
d. $CH_3CH(OH)CH_3$	(iv) With Lucas reagent cloudiness appears after 5 minutes

(1) a(ii), b(i), c(iv), d(iii)

(2) a(iii), b(ii), c(i), d(iv)

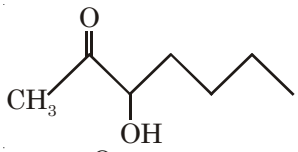
(3) a(ii), b(iii), c(i), d(iv)

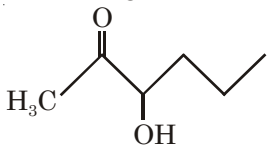
(4) a(iv), b(ii), c(iii), d(i)

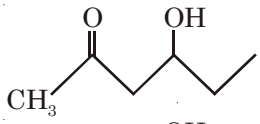
Ans. (3)

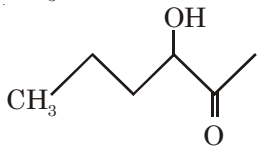
Sol. Fact.

109. Which one of the following compounds will be most readily dehydrated?

(1) 

(2) 

(3) 

(4) 

Ans. **(3)**

Sol. As carbocation intermediate, more the stability of carbocation, faster the rate of dehydration.

110. The rate of the reaction

$2NO + Cl_2 \rightarrow 2NOCl$ is given by the rate equation

rate = $k[NO]^2[Cl_2]$

The value of the rate constant can be increased by

(1) Increasing the temperature

(2) Increasing the concentration of NO

(3) Increasing the concentration of the Cl_2

(4) Doing all of these

Ans. **(1)**

Sol. Concentration do not affect rate constant.

111. Which one of the following complexes is **not** expected to exhibit isomerism?

(1) $[Ni(NH_3)_4 (H_2O)_2]^{2+}$

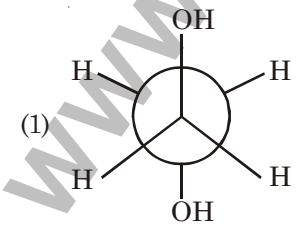
(2) $[Pt (NH_3)_2 Cl_2]$

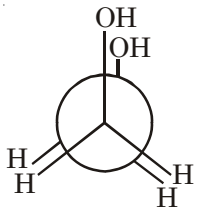
(3) $[Ni (NH_3)_2 Cl_2]$

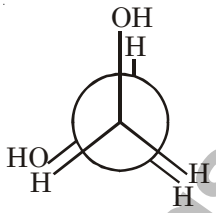
(4) $[Ni (en)_3]^{2+}$

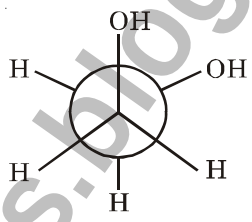
Ans. **(3)**

112. Which of the following conformers for ethylene glycol is most stable?

(1) 

(2) 

(3) 

(4) 

Ans. **(4)**

Sol. Intramolecular H-bonding.

113. The IUPAC name of the compound $CH_3CH{=}CHC{\equiv}CH$ is

(1) Pent-4-yn-2-ene (2) Pent-3-en-1-yne

(3) Pent-2-en-4-yne (4) Pent-1-yn-3-ene

Ans. **(2)**

Sol. Fact.

114. Which of the following oxidation states is the most common among the lanthanoids?

(1) 4 (2) 2

(3) 5 (4) 3

Ans. **(4)**

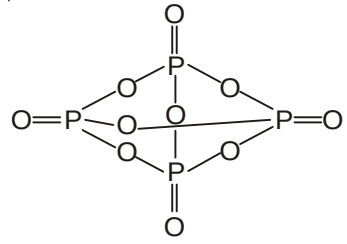
Sol. Fact

115. How many bridging oxygen atoms are present in P_4O_{10}?

(1) 6 (2) 4

(3) 2 (4) 5

Ans. **(1)**

Sol. 

116. Some of the properties of the two species, NO_3^- and H_3O^+ are described below. Which one of them is correct?

(1) Dissimilar in hybridization for the central atom with different structures

(2) Isostructural with same hybridization for the central atom

(3) Isostructural with different hybridization for the central atom

(4) Similar in hybridization for the central atom with different structures

Ans. **(1)**

Sol. $NO_3^{\ominus} = sp^2$

$H_3O^+ = sp^3$

117. The following two reactions are known :

$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$;

$\Delta H = -26.8$ kJ

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)$;

$\Delta H = -16.5$ kJ

The value of ΔH for the following reaction

$Fe_2O_3(s) + CO(g) \rightarrow 2FeO(s) + CO_2(g)$ is

(1) +10.3 kJ (2) – 43.3 kJ

(3) –10.3 kJ (4) +6.2 kJ

Ans. (4)

Sol. (1) – 2(2)

i.e. $-26.8 - (2)(-16.5)$

$= 6.2$ kJ

118. Following compounds are given

a. CH_3CH_2OH

b. CH_3COCH_3

c. $CH_3-\underset{\displaystyle CH_3}{\overset{}{|}}CHOH$

d. CH_3OH

Which of the above compound(s), on being warmed with iodine solution and NaOH, will give iodoform?

(1) a, c and d

(2) Only b

(3) a, b and c

(4) a and b

Ans. **(3)**

Sol. Terminal $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-$ or $CH_3-\underset{\displaystyle H}{\overset{\displaystyle OH}{\overset{|}{\underset{|}{C}}}}-$ show positive iodoform test.

119. Fructose reduces Tollen's reagent due to

(1) Asymmetric carbons

(2) Primary alcoholic group

(3) Secondary alcoholic group

(4) Enolisation of fructose followed by conversion to aldehyde by base

Ans. **(4)**

Sol. Fact.

120. In the following reaction

$$C_6H_5CH_2Br \xrightarrow[2.\ H_3O^+]{1.\ Mg,\ Ether} X,$$

the product 'X' is

(1) $C_6H_5CH_2OCH_2C_6H_5$

(2) $C_6H_5CH_2OH$

(3) $C_6H_5CH_3$

(4) $C_6H_5CH_2CH_2C_6H_5$

Ans. **(3)**

Sol. $C_6H_5CH_2Br \xrightarrow{Mg,\ ether} C_6H_5CH_2MgBr \xrightarrow{H_3O^+} C_6H_5CH_3 + Mg\begin{matrix}Br\\OH\end{matrix}$

AIPMT
SAMPLE PAPERS WITH SOLUTIONS

1. The cells lining the blood vessels belong to the category of

(1) Columnar epithelium

(2) Connective tissue

(3) Smooth muscle tissue

(4) Squamous epithelium

Ans. (4)

Sol. Simple squamous epithelium is present where diffusion and filtration is required. Cells lining our blood vessels belong to the category of simple squamous epithelium.

2. Consider the following statements (A-D) about organic farming

A. Utilizes genetically modified crops like Bt cotton

B. Uses only naturally produced inputs like compost

C. Does not use pesticides and urea

D. Produces vegetables rich in vitamins and minerals

Which of the above statements are correct?

(1) (B) and (C) only (2) (A) and (B) only

(3) (B), (C) and (D) (4) (C) and (D) only

Ans. (1)

Sol. Organic farming is a zero waste cyclical procedure, where waste from one process are cycled in as nutrient for other process.

3. Select the **correct** statement with respect to diseases and immunisation

(1) Certain protozoans have been used to mass produce hepatitis B vaccine

(2) Injection of snake antivenom against snake bite is an example of active immunisation

(3) If due to some reason B-and T-lymphocytes are damaged, the body will not produce antibodies against a pathogen

(4) Injection of dead / inactivated pathogens causes passive immunity

Ans. (3)

Sol. Clone of B-cells is called as plasma cells which produce antibodies. Helper T-cells secrete IL-2 (interleukin-2) which stimulate B cells to produce antibodies. Injection of snake antivenom against snake bite is an example of artificially acquired passive immunity.

4. *Selaginella* and *Salvinia* are considered to represent a significant step toward evolution of seed habit because

(1) Megaspores possess endosperm and embryo surrounded by seed coat

(2) Embryo develops in female gametophyte which is retained on parent sporophyte

(3) Female gametophyte is free and gets dispersed like seeds

(4) Female gametophyte lacks archegonia

Ans. (2)

Sol. Both are heterosporous genera; archegonia are present in both cases.

5. Which one of the following animals may occupy more than one trophic levels in the same ecosystem at the same time?

(1) Goat (2) Frog

(3) Sparrow (4) Lion

Ans. (3)

Sol. Sparrow can be herbivorous (eating seeds and fruits) or carnivorous (eating insects).

6. Which one of the following is essential for photolysis of water?

(1) Copper (2) Boron

(3) Manganese (4) Zinc

Ans. (3)

Sol. Manganese is the component of OEC that takes up e^- from H_2O.

7. What happens during fertilisation in humans after many sperms reach close to the ovum?

(1) Cells of corona radiata trap all the sperms except one

(2) Only two sperms nearest the ovum penetrate zona pellucida

(3) Secretions of acrosome helps one sperm enter cytoplasm of ovum through zona pellucida

(4) All sperms except the one nearest to the ovum lose their tails

Ans. (3)

Sol. At the time of fertilisation secretions of acrosome helps one sperm to enter the cytoplasm of ovum through zona pellucida.

8. Bulk of carbon dioxide (CO_2) released from body tissues into the blood is present as

(1) 70% carbamino-haemoglobin and 30% as bicarbonate

(2) Carbamino-haemoglobin in RBCs

(3) Bicarbonate in blood plasma and RBCs

(4) Free CO_2 in blood plasma

Ans. (3)

Sol. 20-25% of CO_2 is transported by RBCs in the form of carbamino hemoglobin. Whereas, 70% is carried as bicarbonate about 7% of CO_2 is carried in a dissolved state in plasma.

9. In mitochondria, protons accumulate in the

(1) Intermembrane space

(2) Matrix

(3) Outer membrane

(4) Inner membrane

Ans. (1)

Sol. Protons from complex I, III and IV of respiratory e^- transport moves to PMS, creating proton gradient.

10. The unequivocal proof of DNA as the genetic material came from the studies on a

(1) Viroid (2) Bacterial virus

(3) Bacterium (4) Fungus

Ans. (2)

Sol. Hershey and Chase worked with viruses that infect bacteria (*i.e.*, bacteriophages).

11. Whorled simple leaves with reticulate venation are present in

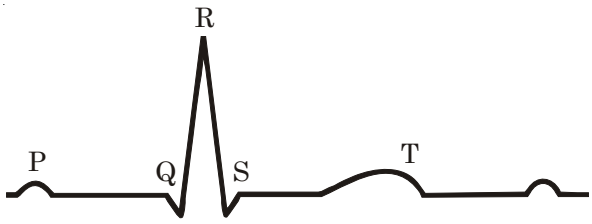
(1) China Rose (2) *Alstonia*

(3) *Calotropis* (4) Neem

Ans. (2)

Sol. Neem – Compound leaf; *Calotropis* – opposite phyllotaxy; China rose – alternate phyllotaxy.

12. Given below is the ECG of a normal human. Which one of its components is **correctly** interpreted below?



(1) Peak P and Peak R together – systolic and diastolic blood pressures

(2) Peak P – Initiation of left atrial contraction only

(3) Complex QRS – One complete pulse

(4) Peak T – Initiation of total cardiac contraction

Ans. (3)

Sol. The P-wave represents depolarisation of atria, which leads to the contraction of both atria.

QRS wave represents depolarisation of atria which initiates ventricular contraction. There is one ventricular contraction during one heart beat as heart beat rate is equal to pulse rate, so QRS complex represents one complete pulse.

13. Three of the following pairs of the human skeletal parts are correctly matched with their respective inclusive skeletal category and one pair is not matched. Identify the **non-matching** pair.

	Pairs of skeletal parts	**Category**
(1)	Humerus and ulna	Appendicular skeleton
(2)	Malleus and stapes	Ear ossicles
(3)	Sternum and Ribs	Axial skeleton
(4)	Clavicle and Glenoid cavity	Pelvic girdle

Ans. (4)

Sol. Clavicle and glenoid cavity are a part of pectoral girdle.

14. What is common between vegetative reproduction and Apomixis?

(1) Both occur round the year

(2) Both produces progeny identical to the parent

(3) Both are applicable to only dicot plants

(4) Both bypass the flowering phase

Ans. (2)

Sol. Both processes do not involves meiosis and syngamy.

15. Read the following statement having two blanks (A and B)

"A drug used for ___(A)___ patients is obtained from a species of the organism ___(B)___."

The one **correct** option for the two blanks is

	Blank-A	**Blank-B**
(1)	Swine flu	*Monascus*
(2)	AIDS	*Pseudomonas*
(3)	Heart	*Penicillium*
(4)	Organ-transplant	*Trichoderma*

Ans. (4)

Sol. Cyclosporin drug is obtained from the fungus *Trichoderma* and is used in organ-transplantation.

16. Which one of the following conditions of the zygotic cell would lead to the birth of a normal human female child?

(1) Only one X chromosome

(2) One X and one Y chromosome

(3) Two X chromosome

(4) Only one Y chromosome

Ans. (3)

Sol. In human female

$2n = 46$

$= 44 + XX$

17. The 24 hour (diurnal) rhythm of our body such as the sleep-wake cycle is regulated by the hormone.

(1) Adrenaline (2) Melatonin

(3) Calcitonin (4) Prolactin

Ans. (2)

Sol. The 24 hour (diurnal) rhythm of our body such as the sleep wake cycle is regulated by melatonin hormone.

18. Which one of the following pairs is **wrongly** matched while the remaining three are correct?

(1) *Bryophyllum* – Leaf buds

(2) *Agave* – Bulbils

(3) *Penicillium* – Conidia

(4) Water hyacinth – Runner

Ans. (4)

Sol. Water hyacinth – Offset.

19. Function of companion cells is

(1) Loading of sucrose into sieve elements by passive transport

(2) Loading of sucrose into sieve elements

(3) Providing energy to sieve elements for active transport

(4) Providing water to phloem

Ans. (2)

Sol. Companion cell maintains pressure gradient in sieves.

20. Which one of the following is **not** considered as a part of the endomembrane system?

(1) Vacuole

(2) Lysosome

(3) Golgi complex

(4) Peroxisome

Ans. (4)

Sol. Endomembrane system involves – Golgi, ER, vacuole and lysosome.

21. In Kranz anatomy, the bundle sheath cells have

(1) Thin walls, no intercellular spaces and several chloroplasts

(2) Thick walls, many intercellular spaces and few chloroplasts

(3) Thin walls, many intercellular spaces and no chloroplasts

(4) Thick walls, no intercellular spaces and large number of chloroplasts

Ans. (4)

Sol. Thin walls with few chloroplast is character of mesophyll cells in C_4 plants.

22. Sweet potato is homologous to

(1) Ginger

(2) Turnip

(3) Potato

(4) Colocasia

Ans. (2)

Sol. Turnip – Modified tap root for food storage.

Sweet potato – Modified adventitious root for food storage.

23. Ureters act as urinogenital ducts in

(1) Frog's both males and females

(2) Frog's males

(3) Human males

(4) Human females

Ans. (2)

Sol. Ureters act as urinogenital duct in male frog. In human beings urethra acts as male urinogenital duct.

24. Which one of the following is a possibility for most of us in regard to breathing, by making a *conscious effort*?

(1) One can consciously breathe in and breathe out by moving the diaphragm alone, without moving the ribs at all

(2) The lungs can be made fully empty by forcefully breathing out all air from them

(3) One can breathe out air totally without oxygen

(4) One can breathe out air through eustachian tubes by closing both the nose and the mouth

Ans. (1)

25. Read the following four statements (A-D) about certain mistakes in two of them

(A) The first tranrgenic buffalo Rosie produced milk which was human alpha-lactalbumin enriched

(B) Restriction enzymes are used in isolation of DNA from other macro-molecules

(C) Downstream processing is one of the steps of R-DNA technology

(D) Disarmed pathogen vectors are also used in transfer of R-DNA into the host

Which are the two statements having mistakes?

(1) Statements (A) and (C)

(2) Statements (A) and (B)

(3) Statements (B) and (C)

(4) Statements (C) and (D)

Ans. (2)

Sol. In statement A, the first transgenic cow was named as Rosie. In Statement B, Restriction endonucleases are used for cutting the DNA at specific points.

26. The pathogen *Microsporum* responsible for ringworm disease in humans belongs to the same Kingdom of organisms as that of

(1) *Rhizopus,* a mould

(2) *Ascaris,* a round worm

(3) *Taenia*, a tapeworm

(4) *Wuchereria,* a filarial worm

Ans. (1)

Sol. *Microsporum* which causes ringworm disease is a fungus.

27. Which one of the following techniques made it possible to genetically engineer living organisms?

(1) Heavier isotope labelling

(2) Hybridization

(3) Recombinant DNA techniques

(4) X-ray diffraction

Ans. (3)

28. "Good ozone" is found in the

(1) Stratosphere

(2) Ionosphere

(3) Mesorphere

(4) Troposphere

Ans. (1)

Sol. Tropospheric ozone is bad ozone.

29. Guttation is the result of

(1) Osmosis

(2) Root pressure

(3) Diffusion

(4) Transpiration

Ans. (2)

Sol. Root pressure leads to both guttation and bleeding.

30. Biodiversity of a geographical region represents

(1) Genetic diversity present in the dominant species of the region

(2) Species endemic to the region

(3) Endangered species found in the region

(4) The diversity in the organisms living in the region

Ans. (4)

Sol. Biodiversity represents the sum total of variations in all components of biosphere.

31. At metaphase, chromosomes are attached to the spindle fibres by their

(1) Kinetochores

(2) Centromere

(3) Satellites

(4) Secondary constrictions

Ans. (1)

Sol. Kinetochore-site of attachment of spindles.

32. Which one of the following is a wrong matching of a microbe and its industrial product, while the remaining three are correct?

(1) *Clostridium butylicum* - lactic acid

(2) *Aspergillus niger* - citric acid

(3) Yeast - statins

(4) *Acetobacter aceti* - acetic acid

Ans. (1)

Sol. *Clostridium butylicum*- Butyric acid.

33. Silencing of mRNA has been used in producing tranrgenic plants resistant to

(1) White rusts (2) Bacterial blights

(3) Bollworms (4) Nematodes

Ans. (4)

Sol. Silencing of m-RNA has been used in producing transgenic plants resistant to nematoda, *Meloidegyne incognita.*

34. Which one of the following statements is **totally wrong** about the occurrence of notochord while the other three are correct

(1) It is absent throughtout life in humans from the very beginning

(2) It is present througout life in *Amphioxus*

(3) It is present only in larval tail in *Ascidians*

(4) It is replaced by a vertebral column in adult frog

Ans. (1)

Sol. Notochord is present in the embryonic development of all chordates but in vertebrates it is replaced by vertebral column.

35. The technique called gamete intrafallopian transfer (GIFT) is recommended for those females

(1) Whore cervical canal is too narrow to allow passage for the sperms

(2) Who cannot provide suitable environment for fertilisation

(3) Who cannot produce an ovum

(4) Who cannot retain the foetus inside uterus

Ans. (3)

Sol. GIFT is gamete intrafallopian transfer. In this gametes are transferred into the fallopian tube of females.

36. Common cold is not cured by antibiotics because it is

(1) Caused by a Gram-negative bacterium

(2) Not an infectious disease

(3) Caused by a virus

(4) Caused by a Gram-positive bacterium

Ans. (3)

Sol. Common cold is not cured by antibiotics because it is caused by virus. Viral diseases cannot be treated by antibiotics as they lack cell wall.

37. Which one of the following options gives the **correct** matching of a disease with its causative organism and mode of infection

	Desease	**Causative Organisms**	**Mode of Ifection**
(1)	Elephan-tiasis	*Wuchereria bancrofti*	With infected water and food
(2)	Malaria	*Plasmodium vivax*	Bite of male *Anopheles mosquito*
(3)	Typhoid	*Salmonella* typhi	With inspired air
(4)	Pneumonia	*Streptococcus Pneumoniae*	Droplet infection

Ans. (4)

38. Frogs differ from humans in possessing

(1) Nucleated red blood cells

(2) Thyroid as well as parathyroid

(3) Paired cerebral hemispheres

(4) Hepatic portal system

Ans. (1)

39. Test cross in plants or in *Drosophila* involves crossing

(1) The F_1 hybrid with a double recessive genotype

(2) Between two genotypes with dominant trait

(3) Between two genotypes with recessive trait

(4) Between two F_1 hybrids

Ans. (1)

Sol. F_1, crossed with pure recessive parent, like

Tt × tt / TtRr × ttrr

40. The logistic population growth is expressed by the equation

(1) dN/dt = rN

(2) $dN/dt = rN\left(\frac{N-K}{N}\right)$

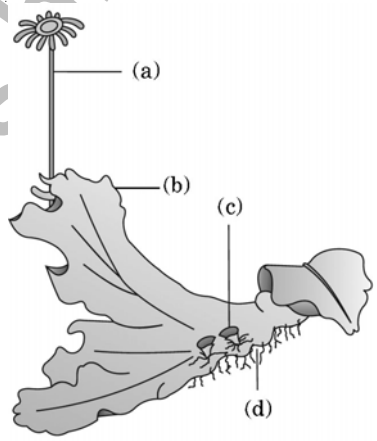
(3) $dt/dN = Nr\left(\frac{K-N}{K}\right)$

(4) $dN/dt = rN\left(\frac{K-N}{K}\right)$

Ans. (4)

Sol. $\frac{dN}{dt} = rN$ explains exponential growth.

41. Examine the figure given below and select the right option giving all the four parts (a, b, c, d) correctly identified



	A	**B**	**C**	**D**
(1)	Seta	Sporophyte	Protonema	Rhizoids
(2)	Antherid-iophore	Male thallus	Globule	Roots
(3)	Archego-niophore	Female thallus	Gemma-cup	Rhizoids
(4)	Archego-niophore	Female thallus	Bud	Foot

Ans. (3)

Sol. Female plant of *Marchantia* is given.

42. About which day in a normal human menstrual cycle does rapid secretion of LH (Popularly called LH-surge) normally occurs

(1) 5^{th} day (2) 11^{th} day

(3) 14^{th} day (4) 20^{th} day

Ans. (3)

43. In history of bilogy, human genome project led to the development of?

(1) Bioinformatics (2) Biosystematics

(3) Biotechnology (4) Biomonitoring

Ans. (1)

Sol. HGP was closely associated with the rapid development of a new area in biology called as bioinformatics.

44. Which one of the following correctly represents the normal adult human dental formula?

(1) $\frac{2}{2},\frac{1}{1},\frac{2}{2},\frac{3}{3}$ (2) $\frac{3}{3},\frac{1}{1},\frac{3}{3},\frac{3}{3}$

(3) $\frac{3}{3},\frac{1}{1},\frac{3}{2},\frac{1}{1}$ (4) $\frac{2}{2},\frac{1}{1},\frac{3}{2},\frac{3}{3}$

Ans. (1)

Sol. Dental formula of adult human is $\frac{2123}{2123}$.

45. The type of muscles present in our

(1) *Thigh* are striated and voluntary

(2) *Upper arm* are smooth muscle fibres fusiform in shape

(3) *Heart* are involuntary and unstriated smooth muscles

(4) *Intestine* are striated and involuntary

Ans. (1)

Sol. The type of muscles present in our thigh are striated/voluntary/skeletal.

46. Which one of the following is not an essential mineral element for plants while the remaining three are?

(1) Cadmium (2) Phosphorus

(3) Iron (4) Manganese

Ans. (1)

Sol. Cadmium- non essential element, heavy metal causing itai-itai disease.

47. Consider the following four statements whether they are correct or wrong?

(A) The sporophyte in liverworts is more elaborate than that in mosses

(B) *Salvinia* is heterosporous

(C) The life-cycle in all seed bearing plants is diplontic

(D) In *Pinus* male and female cones are borne on different trees

The two *wrong* statements together are

(1) Statements (B) and (C)

(2) Statements (A) and (B)

(3) Statements (A) and (C)

(4) Statements (A) and (D)

Ans. (4)

Sol. Sporophyte is more elaborate in mosses as compared to liverworts; *Pinus* is a monoecious plant.

48. Consider the following four statements (A-D) related to the common from *Rana tigrina*, and select the correct option stating which ones are true (T) and which ones are false (F).

Statements:

(A) One dry land it would die due to lack of O_2 if its mouth is forcibly kept closed for a few days.

(B) It has four chambered heart.

(C) On dry land it turns uricotelic from ureotelic.

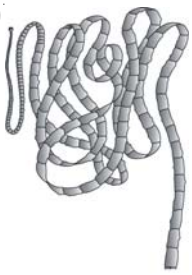
(D) Its life history is carried out in pond water.

Options :

	(A)	(B)	(C)	(D)
(1)	F	F	T	T
(2)	F	T	T	F
(3)	T	F	F	T
(4)	T	T	F	F

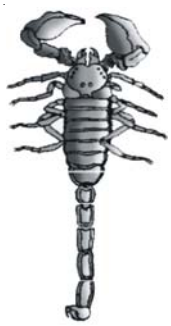
Ans. (1)

49. The figure shows four animals (a), (b), (c) and (d). Select the correct answer with respect to a common characteristics of two of these animals.

(a) 

(b) 

(c) 

(d) 

(1) (a) and (d) have cnidoblasts for self-defence

(2) (c) and (d) have a true coelom

(3) (a) and (d) respire mainly through body wall

(4) (b) and (c) show radial symmetry

Ans. (2)

50. In angiosperms, functional megaspore develops into

(1) Endosperm (2) Pollen sac

(3) Embryo sac (4) Ovule

Ans. (3)

Sol. Megaspore develops into female gametophyte (embryo sac) in angiosperms.

51. Which one of the following aspects is an exclusive characteristic of living things?

(1) Perception of events happening in the environment and their memory

(2) Increase in mass by accumulation of material both on surface as well as internally

(3) Isolated metabolic reactions occur *in vitro*

(4) Increase in mass from inside only

Ans. (1)

Sol. Consciousness/irritability is most obvious complicated and technical character of living beings.

52. Some vascular bundles are described as open because these

(1) Possess conjunctive tissue between xylem and phloem

(2) Are not surrounded by pericycle

(3) Are surrounded by pericycle but no endodermis

(4) Are capable of producing secondary xylem and phloem

Ans. (4)

Sol. Intrafascicular cambium is present between xylem and phloem in dicot stem bundles.

53. *Bacillus thuringiensis* forms protein crystals which contain insecticidal protein.

This protein :

(1) Is activated by acid pH of the foregut of the insect pest

(2) Does not kill the carrier bacterium which is itself resistant to this toxin

(3) Binds with epithelial cells of midgut of the insect pest ultimately killing it

(4) Is coded by several genes including the gene *cry*

Ans. (3)

Sol. Bt toxins can bind with the mid gut epithelium of the insect pest and create pores killing it.

54. One of the constituents of the pancreatic juice while poured into the duodenum in humans is

(1) Trypsin (2) Enterokinase

(3) Trypsinogen (4) Chymotrypsin

Ans. (3)

55. Which one of the following structures in *Pheretima* is *correctly* matched with its function?

(1) Setae-defence against predators

(2) Typhlosole - storage of extra nutrients

(3) Clitellum - secretes cocoon

(4) Gizzard - absorbs digested food

Ans. (3)

56. Both, hydrarch and xerarch successions lead to

(1) Highly dry conditions

(2) Excessive wet conditions

(3) Medium water conditions

(4) Xeric conditions

Ans. (3)

Sol. Both successional events leads to mesic climate.

57. The breakdown of detritus into smaller particles by earthworm is a process called

(1) Mineralisation (2) Catabolism

(3) Humification (4) Fragmentation

Ans. (4)

Sol. Others are performed by heterotrophic microbes.

58. Which one of the following diagrams represnts the placentation in *Dianthus*?

(1) 

(2) 

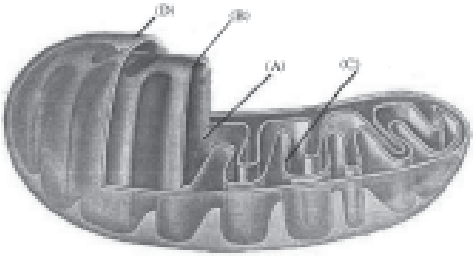
(3) 

(4) 

Ans. (4)

Sol. Free central placentation.

59. The figure below shows the structure of a mitochondrion with its four parts labelled (A), (B), (C) and (D). Select the part correctly matched with its function.



(1) Part (C) : Cristae – possess single circular DNA molecule and ribosomes

(2) Part (A) : Matrix – major site for respiratory chain enzymes

(3) Part (D) : Outer membrane – gives rise to inner membrane by splitting

(4) Part (B) : Inner membrane – forms infoldings called cristae

Ans. (4)

Sol. Circular DNA and 70 S ribosomes are present in matrix.

60. Consider the following statement (A)-(D) each with one or two blanks.

(A) Bears go into _____(1)_____ during winter to _____(2)_____ cold weather

(B) A conical age pyramid with a broad base represents _____(3)_____ human population

(C) A wasp pollinating a fig flower is an example of _____(4)_____

(D) An area with high levels of species richness is known as _____(5)_____

Which one of the following options, gives the correct fill ups for the respective **blank numbers** from (1) to (5) in the statements?

(1) (3) - expanding, (4) - commensalism, (5) - biodiversity park

(2) (1) - hibernation, (2) - escape, (3) - expanding, (5) - hot spot

(3) (3) - stable, (4) - commensalism, (5) - marsh

(4) (1) - aestivation, (2) - escape, (3) - stable, (4) - mutualism

Ans. (2)

Sol. Hibernation - winter sleep; triangular pyramid shows positive growth.

61. A galvanometer of resistance, G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is

(1) $\frac{G^2}{(S+G)}$ (2) $\frac{G}{(S+G)}$

(3) $\frac{S^2}{(S+G)}$ (4) $\frac{SG}{(S+G)}$

Ans. (1)

Sol. $G = \frac{GS}{G+S} + R$

$\therefore \quad R = \frac{G^2}{S+G}$

62. A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2. Its average speed during the complete journey is

(1) $\frac{v_1^2 v_2^2}{v_1^2 + v_2^2}$ (2) $\frac{v_1 + v_2}{2}$

(3) $\frac{v_1 v_2}{v_1 + v_2}$ (4) $\frac{2v_1 v_2}{v_1 + v_2}$

Ans. (4)

Sol. $\frac{2S}{\frac{S}{V_1} + \frac{S}{V_2}} = \frac{2V_1V_2}{V_1 + V_2}$

63. A thermocouple of negligible resistance produces an e.m.f. of 40 μV/°C in the linear range of temperature. A galvanometer of resistance 10 ohm whose sensitivity is 1 μA/div, is employed with the thermocouple. The smallest value of temperature difference that can be detected by the system will be

(1) 0.1°C (2) 0.25°C

(3) 0.5°C (4) 1°C

Ans. (2)

Sol. $\frac{\frac{1\mu A}{\text{div}} \times 10 \text{ ohm}}{40 \ \mu\text{V/°C}} = 0.25°\text{C}$

64. A mass m moving horizontally (along the x-axis) with velocity v collides and sticks to a mass of $3m$ moving vertically upward (along the y-axis) with velocity $2v$. The final velocity of the combination is

(1) $\frac{2}{3}v\hat{i} + \frac{1}{3}v\hat{j}$ (2) $\frac{3}{2}v\hat{i} + \frac{1}{4}v\hat{j}$

(3) $\frac{1}{4}v\hat{i} + \frac{3}{2}v\hat{j}$ (4) $\frac{1}{3}v\hat{i} + \frac{2}{3}v\hat{j}$

Ans. (3)

Sol. $\frac{mv\,\hat{i} + 3m2v\,\hat{j}}{m+3m}$

$= \frac{v}{4}\hat{i} + \frac{3v}{2}\hat{j}$

65. A converging beam of rays is incident on a diverging lens. Having passed through the lens the rays intersect at a point 15 cm from the lens on the opposite side. If the lens is removed the point where the rays meet will move 5 cm closer to the lens. The focal length of the lens is

(1) –30 cm (2) 5 cm

(3) –10 cm (4) 20 cm

Ans. (1)

Sol. $v = +15$

$u = +10$

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\therefore \quad f = -30$ cm

66. The threshold frequency for a photosensitive metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly

(1) 5 V (2) 1 V

(3) 2 V (4) 3 V

Ans. (3)

Sol. $V = \frac{(8.2-3.3)\times10^{14}\times6.628\times10^{-34}}{1.6\times10^{-19}} = 2V$

67. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function 2.75 eV. If the stopping potential of the photoelectron is 10 V, then the value of n is

(1) 5 (2) 2

(3) 3 (4) 4

Ans. (4)

Sol. $-13.6 + 10 + 2.75 = -0.85 = \frac{-13.6}{n^2}$

$\therefore \quad n = 4$

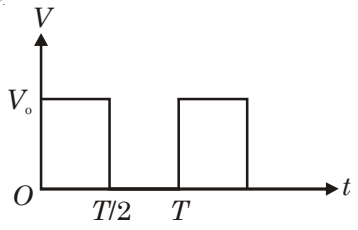
68. The r.m.s. value of potential difference V shown in the figure is

(1) $\frac{V_o}{2}$

(2) $\frac{V_o}{\sqrt{3}}$

(3) V_o

(4) $\frac{V_o}{\sqrt{2}}$



Ans. (4)

Sol. $\sqrt{\frac{V_o^2 \cdot \frac{T}{2}}{T}} = \frac{V_o}{\sqrt{2}}$

69. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The magnitude of the gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre, will be

(1) $\frac{4GM}{a}$ (2) $\frac{GM}{a}$

(3) $\frac{2GM}{a}$ (4) $\frac{3GM}{a}$

Ans. (4)

Sol. $\frac{GM}{a/2} + \frac{GM}{a} = \frac{3GM}{a}$

70. Two particles are oscillating along two close parallel straight lines side by side, with the same frequency and amplitudes. They pass each other, moving in opposite directions when their displacement is half of the amplitude. The mean positions of the two particles lie on a straight line perpendicular to the paths of the two particles. The phase difference is

(1) π (2) $\frac{\pi}{6}$

(3) 0 (4) $\frac{2\pi}{3}$

Ans. (4)

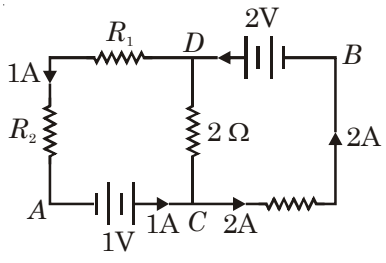
Sol. $X = A \sin\theta$

$\frac{A}{2} = A\sin\theta$

$\therefore \quad \theta = 30°, 150°$

$\therefore$ Difference = 150° – 30° = 120° = $\frac{2\pi}{3}$

71. In the circuit shown in the figure, if the potential at point A is taken to be zero, the potential at point B is



(1) –2 V (2) +1 V

(3) –1 V (4) +2 V

Ans. (2)

Sol. $0 + 1 + 2 - 2 = V_B$

$\therefore \quad V_B = 1$ volt

72. A conveyor belt is moving at a constant speed of 2 m/s. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it, taking $g = 10\ ms^{-2}$, is

(1) Zero (2) 0.4 m

(3) 1.2 m (4) 0.6 m

Ans. (2)

Sol. $u = 2$ m/s

$a = -g\mu = -10 \times 0.5 = -5\ m/s^2$

$v^2 = u^2 + 2as \qquad (v = 0)$

$\therefore \quad s = \dfrac{2^2}{2 \times 5} = 0.4\ m$

73. A mass of diatomic gas ($\gamma = 1.4$) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C. The pressure of the gas in the final state is

(1) 256 atm (2) 8 atm

(3) 28 atm (4) 68.7 atm

Ans. (1)

Sol. $P = 2\left(\dfrac{1200}{300}\right)^{\frac{7}{2}} = 256$ atm

74. Charge q is uniformly spread on a thin ring of radius R. The ring rotates about its axis with a uniform frequency f Hz. The magnitude of magnetic induction at the center of the ring is :

(1) $\dfrac{\mu_0 q}{2\pi f R}$ (2) $\dfrac{\mu_0 q f}{2\pi R}$

(3) $\dfrac{\mu_0 q f}{2R}$ (4) $\dfrac{\mu_0 q}{2fR}$

Ans. (3)

Sol. $B = \dfrac{\mu_0 I}{2R} = \dfrac{\mu_0 q f}{2R}$

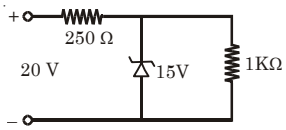
75. A zener diode, having breakdown voltage equal to 15 V is used in a voltage regulator circuit shown in figure. The current through the diode is :

(1) 20 mA

(2) 5 mA

(3) 10 mA

(4) 15 mA



Ans. (2)

Sol. $\dfrac{20 - 15}{250} - \dfrac{15}{1000} = 5$ mA

76. Out of the following which one is not a possible energy for a photon to be emitted by hydrogen atom according to Bohr's atomic model?

(1) 13.6 eV (2) 0.65 eV

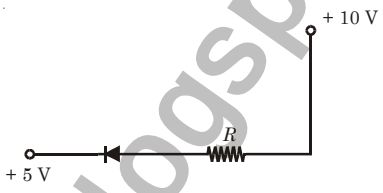
(3) 1.9 eV (4) 11.1 eV

Ans. (4)

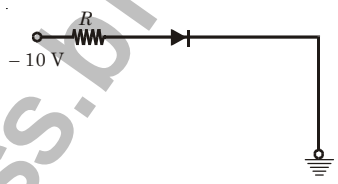
Sol. Energy values are –13.6 eV, –3.4 eV, –1.51 eV, –0.85 eV etc. See the difference by hit and trial.

77. In the following figure, the diodes which are forward biased are

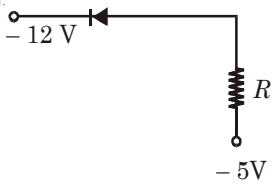
(a)



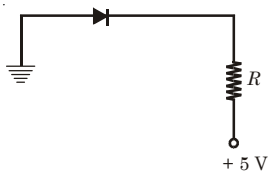
(b)



(c)



(d)



(1) (b) and (d) (2) (a), (b) and (d)

(3) (c) only (4) (c) and (a)

Ans. (4)

Sol. P should be at higher voltage than N.

78. Two radioactive nuclei P and Q in a given sample decay into a stable nucleus R. At time $t = 0$, number of P species are $4N_0$ and that of Q are N_0. Half-life of P (for conversion to R) is 1 minute whereas that of Q is 2 minutes. Initially there are no nuclei of R present in the sample. When number of nuclei of P and Q are equal the number of nuclei of R present in the sample would be :

(1) $\dfrac{5N_0}{2}$ (2) $2N_0$

(3) $3N_0$ (4) $\dfrac{9N_0}{2}$

Ans. (4)

Sol. $4N_0e^{-2\lambda t} = N_0e^{-\lambda t}$

$4 = e^{\lambda t}$

$2\ln 2 = \frac{\ln 2}{2}\cdot t \quad \therefore \quad t = 4 \text{ min}$

$\therefore \quad R = \left(4N_0 - \frac{N_0}{4}\right) + \left(N_0 - \frac{N_0}{4}\right) = \frac{9N_0}{2}$

79. Pure Si at 500 K has equal number of electron (n_e) and hole (n_h) concentrations of 1.5×10^{16}m^{-3}. Doping by indium increases n_h to 4.5×10^{22} m^{-3}. The doped semiconductor is of :

(1) n-type with electron concentration $n_e = 2.5 \times 10^{23}$ m^{-3}

(2) p-type having electron concentrations $n_e = 5 \times 10^{9}$ m^{-3}

(3) n-type with electron concentration $n_e = 2.5 \times 10^{22}$ m^{-3}

(4) p-type with electron concentration $n_e = 2.5 \times 10^{10}$ m^{-3}

Ans. (2)

Sol. $\frac{(1.5\times10^{16})^2}{4.5\times10^{22}} = n_e = 5\times10^{9}$ m^{-3}

80. A thin prism of angle 15° made of glass of refractive index $\mu_1 = 1.5$ is combined with another prism of glass of refractive index $\mu_2 = 1.75$. The combination of the prisms produces dispersion without deviation. The angle of the second prism should be

(1) 12° (2) 5°

(3) 7° (4) 10°

Ans. (4)

Sol. $(1.5 - 1)(15°) = (1.75 - 1)A$

$\therefore \quad A = 10°$

81. Two identical piano wires, kept under the same tension T have a fundamental frequency of 600 Hz. The fractional increase in the tension of one of the wires which will lead to occurrence of 6 beats /s when both the wires oscillate together would be

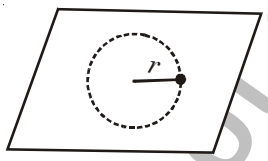
(1) 0.04 (2) 0.01

(3) 0.02 (4) 0.03

Ans. (3)

Sol. $\frac{\Delta f}{f} = \frac{1}{2}\frac{\Delta T}{T} \quad \therefore \quad \frac{\Delta T}{T} = \frac{1}{50} = 0.02$

82. A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2, the kinetic energy of the mass will



(1) Increase by a factor of 4

(2) Decrease by a factor of 2

(3) Remain constant

(4) Increase by a factor of 2

Ans. (1)

Sol. mvr = constant

$mvr = mv'\cdot\frac{r}{2} \quad \therefore \quad v' = 2v$

$\therefore \quad KE' = \frac{1}{2}m(2v)^2 = 4\,(\text{KE})$

83. The electric potential V at any, point (x, y, z), in meters in space is given by $V = 4x^2$ volt. The electric field at the point (1, 0, 2) in volt/meter, is

(1) 16 along positive X-axis

(2) 8 along negative X-axis

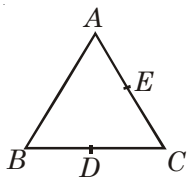
(3) 8 along positive X-axis

(4) 16 along negative X-axis

Ans. (2)

Sol. $E = \frac{-\partial V}{\partial x} = -8x = -8$ V/m

84. Three charges, each $+q$, are placed at the corners of an isosceles triangle ABC of sides BC and AC, $2a$. D and E are the mid points of BC and CA. The work done in taking a charge Q from D to E is



(1) Zero (2) $\frac{3qQ}{4\pi\varepsilon_0 a}$

(3) $\frac{3qQ}{8\pi\varepsilon_0 a}$ (4) $\frac{qQ}{4\pi\varepsilon_0 a}$

Ans. (1)

Sol. Both D and E are at same potential.

85. A particle of mass m is thrown upwards from the surface of the earth, with a velocity u. The mass and the radius of the earth are, respectively, M and R. G is gravitational constant and g is acceleration due to gravity on the surface of the earth. The minimum value of u so that the particle does not return back to earth, is

(1) $\sqrt{2gR^2}$ (2) $\sqrt{\frac{2GM}{R^2}}$

(3) $\sqrt{\frac{2GM}{R}}$ (4) $\sqrt{\frac{2gM}{R^2}}$

Ans. (3)

Sol. Escape velocity = u

86. A short bar magnet of magnetic moment 0.4 JT^{-1} is placed in a uniform magnetic field of 0.16 T. The magnet is in stable equilibrium when the potential energy is

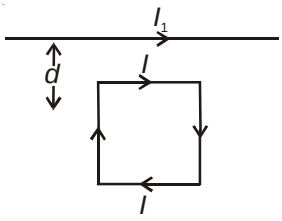
(1) – 0.082 J (2) 0.064 J

(3) – 0.064 J (4) Zero

Ans. (3)

Sol. $-\mu B\cos\theta = -0.4 \times 0.16 \cdot \cos 0° = -0.064$ J

87. A square loop, carrying a steady current I, is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance d from the conductor as shown in figure. The loop will experience



(1) A net torque acting downward normal to the horizontal plane

(2) A net attractive force towards the conductor

(3) A net repulsive force away from the conductor

(4) A net torque acting upward perpendicular to the horizontal plane

Ans. (2)

Sol. Adjacent wires carry current in the same direction so there will be attraction.

88. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection is

(1) $\tan^{-}\left(\frac{\sqrt{3}}{2}\right)$ (2) 45°

(3) 60° (4) $\tan^{-1}\frac{1}{2}$

Ans. (4)

Sol. $\tan\phi + \tan\phi = \tan\theta$

$\therefore \quad \tan\phi = \frac{\tan 45°}{2}$

89. A coil has resistances 30 ohm and inductive reactance 20 Ohm at 50 Hz frequency. If an ac source, of 200 volt, 100 Hz is connected across the coil, the current in the coil will be

(1) $\frac{20}{\sqrt{13}}$ A (2) 2.0 A

(3) 4.0 A (4) 8.0 A

Ans. (3)

Sol. $Z = \sqrt{30^2 + (20\times 2)^2} = 50\ \Omega$

$I = \frac{200}{50} = 4$ A

90. The density of a material in CGS system of units is 4 g/cm^3. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, the value of density of material will be

(1) 400 (2) 0.04

(3) 0.4 (4) 40

Ans. (4)

Sol. $\frac{4g}{\text{cm}^3} = \frac{x100g}{(10\text{ cm})^3}$

$\therefore \quad x = 40$

91. Match list-I with List-II for the composition of substances and select the correct answer using the code given below the lists

List-I Substances		List-II Composition	
(A)	Plaster of paris	(i)	$CaSO_4.2H_2O$
(B)	Epsomite	(ii)	$CaSO_4.\frac{1}{2}H_2O$
(C)	Kieserite	(iii)	$MgSO_4.7H_2O$
(D)	Gypsum	(iv)	$MgSO_4.H_2O$
		(v)	$CaSO_4$

Code :

	(A)	(B)	(C)	(D)
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(iii)	(ii)	(i)
(3)	(iii)	(iv)	(i)	(ii)
(4)	(ii)	(iii)	(iv)	(i)

Ans. (4)

Sol. Fact

92. Which of the following statements is incorrect?

(1) Aluminium reacts with excess NaOH to give $Al(OH)_3$

(2) $NaHCO_3$ on heating gives Na_2CO_3

(3) Pure sodium metal dissolves in liquid ammonia to give blue solution

(4) NaOH reacts with glass to give sodium silicate

Ans. (1)

Sol. Fact

93. Which of the statements about "Denaturation" given below are correct?

Statements :

(a) Denaturation of proteins causes loss of secondary and tertiary structures of the protein

(b) Denaturation leads to the conversion of double strand of DNA into single strand

(c) Denaturation affects primary structure which gets distorted

Options

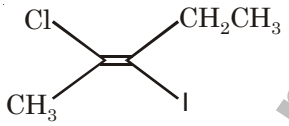
(1) (a) and (b) (2) (a), (b) and (c)

(3) (b) and (c) (4) (a) and (c)

Ans. (1)

Sol. Fact

94. The IUPAC name of the following compound is



(1) trans-3-iodo-4-chloro-3-pentene

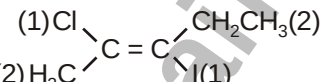
(2) cis-3-chloro-3-iodo-2-pentene

(3) trans-2-chloro-3-iodo-2-pentene

(4) cis-3-iodo-4-chloro-3-pentene

Ans. (3)

Sol.



trans-2-chloro-3-iodo-2-pentene

95. Which of the following oxide is amphoteric?

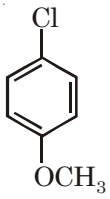
(1) SiO_2 (2) CO_2

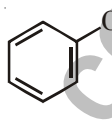
(3) SnO_2 (4) CaO

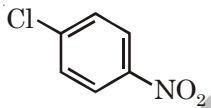
Ans. (3)

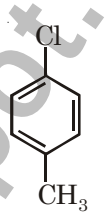
Sol. Oxides of Sn is amphoteric.

96. Which of the following compounds undergoes nucleophilic substitution reaction most easily?

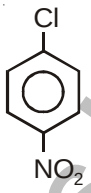
(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. 

has electron withdrawing group NO_2 which reduces the double bond character between carbon of benzene ring and chlorine.

97. A bubble of air is underwater at temperature 15°C and the pressure 1.5 bar. If the bubble rises to the surface where the temperature is 25°C and the pressure is 1.0 bar what will happen to the volume of the bubble?

(1) Volume will become smaller by a factor of 0.70

(2) Volume will become greater by a factor of 2.5

(3) Volume will become greater by a factor of 1.6

(4) Volume will become greater by a factor of 1.1

Ans. (3)

Sol. $\because \quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\Rightarrow \quad \frac{1.5 \times V_1}{288} = \frac{1 \times V_2}{298}$

$\therefore \quad V_2 = \frac{1.5 \times 298 \times V_1}{288}$

$= 1.55\ V_1$

$\approx 1.6\ V_1$

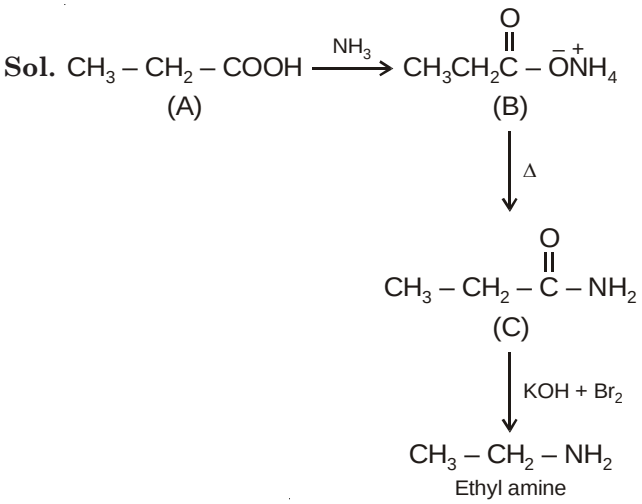
98. An organic compound 'A' on treatment with NH_3 gives 'B' which on heating gives 'C' when treated presence of KOH produces ethylamine. Compound with Br in the 'A' is

(1) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}COOH$ (2) CH_3CH_2COOH

(3) CH_3COOH (4) $CH_3CH_2CH_2COOH$

Ans. (2)

Sol.



99. Consider the following process

	ΔH(kJ/mol)
$\frac{1}{2}A \rightarrow B$	+ 150
$3B \rightarrow 2C + D$	– 125
$E + A \rightarrow 2D$	+ 350

For $B + D \rightarrow E + 2$, ΔH will be

(1) – 325 kJ/mol (2) 325 kJ/mol

(3) 525 kJ/mol (4) – 175 kJ/mol

Ans. (4)

Sol. We have,

$$\frac{1}{2}A \longrightarrow B; \quad \Delta H = +150 \quad ...(i)$$

$$3B \longrightarrow 2C + D; \quad \Delta H = -125 \quad ...(ii)$$

$$E + A \longrightarrow 2D; \quad \Delta H = +350 \quad ...(iii)$$

By [2 × (i) + (ii)] – (iii), we have

$$B + D \longrightarrow E + 2C;$$

$$\Delta H = 150 \times 2 + (-125) - 350$$

$$= -175 \text{ kJ}$$

100. A 0.1 molal aqueous solution of a weak acid is 30% ionized. If K_f for water is 1.86°C/m, the freezing point of the solution will be

(1) – 0.36°C (2) – 0.24°C

(3) – 0.18°C (4) – 0.54°C

Ans. (2)

Sol. For 30% dissociation,

$i = 1.3$

$\therefore \Delta T_f = 1.3 \times 1.86 \times 0.1$

$= 0.2418$

$\therefore$ Freezing point of solution is – 0.24°C.

101. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.

(1) $CaO(s) + SiO_2(s) \rightarrow CaSiO_3(s)$

(2) $2C(s) + O_2(g) \rightarrow 2CO(g)$

(3) $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$

(4) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Ans. (1)

Sol. $CaO + SiO_2 \longrightarrow \underset{\substack{\text{(Slag)}\\\text{Calcium silicate}}}{CaSiO_3}$

102. In qualitative analysis, the metals of group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains Ag^+ and Pb^{2+} at a concentration is 0.10 M. Aqueous HCl is added to this solution until the Cl^- concentration is 0.10 M. What will the concentration of Ag^+ and Pb^{2+} be at equilibrium?

(K_{sp} for $AgCl = 1.8 \times 10^{-10}$, K_{sp} for $PbCl_2 = 1.7 \times 10^{-5}$)

(1) $[Ag^+] = 1.8 \times 10^{-9}$ M
$[Pb^{2+}] = 1.7 \times 10^{-3}$ M

(2) $[Ag^+] = 1.8 \times 10^{-11}$ M
$[Pb^{2+}] = 1.7 \times 10^{-4}$ M

(3) $[Ag^+] = 1.8 \times 10^{-7}$ M
$[Pb^{2+}] = 1.7 \times 10^{-6}$ M

(4) $[Ag^+] = 1.8 \times 10^{-11}$ M
$[Pb^{2+}] = 8.5 \times 10^{-5}$ M

Ans. (1)

Sol. $K_{sp_{(AgCl)}} = [Ag^+][Cl^-]$

$$\therefore [Ag^+] = \frac{1.8 \times 10^{-10}}{10^{-1}}$$

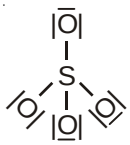
$$= 1.8 \times 10^{-9} \text{ M}$$

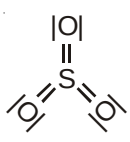
and $K_{sp_{(PbCl_2)}} = [Pb^{++}][Cl^-]^2$

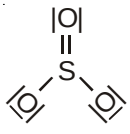
$$\therefore [Pb^{++}] = \frac{1.7 \times 10^{-5}}{10^{-1} \times 10^{-1}}$$

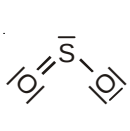
$$= 1.7 \times 10^{-3} \text{ M}$$

103. Which of the following structures is the most preferred and hence of lowest energy for SO_3?

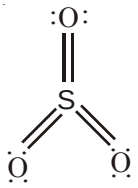
(1) 

(2) 

(3) 

(4) 

Ans. (2)

Sol.  has maximum no. of covalent bonds.

104. The unit of rate constant for a zero order reaction is

(1) $L^2\ mol^{-2}\ s^{-1}$ (2) s^{-1}

(3) $mol\ L^{-1}\ s^{-1}$ (4) $L\ mol^{-1}\ s^{-1}$

Ans. (3)

Sol. For zero order reaction,

$Rate = K \cdot [Reactant]^0$

$\therefore$ $Rate = K$

$\therefore$ Unit of K is $mol\ L^{-1}\ s^{-1}$

105. A solution contains Fe^{2+}, Fe^{3+} and I^- ions. This solution was treated with iodine at 35°C. E° for Fe^{3+}/Fe^{2+} is +0.77 V and E° for $I_2/2I^-$ = 0.536 V. The favourable redox reaction is

(1) I^- will be oxidised to I_2

(2) Fe^{2+} will be oxidised to Fe^{3+}

(3) I_2 will be reduced to I^-

(4) There will be no redox reaction

Ans. (1)

Sol. For $I^- \rightarrow I_2$; the value of E° is +ve.

So, it is favourable redox reaction.

106. 200 mL of an aqueous solution of a protein contains its 1.26 g. The Osmotic pressure of this solution at 300 K is found to be 2.57×10^{-3} bar. The molar mass of protein will be (R = 0.083 L bar $mol^{-1}\ K^{-1}$)

(1) 31011 g mol^{-1} (2) 61038 g mol^{-1}

(3) 51022 g mol^{-1} (4) 122044 g mol^{-1}

Ans. (2)

Sol. $\because \pi = \dfrac{w \times 1000}{M \times V} \times R \times T$

$\therefore$ $M = \dfrac{w \times 1000}{\pi \times V} \times R \times T$

$= \dfrac{1.26 \times 1000 \times 0.083 \times 300}{2.57 \times 10^{-3} \times 200}$

$= 61038\ g\ mol^{-1}$

107. The rate of the reaction

$$2N_2O_5 \longrightarrow 4NO_2 + O_2$$

can be written in three ways :

$$\frac{-d[N_2O_5]}{dt} = k[N_2O_5]$$

$$\frac{d[NO_2]}{dt} = k'[N_2O_5]$$

$$\frac{d[O_2]}{dt} = k''[N_2O_5]$$

The relationship between k and k′ and between k and k″ are

(1) k′ = 2k; k″ = 2k (2) k′ = k; k″ = k

(3) k′ = 2k; k″ = k (4) k′ = 2k; k″ = k/2

Ans. (4)

Sol. $Rate = -\dfrac{1}{2}\dfrac{d[N_2O_5]}{dt} = \dfrac{1}{4}\dfrac{d[NO_2]}{dt} = \dfrac{d[O_2]}{dt}$

$\therefore$ $2k = k' = 4k''$

108. The half life of a substance in a certain enzyme - catalysed reaction is 138 s. The time required for the concentration of the substance to fall from 1.28 mg L^{-1} to 0.04 mg L^{-1} is

(1) 690 s (2) 276 s

(3) 414 s (4) 552 s

Ans. (1)

Sol. $\because$ Fall from 1.28 mg L^{-1} to 0.04 mg L^{-1} involves five half-lives.

$\therefore$ Time-required $= 5 \times t_{1/2}$

$= 5 \times 138$ s

$= 690$ s

109. Which of the following complex compounds will exhibit highest paramagnetic behaviour?

(1) $[Co(NH_3)_6]^{3+}$ (2) $[Zn(NH_3)_6]^{2+}$

(3) $[Ti(NH_3)_6]^{3+}$ (4) $[Cr(NH_3)_6]^{3+}$

(At. No. Ti = 22, Cr = 24, Co = 27, Zn = 30)

Ans. (4)

$[Cr(NH_3)_6]^{3(+)}$ has 3 unpaired $e^{(-)}$

110. A solid compound XY has NaCl structure. If the radius of the cation is 100 pm, the radius of the anion (Y^-) will be

(1) 241.5 pm (2) 165.7 pm

(3) 275.1 pm (4) 322.5 pm

Ans. (1)

Sol. For NaCl structure,

$$\frac{X^+}{Y^-} = 0.414$$

$$\therefore \quad Y^- = \frac{100}{0.414} = 241.5 \text{ pm}$$

111. Which of the following is **not** a fat soluble vitamin?

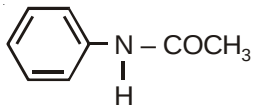
(1) Vitamin E (2) Vitamin A

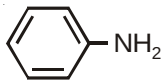
(3) Vitamin B complex (4) Vitamin D

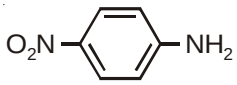
Ans. (3)

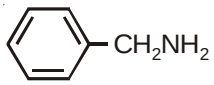
Sol. Fact

112. Which of the following compounds is most basic?

(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. Lone pair of N does not involve in resonance with benzene ring.

113. Which has the maximum number of molecules among the following?

(1) 8 g H_2 (2) 64 g SO_2

(3) 44 g CO_2 (4) 48 g O_3

Ans. (1)

Sol. 64 g $SO_2 \Rightarrow$ 1 mole $SO_2 \Rightarrow N_A$ molecules

44 g $CO_2 \Rightarrow$ 1 mole $CO_2 \Rightarrow N_A$ molecules

48 g $O_3 \Rightarrow$ 1 mole $O_3 \Rightarrow N_A$ molecules

8 g $H_2 \Rightarrow$ 4 mole $H_2 \Rightarrow 4 \times N_A$ molecules

114. Match the compounds given in List-I with List-II and select the suitable option using the code given below.

List-I	List-II
a. Benzaldehyde	(i) Phenolphthalein
b. Phthalic anhydride	(ii) Benzoin condensation
c. Phenyl benzoate	(iii) Oil of wintergreen
d. Methyl salicylate	(iv) Fries rearrangement

(1) a(ii), b(iii), c(iv), d(i)

(2) a(ii), b(i), c(iv), d(iii)

(3) a(iv), b(i), c(iii), d(ii)

(4) a(iv), b(ii), c(iii), d(i)

Ans. (2)

Sol. Fact

115. What is the value of electron gain enthalpy of Na^+ if IE_1 of Na = 5.1 eV?

(1) +2.55 eV (2) +10.2 eV

(3) –5.1 eV (4) –10.2 eV

Ans. (3)

Sol. Electron gain enthalpy is reverse of ionisation energy.

116. Which of the following carbonyls will have the strongest C – O bond?

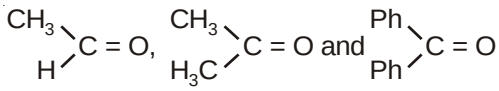
(1) $V(CO)_6^-$ (2) $Fe(CO)_5$

(3) $Mn(CO)_6^+$ (4) $Cr(CO)_6$

Ans. (1)

Sol. V^- has lesser tendency to accept electron pair.

117. The order of reactivity of phenyl magnesium bromide (PhMgBr) with the following compounds :



(1) I > III > II (2) I > II > III

(3) III > II > I (4) II > I > III

Ans. (2)

Sol. Electron density increases from I to III on carbonyl carbon.

118. The pairs of species of oxygen and their magnetic behaviours are noted below. Which of the following presents the correct description?

(1) O_2^+, O_2 – Both paramagnetic

(2) O, O_2^{2-} – Both paramagnetic

(3) O_2^-, O_2^{2-} – Both diamagnetic

(4) O^+, O_2^{2-} – Both paramagnetic

Ans. (1)

Sol. The molecular orbital configurations of O_2^+, O_2^-, O_2^{--} and O_2 are

O_2^+ : $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$, $\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^1 = \pi^* 2p_y^0$

O_2^- : $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$, $\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^2 = \pi^* 2p_y^1$

O_2^{--} : $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$, $\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^2 = \pi^* 2p_y^2$

O_2 : $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$, $\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^1 = \pi^* 2p_y^1$

And the electronic configurations of O and O^+ are

O : $1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^1$

O^+ : $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^1$

119. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the **least energetic** photon?

(1) n = 6 to n = 5 (2) n = 5 to n = 3

(3) n = 6 to n = 1 (4) n = 5 to n = 4

Ans. (1)

Sol. $\Delta E \propto \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$, where $n_2 > n_1$

$\therefore$ n = 6 to n = 5 will give least energetic photon.

120. Consider the reactions :

(i) $(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5OH} (CH_3)_2CH - CH_2OC_2H_5 + HBr$

(ii) $(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5O^-} (CH_3)_2CH - CH_2OC_2H_5 + Br^-$

The mechanisms of reactions (i) and (ii) are respectively

(1) S_N2 and S_N2 (2) S_N2 and S_N1

(3) S_N1 and S_N2 (4) S_N1 and S_N1

Ans. (1)

Sol. The product formed according to S_N2 mechanism in both the reactions.

1. The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are

(1) $[L^{1/2}T^{-1/2}]$ (2) $[L^{-1}T]$

(3) $[LT^{-1}]$ (4) $[L^{1/2}T^{1/2}]$

Ans. (3)

Sol. $c = \dfrac{1}{\sqrt{\mu_0\varepsilon_0}}$

2. A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by

(1) 68% (2) 41%

(3) 200% (4) 100%

Ans. (2)

Sol. $P = \sqrt{2mE} = \sqrt{2m^2gh} = m\sqrt{2gh}$

$P' = m\sqrt{2g2h} = \sqrt{2}P = 1.41\,P$

$\Rightarrow \dfrac{P'-P}{P}\times 100\% = 41\%$

3. A car of mass m is moving on a level circular track of radius R. If μ_s represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by

(1) $\sqrt{\mu_s mRg}$ (2) $\sqrt{\dfrac{Rg}{\mu_s}}$

(3) $\sqrt{mRg/\mu_s}$ (4) $\sqrt{\mu_s Rg}$

Ans. (4)

Sol. $\mu_s mg = \dfrac{mv_{max}^2}{R}$

$\Rightarrow v_{max} = \sqrt{\mu_s Rg}$

4. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude P_0. The instantaneous velocity of this car is proportional to

(1) t^2P_0

(2) $t^{1/2}$

(3) $t^{-1/2}$

(4) $\dfrac{t}{\sqrt{m}}$

Ans. (2)

Sol. $P_0 = mav = m\dfrac{dv}{dt}v$

$\Rightarrow \int_0^v v\,dv = \dfrac{P}{m}\int_0^t dt$

$\Rightarrow \dfrac{v^2}{2} = \dfrac{Pt}{m}$

$\Rightarrow v = \sqrt{\dfrac{2Pt}{m}}$

$\Rightarrow v \propto t^{\frac{1}{2}}$

5. A circular platform is mounted on a frictionless vertical axle. Its radius R = 2 m and its moment of inertia about the axle is 200 kg m^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 ms^{-1} relative to the ground. Time taken by the man to complete one revolution is

(1) π s (2) $\frac{3\pi}{2}$ s

(3) 2π s (4) $\frac{\pi}{2}$ s

Ans. (3)

Sol. Gain of angular speed of disc

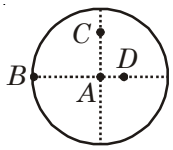
$$\omega' = \frac{mvR}{I} = \frac{50\times1\times2}{200} = \frac{100}{200} = \frac{1}{2} \text{ rad/s}$$

Angular speed of man $(\omega) = \frac{v}{r} = \frac{1}{2}$ rad/s

$$\omega_{rel} = \frac{1}{2} + \frac{1}{2} = 1 \text{ rad/s}$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{1} = 2\pi \text{ s}$$

6. The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through



(1) B (2) C

(3) D (4) A

Ans. (1)

Sol. Parallel axis theorem

$I = I_{CM} + Mh^2$

$h_B > h_C > h_D > h_A \rightarrow I_B > I_C > I_D > I_A$

7. Three masses are placed on the x-axis : 300 g at origin, 500 g at x = 40 cm and 400 g at x = 70 cm. The distance of the centre of mass from the origin is

(1) 40 cm (2) 45 cm

(3) 50 cm (4) 30 cm

Ans. (1)

Sol. $X_{cm} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3}$

$$= \frac{300\times0 + 500\times40 + 400\times70}{1200}$$

$$= \frac{20000 + 28000}{1200} = \frac{48000}{120} = 40 \text{ cm}$$

8. If v_e is escape velocity and v_o is orbital velocity of a satellite for orbit close to the earth's surface, then these are related by

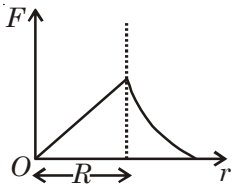
(1) $v_o = \sqrt{2}\,v_e$ (2) $v_o = v_e$

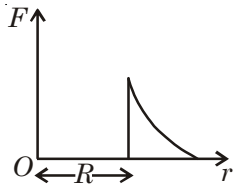
(3) $v_e = \sqrt{2v_o}$ (4) $v_e = \sqrt{2}\,v_o$

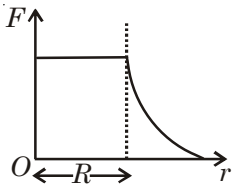
Ans. (4)

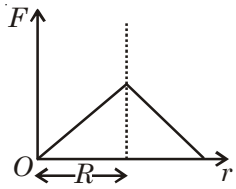
Sol. $v_0 = \sqrt{\frac{GM}{R}}$, $v_e = \sqrt{\frac{2GM}{R}} = \sqrt{2}\,v_0$

9. Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell)

(1) 

(2) 

(3) 

(4) 

Ans. (2)

Sol. E_{ln} = Zero

$$E_0 = \frac{GM}{r^2}$$

10. A slab of stone of area 0.36 m^2 and thickness 0.1 m is exposed on the lower surface to steam at 100°C. A block of ice at 0°C rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is (Given latent heat of fusion of ice = 3.36 × 10^5 J kg^{-1})

(1) 1.24 J/m/s/°C (2) 1.29 J/m/s/°C

(3) 2.05 J/m/s/°C (4) 1.02 J/m/s/°C

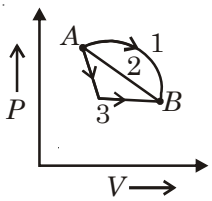
Ans. (1)

Sol. $ML = \dfrac{KAt(\theta_1 - \theta_2)}{d}$

$\Rightarrow \quad 4.8 \times 3.36 \times 10 = \dfrac{K \times 0.36 \times 3600 \times 100}{(0.1)}$

$\Rightarrow \quad K = 1.24$ J/m/s/°C

11. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram



If Q_1, Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and ΔU_1, ΔU_2, ΔU_3 indicate the change in internal energy along the three processes respectively, then

(1) $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(2) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(3) $Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

(4) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

Ans. (1)

Sol. $\Delta U_1 = \Delta U_2 = \Delta U_3$

and $W_1 > W_2 > W_3$

$\Rightarrow \quad Q_1 > Q_2 > Q_3$

12. The equation of a simple harmonic wave is given by :

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

where x and y are in metres an t is in seconds. The ratio of maximum particle velocity to the wave velocity is

(1) 2π (2) $\dfrac{3}{2}\pi$

(3) 3π (4) $\dfrac{2}{3}\pi$

Ans. (2)

Sol. $\dfrac{V_{p_{max}}}{V} = \dfrac{\omega A}{\left(\dfrac{\omega}{K}\right)} = KA = \dfrac{\pi}{2} \times 3 = \dfrac{3\pi}{2}$

13. A train moving at a speed of 220 ms^{-1} towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is

(Speed of sound in air is 330 ms^{-1})

(1) 3500 Hz

(2) 4000 Hz

(3) 5000 Hz

(4) 3000 Hz

Ans. (3)

Sol. $f' = \left(\dfrac{v + v_0}{v - v_s}\right) f$

$= \left(\dfrac{330 + 220}{330 - 220}\right) \times 1000$

$= \dfrac{550}{110} \times 1000$

$= 5000$ Hz

14. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

(1) $\dfrac{1}{2}\varepsilon_0 E^2$ (2) $E^2 \dfrac{Ad}{\varepsilon_0}$

(3) $\dfrac{1}{2}\varepsilon_0 E^2 Ad$ (4) $\varepsilon_0 EAd$

Ans. (3)

Sol. $E = U_E \times V = \dfrac{1}{2}\varepsilon_0 E^2 Ad$

15. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is

(1) 2×10^{-2} C (2) 3×10^{-2} C

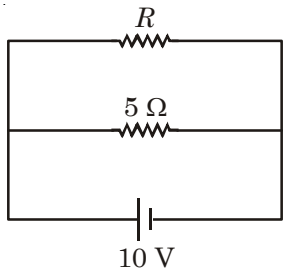
(3) 4×10^{-2} C (4) 1×10^{-2} C

Ans. (2)

Sol. $Q_2 = \dfrac{QR_2}{R_1 + R_2} = \dfrac{(-1+5) \times 10^{-2} \times 3}{1+3}$

$= 3 \times 10^{-2}$ C

16. The power dissipated in the circuit shown in the figure is 30 watts. The value of R is



(1) 20 Ω (2) 15 Ω

(3) 10 Ω (4) 30 Ω

Ans. (3)

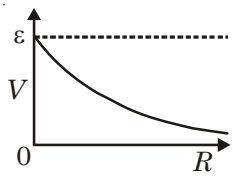
Sol. $P = \frac{V^2}{R_1} + \frac{V^2}{R_2}$

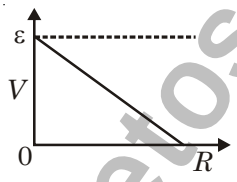
$\Rightarrow \frac{10^2}{R} = 30 - \frac{10^2}{5}$

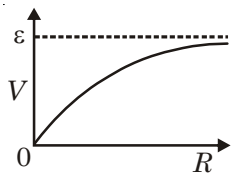
$\Rightarrow \frac{100}{R} = 30 - 20$

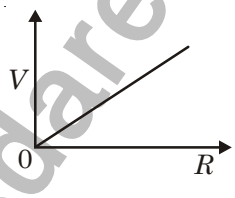
$\Rightarrow R = 10\ \Omega$

17. A cell having an emf ε and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. $V = \frac{\varepsilon R}{R + r} = \frac{\varepsilon}{1 + \frac{r}{R}}$

18. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an α-particle to describe a circle of same radius in the same field?

(1) 2 MeV (2) 1 MeV

(3) 0.5 MeV (4) 4 MeV

Ans. (2)

Sol. $R = \frac{\sqrt{2ME}}{qB}$

$\Rightarrow \frac{\sqrt{M_p E_p}}{q_p} = \frac{\sqrt{M_\alpha E_\alpha}}{q_\alpha}$

$\Rightarrow E_\alpha = \left(\frac{q_\alpha}{q_p}\right)^2 \left(\frac{M_p}{M_\alpha}\right) E_p$

$= 4 \times \frac{1}{4} \times 1\ \text{MeV} = 1\ \text{MeV}$

19. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$ J of work to turn it through 60°. The torque needed to maintain the needle in this position will be

(1) $2\sqrt{3}$ J (2) 3 J

(3) $\sqrt{3}$ J (4) $\frac{3}{2}$ J

Ans. (2)

Sol. $W = MB(\cos 0 - \cos 60) = MB \times \frac{1}{2} = \sqrt{3}$

$\Rightarrow MB = 2\sqrt{3}$

$\tau = MB \sin 60 = 2\sqrt{3} \times \frac{\sqrt{3}}{2} = 3\ \text{J}$

20. The instantaneous values of alternating current and voltages in a circuit are given as

$i = \frac{1}{\sqrt{2}} \sin(100\pi t)$ ampere

$e = \frac{1}{\sqrt{2}} \sin\left(100\pi t + \frac{\pi}{3}\right)$ volt

The average power in Watts consumed in the circuit is

(1) $\frac{1}{4}$ (2) $\frac{\sqrt{3}}{4}$

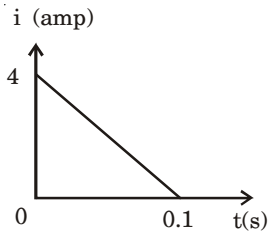
(3) $\frac{1}{2}$ (4) $\frac{1}{8}$

Ans. (4)

Sol. $P_{av} = \frac{E_0 I_0}{2} \cos\phi = \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} \times \frac{1}{2} \times \cos\frac{\pi}{3}$

$= \frac{1}{8}\ \text{W}$

21. In a coil of resistance 10 Ω, the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is



(1) 8 (2) 2

(3) 6 (4) 4

Ans. (2)

Sol. $Q = \frac{\Delta\phi}{R}$

$\Delta\phi = RQ = 10 \times \frac{1}{2} \times (0.1 \times 4) = 2$ Wb

22. The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to

(1) The speed of light in vacuum

(2) Reciprocal of speed of light in vacuum

(3) The ratio of magnetic permeability to the electric susceptibility of vacuum

(4) Unity

Ans. (2)

Sol. $c = \frac{E}{B}$

23. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index

(1) lies between $\sqrt{2}$ and 1

(2) lies between 2 and $\sqrt{2}$

(3) is less than 1

(4) is greater than 2

Ans. (2)

Sol. $\delta_{min} = (i + e) - A$

$A = 2i - A$

$i = A,\ r_1 = r_2 = \frac{A}{2}$

$\mu = \frac{\sin i}{\sin r} = 2\cos\frac{A}{2}$

24. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is

(1) 10 cm (2) 15 cm

(3) 2.5 cm (4) 5 cm

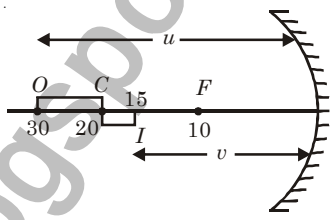
Ans. (4)

Sol. $u = -30$

$f = -10$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$



$= \frac{1}{-10} - \frac{1}{-30} = \frac{1}{30} - \frac{1}{10} = \frac{1-3}{30} = \frac{-2}{30}$

$v = -15$

Length of image = 20 – 15 = 5 cm

25. If the momentum of an electron is changed by P, then the de-Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be

(1) 200 P (2) 400 P

(3) $\frac{P}{200}$ (4) 100 P

Ans. (1)

Sol. $\lambda = \frac{h}{p}$

$\left|\frac{\Delta\lambda}{\lambda}\right| = \left|\frac{\Delta p}{p}\right|$

$p = \frac{\Delta p}{\left(\frac{\Delta\lambda}{\lambda}\right)} = \frac{P}{0.005} = 200P$

26. Two radiations of photons energies 1 eV and 2.5 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximum speeds of the emitted electrons is

(1) 1 : 4 (2) 1 : 2

(3) 1 : 1 (4) 1 : 5

Ans. (2)

Sol. $v \propto \sqrt{E}$

$\frac{v_1}{v_2} = \sqrt{\frac{1-0.5}{2.5-0.5}} = \sqrt{\frac{0.5}{2}} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

27. The transition from the state $n = 3$ to $n = 1$ in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from

(1) $2 \rightarrow 1$

(2) $3 \rightarrow 2$

(3) $4 \rightarrow 2$

(4) $4 \rightarrow 2$

Ans. (4)

Sol. $3 \rightarrow 1$ $UV \rightarrow$ Hydrogen atom

$\left.\begin{matrix} 3 \rightarrow 2 \\ 4 \rightarrow 2 \end{matrix}\right| \rightarrow$ Visible

$4 \rightarrow 3 \rightarrow$ Infrared

28. The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed as

(1) 30 days (2) 50 days

(3) 60 days (4) 15 days

Ans. (2)

Sol. $t_1 \rightarrow$ time at which $\frac{2}{3}$ is active *i.e.* A_1

$t_2 \rightarrow$ time at which $\frac{1}{3}$ is active *i.e.* A_2

$\frac{A_1}{A_2} = 2$ so one half life is required (50 days).

29. The input resistance of a silicon transistor is 100 Ω. Base current is changed by 40 μA which results in a change in collector current by 2 mA. This transistor is used as a common emitter amplifier with a load resistance of 4 KΩ. The voltage gain of the amplifier is

(1) 2000 (2) 3000

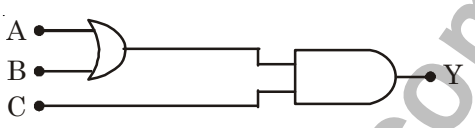
(3) 4000 (4) 1000

Ans. (1)

Sol. $\beta = \frac{\Delta I_C}{\Delta I_B} = \frac{2 \text{ mA}}{40 \ \mu A} = \frac{2 \times 10^{-3}}{40 \times 10^{-6}} = 0.5 \times 10^2 = 50$

$A_v = \beta \frac{R_L}{R_i} = 50 \times \frac{4 \text{ k}\Omega}{100 \ \Omega} = 2000$

30. To get an output Y = 1 in given circuit which of the following input will be correct



	A	B	C
(1)	1	0	0
(2)	1	0	1
(3)	1	1	0
(4)	0	1	0

Ans. (2)

Sol. $y = (A + B) \cdot C$

C should be 1

Either of A and B OR both A and B are 1.

31. Given that the equilibrium constant for the reaction

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2\ SO_{3(g)}$

has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature ?

$SO_{3(g)} \rightleftharpoons SO_{2(g)} + \frac{1}{2} O_{2(g)}$

(1) 1.8×10^{-3} (2) 3.6×10^{-3}

(3) 6.0×10^{-2} (4) 1.3×10^{-5}

Ans. (3)

Sol. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

$k_1 = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = 278$

$SO_3(g) \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$

$k = \frac{[SO_2][O_2]^{\frac{1}{2}}}{[SO_3]}$

$\frac{1}{k} = \frac{[SO_3]}{[SO_2][O_2]^{\frac{1}{2}}}$

$\left(\frac{1}{k_2}\right)^2 = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = 278$

$\frac{1}{k_2} = \sqrt{278}$

$k_2 = \frac{1}{\sqrt{278}} = 0.0614 = 6.14 \times 10^{-2}$

32. Structure of a mixed oxide is cubic close packed (c.c.p.). The cubic unit cell of mixed oxide is composed of oxide ions. One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B. The formula of the oxide is :

(1) ABO_2

(2) A_2BO_2

(3) $A_2B_3O_4$

(4) AB_2O_2

Ans. (4)

Sol. Number of O^{-2} ions = 4

Number of $A = \frac{1}{4} \times 8 = 2$

Number of B = 4

Formula = $A_2B_4O_4 = AB_2O_2$

33. Given the reaction between 2 gases represented by A_2 and B_2 to give the compound $AB_{(g)}$.

$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}$.

At equilibrium, the concentration

of $A_2 = 3.0 \times 10^{-3}$ M

of $B_2 = 4.2 \times 10^{-3}$ M

of AB = 2.8×10^{-3} M

If the reaction takes place in a sealed vessel at 527°C, then the value of K_c will be :

(1) 2.0

(2) 1.9

(3) 0.62

(4) 4.5

Ans. (3)

Sol. $K_c = \frac{[AB]^2}{[A_2][B_2]}$

$= \frac{[2.8 \times 10^{-3}]^2}{3 \times 10^{-3} \times 4.2 \times 10^{-3}}$

$= \frac{7.84 \times 10^{-6}}{12.6 \times 10^{-6}} = \frac{7.84}{12.6} = 0.622$

34. Activation energy (E_a) and rate constants (k_1 and k_2) of a chemical reaction at two different temperatures (T_1 and T_2) are related by

(1) $\ln \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

(2) $\ln \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

(3) $\ln \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} + \frac{1}{T_1}\right)$

(4) $\ln \frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

Ans. (2, 4)

Sol. Fact

35. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals?

(1) π^* orbitals

(2) π orbitals

(3) σ^* orbitals

(4) σ orbitals

Ans. (1)

Sol. Electron is added in π^* orbitals.

36. Standard reduction potentials of the half reactions are given below

$F_{2(g)} + 2e^- \rightarrow 2F^-_{(aq)}$; $E^o = +2.85$ V

$Cl_{2(g)} + 2e^- \rightarrow 2Cl^-_{(aq)}$; $E^o = +1.36$ V

$Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$; $E^o = +1.06$ V

$I_{2(s)} + 2e^- \rightarrow 2I^-_{(aq)}$; $E^o = +0.53$ V

The strongest oxidising and reducing agents respectively are

(1) F_2 and I^- (2) Br_2 and Cl^-

(3) Cl_2 and Br^- (4) Cl_2 and I_2

Ans. (1)

Sol. Reduction potential is highest for F_2 and lowest for I^-.

37. A certain gas takes three times as long to effuse out as helium. Its molecular mass will be

(1) 27 u (2) 36 u

(3) 64 u (4) 9 u

Ans. (2)

Sol. $\frac{r_{He}}{r_X} = \sqrt{\frac{M_X}{M_{He}}}$

or $\frac{V_{He}}{t_{He}} \times \frac{t_X}{V_X} = \sqrt{\frac{M_X}{4}}$

$\frac{3}{1} = \sqrt{\frac{M_X}{4}}$

or $9 = \frac{M_X}{4}$

$M_X = 36$

38. The orbital angular momentum of a p-electron is given as

(1) $\frac{h}{\sqrt{2}\pi}$ (2) $\sqrt{3}\frac{h}{2\pi}$

(3) $\sqrt{\frac{3}{2}}\frac{h}{\pi}$ (4) $\sqrt{6}\cdot\frac{h}{2\pi}$

Ans. (1)

Sol. For *p*-orbital $l = 1$

Orbital angular momentum $= \sqrt{l(l+1)}\frac{h}{2\pi}$

$= \sqrt{1(1+1)}\frac{h}{2\pi}$

$= \sqrt{2}\frac{h}{2\pi}$

$= \frac{h}{\sqrt{2}\pi}$

39. Vapour pressure of chloroform ($CHCl_3$) and dichloromethane (CH_2Cl_2) at 25°C are 200 mmHg and 41.5 mmHg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at the same temperature will be (Molecular mass of $CHCl_3$ = 119.5 u and molecular mass of CH_2Cl_2 = 85 u)

(1) 173.9 mmHg (2) 615.0 mmHg

(3) 347.9 mmHg (4) 285.5 mmHg

Ans. (No one is correct option)

Sol. $n_{CHCl_3} = \frac{25.5}{119.5} = 0.21$

$n_{CH_2Cl_2} = \frac{40}{85} = 0.47$

$n_{Total} = 0.68$

$X_{CHCl_3} = \frac{0.21}{0.68} = 0.31$

$X_{CH_2Cl_2} = \frac{0.47}{0.68} = 0.69$

$P_{CHCl_3} = P^\circ_{CHCl_3} \cdot X_{CHCl_3} = 200 \times 0.31 = 62$

$X_{CH_2Cl_2} = P^\circ_{CH_2Cl_2} \cdot X_{CH_2Cl_2} = 41.5 \times 0.69 = 28.63$

$P_{solution}$ = 62 + 28.63 = 90.63 mm

40. Molar conductivities $\left(\Lambda^\circ_m\right)$ at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and 91.0 S cm^2 mol^{-1} respectively Λ°_m for CH_3COOH will be

(1) 425.5 S cm^2 mol^{-1} (2) 180.5 S cm^2 mol^{-1}

(3) 290.8 S cm^2 mol^{-1} (4) 390.5 S cm^2 mol^{-1}

Ans. (4)

Sol. $\Lambda^\circ_{m(CH_3COOH)} = \Lambda^\circ_{m(CH_3COONa)} + \Lambda^\circ_{m(HCl)} - \Lambda^\circ_{m(NaCl)}$

$= 91 + 425.9 - 126.4$

$= 390.5$ S cm^2 mol^{-1}

41. For real gases van der Waals equation is written as $\left(p + \frac{an^2}{V^2}\right)(V - nb) = n\,RT$

where 'a' and 'b' are van der Waals constants.

Two sets of gases are :

(I) O_2, CO_2, H_2 and He

(II) CH_4, O_2 and H_2

The gases given in set-I in increasing order of 'b' and gases given in set-II in decreasing order of 'a', are arranged below. Select the correct order from the following :

(1) (I) He < H_2 < CO_2 < O_2 (II) CH_2 > H_2 > O_2

(2) (I) O_2 < He < H_2 < CO_2 (II) H_2 > O_2 > CH_4

(3) (I) H_2 < He < O_2 < CO_2 (II) CH_4 > O_2 > H_2

(4) (I) H_2 < O_2 <He < CO_2 (II) O_2 > CH_4 > H_2

Ans. (3)

42. Equal volumes of two monoatomic gases, A and B, at same temperature and pressure are mixed. The ratio of specific heats (C_p/C_v) of the mixture will be:

(1) 0.83 (2) 1.50

(3) 3.3 (4) 1.67

Ans. (4)

Sol. For monoatomic gas $\frac{C_p}{C_v} = 1.67$.

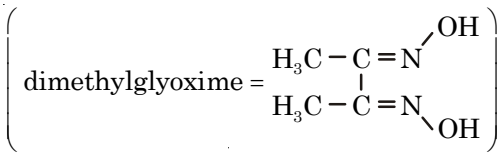
43. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal Ni(II). Which of the following statements is not true?

(1) Red complex has a square planar geometry.

(2) Complex has symmetrical H-bonding

(3) Red complex has a tetrahedral geometry

(4) Dimethylglyoxime functions as bidentate ligand



Ans. (3)

44. Low spin complex of d^6–cation in an octahedral field will have the following energy:

(1) $\frac{-12}{5}\Delta_o + P$ (2) $\frac{-12}{5}\Delta_o + 3P$

(3) $\frac{-2}{5}\Delta_o + 2P$ (4) $\frac{-2}{5}\Delta_o + P$

(Δ_o = Crystal Field Splitting Energy in an octahedral field, P = Electron pairing energy)

Ans. (2)

45. Which one of the following does not correctly represent the correct order of the property indicated against it?

(1) Ti < V < Cr < Mn : increasing number of oxidation states

(2) $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$: increasing magnetic moment

(3) Ti < V < Cr < Mn : increasing melting points

(4) Ti < V < Mn < Cr : increasing 2nd ionization enthalpy

Ans. (3)

Sol. M.P. increases from Ti to Cr and then decreases.

46. Four successive members of the first series of the transition metals are listed below. For which one of them the standard potential $\left(E^o_{M^{2+}/M}\right)$ value has a positive sign?

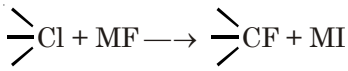
(1) Co (Z = 27) (2) Ni (Z = 28)

(3) Cu (Z = 29) (4) Fe (Z = 26)

Ans. (3)

Sol. $E^\circ_{Cu^{+2}/Cu}$ = +0.34 volt

47. In the replacement reaction



The reaction will be most favourable if M happens to be

(1) Na (2) K

(3) Rb (4) Li

Ans. (3)

Sol. The reaction is SN^1. The reaction will be more favoured when there is more release of F^- which depends upon polarising power of metal. Size of Rb is largest among the given options so more release of F^- will take place.

48. In which of the following arrangements the given sequence is not strictly according to the property indicated against it?

(1) HF < HCl < HBr < HI : increasing acidic strength

(2) $H_2O < H_2S < H_2Se < H_2Te$: increasing pK_a values

(3) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing acidic character

(4) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

Ans. (2)

Sol. $H_2O < H_2S < H_2Se < H_2Te$

Acidic nature increases so pK_a decreases in the same order.

49. Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them

(1) $NO < O_2^- < C_2^{2-} < He_2^+$

(2) $O_2^- < NO < C_2^{2-} < He_2^+$

(3) $C_2^{2-} < He_2^+ < O_2^- < NO$

(4) $He_2^+ < O_2^- < NO < C_2^{2-}$

Ans. (4)

Sol. Fact

50. The catalytic activity of transition metals and their compounds is ascribed mainly to

(1) Their magnetic behaviour

(2) Their unfilled *d*-orbitals

(3) Their ability to adopt variable oxidation states

(4) Their chemical reactivity

Ans. (3)

Sol. Catalytic property of transition metal is mainly due to ability to adopt multiple oxidation state and complex formation.

51. Which of the following exhibits only +3 oxidation state?

(1) U

(2) Th

(3) Ac

(4) Pa

Ans. (3)

Sol. Actinium exhibit only + 3 oxidation state.

52. The Gibb's energy for the decomposition of Al_2O_3 at 500°C is as follows :

$$\frac{2}{3}Al_2O_3 \longrightarrow \frac{4}{3}Al + O_2;\ \Delta_rG = +960\ kJ\ mol^{-1}$$

The potential difference needed for the electrolytic reduction of aluminium oxide (Al_2O_3) at 500°C is at least:

(1) 4.5 V

(2) 3.0 V

(3) 2.5 V

(4) 5.0 V

Ans. (3)

Sol. $\Delta G = -nFE°$

53. Chloroamphenicol is an

(1) Antifertility drug

(2) Antihistaminic

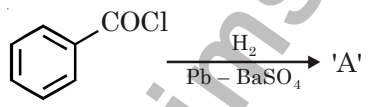
(3) Antispetic and disinfectant

(4) Antibiotic-broad spectrum

Ans. (4)

Sol. Fact

54. Consider the following reaction



The product 'A; is

(1) C_6H_5CHO

(2) C_6H_5OH

(3) $C_6H_5COCH_3$

(4) C_6H_5Cl

Ans. (1)

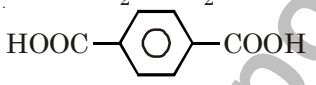
Sol. It is Rosenmund reduction.

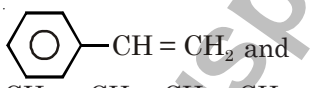
55. Which one of the following sets forms the biodegradable polymer?

(1) $CH_2 = CH - CN$ and
$CH_2 = CH - CH = CH_2$

(2) $H_2N - CH_2 - COOH$ and
$H_2N - (CH_2)_5 - COOH$

(3) $HO - CH_2 - CH_2 - OH$ and



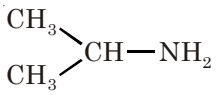
(4) 

and
$CH_2 = CH - CH = CH_2$

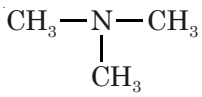
Ans. (2)

Sol. Nylon-2-nylon-6 is a biodegradable polymer which monomer is $H_2N - CH_2 - COOH$ and $H_2N - (CH_2)_5 - COOH$

56. An organic compound (C_3H_9N) (A), when treated with nitrous acid, gave an alcohol and N_2 gas was evolved. (A) on warming with $CHCl_3$ and caustic potash gave (C) which on reduction gave isopropylmethylamine. Predict the structure of (A).

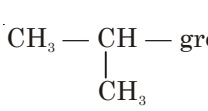
(1) 

(2) $CH_3CH_2—NH—CH_3$

(3) 

(4) $CH_3CH_2CH_2—NH_2$

Ans. (1)

Sol. Condition of reaction is satisfied by 1° amine containing 

57. Which of the following reagents will be able to distinguish between 1-butyne and 2-butyne?

(1) $NaNH_2$ (2) HCl

(3) O_2 (4) Br_2

Ans. (1)

Sol. $NaNH_2$ reacts with but-1-yne due to presence of acidic hydrogen but not with but-2-yne.

58. Consider the reaction

$RCHO + NH_2NH_2 \longrightarrow RCH = N - NH_2$

What sort of reaction is it?

(1) Electrophilic addition - elimination reaction

(2) Free radical addition - elimination reaction

(3) Electrophilic substitution - elimination reaction

(4) Nucleophilic addition - elimination reaction

Ans. (4)

Sol. It is the nucleophilic addition elimination reaction of aldehyde.

59. Which of the following compounds will give a yellow precipitate with iodine and alkali?

(1) Acetophenone

(2) Methyl acetate

(3) Acetamide

(4) 2-hydroxypropane

Ans. (1, 4)

Sol. Both Acetophenone and 2-hydroxypropane give iodoform reaction.

60. Which of the following compounds can be used as antifreeze in automobile radiators?

(1) Methyl alcohol

(2) Glycol

(3) Nitrophenol

(4) Ethyl alcohol

Ans. (2)

Sol. Glycol act as antifreeze substance.

61. How many organisms in the list given below are autotrophs?

Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Sacharomyces, Trypansoma, Porphyra, Wolfia

(1) Four (2) Five

(3) Six (4) Three

Ans. (3)

Sol. *Nostoc, Porphyra, Wolfia, Chara* → Photosynthetic autotrophs

Nitrosomonas, Nitrobacter → Chemosynthetic autotrophs

62. Read the following five statements (A - E) and answer as asked next to them.

(A) In *Equisetum*, the female gametophyte is retained on the parent sporophyte.

(B) In Ginkgo male gametophyte is not independent.

(C) The sporophyte in *Riccia* is more developed than that in *Polytrichum*.

(D) Sexual reproduction in *Volvox* is isogamous.

(E) The spores of slime molds lack cell walls.

How many of the above statements are **correct**?

(1) Two (2) Three

(3) Four (4) One

Ans. (4)

Sol. *Equisetum* → Homosporous pteridophyte

63. Which one of the following pairs is **wrongly** matched?

(1) *Ginkgo* - Archegonia

(2) *Salvinia* - Prothallus

(3) Viroids - RNA

(4) Mustard - Synergids

Ans. (2)

Sol. *Salvinia* → Heterosporous pteridophyte

64. In the five-kingdom classification, *Chlamydomonas* and *Chlorella* have been included in

(1) Protista (2) Algae

(3) Plantae (4) Monera

Ans. (1)

Sol. Kingdom Protista has brought together *Chlamydomonas*, *Chlorella* (earlier placed in Algae within plants and both having cell walls) with *Paramoecium* and *Amoeba* (which were earlier placed in animal kingdom) which lack it.

65. For its activity, carboxypeptidase requires

(1) Zinc (2) Iron

(3) Niacin (4) Copper

Ans. (1)

Sol. Zinc is a cofactor for the proteolytic enzyme carboxypeptidase.

66. Which one of the following structures is an organelle within an organelle?

(1) Ribosome (2) Peroxisome

(3) ER (4) Mesosome

Ans. (1)

Sol. Ribosome is found in chloroplast and mitochondria.

67. Which one of the following is a **wrong** statement regarding mutations?

(1) Deletion and insertion of base pairs cause frame-shift mutations

(2) Cancer cells commonly show chromosomal aberrations

(3) UV and Gamma rays are mutagens

(4) Change in a single base pair of DNA does not cause mutation

Ans. (4)

Sol. Change in a single base pair of DNA is called point mutation.

68. A test cross is carried out to

(1) Determine the genotype of a plant at F_2

(2) Predict whether two traits are linked

(3) Assess the number of alleles of a gene

(4) Determine whether two species or varieties will breed successfully

Ans. (1)

Sol. To determine the genotype of a tall plant at F_2, Mendel crossed the tall plant from F_2 with a dwarf plant. This is called a test cross.

69. Read the following four statements (A - D)

(A) In transcription, adenosine pairs with uracil.

(B) Regulation of *lac* operon by repressor is referred to as positive regulation.

(C) The human genome has approximately 50,000 genes.

(D) Haemophilia is a sex-linked recessive disease.

How many of the above statements are **right**?

(1) Two (2) Three

(3) Four (4) One

Ans. (1)

Sol. (B) Negative control

(C) 30,000 genes

70. Which one of the following organisms is **correctly** matched with its three characteristics?

(1) Pea : C_3 pathway, Endospermic seed, Vexillary aestivation

(2) Tomato : Twisted aestivation, Axile placentation, Berry

(3) Onion : Bulb, Imbricate aestivation, Axile placentation

(4) Maize : C_3 pathway, Closed vascular bundles, Scutellum

Ans. (4)

Sol. Maize is a C_4 plant having C_3 as well as C_4 pathway.

71. How many plants in the list given below have marginal placentation?

Mustard, Gram, Tulip, Asparagus, Arhar, Sun hemp, Chilli, Colchicine, Onion, Moong, Pea, Tobacco, Lupin

(1) Four (2) Five

(3) Six (4) Three

Ans. (3)

Sol. Gram, Arhar, Sun hemp, Moong, Pea, Lupin → Plants of Fabaceae family.

72. Read the following four statements (A - D)

(A) Both, photophosphorylation and oxidative phosphorylation involve uphill transport of protons across the membrane.

(B) In dicot stems, a new cambium originates from cells of pericycle at the time of secondary growth.

(C) Stamens in flowers of *Gloriosa* and *Petunia* are polyandrous.

(D) Symbiotic nitrogen-fixers occur in free-living state also in soil.

How many of the above statements are **right**?

(1) Two (2) Three

(3) Four (4) One

Ans. (1)

Sol. *Petunia* → A_5

Gloriosa → A_{3+3}

73. Through their effect on plant growth regulators, what do the temperature and light control in the plants?

(1) Apical dominance (2) Flowering

(3) Closure of stomata (4) Fruit elongation

Ans. (2)

Sol. Many of the extrinsic factors such as temperature and light, control plant growth and development via PGR. Some of such events could be : Vernalisation, flowering, dormancy, seed germination, plant movements etc.

74. Which one of the following generally acts as an antagonist to gibberellins?

(1) Zeatin (2) Ethylene

(3) ABA (4) IAA

Ans. (3)

Sol. ABA = Antigibberellic acid

75. As compared to a dicot root, a monocot root has

(1) More abundant secondary xylem

(2) Many xylem bundles

(3) Inconspicuous annual rings

(4) Relatively thicker periderm

Ans. (2)

Sol. Monocot root has polyarch condition.

76. For its action, nitrogenase requires

(1) High input of energy

(2) Light

(3) Mn^{2+}

(4) Super oxygen radicals

Ans. (1)

Sol. ATP for each NH_3 produced.

77. Vernalisation stimulates flowering in

(1) Zamikand (2) Turmeric

(3) Carrot (4) Ginger

Ans. (3)

Sol. Subjecting the growing of a biennial plant (e.g., Sugarbeet, Cabbage, Carrot) to a cold treatment stimulates a subsequent photoperiodic flowering response.

78. What is the function of germ pore?

(1) Emergence of radicle

(2) Absorption of water for seed germination

(3) Initiation of pollen tube

(4) Release of male gametes

Ans. (3)

Sol. Pollen grain germinates on the stigma to produce a pollen tube through one of the germ pores.

79. Which one of the following statements is **wrong**?

(1) When pollen is shed at two-celled stage, double fertilization does not take place

(2) Vegetative cell is larger than generative cell

(3) Pollen grains in some plants remain viable for months

(4) Intine is made up of cellulose and pectin

Ans. (1)

Sol. Double fertilisation event is unique to angiosperms.

80. Plants with ovaries having only one or a few ovules, are generally pollinated by

(1) Bees (2) Butterflies

(3) Birds (4) Wind

Ans. (4)

Sol. Wind pollination is quite common in grasses (basal placentation).

81. Sacred groves are specially useful in

(1) Generating environmental awareness

(2) Preventing soil erosion

(3) Year-round flow of water in rivers

(4) Conserving rare and threatened species

Ans. (4)

Sol. In Meghalaya, sacred groves are the last refuges for a large number of rare and threatened plants.

82. The rate of formation of new organic matter by rabbit in a grassland, is called

(1) Net productivity

(2) Secondary productivity

(3) Net primary productivity

(4) Gross primary productivity

Ans. (2)

Sol. Secondary productivity is defined as the rate of formation of new organic matter by consumers.

83. *Cuscuta* is an example of

(1) Ectoparasitism (2) Brood parasitism

(3) Predation (4) Endoparasitism

Ans. (1)

Sol. It is a total stem parasite.

84. The second stage of hydrosere is occupied by plants like

(1) *Azolla*

(2) *Typha*

(3) *Salix*

(4) *Vallisneria*

Ans. (4)

Sol. Submerged plant stage

85. Green revolution in India occurred during

(1) 1960's (2) 1970's

(3) 1980's (4) 1950's

Ans. (1)

Sol. 1960 decade is the phase of green revolution.

86. In gobar gas, the maximum amount is that of

(1) Butane

(2) Methane

(3) Propane

(4) Carbon dioxide

Ans. (2)

Sol. Large amount of methane along with CO_2 and H_2.

87. Read the following statements (A - D)

(A) Colostrum is recommended for the new born because it is rich in antigens

(B) Chikengunya is caused by a Gram negative bacterium

(C) Tissue culture has proved useful in obtaining virus-free plants

(D) Beer is manufactured by distillation of fermented grape juice

How many of the above statements are **wrong**?

(1) Two (2) Three

(3) Four (4) One

Ans. (2)

Sol. A, B and D statements are wrong

The correct statements for

A : Colostrum is recommended for the new born because it is rich in antibodies.

B : Chikungunya is caused by arbovirus.

D : Beer is manufactured without distillation of fermented grape juice.

88. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells)

(1) Both sense and anti-sense RNA

(2) A particular hormone

(3) An antifeedant

(4) A toxic protein

Ans. (1)

Sol. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produces both sense and anti-sense RNA in the host cells.

89. Biolistics (gene-gun) is suitable for

(1) Disarming pathogen vectors

(2) Transformation of plant cells

(3) Constructing recombinant DNA by joining with vectors

(4) DNA finger printing

Ans. (2)

Sol. Biolistic (gene gun) is suitable for transformation of plant cells.

90. In genetic engineering, the antibiotics are used :

(1) As selectable markers

(2) To select healthy vectors

(3) As sequences from where replication starts

(4) To keep the cultures free of infection

Ans. (1)

Sol. In genetic engineering, the antibiotics are used as selectable markers.

91. Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them?

(1) *Pteropus and Ornithorhyncus*-Viviparity

(2) Garden lizard and Crocodile - Three chambered heart

(3) *Ascaris* and *Ancylostoma* - Metameric segmentation

(4) Sea horse and Flying fish - Cold blooded (poikilothermal)

Ans. (4)

Sol. Sea horse is *Hippocampus*

Flying fish is *Exocoetus*

Both are fishes and cold blooded animals.

92. Which one of the following categories of animals, is correctly described **with no single exception in it?**

(1) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal)

(2) All bony fishes have four pairs of gills and an operculum on each side

(3) All sponges are marine and have collared cells

(4) All mammals are viviparous and possess diaphragm for breathing

Ans. (2)

Sol. All bony fishes have four pair of gills and an operculum on each side without any exception.

93. Which one of the following organisms is **scientifically correctly named, correctly printed** according to the International Rules of Nomenclature and **correctly described**?

(1) *Musca domestica* - The common house lizard, a reptile

(2) *Plasmodium falciparum* - A protozoan pathogen causing the most serious type of malaria

(3) *Felis tigris* - The Indian tiger, well protected in Gir forests

(4) *E.coli* - Full name *Entamoeba coli*, a commonly occurring bacterium in human intestine

Ans. (2)

Sol. *Plasmodium falciparum* is a protozoan pathogen causing malignant malaria

94. Which one of the following cellular parts is **correctly** described?

(1) Thylakoids - flattened membranous sacs forming the grana of chloroplasts

(2) Centrioles - sites for active RNA synthesis

(3) Ribosomes - those on chloroplasts are larger (80s) while those in the cytoplasm are smaller (70 s)

(4) Lysosomes - optimally active at a pH of about 8.5

Ans. (1)

Sol. Nucleolus : Sites for active RNA synthesis

Lysosomes : Acidic pH

95. Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres :

(1) Metaphase I (2) Metaphase II

(3) Anaphase I (4) Anaphase II

Ans. (3)

Sol. Anaphase, Anaphase II → division of centromere.

96. Which one of the following biomolecules is **correctly** characterised?

(1) Lecithin - a phosphorylated glyceride found in cell membrane

(2) Palmitic acid - an unsaturated fatty acid with 18 carbon atoms

(3) Adenylic acid - adenosine with a glucose phosphate molecule

(4) Alanine amino acid - Contains an amino group and an acidic group anywhere in the molecule

Ans. (1)

Sol. Lecithin is a phospholipid present in the cell membranes.

97. The idea of mutations was brought forth by :

(1) **Hugo de Vries**, who worked on evening primrose

(2) **Gregor Mendel,** who worked on *Pisum sativum*

(3) **Hardy Weinberg**, who worked on allele frequencies in a population

(4) **Charles Darwin,** who observed a wide variety of organisms during sea voyage

Ans. (1)

Sol. Hugo de Vries, worked on evening primrose and gave the concept of mutation.

98. What is it that forms the basis of DNA Fingerprinting?

(1) The relative proportions of purines and pyrimidines in DNA

(2) The relative difference in the DNA occurrence in blood, skin and saliva

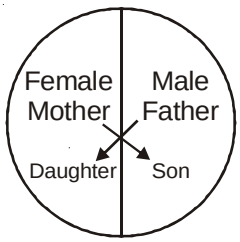
(3) The relative amount of DNA in the ridges and grooves of the fingerprints

(4) Satellite DNA occurring as highly repeated short DNA segments

Ans. (4)

Sol. Satellite DNA normally do not code for any proteins, but they form a large portion of human genome. These sequence show high degree of polymorphism and form the basis of DNA finger printing.

99. Represented below is the inheritance pattern of a certain type of traits in humans. Which one of the following conditions could be an example of this pattern?



(1) Phenylketonuria

(2) Sickle cell anaemia

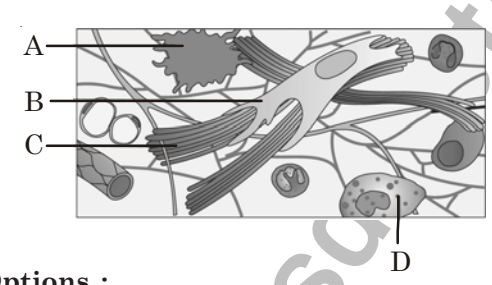
(3) Haemophilia

(4) Thalassemia

Ans. (3)

Sol. Criss-cross inheritance is a feature of X-linked recessive traits.

100. Given below is the diagrammatic sketch of a certain type of connective tissue. Identify the parts labelled A, B, C and D and select the right option about them.



Options :

	Part-A	Part-B	Part-C	Part-D
(1)	Macro-phage	Fibroblast	Collagen fibres	Mast cells
(2)	Mast cell	Macro-Phage	Fibroblast	Collagen fibres
(3)	Macro-phage	Collagen fibres	Fibroblast	Mast cell
(4)	Mast cell	Collagen fibres	Fibroblast	Macro-phage

Ans. (1)

101. Which one of the following options gives the **correct** categorisation of six animals according to the type of nitrogenous wastes (A, B, C) they give out?

	A AMMONO TELIC	B UREOTELIC	C URICOTELIC
(1)	Pigeon, Humans	Aquatic Amphibia, Lizards	Cockroach, Frog
(2)	Frog, Lizards	Aquatic Amphibia, Humans	Cockroach, Pigeon
(3)	Aquatic Amphibia	Frog, Humans	Pigeon, Lizards, Cockroach
(4)	Aquatic Amphibia	Cockroach, Humans	Frog, Pigeon, Lizards

Ans. (3)

102. Where do certain symbiotic microorganisms normally occur in human body?

(1) Caecum

(2) Oral lining and tongue surface

(3) Vermiform appendix and rectum

(4) Duodenum

Ans. (1)

Sol. Caecum is a small blind sac that hosts some symbiotic micro-organisms.

103. Which one of the following pairs of chemical substances, is **correctly** categorised?

(1) Calcitonin and thymosin – Thyroid hormones

(2) Pepsin and prolactin – Two digestive enzymes secreted in stomach

(3) Troponin and myosin – Complex proteins in striated muscles

(4) Secretin and rhodopsin – polypeptide hormones

Ans. (3)

Sol. Troponin and myosin are complex proteins in striated muscles.

104. The supportive skeletal structures in the human external ears and in the nose tip are examples of

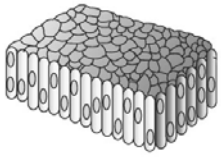
(1) Ligament (2) Areolar tissue

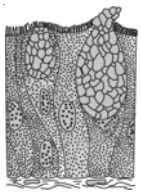
(3) Bone (4) Cartilage

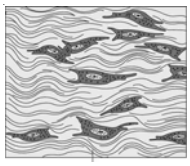
Ans. (4)

Sol. In ear pinna and tip of nose elastic cartilage is present.

105. The four sketches (A, B, C and D) given below, represent four different types of animal tissues. Which one of these is correctly identified in the options given, along with its correct location and function?

(A) 

(B) 

(C) 

(D) 

		Tissue	Location	Function
(1)	(B)	Glandular epithelium	Intestine	Secretion
(2)	(C)	Collagen fibres	Cartilage	Attach skeletal muscles to bones
(3)	(D)	Smooth muscle tissue	Heart	Heart contraction
(4)	(A)	Columnar epithelium	Nephron	Secretion and absorption

Ans. (1)

106. A fall in glomerular filtration rate (GFR) activates

(1) Juxta glomerular cells to release renin

(2) Adrenal cortex to release aldosterone

(3) Adrenal medulla to release adrenaline

(4) Posterior pituitary to release vasopressin

Ans. (1)

Sol. A fall in GFR activates JG cells to release renin.

107. Which one of the following characteristics is common both in humans and adult frogs?

(1) Four-chambered heart

(2) Internal fertilisation

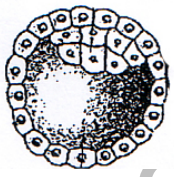
(3) Nucleated RBCs

(4) Ureotelic mode of excretion

Ans. (4)

Sol. Adult frogs and humans are ureotelic.

108. Identify the human development stage shown below as well as the related right place of its occurrence in a normal pregnant woman, and select the right option for the two together.



Options :

	Developmental stage	Site of occurrence
(1)	Late morula	Middle part of Fallopian tube
(2)	Blastula	End part of Fallopian tube
(3)	Blastocyst	Uterine wall
(4)	8 - celled morula	Starting point of Fallopian tube

Ans. (3)

109. Which one of the following human organs is often called the "graveyard" of RBCs?

(1) Gall bladder (2) Kidney

(3) Spleen (4) Liver

Ans. (3)

110. The secretory phase in the human menstrual cycle is also called

(1) Luteal phase and lasts for about 6 days

(2) Follicular phase lasting for about 6 days

(3) Luteal phase and lasts for about 13 days

(4) Follicular phase and lasts for about 13 days

Ans. (3)

Sol. Secretory phase in the human menstrual cycle is also called as luteal phase which is of about 13-14 days.

111. Select the correct statement about biodiversity

(1) The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals

(2) Large scale planting of BT cotton has no adverse effect on biodiversity

(3) Western Ghats have a very high degree of species richness and endemism

(4) Conservation of biodiversity in just a fad pursued by the developed countries

Ans. (3)

Sol. Western Ghats → Hot spot

112. The domestic sewage in large cities

(1) Has a high BOD as it containing both aerobic and anaerobic bacteria

(2) Is processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plants (STPs)

(3) When treated in STPs does not really require the aeration step as the sewage contains adequate oxygen

(4) Has very high amounts of suspended solids and dissolved salts

Ans. (2)

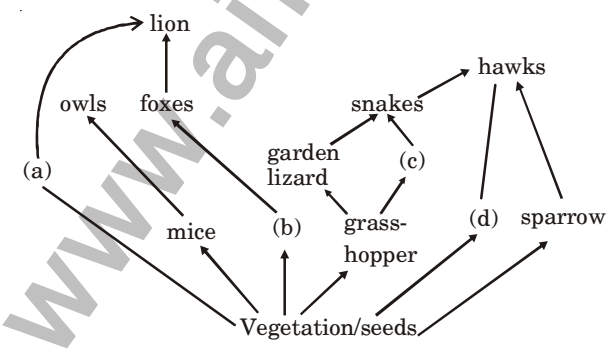
Sol. A mere 0.1% impurities make domestic sewage unfit for human use.

113. Which one of the following sets of items in the options (1) - (4) are correctly categorised with one exception in it?

	Items	Category	Exception
(1)	UAA, UAG, UGA	Stop codons	UAG
(2)	Kangaroo, Koala, Wombat	Australian marsupials	Wombat
(3)	*Plasmodium, Cuscuta, Trypanosoma*	Protozoan parasites	*Cuscuta*
(4)	Typhoid, Pneumonia, Diphtheria	Bacterial diseases	Diphtheria

Ans. (3)

114. Identify the likely organisms (a), (b), (c) and (d) in the food web shown below



Options

	(a)	(b)	(c)	(d)
(1)	Deer	Rabbit	Frog	Rat
(2)	Dog	Squirrel	Bat	Deer
(3)	Rat	Dog	Tortoise	Crow
(4)	Squirrel	Cat	Rat	Pigeon

Ans. (1)

Sol. Herbivores → rabbit, deer, field mouse

Primary carnivore → frog

115. Consider the following four statements (a-d) and select the option which includes all the **correct** ones only

a. Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins etc.

b. Body weight-wise the micro-organism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day.

c. Common button mushrooms are a very rich source of vitamin C.

d. A rice variety has been developed which is very rich in calcium

Options

(1) Statements (c), (d)

(2) Statements (a), (c) and (d)

(3) Statements (b), (c) and (d)

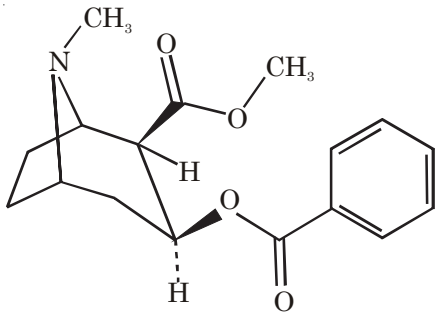
(4) Statements (a), (b)

Ans. (4)

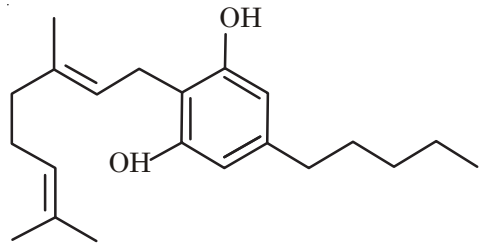
Sol. It has been possible to develop an iron fortified rice variety containing over five times.

116. Identify the molecules (a) and (b) shown below and select the right option giving their source and use

(a)



(b)



Options :

	Molecule	Source	Use
(1)	(a) Cocaine	*Erythroxylum coca*	Accelerates the transport of dopamine
(2)	(b) Heroin	*Cannabis sativa*	Depressant and slows down body functions
(3)	(b) Cannabinoid	*Atropa belladona*	Produces halluci-nations
(4)	(a) Morphine	*Papaver somniferum*	Sedative and pain killer

Ans. (4)

117. Which one of the following statements is correct with respect to immunity?

(1) Preformed antibodies need to be injected to treat the bite by a viper snake

(2) The antibodies against small pox pathogen are produced by T-lymphocytes

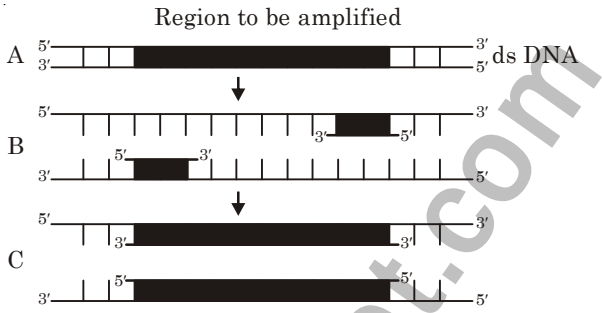
(3) Antibodies are protein molecules, each of which has four light chains

(4) Rejection of a kidney graft is the function of B-lymphocytes

Ans. (1)

Sol. Preformed antibodies need to be injected to treat the bite by a viper.

118. The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?



(1) B-Denaturation at a temperature of about 98°C separating the two DNA strands

(2) A - Denaturation at a temperature of about 50°C

(3) C - Extension in the presence of heat stable DNA polymerase

(4) A - Annealing with two sets of primers

Ans. (1)

119. The first clinical gene therapy was given for treating?

(1) Diabetes mellitus

(2) Chicken pox

(3) Rheumatoid arthritis

(4) Adenosine deaminase deficiency

Ans. (4)

120. Which one of the following represents a palindromic sequence in DNA?

(1) 5′ - GAATTC - 3′
3′ - CTTAAG - 5′

(2) 5′ - CCAATG - 3′
3′ - CAATCC - 5′

(3) 5′ - CATTAG - 3′
3′ - GATAAC - 5′

(4) 5′ - GATACC - 3′
3′ - CCTAAG - 5′

Ans. (1)

Sol. Palindromic sequence in DNA should read the same provided that orientation of reading is kept the same.

1. In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows :

$$P = \frac{a^3b^2}{cd}$$

% error in P is

(1) 14% (2) 10%

(3) 7% (4) 4%

Answer (1)

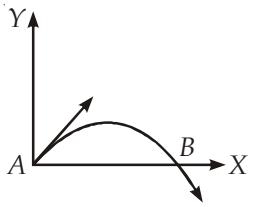
Sol. $P = \frac{a^3b^2}{cd}$

$$\Rightarrow \frac{\Delta P}{P}\times 100 = 3\left(\frac{\Delta a}{a}\times 100\right) + 2\left(\frac{\Delta b}{b}\times 100\right) + \left(\frac{\Delta c}{c}+100\right) + \left(\frac{\Delta d}{d}\times 100\right)$$

$= 3 \times 1 + 2 \times 2 + 3 + 4$

$= 3 + 4 + 3 + 4 = 14\%$

2. The velocity of a projectile at the initial point A is $(2\hat{i}+3\hat{j})$ m/s. Its velocity (in m/s) at point B is



(1) $-2\hat{i}-3\hat{j}$ (2) $-2\hat{i}+3\hat{j}$

(3) $2\hat{i}-3\hat{j}$ (4) $2\hat{i}+3\hat{j}$

Answer (3)

Sol. X component remain unchanged and Y component reverses.

3. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is

(1) $h_1 = 2h_2 = 3h_3$ (2) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

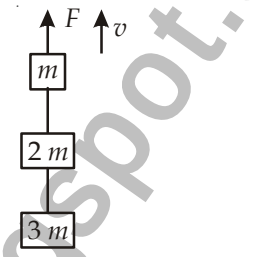
(3) $h_2 = 3h_1$ and $h_3 = 3h_2$ (4) $h_1 = h_2 = h_3$

Answer (2)

Sol. $h_1 : h_2 : h_3 = 1 : 3 : 5$

4. Three blocks with masses m, $2m$ and $3m$ are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2 m?

(g is the acceleration due to gravity)



(1) Zero (2) 2 mg

(3) 3 mg (4) 6 mg

Answer (1)

Sol. All blocks are moving with constant velocity so net force on all blocks are zero.

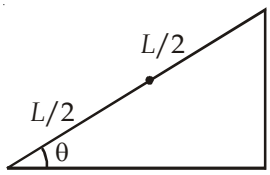
5. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by

(1) $\mu = \frac{1}{\tan\theta}$ (2) $\mu = \frac{2}{\tan\theta}$

(3) $\mu = 2\tan\theta$ (4) $\mu = \tan\theta$

Answer (3)

Sol.



$$mg\sin\theta\cdot L = \mu mg\cos\theta\times\frac{L}{2}$$

$$\mu = \frac{2\sin\theta}{\cos\theta} = 2\tan\theta$$

6. A uniform force of $(3\hat{i}+\hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i}+\hat{k})$ metre to position $(4\hat{i}+3\hat{j}-\hat{k})$ metre. The work done by the force on the particle is

(1) 9 J (2) 6 J

(3) 13 J (4) 15 J

Answer (1)

Sol. $\vec{F} = 3\hat{i} + \hat{j}$ $\qquad \vec{S} = \vec{r}_2 - \vec{r}_1 = 2\hat{i} + 3\hat{j} - 2\hat{k}$

$W = \vec{F} \cdot \vec{S} = 6 + 3 + 0 = 9$ J

7. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second part of mass 2 kg moves with 8 ms^{-1} speed. If the third part flies off with 4 ms^{-1} speed, then its mass is

(1) 3 kg (2) 5 kg

(3) 7 kg (4) 17 kg

Answer (2)

Sol. $\vec{P_1} + \vec{P_2} + \vec{P_3} = \vec{0}$

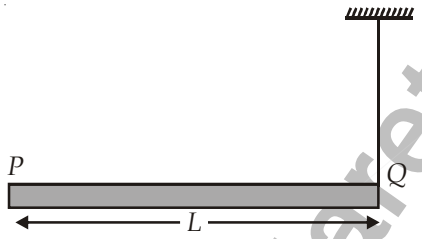
$\Rightarrow \quad 1 \times 12\hat{i} + 2 \times 8\hat{j} + \vec{P_3} = 0$

$\vec{P_3} = -\left(12\hat{i} + 16\hat{j}\right)$

$P_3 = \sqrt{12^2 + 16^2} = 20$ kg ms^{-1}

$m_3 = \frac{P_3}{v_3} = 5$ kg

8. A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is

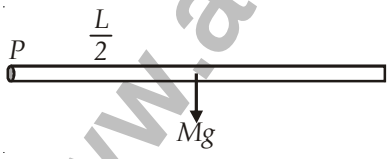


(1) $\frac{3g}{2L}$ (2) $\frac{g}{L}$

(3) $\frac{2g}{L}$ (4) $\frac{2g}{3L}$

Answer (1)

Sol.



$Mg\frac{L}{2} = \frac{ML^2}{3}\alpha$

$\alpha = \frac{3g}{2L}$

9. A small object of uniform density rolls up a curved surface with an initial velocity v'. It reaches up to a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is

(1) Ring (2) Solid sphere

(3) Hollow sphere (4) Disc

Answer (4)

Sol. $v = \sqrt{\frac{2gh}{1 + \frac{k^2}{r^2}}}$

$v^2 = \frac{2g\ 3v^2}{4g\left(1 + \frac{k^2}{r^2}\right)}$

$\Rightarrow \quad 1 + \frac{k^2}{r^2} = \frac{3}{2}$

$k^2 = \frac{1}{2}r^2 \rightarrow$ disc

10. A body of mass 'm' taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be

(1) $mg2R$ (2) $\frac{2}{3}mgR$

(3) $3mgR$ (4) $\frac{1}{3}mgR$

Answer (2)

Sol. $\Delta U = \frac{mgRh}{R+h} = \frac{mgR2R}{3R} = \frac{2mgR}{3}$

11. Infinite number of bodies, each of mass 2 kg are situated on x-axis at distance 1 m, 2 m, 4 m, 8 m, ... respectively, from the origin. The resulting gravitational potential due to this system at the origin will be

(1) $-G$ (2) $-\frac{8}{3}G$

(3) $-\frac{4}{3}G$ (4) $-4G$

Answer (4)

Sol. $V = -2G\left[\frac{1}{1} + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} \ldots\ldots\right]$

$= -2G\left[1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} \ldots\ldots\right]$

$= -2G\frac{1}{\left(1 - \frac{1}{2}\right)} = -4G$

12. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

(1) Length = 50 cm, diameter = 0.5 mm

(2) Length = 100 cm, diameter = 1 mm

(3) Length = 200 cm, diameter = 2 mm

(4) Length = 300 cm, diameter = 3 mm

Answer (1)

Sol. $\Delta L = \frac{FL}{AY}$, $\frac{L}{A}$ is maximum for option (1).

13. The wettability of a surface by a liquid depends primarily on

(1) Viscosity

(2) Surface tension

(3) Density

(4) Angle of contact between the surface and the liquid

Answer (4)

14. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to

(1) $\frac{1+\gamma}{1-\gamma}$ (2) $\frac{R}{(\gamma-1)}$

(3) $\frac{(\gamma-1)}{R}$ (4) γR

Answer (2)

Sol. $C_v = \frac{R}{\gamma - 1}$

15. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using

(1) Stefan's Law

(2) Wien's displacement Law

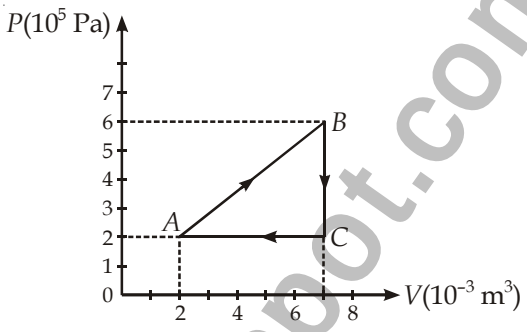
(3) Kirchoff's Law

(4) Newton's Law of cooling

Answer (2)

Sol. $\lambda_m T$ = constant

16. A gas is taken through the cycle $A \to B \to C \to A$, as shown. What is the net work done by the gas?



(1) 2000 J (2) 1000 J

(3) Zero (4) –2000 J

Answer (2)

Sol. W = Area enclosed in P-V curve

$= \frac{1}{2} \times 5 \times 10^{-3} \times 4 \times 10^5$

$= 10 \times 10^2$

$= 1000$ J

17. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_p}{C_v}$ for the gas is

(1) $\frac{4}{3}$

(2) 2

(3) $\frac{5}{3}$

(4) $\frac{3}{2}$

Answer (4)

Sol. $P \propto T^3$,

$PV = nRT$

$P \propto T^3$

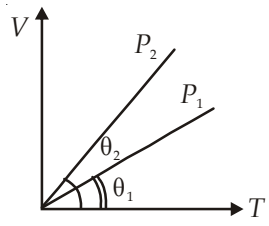
$P \propto (PV)^3$

$P^2V^3 = \text{constant}$

$PV^{\frac{3}{2}} = \text{constant}$

$\gamma = \frac{3}{2}$

18. In the given (V – T) diagram, what is the relation between pressures P_1 and P_2?



(1) $P_2 = P_1$ (2) $P_2 > P_1$

(3) $P_2 < P_1$ (4) Cannot be predicted

Answer (3)

Sol. Slope of the graph $\propto \frac{1}{\text{Pressure}}$.

19. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1K to T_2K is

(1) $\frac{3}{8}N_a k_B(T_2 - T_1)$ (2) $\frac{3}{2}N_a k_B(T_2 - T_1)$

(3) $\frac{3}{4}N_a k_B(T_2 - T_1)$ (4) $\frac{3}{4}N_a k_B\left(\frac{T_2}{T_1}\right)$

Answer (1)

Sol. $Q = \frac{f}{2}nR\Delta T$

$\frac{3}{2} \times \frac{1}{4} \times k_B N_a \Delta T$

$= \frac{3}{8}N_a k_B (T_2 - T_1) = \frac{3}{8}N_a k_B (T_2 - T_1)$

20. A wave travelling in the +ve x-direction having displacement along y-direction as 1 m, wavelength 2π m and frequency of $\frac{1}{\pi}$ Hz is represented by

(1) $y = \sin(x - 2t)$ (2) $y = \sin(2\pi x - 2\pi t)$

(3) $y = \sin(10\pi x - 20\pi t)$ (4) $y = \sin(2\pi x + 2\pi t)$

Answer (1)

Sol. $y = a\sin(kx - \omega t)$

$= \sin\left[\frac{2\pi}{2\pi}x - 2\pi \times \frac{1}{\pi}t\right]$

$= \sin(x - 2t)$

21. If we study the vibration of a pipe open at both ends, then the following statement is not true

(1) Open end will be anti-node

(2) Odd harmonics of the fundamental frequency will be generated

(3) All harmonics of the fundamental frequency will be generated

(4) Pressure change will be maximum at both ends

Answer (4)

Sol. At open ends pressure change will be zero.

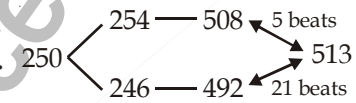
22. A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is

(1) 254 Hz (2) 246 Hz

(3) 240 Hz (4) 260 Hz

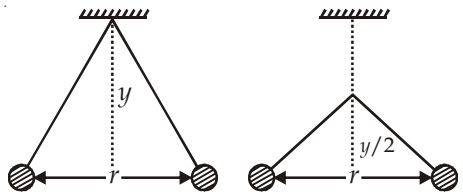
Answer (1)

Sol.



$\therefore$ Unknown frequency is 254 Hz.

23. Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become



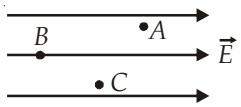
(1) $\left(\frac{1}{\sqrt{2}}\right)^2$ (2) $\left(\frac{r}{\sqrt[3]{2}}\right)$

(3) $\left(\frac{2r}{\sqrt{3}}\right)$ (4) $\left(\frac{2r}{3}\right)$

Answer (2)

Sol. $F_e = mg\tan\theta$, $\frac{F_e'}{F_e} = \frac{\tan\theta_2}{\tan\theta_1}$

24. A, B and C are three points in a uniform electric field. The electric potential is



(1) Maximum at A

(2) Maximum at B

(3) Maximum at C

(4) Same at all the three points A, B and C

Answer (2)

Sol. Electric field is directed along decreasing potential $V_B > V_C > V_A$.

25. A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be

(1) 2 Ω (2) 4 Ω

(3) 8 Ω (4) 16 Ω

Answer (4)

Sol. $R' = 16\ \Omega$ $(R' = n^2R)$

26. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

(1) 0.2 Ω

(2) 0.5 Ω

(3) 0.8 Ω

(4) 1.0 Ω

Answer (2)

Sol. $I = \dfrac{E}{R+r}$

$0.2 \times (10 + r) = 2.1$

$10 + r = \dfrac{2.1}{2} \times 10$

$r = 10.5 - 10 = 0.5\ \Omega$

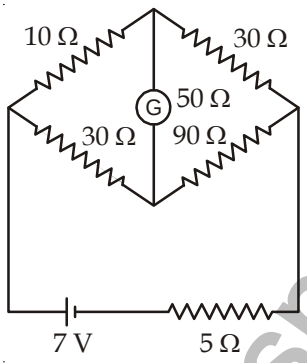
27. The resistances of the four arms P, Q, R and S in a Wheatstone's bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be

(1) 1.0 A (2) 0.2 A

(3) 0.1 A (4) 2.0 A

Answer (2)

Sol.



$R_{\text{eff}} = \dfrac{40 \times 120}{120 + 40} = 30\ \Omega$

$I = \dfrac{7\ \text{V}}{(30 + 5)\Omega} = 0.2\ \text{A}$

28. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are

(1) $\dfrac{ma_0}{e}$ west, $\dfrac{2ma_0}{ev_0}$ up

(2) $\dfrac{ma_0}{e}$ west, $\dfrac{2ma_0}{ev_0}$ down

(3) $\dfrac{ma_0}{e}$ east, $\dfrac{3ma_0}{ev_0}$ up

(4) $\dfrac{ma_0}{e}$ east, $\dfrac{3ma_0}{ev_0}$ down

Answer (2)

Sol. $a_0 = \dfrac{eE}{m} \Rightarrow E = \dfrac{ma_0}{e}$

$\dfrac{ev_0B + eE}{m} = 3a_0$

$ev_0B = 3ma_0 - eE$

$= 3ma_0 - ma_0$

$= 2ma_0$

$B = \dfrac{2ma_0}{ev_0}$

29. A current loop in a magnetic field

(1) Experiences a torque whether the field is uniform or non uniform in all orientations

(2) Can be in equilibrium in one orientation

(3) Can be in equilibrium in two orientations, both the equilibrium states are unstable

(4) Can be in equilibrium in two orientations, one stable while the other is unstable

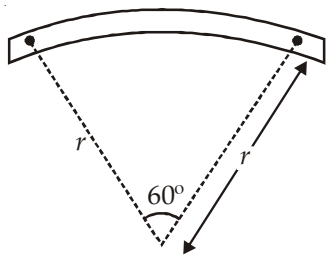
Answer (4)

Sol.

Parallel $\vec{M}$ – stable

Anti-parallel $\vec{M}$ – unstable

30. A bar magnet of length l and magnetic dipole moment M is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be



(1) M (2) $\frac{3}{\pi}M$

(3) $\frac{2}{\pi}M$ (4) $\frac{M}{2}$

Answer (2)

Sol. $M = mL$

$$L = \frac{\pi}{3} \times r \qquad r = \frac{3L}{\pi}$$

$$M' = m \times r = m\frac{3L}{\pi} = \frac{3M}{\pi}$$

31. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is

(1) Once per revolution

(2) Twice per revolution

(3) Four times per revolution

(4) Six times per revolution

Answer (2)

32. A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when

(1) Frequency of the AC source is decreased

(2) Number of turns in the coil is reduced

(3) A capacitance of reactance $X_C = X_L$ is included in the same circuit

(4) An iron rod is inserted in the coil

Answer (4)

Sol. $Z = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + (2\pi fL)^2}$

$I = \frac{V}{Z}$, $P = I^2R$, $\mu\uparrow$ $L\uparrow$ $Z\uparrow$ $I\downarrow$ $P\downarrow$

33. The condition under which a microwave oven heats up a food item containing water molecules most efficiently is

(1) The frequency of the microwaves must match the resonant frequency of the water molecules

(2) The frequency of the microwaves has no relation with natural frequency of water molecules

(3) Microwaves are heat waves, so always produce heating

(4) Infra-red waves produce heating in a microwave oven

Answer (1)

Sol. Electromagnetic waves.

34. Ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is

(1) $\frac{5}{27}$ (2) $\frac{3}{23}$

(3) $\frac{7}{29}$ (4) $\frac{9}{31}$

Answer (1)

Sol. $\lambda_L = \frac{1}{R\left(1-\frac{1}{4}\right)} = \frac{4}{3R}$

$$\lambda_B = \frac{1}{R\left(\frac{1}{4}-\frac{1}{9}\right)} = \frac{1}{R\left(\frac{5}{36}\right)} = \frac{36}{5R}$$

$$\frac{\lambda_L}{\lambda_B} = \frac{4}{3R} \times \frac{5R}{36}$$

$$= \frac{5}{27}$$

35. The half life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1 : 7 in a sample of a given rock. The age of the rock is estimated to be

(1) 40 years (2) 60 years

(3) 80 years (4) 100 years

Answer (2)

Sol.

$$\frac{N}{N_0} = \frac{1}{8} = \frac{1}{2^3}$$

3 half lives, $T = 3 \times 20 = 60$ years

36. A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 u. The energy liberated per u is (given 1 u = 931 MeV)

(1) 2.67 MeV (2) 26.7 MeV

(3) 6.675 MeV (4) 13.35 MeV

Answer (3)

Sol. $\frac{0.02866\times 931}{4}\text{ MeV} = \frac{26.7}{4}\text{MeV}$

$= 6.675$ MeV

37. For photoelectric emission from certain metal the cut-off frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass)

(1) $\sqrt{\frac{h\nu}{(2m)}}$ (2) $\sqrt{\frac{h\nu}{m}}$

(3) $\sqrt{\frac{2h\nu}{m}}$ (4) $2\sqrt{\frac{h\nu}{m}}$

Answer (3)

Sol. $\frac{1}{2}mv_{\max}^2 = h2\nu - h\nu$

$v_{\max} = \sqrt{\frac{2h\nu}{m}}$

38. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by

(1) $\lambda_p \propto \lambda_e^2$ (2) $\lambda_p \propto \lambda_e$

(3) $\lambda_p \propto \sqrt{\lambda_e}$ (4) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$

Answer (1)

Sol.

$\lambda_e = \frac{h}{\sqrt{2mE}}$ $\lambda_p = \frac{hc}{E}$

$\lambda_e^2 = \frac{h^2}{2mE}$

$\lambda_e^2 = \frac{h^2}{2m\frac{hc}{\lambda_p}} \Rightarrow \lambda_e^2 \propto \lambda_p$

39. A plano-convex lens fits exactly into a plano-concave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is

(1) $\frac{R}{2(\mu_1+\mu_2)}$ (2) $\frac{R}{2(\mu_1-\mu_2)}$

(3) $\frac{R}{(\mu_1-\mu_2)}$ (4) $\frac{2R}{(\mu_2-\mu_1)}$

Answer (3)

Sol.

$f = \frac{1}{f_1} + \frac{1}{f_2}$

$f_1 = \frac{R}{(\mu_1-1)}$; $f_2 = \frac{-R}{(\mu_2-1)}$

$\frac{1}{f} = \frac{(\mu_1-1)}{R} - \frac{(\mu_2-1)}{R}$

$= \frac{[\mu_1-1-\mu_2+1]}{R}$

$= \frac{[\mu_1-\mu_2]}{R}$

40. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea - eye lens can be estimated to be

(1) 5 cm

(2) 2.5 cm

(3) 1.67 cm

(4) 1.5 cm

Answer (3)

Sol. P_{eff} = 40 D + 20 D = 60 D

$f = \frac{100}{P_{\text{eff}}}$

41. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths λ_1 = 12000 Å and λ_2 = 10000 Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

(1) 8 mm (2) 6 mm

(3) 4 mm (4) 3 mm

Answer (2)

Sol. $\frac{\lambda_1}{\lambda_2}=\frac{n_2}{n_1}=\frac{12000}{10000}=\frac{6}{5}$

$$x=\frac{n_1\lambda_1 D}{d}=\frac{5\times12000\times10^{-10}\times2}{2\times10^{-3}}$$

= 6 mm

42. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct?

(1) Diffraction pattern is not observed on the screen in the case of electrons

(2) The angular width of the central maximum of the diffraction pattern will increase

(3) The angular width of the central maximum will decrease

(4) The angular width of the central maximum will be unaffected

Answer (3)

Sol. $v\uparrow \quad \lambda\downarrow$

43. In a *n*-type semiconductor, which of the following statement is true?

(1) Electrons are majority carriers and trivalent atoms are dopants

(2) Electron are minority carriers and pentavalent atoms are dopants

(3) Holes are minority carriers and pentavalent atoms are dopants

(4) Holes are majority carriers and trivalent atoms are dopants

Answer (3)

44. In a common emitter (CE) amplifier having a voltage gain *G*, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be

(1) $\frac{2}{3}G$ (2) 1.5 *G*

(3) $\frac{1}{3}G$ (4) $\frac{5}{4}G$

Answer (1)

Sol. $A_v=\beta\frac{R_L}{R_i}$ $\left(g_m=\frac{\Delta I_C}{\Delta V_B}=\frac{\Delta I_C}{\Delta I_B R_i}\right)$

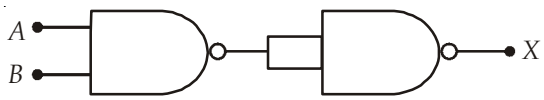
$G=\left(\frac{\beta}{R_i}\right)R_L$ $\left(g_m=\frac{\beta}{R_i}\right)$

$= g_m R_L \Rightarrow G\propto g_m$

$\frac{G_2}{G_1}=\frac{g_{m_2}}{g_{m_1}} \Rightarrow G_2=\frac{0.02}{0.03}\times G$

$=\frac{2}{3}G$

45. The output (*X*) of the logic circuit shown in figure will be



(1) $X=\overline{\overline{A}.\overline{B}}$ (2) $X=\overline{A.B}$

(3) $X=A.B$ (4) $X=\overline{A+B}$

Answer (3)

Sol. $X=\overline{\overline{AB}}=A\cdot B$

46. The value of Planck's constant is 6.63×10^{-34} Js. The speed of light is 3×10^{17} nm s^{-1}. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of 6×10^{15} s^{-1}?

(1) 10 (2) 25

(3) 50 (4) 75

Answer (3)

Sol. $\nu=\frac{c}{\lambda}$

$\therefore \quad \lambda=\frac{3\times10^{17}\,\text{nms}^{-1}}{6\times10^{15}\,\text{s}^{-1}}$

= 50 nm

47. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers?

n = 3, l = 1 and m = –1

(1) 10 (2) 6

(3) 4 (4) 2

Answer (4)

Sol. Fact.

48. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20°C to 35°C ? (R = 8.314 J mol^{-1} K^{-1})

(1) 342 kJ mol^{-1} (2) 269 kJ mol^{-1}

(3) 34.7 kJ mol^{-1} (4) 15.1 kJ mol^{-1}

Answer (3)

Sol. $\log\frac{K_2}{K_1} = -\frac{E_a}{2.303R}\left[\frac{T_1 - T_2}{T_1.T_2}\right]$

$$\log 2 = -\frac{E_a}{2.303\times 8.314}\left[\frac{293-308}{293\times 308}\right]$$

$$E_a = \frac{0.301\times 2.303\times 8.314\times 293\times 308}{15}$$

= 34.67 kJ mol^{-1} ≈ 34.7 kJ mol^{-1}

49. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The oxidation potential of electrode would be

(1) 0.059 V (2) 0.59 V

(3) 0.118 V (4) 1.18 V

Answer (2)

Sol. $E_{cell} = \frac{0.059}{1}\log\frac{1}{10^{-10}}$

= +0.59 V

50. A reaction having equal energies of activation for forward and reverse reactions has

(1) $\Delta S = 0$ (2) $\Delta G = 0$

(3) $\Delta H = 0$ (4) $\Delta H = \Delta G = \Delta S = 0$

Answer (3)

Sol. Fact.

51. At 25°C molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 ohm^{-1} cm^2 mol^{-1} and at infinite dilution its molar conductance is 238 ohm^{-1} cm^2 mol^{-1}. The degree of ionisation of ammonium hydroxide at the same concentration and temperature is

(1) 2.080% (2) 20.800%

(3) 4.008% (4) 40.800%

Answer (3)

Sol. Degree of ionization = $\frac{\lambda_m}{\lambda_m^\infty}\times 100$

$$= \frac{9.54\times 100}{238} = 4.008\%$$

52. Based on equation $E = -2.178\times 10^{-18}\ J\left(\frac{Z^2}{n^2}\right)$ certain conclusions are written. Which of them is **not** correct?

(1) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus

(2) Larger the value of n, the larger is the orbit radius

(3) Equation can be used to calculate the change in energy when the electron changes orbit

(4) For n = 1, the electron has a more negative energy than it does for n = 6 which means that the electron is more loosely bound in the smallest allowed orbit

Answer (4)

Sol. Fact.

53. A button cell used in watches functions as following

$$Zn(s) + Ag_2O(s) + H_2O(l) \rightleftharpoons 2Ag(s) +$$

Zn^{2+} (aq) + $2OH^-$ (aq)

If half cell potentials are

Zn^{2+} (aq) + $2e^-$ → Zn(s) ; E° = –0.76 V

$Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-$ (aq),

E° = 0.34 V

The cell potential will be

(1) 1.10 V (2) 0.42 V

(3) 0.84 V (4) 1.34 V

Answer (1)

Sol. $E^\circ_{cell} = E^o_{cathode} - E^o_{anode}$

= 0.34 – (–0.76) = 1.1 V

54. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3? The concentrated acid is 70% HNO_3.

(1) 45.0 g conc. HNO_3 (2) 90.0 g conc. HNO_3

(3) 70.0 g conc. HNO_3 (4) 54.0 g conc. HNO_3

Answer (1)

Sol. M × V = Moles of HNO_3 = $\frac{250\times2}{1000} = 0.5$

$\therefore$ HNO_3 required = $0.5\times63\times\frac{100}{70} = 45$ g

55. The number of carbon atoms per unit cell of diamond unit cell is

(1) 4 (2) 8

(3) 6 (4) 1

Answer (2)

Sol. Fact.

56. Maximum deviation from ideal gas is expected from

(1) $H_2(g)$ (2) $N_2(g)$

(3) $CH_4(g)$ (4) $NH_3(g)$

Answer (4)

Sol. Fact.

57. A metal has a fcc lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g cm^{-3}. The molar mass of the metal is

(N_A Avogadro's constant = 6.02×10^{23} mol^{-1})

(1) 40 g mol^{-1} (2) 30 g mol^{-1}

(3) 27 g mol^{-1} (4) 20 g mol^{-1}

Answer (3)

Sol. $d = \frac{Z\times M}{V\times N_A}$

$2.72 = \frac{4\times M}{(4.04\times10^{-8})^3\times6.02\times10^{23}}$

$M = \frac{2.72\times(4.04)^3\times6.02\times10^{-1}}{4}$

= 27 g/mol.

58. Dipole-induced dipole interactions are present in which of the following pairs?

(1) H_2O and alcohol (2) Cl_2 and CCl_4

(3) HCl and He atoms (4) SiF_4 and He atoms

Answer (3)

Sol. $\overset{\delta+}{H}-\overset{\delta-}{Cl}\cdots\cdots$ ⊕ He

59. A magnetic moment of 1.73 BM will be shown by one among the following

(1) $[Cu(NH_3)_4]^{2+}$ (2) $[Ni(CN)_4]^{2-}$

(3) $TiCl_4$ (4) $[CoCl_6]^{4-}$

Answer (1)

Sol. Magnetic moment (μ) = $\sqrt{n(n+2)}$

$1.73 = \sqrt{n(n+2)}$

n = 1

So, compound must contain one unpaired electron. The compound is $[Cu(NH_3)_4]^{2+}$.

60. Roasting of sulphides gives the gas X as a by-product. This is a colorless gas with choking smell of burnt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic acts as a reducing agent and its acid has never been isolated. The gas X is

(1) H_2S (2) SO_2

(3) CO_2 (4) SO_3

Answer (2)

Sol. Fact.

61. Which is the strongest acid in the following?

(1) H_2SO_4 (2) $HClO_3$

(3) $HClO_4$ (4) H_2SO_3

Answer (3)

Sol. Fact.

62. Which of the following is paramagnetic?

(1) CO (2) O_2^-

(3) CN^- (4) NO^+

Answer (2)

Sol. O_2^- ⇒ It has one unpaired electron.

63. Which of the following structure is similar to graphite?

(1) BN (2) B

(3) B_4C (4) B_2H_6

Answer (1)

Sol. Fact.

64. The basic structural unit of silicates is

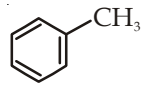
(1) SiO^- (2) SiO_4^{4-}

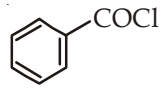
(3) SiO_3^{2-} (4) SiO_4^{2-}

Answer (2)

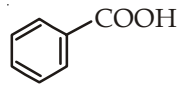
Sol. Fact.

65. Reaction by which Benzaldehyde cannot be prepared?

(1)  + CrO_2Cl_2 in CS_2 followed by H_3O^+

(2)  + H_2 in presence of Pd-$BaSO_4$

(3)  + CO + HCl in presence of anhydrous $AlCl_3$

(4)  + Zn/Hg and conc. HCl

Answer (4)

Sol. Fact.

66. Which of the following does not give oxygen on heating?

(1) $KClO_3$ (2) $Zn(ClO_3)_2$

(3) $K_2Cr_2O_7$ (4) $(NH_4)_2Cr_2O_7$

Answer (4)

Sol. $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2(\uparrow) + Cr_2O_3 + 4H_2O$

67. Which of the following lanthanoid ions is diamagnetic?

(At. nos. Ce = 58, Sm = 62, Eu = 63, Yb = 70)

(1) Ce^{2+} (2) Sm^{2+}

(3) Eu^{2+} (4) Yb^{2+}

Answer (4)

Sol. Yb^{2+} has an electronic configuration of $4f^{14}$.

68. Identify the correct order of solubility in aqueous medium

(1) CuS > ZnS > Na_2S

(2) ZnS > Na_2S > CuS

(3) Na_2S > CuS > ZnS

(4) Na_2S > ZnS > CuS

Answer (4)

Sol. Fact.

69. XeF_2 is isostructural with

(1) TeF_2 (2) ICl_2^-

(3) $SbCl_3$ (4) $BaCl_2$

Answer (2)

Sol. ICl_2^- (Same number of lp and bp on "I")

70. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium(III) chloride. The number of moles of AgCl precipitated would be

(1) 0.001 (2) 0.002

(3) 0.003 (4) 0.01

Answer (1)

Sol. $[Cr(H_2O)_4Cl_2]Cl$, one ionizable Cl^-.

71. Which of these is least likely to act as a Lewis base?

(1) CO (2) F^-

(3) BF_3 (4) PF_3

Answer (3)

Sol. BF_3, it is a Lewis acid.

72. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction:

$$3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$$

The reaction can go to completion by removing OH^- ions by adding

(1) HCl (2) KOH

(3) CO_2 (4) SO_2

Answer (3)

Sol. Fact.

73. Which of the following is electron-deficient?

(1) $(CH_3)_2$

(2) $(SiH_3)_2$

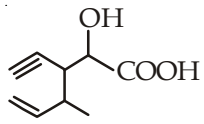
(3) $(BH_3)_2$

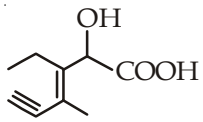
(4) PH_3

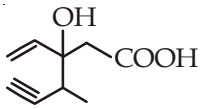
Answer (3)

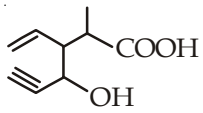
Sol. $(BH_3)_2$, Diborane is electron deficient.

74. Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid is

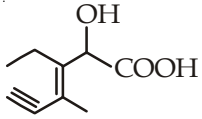
(1) 

(2) 

(3) 

(4) 

Answer (2)

Sol. 

75. Which of these is **not** a monomer for a high molecular mass silicone polymer?

(1) $MeSiCl_3$ (2) Me_2SiCl_2

(3) Me_3SiCl (4) $PhSiCl_3$

Answer (3)

Sol. Fact.

76. Which of the following statements about the interstitial compounds is incorrect?

(1) They retain metallic conductivity

(2) They are chemically reactive

(3) They are much harder than the pure metal

(4) They have higher melting points than the pure metal

Answer (2)

Sol. Fact.

77. Which one of the following molecules contains no π bond?

(1) CO_2 (2) H_2O

(3) SO_2 (4) NO_2

Answer (2)

Sol. Fact.

78. Antiseptics and disinfectants either kill or prevent growth of microorganisms. Identify which of the following statements is **not true**

(1) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant

(2) Chlorine and Iodine are used as strong disinfectants

(3) Dilute solutions of Boric acid and Hydrogen, Peroxide are strong antiseptics

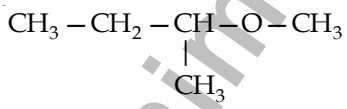
(4) Disinfectants harm the living tissues

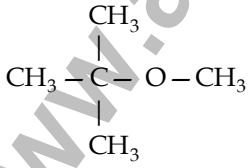
Answer (3)

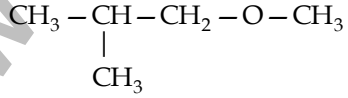
Sol. Dilute solutions of boric acid and H_2O_2 are mild antiseptics.

79. Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI?

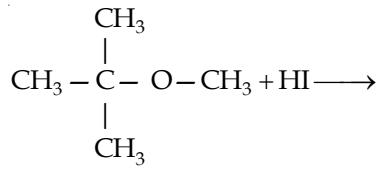
(1) $CH_3-CH_2-CH_2-CH_2-O-CH_3$

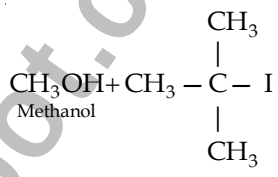
(2) 

(3) 

(4) 

Answer (3)

Sol. 



80. Nylon is an example of

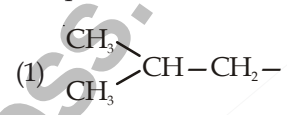
(1) Polyester (2) Polysaccharide

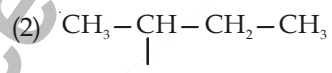
(3) Polyamide (4) Polythene

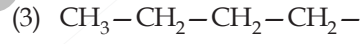
Answer (3)

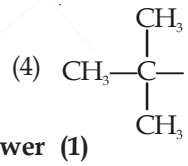
Sol. Fact.

81. The structure of isobutyl group in an organic compound is

(1) 

(2) 

(3) 

(4) 

Answer (1)

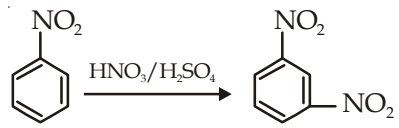
Sol. Fact.

82. Nitrobenzene on reaction with conc. HNO_3/H_2SO_4 at 80-100°C forms which one of the following products?

(1) 1, 2-Dinitrobenzene (2) 1, 3-Dinitrobenzene

(3) 1, 4-Dinitrobenzene (4) 1, 2, 4-Trinitrobenzene

Answer (2)

Sol. 

83. Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating?

(1) $-C\equiv N$ (2) $-SO_3H$

(3) $-COOH$ (4) $-NO_2$

Answer (4)

Sol. Fact.

84. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is

(1) 0.02 M (2) 0.01 M

(3) 0.001 M (4) 0.1 M

Answer (2)

Sol. $M = \dfrac{\dfrac{6.02\times10^{20}}{6.02\times10^{23}}}{\dfrac{100}{1000}} = 0.01\,M$

85. Which of the following is a polar molecule?

(1) BF_3 (2) SF_4

(3) SiF_4 (4) XeF_4

Answer (2)

Sol. SF_4 (Due to presence of a lone pair of electron on "S" it has distorted geometry).

86. Which is the monomer of Neoprene in the following?

(1) $CH_2 = CH - C \equiv CH$

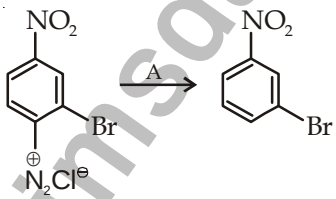
(2) $CH_2 = \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} - CH = CH_2$

(3) $CH_2 = \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} - CH = CH_2$

(4) $CH_2 = CH - CH = CH_2$

Answer (3)

Sol. Chloroprene $\left(CH_2 = \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} - CH = CH_2\right)$

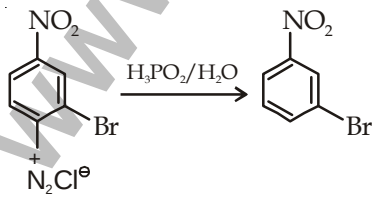
87. In the reaction 

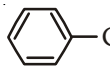
A is

(1) $HgSO_4/H_2SO_4$ (2) Cu_2Cl_2

(3) H_3PO_2 and H_2O (4) H^+/H_2O

Answer (3)

Sol. 

88. The radical  is aromatic because it has

(1) 6 p-orbitals and 6 unpaired electrons

(2) 7 p-orbitals and 6 unpaired electrons

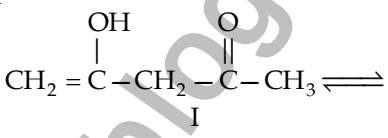
(3) 7 p-orbitals and 7 unpaired electrons

(4) 6 p-orbitals and 7 unpaired electrons

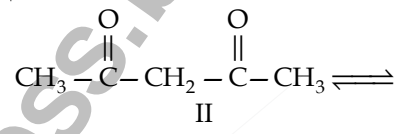
Answer (1)

Sol. 6p orbitals and 6 unpaired electrons contributes to aromaticity.

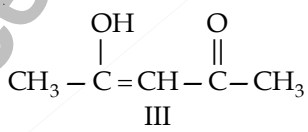
89. The order of stability of the following tautomeric compounds is



I



II



III

(1) I > II > III (2) III > II > I

(3) II > I > III (4) II > III > I

Answer (2)

Sol. Fact.

90. Which of the following compounds will not undergo Friedal-Craft's reaction easily?

(1) Cumene (2) Xylene

(3) Nitrobenzene (4) Toluene

Answer (3)

Sol. Nitrobenzene ($-NO_2$ is deactivating group)

91. Select the **wrong** statement:

(1) Isogametes are similar in structure, function and behaviour

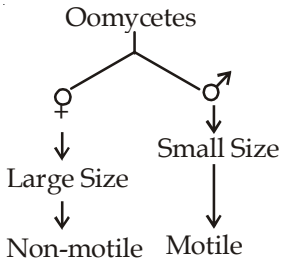
(2) Anisogametes differ either in structure, function or behaviour

(3) In Oomycetes female gemete is smaller and motile, while male gamete is larger and non-motile

(4) *Chlamydomomas* Exhibits both isogamy and anisogamy and *Fucus* shows oogamy

Answer (3)

Sol.



92. Which one of the following is **not** a correct statement?
(1) Herbarium houses dried, pressed and preserved plant specimens
(2) Botanical gardens have collection of living plants for reference.
(3) A museum has collection of photographs of plants and animals.
(4) Key is a taxonomic aid for identification of specimens.

Answer (3)

Sol. A museum has collection of dead remains of plants and animals in preserved form.

93. Isogamous condition with non-flagellated gametes is found in
(1) *Chlamydomonas*
(2) *Spirogyra*
(3) *Volvox*
(4) *Fucus*

Answer (2)

Sol.

Organism	Reproduction	Gametes
Spirogyra	Isogamous	Non-motile
Volvox	Oogamous	♂ -Motile ♀ -Non-motile
Fucus	Oogamous	♂ -Motile ♀ -Non-motile
Chlamydomonas	All three	Motile/Non-motile

94. Besides paddy fields, cyanobacteria are also found inside vegetative part of
(1) *Pinus* (2) *Cycas*
(3) *Equisetum* (4) *Psilotum*

Answer (2)

Sol. BGA → *Anabaena cycadae* → Coralloid roots of *Cycas*
Fungi → *Boletus (B)* → Roots of *Pinus*
→ Mycorrhizal roots

95. Megasporangium is equivalent to
(1) Embryo sac (2) Fruit
(3) Nucellus (4) Ovule

Answer (4)

Sol. Megasporangium
Ovule → MMC → Megaspore

96. Read the following statements (A-E) and answer the question which follows them
(A) In liverworts, mosses, and ferns gametophytes are free-living
(B) Gymnosperms and some ferns are heterosporous
(C) Sexual reproduction in *Fucus, Volvox* and *Albugo* is oogamous
(D) The sporophyte in liverworts is more elaborate than that in mosses
(E) Both, *Pinus* and *Marchantia* are dioecious
How many of the above statements are correct ?
(1) One (2) Two
(3) Three (4) Four

Answer (3)

Sol. In statement 'D', the sporophyte of moss is more elaborate than liverworts.
Statement 'E' → *Pinus* is monoecious plant.

97. Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunnhemp, gram, guava, bean, chilli, plum, petunia, tomato, rose, withania, potato, onion, aloe and tulip how many plants have hypogynous flower?
(1) Six (2) Ten
(3) Fifteen (4) Eighteen

Answer (3)

Sol. Hypogynous flower – mustard, brinjal, china rose, lupin, sunhemp, gram, bean, chilli, petunia, tomato, withania, potato, onion, aloe and tulip.

98. Interfascicular cambium develops from the cells of
(1) Medullary rays (2) Xylem parenchyma
(3) Endodermis (4) Pericycle

Answer (1)

Sol. Interfascicular cambium develops from the cells of medullary rays.

99. In China rose the flowers are
(1) Actinomorphic, hypogynous with twisted aestivation
(2) Actinomorphic, epigynous with valvate aestivation
(3) Zygomorphic, hypogynous with imbricate aestivation
(4) Zygomorphic, epigynous with twisted aestivation

Answer (1)

100. Lenticels are involved in

(1) Transpiration (2) Gaseous exchange

(3) Food transport (4) Photosynthesis

Answer (2)

Sol. Lenticels are lense like opening in periderm developed during secondary growth.

101. Age of a tree can be estimated by

(1) Its height and girth

(2) Biomass

(3) Number of annual rings

(4) Diameter of its heartwood

Answer (3)

Sol. Number of annual rings = Number of Years

102. Seed coat is **not** thin, membranous in

(1) Maize (2) Coconut

(3) Groundnut (4) Gram

Answer (2)

Sol. Coconut–Thick

Groundnut, gram, Maize–thin, membranous

103. Transition state structure of the substrate formed during an enzymatic reaction is

(1) Transient but stable

(2) Permanent but unstable

(3) Transient and unstable

(4) Permanent and stable

Answer (3)

Sol. Transition state structure of the substrate formed during an enzymatic reaction is transient and unstable.

104. A phosphoglyceride is always made up of

(1) Only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(2) Only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(3) A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(4) A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule

Answer (3)

105. Pigment-containing membranous extensions in some cyanobacteria are

(1) Heterocysts (2) Basal bodies

(3) Pneumatophores (4) Chromatophores

Answer (4)

106. A major site for synthesis of lipids is

(1) RER

(2) SER

(3) Symplast

(4) Nucleoplasm

Answer (2)

Sol. SER is the site for synthesis of lipids.

107. The complex formed by a pair of synapsed homologous chromosomes is called

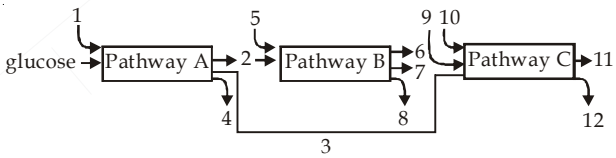
(1) Equatorial plate (2) Kinetochore

(3) Bivalent (4) Axoneme

Answer (3)

Sol. Bivalent is paired homologous chromosome in zygotene stage.

108. The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products



Arrows numbered 4, 8, and 12 can all be

(1) NADH (2) ATP

(3) H_2O (4) FAD^+ or $FADH_2$

Answer (2)

Sol. ATP is generated at substrate level in glycolysis (A) and Kreb's cycle (B) but through oxidative phosphorylation in ETS (C).

109. The most abundant intracellular cation is

(1) Na^+ (2) Ca^{++}

(3) H^+ (4) K^+

Answer (4)

Sol. K^+ is most abundant intracellular cation.

110. During seed germination its stored food is mobilized by

(1) Ethylene (2) Cytokinin

(3) ABA (4) Gibberellin

Answer (4)

Sol. Gibberellin induces aleurone cells to secrete enzyme to break stored food in seed.

111. Which of the following criteria **does not** pertain to facilitated transport ?
(1) Requirement of special membrane proteins
(2) High selectivity
(3) Transport saturation
(4) Uphill transport

Answer (4)

Sol. Downhill movement

Net transport of molecules is from high conc. to low conc.

112. The first stable product of fixation of atmospheric nitrogen in leguminous plants is
(1) NO_2^- (2) Ammonia
(3) NO_3^- (4) Glutamate

Answer (2)

Sol. $N_2 \longrightarrow N_2H_2 \longrightarrow N_2H_4 \longrightarrow 2NH_3$
Nitrogen Dimide Hydrazine Ammonia

113. Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins?
(1) Glucose-6-phosphate
(2) Fructose 1,6-bisphosphate
(3) Pyruvic acid
(4) Acetyl CoA

Answer (4)

Sol. Acetyl CoA (2C compound) is common to respiration mediated breakdown of fats, carbohydrates and proteins.

114. Which one of the following statements is correct?
(1) Hard outer layer of pollen is called intine
(2) Sporogenous tissue is haploid
(3) Endothecium produces the microspores
(4) Tapetum nourishes the developing pollen

Answer (4)

Sol. Tapetum is innermost nutritive structure of anther wall.

115. Product of sexual reproduction generally generates
(1) Longer viability of seeds
(2) Prolonged dormancy
(3) New genetic combination leading to variation
(4) Large biomass

Answer (3)

Sol. Sexual reproduction generally generates new genetic combination leading to variation.

116. Meiosis takes place in
(1) Meiocyte (2) Conidia
(3) Gemmule (4) Megaspore

Answer (1)

Sol. The cells in which meiosis takes place are called meiocyte.

117. Advantage of cleistogamy is
(1) Higher genetic variability
(2) More vigorous offspring
(3) No dependence on pollinators
(4) Vivipary

Answer (3)

Sol. Cleistogamous/ closed flowers ensure cent percent seed setting even in the absence of pollinators.

118. Monoecious plant of *Chara* shows occurrence of
(1) Antheridiophore and archegoniophore on the same plant
(2) Stamen and carpel on the same plant
(3) Upper antheridium and lower oogonium on the same plant
(4) Upper oogonium and lower antheridium on the same plant

Answer (4)

Sol. *Chara* is monoecious green algae.

119. Perisperm differs from endosperm in
(1) Being a haploid tissue
(2) Having no reserve food
(3) Being a diploid tissue
(4) Its formation by fusion of secondary nucleus with several sperms

Answer (3)

Sol.

Preisperm	Endosperm
Remains of nucellus	Triple fusion
Reserve food	Reserve food
2n	3n

120. Which of the following statements is **not** true of two genes that show 50% recombination frequency ?
(1) The genes may be on different chromosomes
(2) The genes are tightly linked
(3) The genes show independent assortment
(4) If the genes are present on the same chromosome, they undergo more than one crossovers in every meiosis

Answer (2)

Sol. The tightly linked genes show 100% parental types and 0% recombinants.

121. Variation in gene frequencies within populations can occur by chance rather than by natural selection. This is referred to as

(1) Genetic flow (2) Genetic drift

(3) Random mating (4) Genetic load

Answer (2)

Sol. Variation in gene frequencies within populations can occur by chance is called as genetic drift.

122. If two persons with 'AB' blood group marry and have sufficiently large number of children, these children could be classified as 'A' blood group : 'AB' blood group : 'B' blood group in 1 : 2 : 1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of

(1) Codominance

(2) Incomplete dominance

(3) Partial dominance

(4) Complete dominance

Answer (1)

Sol. Phenotype **AB**

↓

Genotype I^AI^B

↓

Antigen A+Antigen B

↓

Co-dominance

123. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called

(1) Natural selection

(2) Convergent evolution

(3) Non-random evolution

(4) Adaptive radiation

Answer (2)

Sol. Convergent evolution occurs in unrelated group of organisms. It is the development of similar functional structures but in unrelated groups.

124. The tendency of population to remain in genetic equilibrium may be disturbed by

(1) Random mating

(2) Lack of migration

(3) Lack of mutations

(4) Lack of random mating

Answer (4)

Sol. According to Hardy-Weinberg principle, allele frequencies in a population are stable and is constant from generation to generation.

125. Which of the following Bt crops is being grown in India by the farmers?

(1) Maize (2) Cotton

(3) Brinjal (4) Soybean

Answer (2)

Sol. Bt cotton is being grown in India by the farmers.

126. A good producer of citric acid is

(1) *Aspergillus* (2) *Pseudomonas*

(3) *Clostridium* (4) *Saccharomyces*

Answer (1)

127. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by

(1) Centrifugation

(2) Polymerase chain reaction

(3) Electrophoresis

(4) Restriction mapping

Answer (3)

Sol. DNA fragments generated by restriction endonucleases in a chemical reaction can be separated by gel electrophoresis.

128. Which of the following is not correctly matched for the organism and its cell wall degrading enzyme?

(1) Bacteria - Lysozyme

(2) Plant cells - Cellulase

(3) Algae - Methylase

(4) Fungi - Chitinase

Answer (3)

Sol. In algae, cell wall is made up of cellulose degrades by cellulase.

129. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of

(1) Non-recombinant bacteria containing beta-galactosidase

(2) Insertional inactivation of alpha-galactosidase in non-recombinant bacteria

(3) Insertional inactivation of alpha-galactosidase in recombinant bacteria

(4) Inactivation of glycosidase enzyme in recombinant bacteria

Answer (3)

Sol. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of insertional inactivation of alpha-galactosidase in recombinant bacteria.

130. Which of the following are likely to be present in deep sea water?

(1) Archaebacteria (2) Eubacteria

(3) Blue-green algae (4) Saprophytic fungi

Answer (1)

Sol. Archaebacteria flourish in hot springs and deep sea hydrothermal vents.

131. Natural reservoir of phosphorus is

(1) Sea water

(2) Animal bones

(3) Rock

(4) Fossils

Answer (3)

Sol. Phosphorous – Sedimentary cycle

Reservoir – Rocks

132. Secondary productivity is rate of formation of new organic matter by

(1) Producer (2) Parasite

(3) Consumer (4) Decomposer

Answer (3)

Sol. Secondary productivity is rate of formation of new organic matter by consumer.

133. Which one of the following is not used for *ex situ* plant conservation?

(1) Field gene banks (2) Seed banks

(3) Shifting cultivation (4) Botanical Gardens

Answer (3)

Sol. Shifting cultivation results into deforestation.

134. Kyoto Protocol was endorsed at

(1) CoP-3 (2) CoP-5

(3) CoP-6 (4) CoP-4

Answer (1)

135. Which of the following represent maximum number of species among global biodiversity?

(1) Algae (2) Lichens

(3) Fungi (4) Mosses and Ferns

Answer (3)

136. Match the name of the animal (Column I) with one characteristics (Column II) and the phylum/class (column III) to which it belongs.

	Column I	**Column II**	**Column III**
(1)	*Petromyzon*	Ectoparasite	Cyclostomata
(2)	*Ichthyophis*	Terrestrial	Reptilia
(3)	*Limulus*	Body covered by chitinous exoskeleton	Pisces
(4)	*Adamsia*	Radially symmetrical	Porifera

Answer (1)

Sol. *Petromyzon* (Lamprey) is ectoparasite on fishes belongs to cyclostomata.

137. Which of the following are correctly matched with respect to their taxonomic classification?

(1) Flying fish, cuttlefish, silverfish, – Pisces

(2) Centipede, millipede, spider, scorpion – Insecta

(3) House fly, butterfly, tsetsefly, silverfish – Insecta

(4) Spiny anteater, sea urchin, sea cucumber – Echinodermata

Answer (3)

Sol. Housefly, butterfly, tsetse fly, silverfish belong to class insecta of phylum arthropoda.

138. Which group of animals belong to the same phylum?

(1) Malarial parasite, *Amoeba,* Mosquito

(2) Earthworm, Pinworm, Tapeworm

(3) Prawn, Scorpion, *Locusta*

(4) Sponge, Sea anemone, Starfish

Answer (3)

Sol. *Prawn, Scorpion, Locusta* belong to phylum arthropoda.

139. One of the representatives of Phylum Arthropoda is

(1) Cuttlefish (2) Silverfish

(3) Pufferfish (4) Flying fish

Answer (2)

Sol. Silverfish belongs to phylum arthropoda.

140. The H-zone in the skeletal muscle fibre is due to

(1) The absence of myofibrils in the central portion of A-band

(2) The central gap between myosin filaments in the A-band

(3) The central gap between actin filaments extending through myosin filaments in the A-band

(4) Extension of myosin filaments in the central portion of the A-band

Answer (3)

Sol. H-zone in skeletal muscle is the central gap between actin filaments extending through myosin filaments in the A band.

141. What external changes are visible after the last moult of a cockroach nymph?

(1) Mandibles become harder

(2) Anal cerci develop

(3) Both fore wings and hind wings develop

(4) Labium develops

Answer (3)

Sol. In cockroach, development is paurometabolous. The nymph grows by moulting about 13 times to reach the adult form. The next to last nymphal stage has wing pads but only adult cockroaches have wings.

142. The Golgi complex plays a major role

(1) In trapping the light and transforming it into chemical energy

(2) In digesting proteins and carbohydrates

(3) As energy transferring organelles

(4) In post translational modification of proteins and glycosidation of lipids

Answer (4)

Sol. Protein + Carbohydrate $\longrightarrow$ Glycosylation

Lipid + Carbohydrate $\longrightarrow$ Glycosidation

143. Which one of the following organelle in the figure correctly matches with its function ?

(1) Rough endoplasmic reticulum, formation of glycoproteins

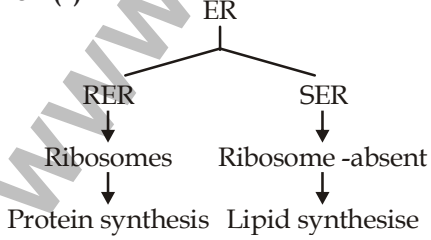
(2) Golgi apparatus, protein synthesis

(3) Golgi apparatus, formation of glycolipids

(4) Rough endoplasmic reticulum, protein synthesis

Answer (4)

Sol.



144. Macro molecule chitin is

(1) Nitrogen containing polysaccharide

(2) Phosphorus containing polysaccharide

(3) Sulphur containing polysaccharide

(4) Simple polysaccharide

Answer (1)

Sol. Macromolecule chitin is a complex polysaccharide containing amino sugars and chemically modified sugars (*e.g.* glucosamine, N-acetyl galactosamine, etc.)

145. The essential chemical components of many coenzymes are

(1) Proteins

(2) Nucleic acids

(3) Carbohydrates

(4) Vitamins

Answer (4)

Sol. Essential chemical components of many coenzymes are vitamins, *e.g.*, coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain the vitamin niacin.

146. A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics.

(1)	Telophase	Nuclear envelop reforms, golgi complex reforms.
(2)	Late Anaphase	Chromosomes move away from equatorial plate, golgi complex not present.
(3)	Cytokinesis	Cell plate formed, mitochondria distributed between two daughter cells.
(4)	Telophase	Endoplasmic reticulum and nucleolus not reformed yet.

Answer (1)

Sol. Telophase is reverse of prophase.

147. Select the **correct** match of the digested products in humans given in **column I** with their absorption site and mechanism in **column II**

	Column I	Column II
(1)	Glycine, glucose	Small intestine, active absorption
(2)	Fructose, Na^+	Small intestine passive absorption
(3)	Glycerol, fatty acids	Duodenum, move as chilomicrons
(4)	Cholesterol, maltose	Large intestine, active absorption

Answer (1)

Sol. Amino acids, monosaccharides like glucose, electrolytes like Na^+ are absorbed into the blood by active transport.

148. A pregnant female delivers a baby who suffers from stunted growth, mental retardation low intelligence quotient and abnormal skin. This is the result of

(1) Deficiency of iodine in diet

(2) Low secretion of growth hormone

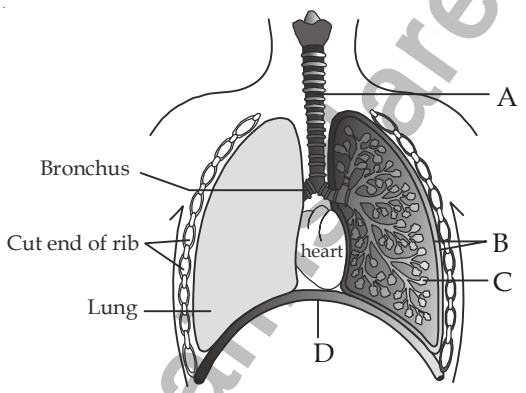
(3) Cancer of the thyroid gland

(4) Over secretion of pars distalis

Answer (1)

Sol. Hypothyroidism during pregnancy causes defective development and maturation of the growing foetus leading to stunted growth.

149. The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and/or characteristic.



(1) A - trachea - long tube supported by complete cartilaginous rings for conducting inspired air

(2) B-pleural membrane - surround ribs on both sides to provide cushion against rubbing

(3) C-Alveoli - thin walled vascular bag like structures for exchange of gases

(4) D-Lower end of lungs - diaphragm pulls it down during inspiration

Answer (3)

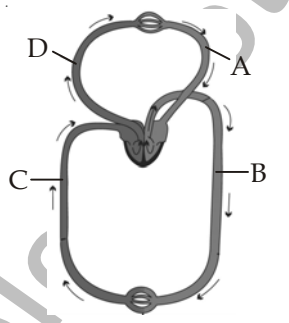
Sol. A – Trachea

B – Pleural membrane

C – Alveoli

D – Diaphragm

150. Figure shows schematic plan of blood circulation in humans with labels A to D. Identify the label and give its function/s.



(1) A – Pulmonary vein – takes impure blood from body parts, PO_2 = 60 mm Hg

(2) B – Pulmonary artery – takes blood from heart to lungs, PO_2 = 90 mm Hg

(3) C – Vena Cava – takes blood from body parts to right auricle, PCO_2 = 45 mm Hg

(4) D – Dorsal aorta – takes blood from heart to body parts, PO_2 = 95 mm Hg

Answer (3)

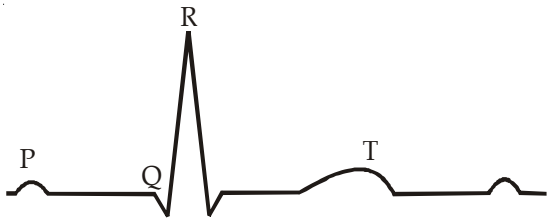
Sol. A – Pulmonary vein takes pure blood from lungs to left atria.

B – Dorsal Aorta – takes blood from heart to body parts.

C – Vena cava – takes blood from body parts to right auricle.

D – Pulmonary artery – takes impure blood from heart to lungs.

151. The diagram given here is the standard ECG of a normal person. The P-wave represents the



(1) Contraction of both the atria

(2) Initiation of the ventricular contraction

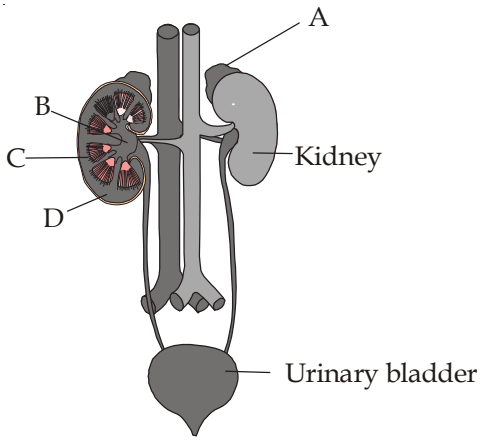
(3) Beginning of the systole

(4) End of systole

Answer (1)

Sol. In ECG, P wave represents the depolarisation of atria which leads to the contraction of both atria.

152. Figure shows human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their characteristics and/ or functions



(1) A-Adrenal gland-located at the anterior part of kidney. Secrete Catecholamines which stimulate glycogen breakdown

(2) B-Pelvis-broad funnel shaped space inner to hilum, directly connected to loops of Henle

(3) C-Medulla - inner zone of kidney and contains complete nephrons

(4) D-Cortex - outer part of kidney and do not contain any part of nephrons

Answer (1)

Sol. A – Adrenal gland

B – Renal pelvis

C – Medulla

D – Cortex

153. Select the correct statement with respect to locomotion in humans

(1) A decreased level of progesterone causes osteoporosis in old people.

(2) Accumulation of uric acid crystals in joints causes their inflammation.

(3) The vertebral column has 10 thoracic vertebrae.

(4) The joint between adjacent vertebrae is a fibrous joint.

Answer (2)

Sol. Inflammation of joints due to accumulation of uric acid crystals is gout.

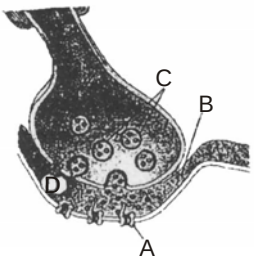
154. The characteristics and an example of a synovial joint in humans is

	Characteristics	Examples
(1)	Fluid cartilage between two bones, limited movements	Knee joints
(2)	Fluid filled between two joints, provides cushion	Skull bones
(3)	Fluid filled synovial cavity between two bones	Joint between atlas and axis
(4)	Lymph filled between two bones, limited movement	Gliding joint between carpals

Answer (3)

Sol. Joint between atlas and axis is pivot joint which is an example of synovial joint characterised by the presence of a fluid filled synovial cavity between the articulating surface of the two bones.

155. A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D



(1) A - Receptor
C - Synaptic vesicles

(2) B - Synaptic connection
D - K^+

(3) A - Neurotransmitter
B - Synaptic cleft

(4) C - Neurotransmitter
D - Ca^{++}

Answer (1)

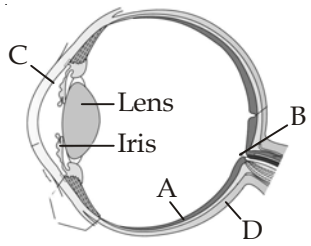
Sol. A – Receptor

B – Synaptic cleft

C – Synaptic vesicles

D – Ca^{++}

156. Parts A, B, C and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions/ characteristics



(1) A – Retina – contains photo receptors – rods and cones.

(2) B – Blind spot – has only a few rods and cones.

(3) C – Aqueous chamber – reflects the light which does not pass through the lens.

(4) D – Choroid – its anterior part forms ciliary body.

Answer (1)

Sol. A – Retina

B – Blind spot

C – Aqueous chamber

D – Sclera

157. Which of the following statement is **correct** in relation to the endocrine system?

(1) Adenohypophysis is under direct neural regulation of the hypothalamus.

(2) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones.

(3) Non - nutrient chemicals produced by the body in trace amount that act as intercellular messenger are known as hormones.

(4) Releasing and inhibitory hormones are produced by the pituitary gland.

Answer (3)

Sol. Endocrine cells are present in different parts of the gastro-intestinal tract, e.g., gastrin, secretin, GIP.

Atrial wall of our heart secretes a peptide hormone called ANF (Atrial Natriuretic Factor). RH/IH are produced by hypothalamus. Adenohypophysis is not directly under neural control, it is under the control of hypothalamic hormones, brought by portal system.

158. Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/ deficiency symptom

	Endocrine gland	**Hormone**	**Function/ deficiency symptoms**
(1)	Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth
(2)	Posterior pituitary	Growth Hormone (GH)	Oversecret-ion stimulates abnormal growth
(3)	Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(4)	Corpus luteum	Testosterone	Stimulates spermatog-enesis

Answer (3)

Sol. Lack of iodine in diet results in goitre.

159. What is the correct sequence of sperm formation?

(1) Spermatid, Spermatocyte, Spermatogonia, Spermatozoa

(2) Spermatogonia, Spermatocyte, Spermatozoa, Spermatid

(3) Spermatogonia, Spermatozoa, Spermatocyte, Spermatid

(4) Spermatogonia, Spermatocyte, Spermatid, Spermatozoa

Answer (4)

160. Menstrual flow occurs due to lack of

(1) Progesterone

(2) FSH

(3) Oxytocin

(4) Vasopressin

Answer (1)

Sol. In menstrual cycle, menstrual flow occurs due to lack of progesterone because progesterone maintains endometrium for pregnancy.

161. Which one of the following is not the function of placenta? It
(1) Facilitates supply of oxygen and nutrients to embryo.
(2) Secretes estrogen.
(3) Facilitates removal of carbon dioxide and waste material from embryo.
(4) Secretes oxytocin during parturition.

Answer (4)

162. One of the legal methods of birth control is
(1) Abortion by taking an appropriate medicine
(2) By abstaining from coitus from day 10 to 17 of the menstrual cycle
(3) By having coitus at the time of day break
(4) By a premature ejaculation during coitus

Answer (1)

Sol. One of the legal methods of birth control is abortion by taking an appropriate medicine.

163. Which of the following **cannot** be detected in a developing foetus by amniocentesis ?
(1) Klinefelter syndrome
(2) Sex of the foetus
(3) Down syndrome
(4) Jaundice

Answer (4)

Sol. Amniocentesis is a foetal sex determination test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo.

164. Artificial insemination means
(1) Transfer of sperms of a healthy donor to a test tube containing ova
(2) Transfer of sperms of husband to a test tube containing ova
(3) Artificial introduction of sperms of a healthy donor into the vagina
(4) Introduction of sperms of healthy donor directly into the ovary

Answer (3)

165. Which Mendelian idea is depicted by a cross in which the F_1 generation resembles both the parents ?
(1) Incomplete dominance
(2) Law of dominance
(3) Inheritance of one gene
(4) Co-dominance

Answer (4)

Sol. Co-dominance

166. The incorrect statement with regard to Haemophilia is
(1) It is a sex-linked disease
(2) It is a recessive disease
(3) It is a dominant disease
(4) A single protein involved in the clotting of blood is affected

Answer (3)

167. If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child?
(1) No chance (2) 50%
(3) 25% (4) 100%

Answer (3)

Sol. Thalassemia–autosomal-linked recessive

AA-Normal

Aa-Carrier

aa-Disease

Aa x Aa

↓

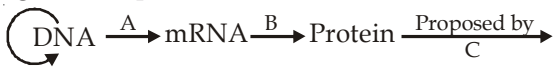
AA : Aa : aa

1 2 1

N C D

Affected = $\frac{1}{4} = 25\%$

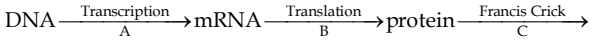
168. The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C



(1) A-transcription, B-replication, C-James Watson
(2) A-translation, B-transcription, C-Erevin Chargaff
(3) A-transcription, B-translation, C-Francis Crick
(4) A-translation, B-extension, C-Rosalind Franklin

Answer (3)

Sol. Central Dogma.



169. Which enzyme/s will be produced in a cell in which there is a nonsense mutation in the *lac Y* gene?
(1) β-galactosidase
(2) Lactose permease
(3) Transacetylase
(4) Lactose permease and transacetylase

Answer (1)

170. According to Darwin, the organic evolution is due to
(1) Intraspecific competition.
(2) Interspecific competition.
(3) Competition within closely related species.
(4) Reduced feeding efficiency in one species due to the presence of interfering species.

Answer (2)

Sol. According to Darwin, the organic evolution is due to interspecific competition.

171. The eye of octopus and eye of cat show different patterns of structure, yet they perform similar function. This is an example of
(1) Homologous organs that have evolved due to convergent evolution.
(2) Homologous organs that have evolved due to divergent evolution.
(3) Analogous organs that have evolved due to convergent evolution.
(4) Analogous organs that have evolved due to divergent evolution.

Answer (3)

Sol. The eye of octopus and the eye of cat (mammal) are example of analogous organs because they differ in the position of retina. In the eye of mammal, retina is inverted in position.

172. Infection of *Ascaris* usually occurs by
(1) Drinking water containing eggs of *Ascaris*
(2) Eating imperfectly cooked port
(3) Tse-tse fly
(4) Mosquito bite

Answer (1)

Sol. Infection of *Ascaris* occurs by contamination of food and water containing eggs of *Ascaris*.

173. The cell-mediated immunity inside the human body is carried out by
(1) T-lymphocytes (2) B-lymphocytes
(3) Thrombocytes (4) Erythrocytes

Answer (1)

174. In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called
(1) Selection of superior recombinants
(2) Cross-hybridisation among the selected parents
(3) Evaluation and selection of parents.
(4) Germplasm collection

Answer (4)

Sol. Germplasm collection/collection of variability

175. During sewage treatment, biogases are produced which include
(1) Methane, hydrogensulphide, carbon dioxide
(2) Methane, oxygen, hydrogensulphide
(3) Hydrogensulphide, methane, sulphur dioxide
(4) Hydrogensulphide, nitrogen, methane

Answer (1)

Sol. Methane, CO_2, H_2S, H_2.

176. A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is
(1) 10 (2) 15
(3) 05 (4) Zero

Answer (4)

Sol. Net increase in population
(B + I) – (D + E)

177. Which one of the following processes during decomposition is **correctly** described?
(1) Fragmentation - Carried out by organisms such as earthworm
(2) Humification - Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate
(3) Catabolism - Last step in the decomposition under fully anaerobic condition
(4) Leaching - Water soluble inorganic nutrients rise to the top layers of soil

Answer (1)

Sol. Fragmentation is one of the steps during decomposition, in which detritus is converted into small fragments.

178. A sedentary sea anemone gets attached to the shell lining of hermit crab. The association is
(1) Ectoparasitism (2) Symbiosis
(3) Commensalism (4) Amensalism

Answer (2)

Sol. Facultative mutualism can be illustrated with the example of sea anemone, which gets attached to the shell of hermit crab. The sea anemone grows on the back of the crab, providing camouflage & protection and, in turn, the sea anemone is transported about reaching new food sources. This type of mutualism is also called protocooperation.

179. Global warming can be controlled by

(1) Reducing deforestation, cutting down use of fossil fuel

(2) Reducing reforestation, increasing the use of fossil fuel

(3) Increasing deforestation, slowing down the growth of human population

(4) Increasing deforestation, reducing efficiency of energy usage

Answer (1)

Sol. Reducing deforestation, cutting down use of fossil fuel results into reduction into one of the green house gas, *i.e.*, CO_2.

180. The Air Prevention and Control of Pollution Act came into force in

(1) 1975

(2) 1981

(3) 1985

(4) 1990

Answer (2)

Sol.
- Air prevention and Control of Pollution protection act – 1981
- Environmental protection act– 1986
- Water (Prevention and Control of Pollution) act – 1974

❑ ❑ ❑

PHYSICS

Choose the correct answer :

1. Which one of the following quantities has not been expressed in proper units?

   (1) $\frac{\text{Stress}}{\text{Strain}} = \frac{N}{m^2}$

   (2) Surface tension = $\frac{N}{m}$

   (3) Energy = kg m/s

   (4) Pressure = $\frac{N}{m^2}$

2. If C and L denote the capacity and inductance, then the dimension of LC are

   (1) $M^0L^0T^2$ (2) ML^2T^{-2}

   (3) $M^2L^2T^{-2}$ (4) MLT^{-1}

3. For the resultant of two vectors to be maximum, what must be the angle between them?

   (1) 0° (2) 60°

   (3) 90° (4) 180°

4. Two blocks of masses 2 kg and 1 kg are in contact with each other on a frictionless table when a horizontal force of 3 N is applied to the block of mass 2 kg, the value of the force of contact between the two blocks

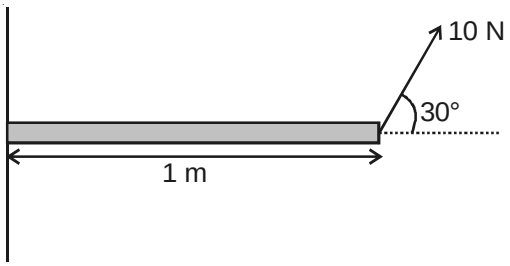
   (1) 4 N

   (2) 3 N

   (3) 2 N

   (4) 1 N

5. Torque acting on rod about an axis, as shown, is



(1) 5 N m (2) $5\sqrt{3}$ N m

(3) 10 N m (4) $10\sqrt{3}$ N m

6. A body of mass 2 kg moving with a velocity of 3 m/s collides head on with a body of mass 1 kg moving with a velocity of 4 m/s in opposite direction. After collision the two bodies stick together and move with a common velocity

(1) $\frac{1}{4}$ m/s (2) $\frac{1}{3}$ m/s

(3) $\frac{2}{3}$ m/s (4) $\frac{3}{4}$ m/s

7. Two skaters *A* and *B* of masses 50 kg and 70 kg respectively stand facing each other 6 m apart. They pull the rope stretched between them. How far has each moved when they meet?

(1) Both have moved 3 m

(2) Both have moved 2.5 m

(3) *A* moves 3.5 m and *B* 2.5 m

(4) *A* moves 2 m and *B* 4 m

8. A particle is moving in a straight line has velocity, displacement equation as $v = \sqrt{1+s}$, where *v* is in m/s and *s* is in m. The initial velocity of the particle

(1) 2 m/s (2) 1 m/s

(3) 3 m/s (4) 4 m/s

9. A weight is suspended from the roof of a lift by a spring balance. When the lift is stationary the spring balance reads *W*. If the lift suddenly falls freely under gravity the reading of the spring balance will be

(1) *Wg* (2) 2*Wg*

(3) $\frac{W}{2}g$ (4) Zero

10. The kinetic energy *E* of a particle of mass *m* moving in a circle of radius *r* varies with distance traced *S* as $E = 4KS^2$. The tangential acceleration of the particle, is

(1) $\frac{4K}{m}$ (2) $\frac{8KS}{m}$

(3) $\frac{2K}{m}$ (4) $\frac{8KS^2}{mr}$

11. A fan of moment of inertia 1.6 kg m^2 is to be run upto a working speed of $\frac{1}{2}$ rps. Correct value of the angular momentum of the fan, is

(1) 1.6 π kg m^2/s (2) 2.6 π kg m^2/s

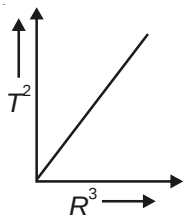
(3) 6 kg m^2/s (4) 3 kg m^2/s

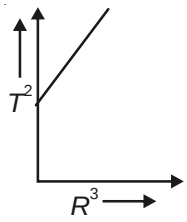
12. A simple pendulum has an amplitude 2*A* and time period $\frac{T}{4}$. The max velocity will be

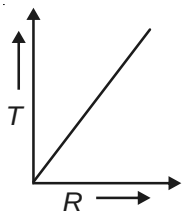
(1) $\frac{\pi A}{T}$ (2) $\frac{3\pi A}{T}$

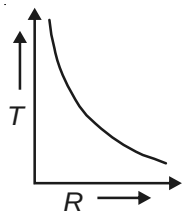
(3) $\frac{16\pi A}{T}$ (4) $\frac{32\pi A}{T}$

13. Which of the following graphs represents the motion of a planet moving around the sun?

(1) 

(2) 

(3) 

(4) 

14. Two pieces of metal when immersed in a liquid have equal upthrust on them, then

(1) Both the pieces must have equal weights

(2) Both the pieces must have equal densities

(3) Both the pieces must have equal volume

(4) Both are floating to the same depth

15. A copper wire of length 1 m and cross-section $\frac{1}{16}$ m^2 stretched by a load of 2 kg. Young's modules for copper is 2×10^{11} N/m^2 and $g = 10$ m/s^2. The extension of the wire

(1) 1.6×10^{-10} m (2) 16×10^{-10} m

(3) 8×10^{-8} m (4) 16×10^{-11} m

16. The speed of sound in air is

(1) $\propto$ pressure of air

(2) $\propto$ square of pressure

(3) $\propto \sqrt{\text{pressure}}$

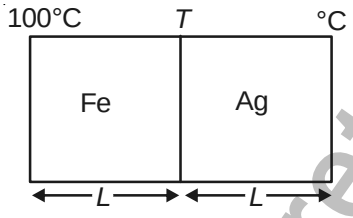
(4) Independent of pressure if temperature is constant

17. An open organ pipe has fundamental frequency of 400 Hz. The frequency of first overtone of this pipe is same as that of 1st overtone of a closed organ pipe. The length of the closed organ pipe is nearly

(1) 31 cm (2) 39 cm

(3) 28 cm (4) 34 cm

18. Two cylinders of same diameter one of iron and other of silver, are placed in closed contact as shown in figure. If $K_{Iron} = 12\ K_{Ag}$ what will the temperature of the interface nearly?



(1) 92°C

(2) 94°C

(3) 95°C

(4) 96°C

19. If 2 moles of a monatomic gas $\gamma = \frac{5}{3}$ is mixed with 1 mole of diatomic gas $\gamma = \frac{7}{5}$, the value of γ for the mixture is

(1) $\frac{17}{11}$ (2) $\frac{11}{17}$

(3) $\frac{16}{11}$ (4) $\frac{11}{16}$

20. In a particular experiment, a gas undergoes adiabatic expansion, satisfying the equation VT^3 = constant. The ratio of specific heats is equal to

(1) 4 (2) 3

(3) $\frac{5}{3}$ (4) $\frac{4}{3}$

21. A concave mirror of focal length f (in air) is immersed in water $\left(\mu = \frac{4}{3}\right)$. The focal length of mirror in water will be

(1) f (2) $\frac{4}{3}f$

(3) $\frac{3}{4}f$ (4) $\frac{7}{3}f$

22. A convex lens and a concave lens, each having same focal length of 30 cm are put in contact to form a combination of lenses. The power in diopters of the combination is

(1) Zero (2) 25

(3) 50 (4) Infinite

23. The refractive indices of violet and red light are 1.54 and 1.52 respectively if the angle of prism is 10°. The angular dispersion is

(1) 0.02° (2) 0.2°

(3) 3.06° (4) 30.6°

24. The least distance of distinct vision for a long-sighted person is x m. He wants to read a newspaper placed at a distance of $\left(\frac{x}{2}\right)$m. The power of the spectacle lens used by him is x diopter. What is the value of x ?

(1) 0.5 (2) 1

(3) 1.5 (4) 2

25. The fringe width in Young's double slit experiment increases when

(1) Wavelength increases

(2) Distance between source and screen decreases

(3) Distance between slit increases

(4) The width of the slit increases

26. If a spherical hollow conductor encloses a charge q, then the total flux coming out of the surface will be

(1) $\frac{1}{\varepsilon_0}$ × the charge enclosed by the surface

(2) ε_0 × charge enclosed by surface

(3) $\frac{1}{4\pi\varepsilon_0}$ × charge enclosed by surface

(4) Zero

27. Two point charges q and $-q$ are at a positions (0, 0, d) and (0, 0, $-d$) respectively. What is the electric field at (a, 0, 0)?

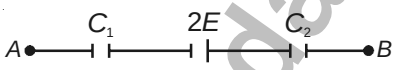
(1) $\frac{2qd}{4\pi\varepsilon_0(a^2+d^2)^{3/2}}\hat{k}$

(2) $\frac{qd}{4\pi\varepsilon_0(a^2+d^2)^{3/2}}\hat{k}$

(3) $\frac{-2qd}{4\pi\varepsilon_0(a^2+d^2)^{3/2}}\hat{k}$

(4) $\frac{-qd}{4\pi\varepsilon_0(a^2+d^2)^{3/2}}\hat{k}$

28. A circuit has a section AB and shown in the figure. If the potential difference between points A and B is V volt, then the potential difference across C_1 is



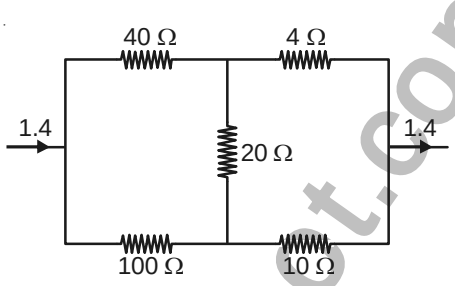
(1) $\frac{(V+2E)C_2}{C_1+C_2}$

(2) $\frac{(V-2E)C_2}{C_1+C_2}$

(3) $\frac{(V+E)C_2}{C_1+C_2}$

(4) $\frac{(V-E)C_2}{C_1+C_2}$

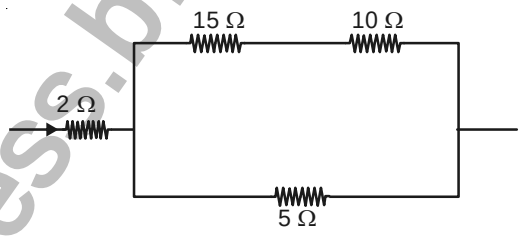
29. In the given figure the current through 4 ohm resistor is



(1) 0.4 A (2) 0.7 A

(3) 1 A (4) 1.4 A

30. In the circuit shown below, if the resistance 5 Ω develops heat of 45 J/s, heat developed in 2 Ω must be about



(1) 26 J/s (2) 20 J/s

(3) 30 J/s (4) 35 J/s

31. An insulating rod of L carries a charge Q distributed uniformly on it. The rod is pivoted at on end and is rotated at a frequency f and about a fixed perpendicular axis. The magnetic dipole moment of the system is

(1) $\frac{\pi Q}{L^2}$ (2) $\frac{QL^2\pi f}{3}$

(3) $QL\pi f$ (4) $\frac{QL^2}{3}$

32. Relative permittivity and permeability of a material are ε_r and μ_r, respectively which of the following values of these quantities are allowed for a diamagnetic material?

(1) ε_r = 0.5, μ_r = 1.5 (2) ε_r = 1.5, μ_r= 0.5

(3) ε_r = 0.5, μ_r = 0.5 (4) ε_r = 1.5, μ_r= 1.5

33. A current of 2 A flows through an inductor of inductance 0.1 H. What is the maximum magnetic energy stored in the inductor ?

(1) 0.2 J (2) 0.1 J

(3) 0.4 J (4) 0.8 J

34. A sinusoidal voltage $V_0 \sin\omega t$ is applied across a series combination of resistance R and inductance L. The amplitude of the current in the circuit is

(1) $\frac{V_0}{\sqrt{R^2+\omega^2L^2}}$ (2) $\frac{V_0}{\sqrt{R^2-\omega^2L^2}}$

(3) $\frac{V_0}{R+\omega L}$ (4) $\frac{V_0}{R}$

35. A plane electromagnetic wave,

$E = 200 \sin(2 \times 10^8 t + 1x)$ V/m propagates in a medium of refractive index

(1) 1.5 (2) 2.0

(3) 10 (4) 2.4

36. An α particle is accelerated through a potential difference of 200 V. The increase in its kinetic energy, in electron volt is

(1) 100 (2) 200

(3) 400 (4) 800

37. The threshold frequency for a certain metal ν_0. When light of frequency $\nu = 2\nu_0$ is incident on it, the maximum velocity of photoelectrons is 4×10^6 m/s. If the frequency of incident radiation is increased to $5\nu_0$, then the maximum velocity of the photoelectron (in m/s) will be

(1) $\frac{4}{5}\times 10^6$ (2) 2×10^6

(3) 8×10^6 (4) 2×10^7

38. The angular speed of the electron in the n^{th} orbit of Bohr's hydrogen atom is

(1) Directly proportional to n

(2) Inversely proportional to $\sqrt{n}$

(3) Inversely proportional to n^2

(4) Inversely proportional to n^3

39. The half life of a radioactive element which has only $\frac{1}{32}$ of its original mass left after a lapse of 60 days, is

(1) 12 days (2) 32 days

(3) 60 days (4) 64 days

40. Fusion reaction takes place at about

(1) 3×10^2 K

(2) 3×10^3 K

(3) 3×10^4 K

(4) 3×10^7 K

41. In a P-N junction diode, holes diffuse from P region to N region because

(1) The force electrons in the N region attract them

(2) They are swept across the junction by potential difference

(3) There is greater concentration of holes in P region as compared to N region

(4) Diffuse only when there is reverse biasing

42. The difference in the variation of resistance with temperature in a metal and a semiconductor arises essentially due to the difference in

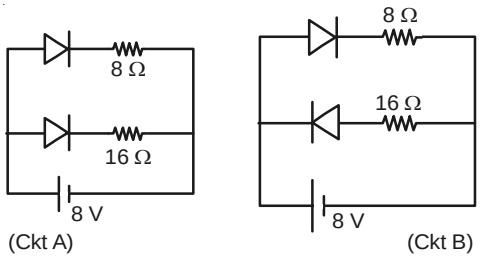
(1) Type of bonding

(2) Crystal structure

(3) Scattering mechanism with temperature

(4) Number of charge carries with temperature

43. Current flowing in each of the circuit A and B respectively



(1) 1 A, $\frac{3}{2}$ A (2) $\frac{3}{2}$ A,1 A

(3) 4 A, 2 A (4) 2 A, 4 A

44. The process of superposition of weak audio signal to a high frequency carrier wave is called

(1) Transmission (2) Communication

(3) Modulation (4) Demodulation

45. A TV tower has a height of 50 m. The maximum distance upto which TV transmission can be received is approximately equal to (R = 6400 km)

(1) 5 km (2) 25 km

(3) 100 km (4) 250 km

CHEMISTRY

46. Which of the following set contains only intensive variables?

(1) Volume, energy, enthalpy

(2) Area, enthalpy, work

(3) Viscosity, surface tension, density

(4) Viscosity, density, volume

47. For a reaction, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, the rate of formation of NH_3 is 34 g hour^{-1}. The rate at which H_2 is consumed, under similar conditions is

(1) 12 g/hr (2) $\frac{4}{3}$ g/hr

(3) 6 g/hr (4) $\frac{1}{2}$ g/hr

48. The number of moles of $KMnO_4$ which is required to react with one mole of sulphite ion (SO_3^{2-}) in acidic medium is

(1) $\frac{4}{5}$ (2) $\frac{3}{5}$

(3) 1 (4) $\frac{2}{5}$

49. Fe^{3+}, Zn^{2+} and Cu^{2+} ions are present in a slightly acidic medium. The reagent which when added in excess would separate Fe^{3+} in one step is

(1) H_2S (2) HCl

(3) NaOH (4) NH_3

50. How many pairs of enantiomers are possible for the molecular formula $C_5H_{11}Br$?

(1) 2 (2) 3

(3) 4 (4) 5

51. The type of isomerism present in $[Cr(NH_3)_5 NO_2]^{2+}$ is

(1) Ionisation isomerism

(2) Optical isomerism

(3) Linkage isomerism

(4) Geometrical isomerism

52. Which of the following will not react with acetylene?

(1) $NaNH_2$

(2) Tollen's reagent

(3) HCl

(4) Both (2) & (3)

53. Equal weights of two gases separately expands in an isothermal and reversible manner and the work done in both the cases is same. The gases are

(1) F_2, O_2 (2) N_2, C_2H_4

(3) CH_4, NO_2 (4) C_2H_6, N_2O

54. The volume of 0.1 M of KOH required to neutralise completely 20 ml of 0.1 M H_3PO_3, is

(1) 50 ml (2) 40 ml

(3) 30 ml (4) 20 ml

55. The coordination number and oxidation number of Cr in $K_3[Cr(C_2O_4)_3]$ are respectively

(1) 6 and +3 (2) 3 and +6

(3) 4 and +2 (4) 3 and +3

56. 2-Methylpentan-2-ol is prepared from acetone and 'x'. '*x*' is

(1) $(CH_3)_3CMgI/H_2O$

(2) C_2H_5MgCl/H_2O

(3) $CH_3CH_2CH_2MgCl/H_2O$

(4) CH_3MgCl/H_2O

57. The conjugate acid of formic acid in the given reaction is

$$HCl + HCOOH \rightleftharpoons HCO\overset{+}{O}H_2 + Cl^-$$

(1) Cl^- (2) $HCOO^-$

(3) $HCO\overset{+}{O}H_2$ (4) HCOOH

58. Consider the following equimolal solutions

a. Sugar b. Sodium chloride

c. Sodium sulphate d. Sodium phosphate

The correct order of increasing freezing point of the given solutions is

(1) a < b < c < d (2) b < c < a < d

(3) d < c < b < a (4) c < d < a < b

59. 0.5 ampere current is passed through copper and silver voltameters for 40 seconds. The metal that gets deposited more in gram is

(1) Cu

(2) Ag

(3) Both in equal quantities

(4) Cannot be predicted

60. In a cubic crystal anions are arranged in fcc and cations occupy half the tetrahedral voids and all the octahedral voids. The ratio of cations and anions in the crystal is

(1) 3 : 2 (2) 1 : 2

(3) 2 : 3 (4) 2 : 1

61. Alcohols reacts with Na according to the equation

$2ROH + 2Na \rightarrow 2RONa + H_2$

The order of reactivity of different alcohols towards Na is

(1) 3° > 2° > 1° (2) 1° > 2° > 3°

(3) 2° > 3° > 1° (4) 3° > 1° > 2°

62. The reagent which reacts differently with HCHO, CH_3CHO and CH_3COCH_3 is

(1) NH_2OH (2) NH_3

(3) HCN (4) Both (2) & (3)

63. The correct statement/s is/are

a. Glucose contains 3 chiral centres in its hemiacetal form

b. Glucose is an aldohexose

c. Naturally occurring glucose is dextrorotatory

d. Glucose contains one 2º alcoholic group and three 1º alcoholic group

(1) Both a & b (2) Both b & c

(3) a, b & c (4) All are correct

64. Which of the following can be hydrolysed most readily?

(1) $CH_3-\underset{\underset{O}{\|}}{C}-Cl$

(2) $CH_3-\overset{\overset{O}{\|}}{C}-O-\underset{\underset{O}{\|}}{C}-CH_3$

(3) $CH_3-\underset{\underset{O}{\|}}{C}-OC_2H_5$

(4) $CH_3-\underset{\underset{O}{\|}}{C}-NH_2$

65. Which statement about pyridine is correct?

(1) It is more basic than ethylamine

(2) It cannot act as a good nucleophile

(3) It is less basic than pyrrole

(4) All are correct

66. The equilibrium constant of the reaction

$HONO + CN^- \rightleftarrows HCN + ONO^-$ is 1.1×10^{-4}

Considering the reaction we can conclude that

(1) CN^- ion is a weaker base than ONO^-

(2) HCN is a weaker acid than HONO

(3) NO^- is the conjugated base of HONO

(4) The conjugate acid of CN^- is HCN

67. If the activation energy of a reaction is zero, then the rate constant (k) of the reaction

(1) Decreases with increase in temperature

(2) Decreases with decrease in temperature

(3) Increases with increase in temperature

(4) Is nearly independent of temperature

68. Which one of the following compounds will not be oxidised by acidified potassium dichromate?

(1) $(CH_3)_2CHOH$ (2) $(CH_3)_3COH$

(3) CH_3OH (4) CH_3CH_2OH

69. Polystyrene, dacron and orlon are classified respectively as

(1) Chain growth, step growth, step growth polymer

(2) Chain growth, step growth, chain growth polymer

(3) Step growth, step growth, chain growth polymer

(4) Step growth, chain growth, step growth polymer

70. When 0.1 mole of urea is dissolved in 10 moles of water, the vapour pressure of water will be

(1) Increased by 10% (2) Decreased by 10%

(3) Decreased by 1% (4) Increased by 1%

71. Acetoxime on reduction followed by acetylation gives

(1) Isopropylamine

(2) Ethylamine

(3) Diacetyl isopropylamine

(4) Monoacetyl isopropylamine

72. Which one of the following is used to make non-stick cookware?

(1) Polystyrene

(2) Polyvinyl chloride

(3) Poly ethylene terephthalate

(4) Poly tetrafluoroethylene

73. Isobutyl bromide reacts with aq. KOH to give (as major product)
(1) n-Butyl alcohol (2) t-Butyl alcohol
(3) Isobutyl alcohol (4) Isobutene

74. Phenyl salicylate can be used as
(1) Antipyretic (2) Antiseptic
(3) Disinfectant (4) Analgesic

75. Pyrolusite is an ore of
(1) Mg (2) Mn
(3) Fe (4) Zn

76. Physical adsorption is favourable at
(1) High temperature
(2) Low temperature
(3) Room temperature
(4) Independent of temperature

77. Be and Al differ in
(1) Exhibiting maximum covalency in compounds
(2) Showing amphoteric nature in their oxides
(3) Forming covalent halides
(4) Forming polymeric halides

78. The number of σ-bonds in P_4O_{10} is
(1) 12 (2) 14
(3) 16 (4) 20

79. Which one of the following has a regular tetrahedral structure?
(1) $[Ni(CN)_4]^{2-}$ (2) BF_4^-
(3) SF_4 (4) XeF_4

80. The products formed by the disproportionation reaction of hypochlorous acid are
(1) $HClO_2$ and $HClO_4$ (2) HCl and $HClO_3$
(3) HCl and Cl_2O (4) $HClO_3$ and Cl_2O

81. CO_2 and NH_3 react at 473 K and 220 atmospheric pressure to form
(1) N_2O and CO (2) $HCONH_2+H_2O$
(3) CH_3CONH_2 (4) Urea and H_2O

82. Which of the following is an acidic hydride of nitrogen?
(1) HN_3 (2) NH_3
(3) N_2H_4 (4) N_2H_2

83. Ozone oxidises iodine in the presence of moisture to
(1) Hydroiodic acid (2) Periodic acid
(3) Iodic acid (4) Hypoiodous acid

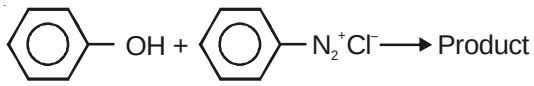
84. Which pair of metals becomes passive in conc. HNO_3?
(1) Fe, Al (2) Cu, Pt
(3) Ni, Mg (4) Sn, Ni

85. CuCl is sparingly soluble in water but it dissolves in KCl solution due to the formation of
(1) $K_3[CuCl_4]$ (2) $K_2[CuCl_4]$
(3) $K_3[CuCl_2]$ (4) $K_2[CuCl_2]$

86. Silver chloride dissolves in NH_4OH forming a compound 'X'. Which of the following is true about 'X'?
(1) X is a complex compound
(2) X is a diamagnetic in a nature
(3) X is a cationic complex
(4) All of these

87. Hexafluorocobaltate (III) ion is a high spin complex where the hybrid state of cobalt is
(1) sp^3d (2) sp^3d^2
(3) d^2sp^3 (4) dsp^2

88. When an organic compound containing phosphorous is fused with fusion mixture, it forms
(1) Na_2HPO_4 (2) Na_3PO_4
(3) NaH_2PO_4 (4) Na_3PO_3

89. 
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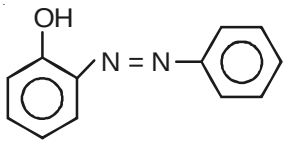
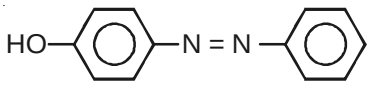
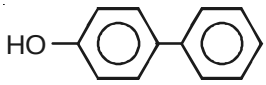
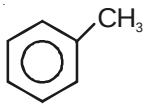
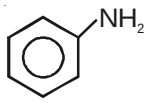
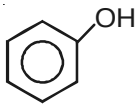
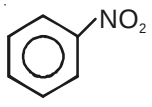
(1) 
(2) 
(3) 
(4) Both (1) & (2)

90. Which of the following compound will be most reactive towards electrophilic substitution reaction?
(1) 
(2) 
(3) 
(4) 

BOTANY

91. Complete oxidation of organic substances in the presence of oxygen

(1) Is most common in higher organisms

(2) Produces alcohol, CO_2 and energy

(3) Releases CO_2, water and small amount of energy

(4) Produces lactic acid and large amount of energy

92. When the electrons pass from NADH to oxygen via ___A___ in the mitochondrial ETS, they are coupled to ___B___ for the production of ATP from ADP and inorganic phosphate.

(1) A – Complex I to V
B – ATP synthase

(2) A – Complex V
B – Complex I to IV

(3) A – Complex I to IV
B – ATP synthase

(4) A – Complex I to III
B – Complex IV and V

93. From tips of coleoptiles of oat seedlings, F.W. Went isolated

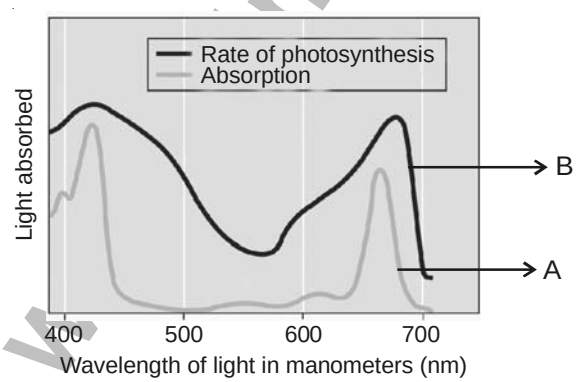
(1) Cytokinin

(2) An intercellular factor

(3) Gibberellic acid

(4) An intracellular factor

94. Examine the figure given below and select the right option giving both of the parts (A & B) **correctly** identified



(1) A - Action spectrum
B - Absorption spectrum of chl-a

(2) A - Absorption spectrum of β-carotene
B - Action spectrum

(3) A - Action spectrum
B - Absorption spectrum of β-carotene

(4) A - Absorption spectrum of chl-a
B - Action spectrum

95. Nucleolus disappears and the nuclear envelope breaks down by the end of

A - Diakinesis B - Prophase-II
C - Telophase D - Pachytene

(1) Only A (2) A, B
(3) Only B (4) C, D

96. Evolution of C_4 photosynthetic system is one of the strategies for

(1) Maximising water loss as well as availability of CO_2

(2) Minimising availability of CO_2 while maximising water loss

(3) Minimising water loss as well as availability of CO_2

(4) Maximising availability of CO_2 while minimising water loss

97. Read the following statement having two blanks (A & B)

"In the case of ___A___ the F_1 generation resembles both parents but in ___B___ the F_1 resembled either of the two parents."

The one **correct** option for the two blanks is

(1) A – Dominance
B – Incomplete dominance

(2) A – Incomplete dominance
B – Co-dominance

(3) A – Co-dominance
B – Dominance

(4) A – Co-dominance
B – Incomplete dominance

98. Heterogamety is shown by

(1) Male grasshopper (2) Female chicks

(3) Female fruit fly (4) Both (1) & (2)

99. Which of the following disease shows its transmission from unaffected carrier female to some of the male progeny?

(1) Haemophilia

(2) Myotonic dystrophy

(3) Turner's syndrome

(4) Down's syndrome

100. How many of the following organisms are chemosynthetic autotrophs?

I. *Nostoc*

II. *Lactobacillus*

III. *Vibrio*

IV. *Nitrobacter*

(1) Three (2) Four

(3) Two (4) One

101. In plants, symptoms like mosaic formation, leaf rolling and vein clearing are produced by

(1) Bacteria (2) Nucleoprotein particles

(3) Prions (4) Nematodes

102. Ascospores, sporangiospores and basidiospores all the three are

(1) Produced in sexual reproduction

(2) Produced during reproduction in fungi

(3) Produced in asexual reproduction

(4) Produced after gametic meiosis

103. In which of the following part(s) of sunflower, vascular cambium is completely secondary in origin?

(1) Root, stem (2) Flower, leaf

(3) Root (4) Leaf, stem

104. Underground stems of *Colocasia* and ginger are modified to perform

(1) Photosynthesis

(2) Storage and perenation

(3) Respiration and absorption of water

(4) Conduction of water and minerals

105. Axonemal microtubules are arranged as 9 + 2 array in the cilia or flagella of

(1) *Agaricus* and morels

(2) T_2 phage and *Vibrio*

(3) *Paramoecium* and *Euglena*

(4) *Porphyra* and *Polysiphonia*

106. Mark the **mis-matched** pair

(1) Medicine – *Aloe*, muliathi

(2) Edible oil – Soyabean, groundnut

(3) Ornamentals – Lupin, *Petunia*

(4) Dyes – *Sesbania*, *Trifolium*

107. Plants with great ecological importance but little economic importance belong to

(1) Bryophytes (2) Pteridophytes

(3) Gymnosperms (4) Algae

108. Mark the **wrongly** matched pair

(1) Yeast – Budding

(2) Date palm – Dioecious plant

(3) *Agave* – Bulbil

(4) *Strobilanthus* – External fertilisation

109. Flowers are not very colourful and do not produce nectar in

A. Entomophily

B. Anemophily

C. Hydrophily

D. Ornithophily

(1) B, C (2) A, B

(3) C, D (4) A, D

110. Which one of the following statements is **true** in respect of post fertilisation structures and events?

(1) Perisperm is residual and persistent endosperm in seed

(2) Zygote gives rise to the proembryo and subsequently to the heart-shaped, globular and mature embryo in dicots

(3) In monocots hypocotyl has a shoot apex and a few leaf primordia enclosed in a hollow foliar structure

(4) Transformation of ovules into seed and ovary into fruit proceeds simultaneously

111. Find out the hybrid varieties of crop plants which have been developed in India

A. TN-1

B. HD 1553

C. IR-8

D. P 1542

(1) B, C, D

(2) B, D

(3) A, B, D

(4) A, C

112. Which one of the following is **mis-matched** pair?

(1) Biomagnification – DDT in aquatic food chain

(2) Integrated organic farming – Cyclical zero waste procedure

(3) Sanitary landfills – Solid wastes

(4) Waste water – Use of phenyl

113. There are several ways of removing particulate matter; the most widely used of which is

(1) Catalytic converter (2) ESP

(3) Bag filters (4) Scrubber

114. The historic convention on Biological Diversity held in

(1) Rio de Janeiro, 2002

(2) Brazil, 1992

(3) South Africa, 2002

(4) Johannesburg, 1992

115. Large quantity of protein rich food within a short duration is possible by growing

(1) *Sequoia* (2) *Spirulina*

(3) Toadstool (4) *Triticum*

116. The dough, which is used for making bread and idli is fermented by

(1) Heterotrophic microbes

(2) Bacteria and fungi respectively

(3) Autotrophic microbes

(4) Fungi and BGA respectively

117. Find **correct** one (w.r.t. defining features of all life forms)

(1) Cellular organisation

(2) Extrinsic growth

(3) Reproduction

(4) Both (1) & (2)

118. Which of the following pair is **wrongly** matched?

(1) Ethephon – Fruit ripening in apples

(2) Bakane disease of rice seedlings – BAP

(3) Vernalisation – Chilling treatment

(4) NAA – Synthetic auxin

119. Reserve food is very similar to amylopectin and glycogen in structure in

(1) *Dictyota*, *Fucus*

(2) *Polysiphonia*, *Porphyra*

(3) *Volvox*, *Cladophora*

(4) *Euglena*, *Ulothrix*

120. Pinnate leaves persist for a few years in a gymnosperm with

(1) Sunken stomata

(2) Branched stem

(3) Coralloid roots

(4) Fungal roots

121. deATP, deCTP, deGTP and deTTP serve as

(1) Source of energy for polymerisation of amino acids

(2) Substrates in replication of DNA

(3) Source of energy for transcription

(4) Both (1) & (2)

122. If the sequence of the coding strand in a transcription unit is written as follows

5'-TGAACTGTAGCATGC-3'

Find out the correct sequence in m-RNA.

(1) 5'-UGAACUGUAGCUUGC-3'

(2) 3'-CGUACGAUGACAAGU-5'

(3) 3'-CGUACGAUGUCAAGU-5'

(4) 5'-UGACUGUAGCUUGC-3'

123. Find out the biomolecule having structural specialities to read the genetic code.

(1) Amino acids

(2) mRNA

(3) Adapter molecule

(4) Peptidyl transferase

124. RuBisCO as well as PEPcase both are found in the leaves of

(1) C_3 plants

(2) All photosynthetic plants

(3) Dry tropical regions

(4) More than one option is correct

125. *Pseudomonas* and *Thiobacillus* perform the

(1) Reduction of nitrate in soil

(2) Denitrification and ammonification respectively

(3) Oxidation of ammonia in soil

(4) Nitrogen fixation and nitrification respectively

126. Read the following statements

A. Cytoskeleton is involved in mechanical support and motility of the bacterial cell.

B. In plants cells, centrioles form spindle apparatus during cell division.

(1) Both A & B are incorrect

(2) Only A is correct

(3) Only B is correct

(4) Both A & B are correct

127. Mature or ripened ovary of mango and coconut resemble in presence of

(1) Double endosperm

(2) Scutellum

(3) Stony hard endocarp

(4) Undifferentiated pericarp

128. Permanent tissues having all cells similar in structure and function is

(1) Collenchyma, sclerenchyma

(2) Xylem, phloem

(3) Parenchyma, xylem

(4) Phloem, collenchyma

129. Which one of the following is an **incorrect** statement?

(1) Root of *Pinus* establishes an obligate association with fungi

(2) Translocation in phloem is explained by the pressure flow hypothesis

(3) Ions are absorbed from the soil mainly by active transport

(4) More the solute molecules in the solution, the higher is the osmotic potential

130. The stage between meiosis I and meiosis II is

(1) Called as interkinesis

(2) Generally short lived

(3) Followed by Prophase II

(4) More than one option

131. Environmental plasticity is found in

(1) Cotton (2) Buttercup

(3) Larkspur (4) Coriander

132. Anther wall layer meant for synthesis of sporopollenin and incompatibility proteins is

(1) Endothecium

(2) Middle layers

(3) Tapetum

(4) Tapetum and middle layers

133. Among plants, maximum species global diversity belong to a taxon, known as

(1) Algae (2) Angiosperms

(3) Mosses (4) Lichens

134. Pyramid of energy in a forest ecosystem considering GFC is

(1) Spindle shaped (2) Inverted

(3) Upright (4) Urn shaped

135. Read the following statements

A. A considerable amount of NPP is utilised by plants in respiration.

B. Trees occupy top vertical strata of a forest, herbs and grasses the second and shrubs occupy the bottom layers.

(1) Both A & B are correct

(2) Only A is correct

(3) Only B is correct

(4) Both A & B are incorrect

ZOOLOGY

136. How many of the given statements are **wrong**?

A. The rate of diffusion of gas at the respiratory membrane depends upon its solubility as well as on the thickness of membrane.

B. The amount of CO_2 that can diffuse through the diffusion membrane per unit difference in partial pressure is much higher when compared to that of O_2.

C. Oxygen can bind with haemoglobin in an irreversible manner to form oxyhaemoglobin.

D. The factors responsible for formation of oxyhaemoglobin include high pO_2, low pCO_2, high H^+ concentration and low temperature.

(1) One (2) Two

(3) Three (4) Four

137. Consider the following statements A–D with certain blanks and choose the option which **correctly** fills up these blanks.

A. A special neural centre in the (i) can moderate the cardiac function through autonomic nervous system.

B. (ii) increase cardiac output.

C. The ventricular systole starts shortly after (iii) .

D. The condition of erythroblastosis foetalis can be avoided by administering (iv) to the mother immediately after delivery of first child.

(1) (i) - Cerebrum
(ii) - Sympathetic nerves
(iii) - Q wave
(iv) - Anti –Rh antibodies

(2) (i) - Medulla Oblongata
(ii) - Parasympathetic nerves
(iii) - R wave
(iv) - Rh - antibodies

(3) (i) - Pons
(ii) - Sympathetic nerves
(iii) - P wave
(iv) - Rh - antibodies

(4) (i) - Medulla Oblongata
(ii) - Adrenal medullary hormones
(iii) - Q wave
(iv) - Anti –Rh antibodies

138. Find out the **incorrect** statement w.r.t. generation conduction of nerve impulse.

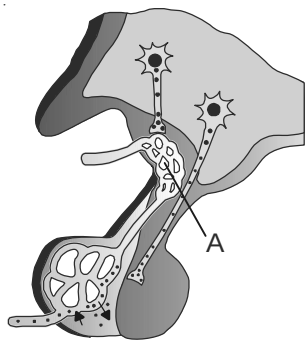
(1) The resting axonal membrane is comparatively more permeable to potassium ions and nearly impermeable to sodium ions

(2) In the resting membrane the outer surface of the axonal membrane possesses a positive charge while its inner surface is negatively charged and therefore, is polarised

(3) The membrane becomes depolarised due to rapid influx of Na^+ on applying threshold stimulus

(4) Depolarisation is followed by repolarisation in which rapid efflux of Na^+ takes place restoring the resting potential of the membrane at the site of excitation

139. Following is a diagrammatic representation of endocrine glands with a labelled part 'A'. The part 'A' serves as the connection between



(1) Hypothalamus and adenohypophysis

(2) Hypothalamus and neurohypophysis

(3) Hypothalamus and pars nervosa

(4) Hypothalamus and epiphysis

140. All of the following are functions of Catecholamines, **except**

(1) Pupilary dilation

(2) Piloerection

(3) Tachycardia

(4) Lipogenesis

141. Given below are four statements A–D w.r.t. mechanism of muscle contraction. Choose from the options stating them as true (T) and false (F)

A. The action potential in the sarcolemma is generated by release of calcium ions in the sarcoplasm.

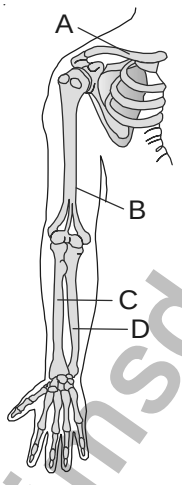
B. The globular head of meromyosin possesses ATPase enzyme activity which causes hydrolysis of ATP and the energy derived make myosin head bind to exposed active sites on actin.

C. Cross bridge formation is followed by pulling the attached myosin filaments towards the centre of 'I' band.

D. The breaking of cross bridge requires binding of new ATP at the myosin head.

	A	B	C	D
(1)	T	T	F	T
(2)	F	T	F	F
(3)	F	T	F	T
(4)	T	F	F	T

142. Find out the **correct** labelling of bones A, B, C & D in the given figure



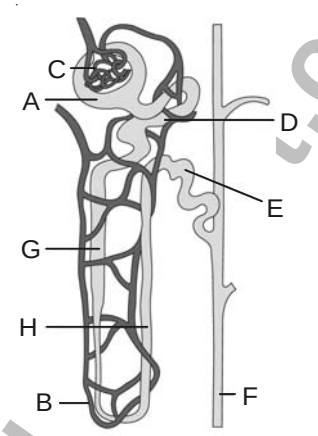
(1) A - Clavicle B - Humerus
C - Ulna D - Radius

(2) A - Clavicle B - Humerus
C - Radius D - Ulna

(3) A - Scapula B - Humerus
C - Ulna D - Radius

(4) A - Clavicle B - Femur
C - Radius D - Ulna

143. Following is a diagrammatic representation of a nephron showing blood vessels, duct and tubule. These structures have been labelled as A, B. Answer the questions that follow.



(i) Which parts are located in cortical region of kidney

(ii) Which structure is highly reduced in cortical nephrons?

(iii) Identify the part F.

(iv) Which parts collectively form malpighian body?

(1) (i) A, C, D, E
(ii) B
(iii) Collecting duct
(iv) A & C

(2) (i) A, C, D, E
(ii) B
(iii) Vasa recta
(iv) A & C

(3) (i) B, F, G, H
(ii) F
(iii) Vasa recta
(iv) A & D

(4) (i) B, F, G, H
(ii) F
(iii) Collecting duct
(iv) C & D

144. Which of the following statement is **incorrect**?

(1) Juxta glomerular apparatus is a special sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact

(2) Nearly 99 percent of the filtrate gets reabsorbed by the renal tubules

(3) Nitrogenous wastes in the filtrate get reabsorbed through active transport

(4) Human kidneys can produce urine nearly four times concentrated than the initial filtrate formed

145. All of the following digestive enzymes are secreted as pro-enzymes, **except**

(1) Pepsin (2) Trypsin

(3) Carboxypeptidase (4) Sucrase

146. Which of the following statements are **correct**?

A. The chemical process of digestion is initiated in oral cavity by the hydrolytic action of the carbohydrate splitting enzyme, the salivary amylase.

B. Lipases are absent in secretion of gastric glands.

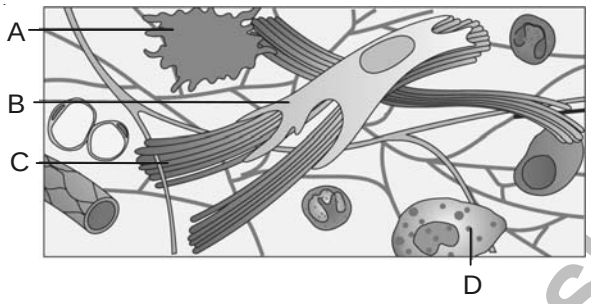
C. Bile helps in emulsification of fats and also activates lipases.

D. Nucleases in the succus entericus acts on nucleic acids to form nucleotides and nucleosides.

(1) A, B, C (2) A, C

(3) C, D (4) A, C, D

147. Given figure represents a type of connective tissue with certain labelled structures A, B, C & D



Which of the following option correctly defines the labelled structure?

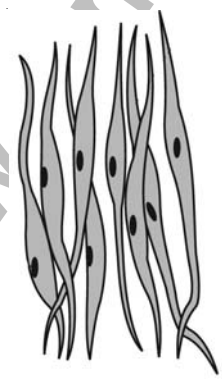
(1) A - Mast cell - Secretes histamine, heparin and serotonin

(2) B - Fibroblast - Secrete major amount of matrix

(3) C - Elastic fibres - Provides tissue tensile strength

(4) D - Macrophage - Engulf germ particle

148. Given below is a diagram of muscular tissue. Find the **correct** description of this tissue w.r.t. it's type and location



(1) Striated and voluntary - Found closely attached to skeletal bones

(2) Non-striated and involuntary - Present only in heart

(3) Non-striated and involuntary - Present in wall of blood vessels, stomach and intestine

(4) Non-striated and voluntary - Present in urinary bladder and uterus

149. Which of the phylum is a **correct** match w.r.t. phylum and its three examples?

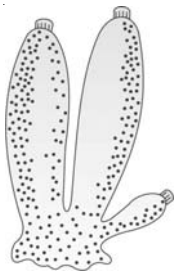
(1) Mollusca - *Pinctada*, *Loligo*, *Cucumaria*

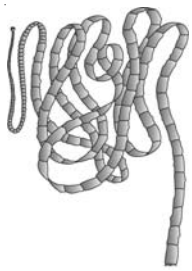
(2) Annelida - *Pheretima*, *Hirudinaria*, *Ctenoplana*

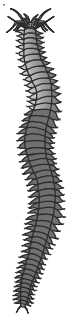
(3) Arthropoda - *Laccifer*, *Limulus*, *Chaetopleura*

(4) Cnidaria - *Pennatula*, *Meandrina*, *Aurelia*

150. Given below are diagrams of four animals A, B, C & D. Find the **correct** option w.r.t. common features of two of these animals.

A. 

B. 

C. 

D. 

(1) A & C are monoecious animals

(2) A & B are bilaterally symmetrical

(3) C & D are eucoelomates

(4) B & D respire through gills

151. Which of the following animal is **correctly** matched with it's genus and two of its characteristics?

(1) **Animal** : 

Genus : *Scoliodon*

Key characteristics : (a) Placoid scales on skin
(b) Air bladder present

(2) **Animal** : 

Genus : *Bufo*

Key characteristics : (a) Body divisible into head and trunk
(b) Cloaca absent

(3) **Animal** : 

Genus : *Chelone*

Key characteristics : (a) Epidermal scales present
(b) Heart Myogenic

(4) **Animal** : 

Genus : *Struthio*

Key characteristics : (a) Skin is dry without glands
(b) Fertilisation external

152. Which of these animals shown are oviparous and viviparous?

A. 

B. 

C. 

D. 

	Oviparous	Viviparous
(1)	A, B, D	C
(2)	A, B	C, D
(3)	B, D	A, C
(4)	A, B, C	D

153. Which of the following statement is **incorrect** w.r.t. alimentary canal of cockroach?

(1) Oesophagus leads into a sac like structure called crop used for storing of food

(2) Gizzard has an outer layer of thick circular muscles and thick inner cuticle forming six highly chitinous plate called teeth

(3) A ring of 6-8 blind tubules called hepatic or gastric caecae is present at the junction of foregut and midgut

(4) The hindgut is narrower than midgut and is differentiated into ileum, colon and rectum

154. Consider the following features

A. Exclusively marine, radially symmetrical, diploblastic organisms with tissue level of organisation.

B. The body bears eight external rows of ciliary comb plates.

C. Digestion is both extra cellular and intra cellular.

D. Exhibit Bioluminescence.

E. Monoecious, fertilisation external with indirect development.

The above mentioned features belong to the animal

(1) *Physalia*

(2) *Euspongia*

(3) *Fasciola*

(4) *Pleurobrachia*

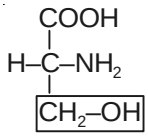
155. Match the following structures of cockroach in column I with their location provided in column II.

	Column I		Column II
a.	Testes in males	(i)	6^{th} abdominal segment
b.	Mushroom gland	(ii)	2^{nd}-6^{th} abdominal segment
c.	Spermatheca	(iii)	6^{th}-7^{th} abdominal segment
d.	Ovaries in females	(iv)	4^{th}-6^{th} abdominal segment

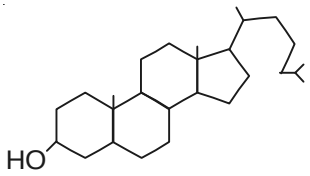
(1) a(ii), b(iii), c(i), d(iv) (2) a(iv), b(iii), c(i), d(ii)

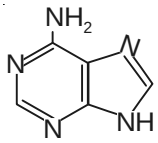
(3) a(ii), b(i), c(iii), d(iv) (4) a(iii), b(i), c(iv), d(ii)

156. Which of the following is an **incorrect** match w.r.t. organic compound shown and its identification?

(1)  - An amino acid with functional group as hydroxymethyl

(2) $CH_3–(CH_2)_{14}–COOH$ - A saturated fatty acid, palmitic acid

(3)  - A phospholipid, lecithin

(4)  - A nitrogenous base, adenine

157. How many of the given statements are **correct**?

A. Water is the most abundant chemical in the living organisms.

B. A protein is a heteropolymer and not a homopolymer.

C. In a polysaccharide, left end is called reducing end and the right end is called non-reducing end.

D. A nucleotide is the building block of nucleic acids, which consist of a heterocyclic compound (nitrogenous base), a monosaccharide and a phosphate.

(1) One (2) Two

(3) Three (4) Four

158. Which of the following factors can affect the enzymatic activity?

A. Change in temperature

B. Change in pH

C. Change in substrate concentration

D. Binding of specific chemical to enzyme

(1) A, B, C, D

(2) A, B, D

(3) A, B

(4) B, C, D

159. Consider the following statements A–D with certain blanks. Find the option which **correctly** fills up these blanks

A. The protein portion of enzyme is called (i) .

B. Prosthetic groups are (ii) bound to the protein part of enzyme.

C. (iii) is the prosthetic group of enzyme catalase.

D. (iv) are nucleic acids with catalytic power.

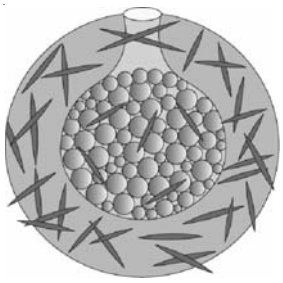
(1) (i) Co-factor (ii) Tightly
(iii) Haem (iv) Ribozyme

(2) (i) Apoenzyme (ii) Loosely
(iii) NAD (iv) Ribonuclease P

(3) (i) Co-factor (ii) Loosely
(iii) NAD (iv) Ribonuclease P

(4) (i) Apoenzyme (ii) Tightly
(iii) Haem (iv) Ribozyme

160. The given reproductive structure is a method of



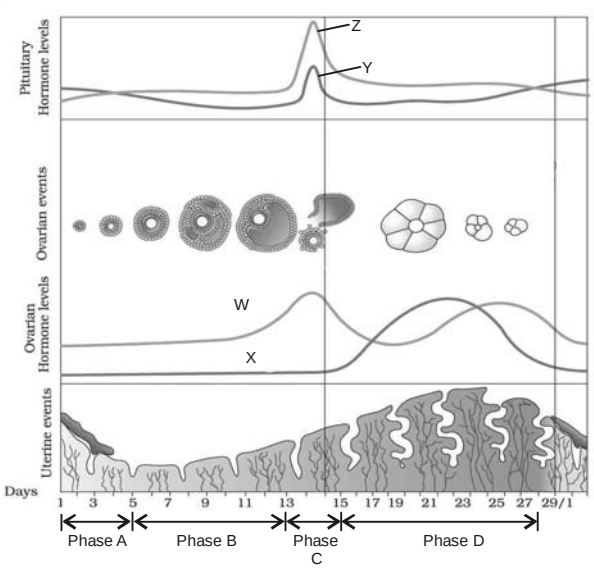
(1) Asexual reproduction in *Hydra*

(2) Sexual reproduction in earthworm

(3) Asexual reproduction in sponges

(4) Sexual reproduction in cockroach

161. Following is diagrammatic representation of menstrual cycle depicting certain events. The uterine events have been labelled as phases A, B, C & D. The ovarian hormones have been labelled as W, X and pituitary hormones as Y and Z. Answer the questions that follow.



(i) Lack of which phase is indicative of pregnancy?

(ii) During which phase implantation of blastocyst takes place?

(iii) Identify the hormones W, X, Y & Z.

(iv) A preovulatory surge of which hormone is necessary to cause ovulation?

(1) (i) Phase A
(ii) Phase B
(iii) W - Estrogen
X - Progesterone
Y - FSH
Z - LH
(iv) Z

(2) (i) Phase A
(ii) Phase D
(iii) W - Estrogen
X - Progesterone
Y - FSH
Z - LH
(iv) Z

(3) (i) Phase D
(ii) Phase C
(iii) W - Estrogen
X - Progesterone
Y - LH
Z - FSH
(iv) Y

(4) (i) Phase D
(ii) Phase B
(iii) W - Progesterone
X - Estrogen
Y - FSH
Z - LH
(iv) Y

162. Find the **incorrect** statement w.r.t. pregnancy and embryonic development in humans.

(1) Placenta is a functional unit between developing embryo and maternal body formed by interdigitation of chorionic villi and uterine tissue

(2) Human chorionic gonadotropin(hCG), human placental lactogen(hPL) and relaxin are produced in women only during pregnancy

(3) The inner cell mass contain stem cells which have the potency to give rise to all the tissues and organs

(4) By the end of second trimester, the first movements of the foetus and appearance of hair on head is usually observed

163. According to 2001 census report, the population growth rate of India was

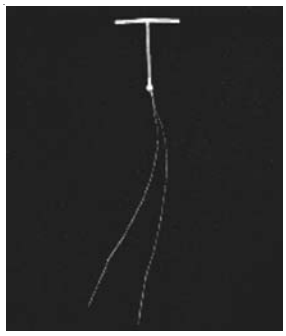
(1) 17/1000/year

(2) 25/1000/year

(3) 33/1000/year

(4) 8/1000/year

164. Which of the following is **correct** description of the contraceptive device shown?



(1) Lippes loop - Increase phagocytosis of sperms in uterus

(2) LNG-20 - Make uterus unsuitable for implantation and cervix hostile to sperms

(3) CuT - Cu ions released suppress sperm motility and the fertilising capacity of sperms

(4) Implant - Inhibit ovulation and implantation as well as alter the quality of cervical mucus to retard entry of sperms

165. How many of the following statements are **wrong** w.r.t. STDs?

A. AIDs is the most dangerous STD.

B. Hepatitis-B, genital herpes and HIV infection are not curable

C. Ectopic pregnancy and cancer are not included under the complications of STDs.

D. The incidence of STDs are reported to be very high among persons in the age group of 15-24 years.

(1) One (2) Two

(3) Three (4) Four

166. Which of the following ART involves transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one, but can provide suitable environment for fertilisation and further development?

(1) IUT (2) ZIFT

(3) ICSI (4) GIFT

167. Which of the following is **correct** match w.r.t. human ancestor, its cranial capacity and certain feature?

	Ancestor	**Cranial capacity**	**Feature**
(1)	*Australopithecus*	500CC	Hunted with stone weapons but essentially ate fruit
(2)	*Homo habilis*	650-800CC	First human like being the hominid. They probably ate meat
(3)	*Homo erectus*	900CC	Probably did not ate meat

(4) More than one option is correct

168. Which of the following factor can change allelic frequency?

A. Gene flow

B. Natural selection

C. Random mating

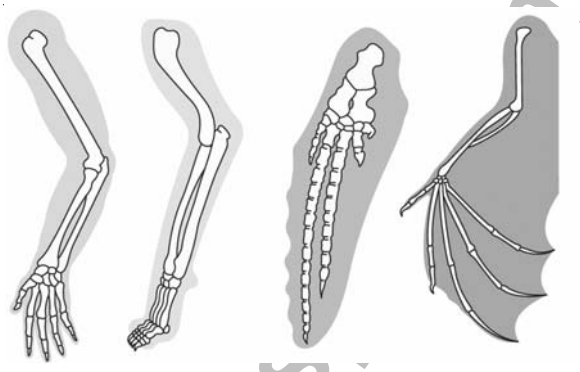
D. Founder effect

E. Genetic recombination

(1) A, B, C, D, E (2) A, B, E

(3) C, D, E (4) A, B, D, E

169. The following diagram shows forelimbs of certain mammals. These represent



(1) Homologous organs - Convergent evolution

(2) Analogous organs - Divergent evolution

(3) Homologous organs - Divergent evolution

(4) Analogous organs - Convergent evolution

170. Based on observations made during a sea Voyage in a sail ship called H.M.S. Beagle, Charles Darwin concluded that

(1) Evolution of life forms had occurred driven by use and disuse of organs

(2) Allelic frequencies in a population are stable and is constant from generation to generation

(3) Mutation causes evolution as these are random and directionless

(4) Existing life forms share similarities to varying degrees not only among themselves but also with life forms that existed millions of years ago

171. Which of the following is a **correct** match w.r.t. pathogen and its site of attack (body cell/organ) in the human body?

(1) *Ascaris* - Lymphatic vessels

(2) *Trichophyton* - Lungs

(3) *Plasmodium* - Hepatocytes and RBCs

(4) *Entamoeba histolytica* - Small intestine

172. All of the following statements are **correct** w.r.t. heroin, **except**

(1) It binds to specific opioid receptors present in our central nervous system and gastrointestinal tract

(2) It is chemically diacetylmorphine

(3) It is formed by ethylation of cannabinoids

(4) It is a depressant and slows down body functions

173. Fill in the blank

A involves mating of animals of two different breeds. *Hisardale*, a new breed of B has been developed through this mechanism.

	A	B
(1)	Cross-breeding	Sheep
(2)	Cross-breeding	Goat
(3)	Out-crossing	Sheep
(4)	Out-crossing	Goat

174. Hydrochloric acid, saliva and tears are included in

(1) Physical barriers of innate immunity

(2) Physiological barriers of innate immunity

(3) Cytokine barriers of innate immunity

(4) Cellular barriers of innate immunity

175. Find the **incorrect** match

(1)	Colostrum	-	IgA antibodies
(2)	Recombinant DNA technology	-	Hepatitis B vaccine produced from yeast
(3)	Allergy	-	Release of chemicals like histamine and serotonin from the mast cells
(4)	Auto-immune disease	-	Adrenaline

176. Which of the following limitation of traditional hybridisation procedure has been overcome by rDNA technology?

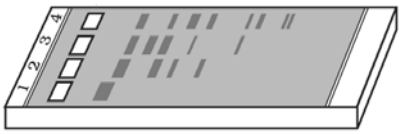
(1) Introduction of desirable genes without introducing undesirable genes into the target organism

(2) To permit variation in the target organism

(3) To produce hybrid vigour

(4) Both (2) & (3)

177. Which of the following technique has been shown in the given diagram?



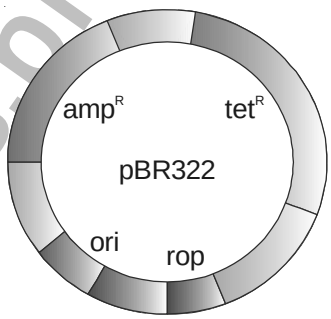
(1) Agarose gel electrophoresis in which smallest DNA fragment moves farther

(2) Identification and elimination of non-transformants

(3) Agarose gel electrophoresis in which DNA fragments resolve according to their size

(4) More than one option is correct

178. In the given *E.coli* cloning vector pBR322, restriction site of *Pvu* II is present in



(1) amp^R (2) tet^R

(3) rop (4) *ori*

179. All of the following are significance of using GM plants, **except**

(1) GM plants are tolerant to abiotic stresses

(2) GM plants are less dependent on chemical pesticides

(3) GM plants have increased efficiency of mineral usage

(4) GM plants help in increasing post harvest losses

180. Which of the following recombinant protein has been used to treat emphysema?

(1) β-galactosidase (2) Alpha-lactalbumin

(3) α-1-antitrypsin (4) Adenosine deaminase

❑ ❑ ❑

ANSWERS

1.	(3)	37.	(3)	73.	(2)	109.	(1)	145.	(4)
2.	(1)	38.	(4)	74.	(2)	110.	(4)	146	(2)
3.	(1)	39.	(1)	75.	(2)	111.	(2)	147.	(2)
4.	(4)	40.	(4)	76.	(2)	112.	(4)	148.	(3)
5.	(1)	41.	(3)	77.	(1)	113.	(2)	149.	(4)
6.	(3)	42.	(4)	78.	(3)	114.	(2)	150.	(3)
7.	(3)	43.	(2)	79.	(2)	115.	(2)	151.	(3)
8.	(2)	44.	(3)	80.	(2)	116.	(1)	152.	(1)
9.	(4)	45.	(2)	81.	(4)	117.	(1)	153.	(4)
10.	(2)	46.	(3)	82.	(1)	118.	(2)	154.	(4)
11.	(1)	47.	(3)	83.	(3)	119.	(2)	155.	(2)
12.	(3)	48.	(4)	84.	(1)	120.	(3)	156.	(3)
13.	(1)	49.	(4)	85.	(1)	121.	(2)	157.	(3)
14.	(3)	50.	(2)	86.	(4)	122.	(3)	158.	(1)
15.	(2)	51.	(3)	87.	(2)	123.	(3)	159.	(4)
16.	(4)	52.	(3)	88.	(2)	124.	(3)	160.	(3)
17.	(1)	53.	(2)	89.	(4)	125.	(1)	161.	(2)
18.	(1)	54.	(2)	90.	(2)	126.	(1)	162.	(4)
19.	(1)	55.	(1)	91.	(1)	127.	(3)	163.	(1)
20.	(4)	56.	(3)	92.	(3)	128.	(1)	164.	(3)
21.	(1)	57.	(3)	93.	(2)	129.	(4)	165.	(1)
22.	(1)	58.	(3)	94.	(4)	130.	(4)	166.	(4)
23.	(2)	59.	(2)	95.	(2)	131.	(2)	167.	(1)
24.	(2)	60.	(4)	96.	(4)	132.	(3)	168.	(4)
25.	(1)	61.	(2)	97.	(3)	133.	(2)	169.	(3)
26.	(1)	62.	(2)	98.	(4)	134.	(3)	170.	(4)
27.	(3)	63.	(2)	99.	(1)	135.	(4)	171.	(3)
28.	(1)	64.	(1)	100.	(4)	136.	(2)	172.	(3)
29.	(3)	65.	(2)	101.	(2)	137.	(4)	173.	(1)
30.	(1)	66.	(4)	102.	(2)	138.	(4)	174.	(2)
31.	(2)	67.	(4)	103.	(3)	139.	(1)	175.	(4)
32.	(2)	68.	(2)	104.	(2)	140.	(4)	176.	(1)
33.	(1)	69.	(2)	105.	(3)	141.	(3)	177.	(4)
34.	(1)	70.	(3)	106.	(4)	142.	(2)	178.	(3)
35.	(1)	71.	(3)	107.	(1)	143.	(1)	179.	(4)
36.	(3)	72.	(4)	108.	(4)	144.	(3)	180.	(3)

PART A : CLASS XII

PHYSICS

Q1

A charge q has been placed at the centre of the line joining two equal positive charges Q. The system of the three charges will be in equilibrium if q is equal to:

(a)$-\frac{Q}{2}$

(b) $-\frac{Q}{4}$

(c)$+\frac{Q}{4}$

(d) $+\frac{Q}{2}$

Q2

Three concentric metallic spherical shells of radii R, 2R,3R have been given charges $Q_1, Q_2$and Q_3, respectively. It has been found that the surface charge densities on the outer surface of the shells are equal. Then, the ratio of the charges given to the shells, $Q_1 : Q_2 : Q_3$, is:

(a)1: 2: 3

(b) 1: 3: 5

(c) 1: 4: 9

(d) 1: 8: 18 **[IIT 2009]**

Q3

A positively charged thin metal ring of radius R has been fixed in the XY-plane, with its centre at the origin O. A negatively charged particle P is released from rest of the point (0, 0, z_0), where z_0>0. Then, the motion of P is:

(a) Periodic for all the values of z_0 satisfying 0<z_0<∞

(b)SHM for all the values of z_0 satisfying 0<z_0<R

(c) nearly SHM provided z_0<<R

(d) so that P crosses O and continues to move along the negative Z-axis towards z=−∞

Q4

A charged oil drop has been suspended in uniform field of $3 \times 10^4 V - m^{-1}$so that it neither falls nor rises. The charge on the drop (assume the mass of the charge to be 9.9×10^{-15}kg and g=10 ms^{-2}) will be

(a) $3.3 \times 10^{-18} C$

(b) $3.2 \times 10^{-18} C$

(c) $1.6 \times 10^{-18} C$

(d) 4.8×10^{-18} **[AIEEE 2004]**

Q5

Four point positive charges of same magnitude Q have been placed at four concers of a rigid square frame as shown in fig. 1.1. The plane of the frame is perpendicular to Z-axis. If a negative point charge is placed at a distance z, away from the above frame, the

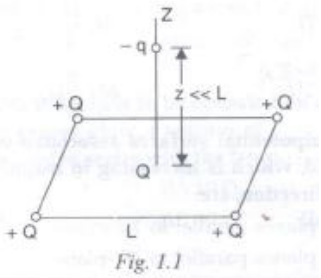


Fig. 1.1

(a) negative charge oscillates along the z-axis

(b) It Moves away from the frame

(c) It moves slowly towards the frame and stays in the plane of the frame,

(d) It passes through the frame only once **[AIIMS 2005]**

Q6

Two infinitely long parallel conducting plates, having surface charge densities +σ and –σ, respectively, have been separated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacuum, the electric field in the region between the plates is:

(a) $2\sigma\varepsilon_0$ v-m^{-1}

(b)$\frac{\sigma \varepsilon_0}{2}$ V-m^{-1}

(c) $\frac{\sigma}{\varepsilon_0}$V-$m^{-1}$

(d) 0 V-m^{-1}

Q7

A hollow insulated conducting sphere has been given a positive charge 10μC. What will be the electric field at the centre of the sphere if its radius is 2 m?

(a) $6\mu C\text{-}m^2$

(b) $8\mu C\text{-}m^{-1}$

(c) $0\mu C\text{-}m^2$

(d) $12\mu C\text{-}m^{-2}$

Q8

Two charged spheres, separated by a distance d, exert some force F on each other. If they are immersed in a liquid of dielectric constant 2, the force exerted by them, if all other conditions are the same, is:

(a) 4F

(b) 2F

(c) F

(d) $\frac{F}{2}$ **[VMMC 2004]**

Q9

A charged particle of mass m and charge q (initially at rest) is released in an electric field of magnitude E. Its kinetic energy after time t will be:

(a) $\frac{2E^2t^2}{mq}$

(b) $\frac{E^2q^2t^2}{2m}$

(c) $\frac{Eq^2m}{2t^2}$

(d) $\frac{Eqm}{2t}$ **[VMMC 2003]**

Q10

The following is not a property of field lines:

(a) Field lines are continuous curves without any breaks (b) Two filed lines cannot cross each other

(c) Field lines start at positive charges and end at negative ones (d) They form closed loops

[**DPMT 2009]**

Q11

Gauss's law is valid for:

(a) any closed surface

(b) only regular closed surfaces

(c) any open surface

(d) only irregular open surface **[DPMT 2009]**

Q12

Two identical capacitors have the same capacitance C. One of them has been charged to potential V_1; the other to potential V_2. The negative ends of the capacitors are connected. Thus , the decrease in energy of the combined system is:

(a) $(V_1^2 - V_2^2)$

(b) $\frac{1}{4}C(V_1^2 - V_2^2)$

(c) $\frac{1}{4}C(V_1 - V_2)^2$

(d) None of these

Q13

Refer Gig. 1.2 The capacitor A has charge q on it whereas B has not been charged. The charge appearing on the capacitor B, a long time after the switch S is closed, is:

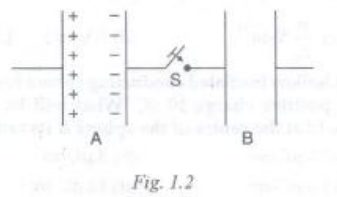


Fig. 1.2

(a) Zero

(b) q/2

(c) q

(d) 2q

Q14

Refer fig. 1.3. There is a system of paint charges. There are three charges q/3,q/3 and -2q/3. They have been placed on the three vertices of a triangle. If O is the centre of the circle with radius R and $m\angle CAB=60^0$, then which one of the following statements is true?

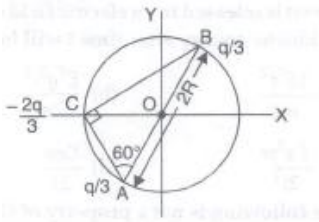


Fig. 1.3

(a) The electric field at point O is $\frac{q}{8\pi\varepsilon_0 R^2}$ and it is directed along the x-axis.

(b) The PE of the system is zero

(c) The magnitude of the force between the charge at C and the one at B is $\frac{q^2}{54\pi\varepsilon_0 R^2}$

(d) The potential at point O is $\frac{q}{12\pi\varepsilon_0 R}$

Q15

What is the angle between an electric field and an equipotential surface?

(a) 90^0 (always) (b) 0^0 (always)

(c) 0^0 to 90^0 (d) 0^0 to 180^0

Q16

Refer Fig.1.4. A hollow conducting sphere has been placed in an electric field produced by a point charge placed at P as shown in Fig. 1.3. Let V_A, V_B and V_C be the potentials at points, A,B and C, respectively.

Thus, we confirm that:

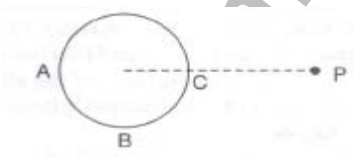


Fig. 1.4

(a) $V_C > V_R$ (b) $V_B > V_C$

(c) $V_A > V_B$ (d) $V_A = V_C$

Q17

Refer Fig.1.5. The equivalent capacitance is:

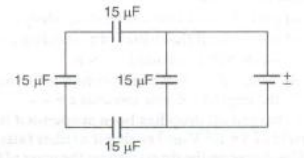


Fig. 1.5

(a) 15μF (b) 20μF

(c) 25μF (d) 30μF

Q18

A capacitors is charged by connecting a battery across its plates.It stores energy U. Now the battery is disconnected across it, then the energy stored by both capacitors of the system will be:

(a) U (b) $\frac{U}{2}$

(c) 2U (d) $\frac{3}{2}U$

Q19

Equipotential surface associated with an electric field, which is increasing in magnitude along the X-direction, are:

(a) Planes parallel to YZ-plane (b) Planes parallel to XY-plane

(c) Planes parallel to XZ-plane (d) coaxial cylinders of increasing radii around the X-axis

[AIIMS 2004]

Q20

Refer Fig. 1.6. The capacitors C_1, C_3 and C_4 have a capacitance 4μF each. If the capacitor C_2 has a capacitance 10μF, the difference capacitance between A and B will be:

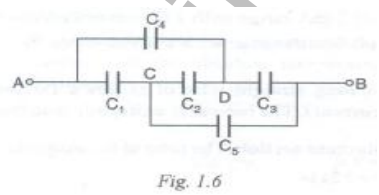


Fig. 1.6

(a) 2μF (b) 4μF

(c) 6mF (d) 8mF

Q21

Identical charges(-q) have been placed at each corner of a cube of side b. Then, the electrostatic potential energy of charge (+q) placed at the centre of the cube will be:

(a) $-\frac{4\sqrt{2}q^2}{\pi\varepsilon_0}$ (b) $\frac{8\sqrt{2}q^2}{\pi\varepsilon_0 b}$

(c) $-\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 b}$ (d) $\frac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$

[CBSE 2002]

Q22

A Capacitors of capacitance C_1 has been charged up to a potential V and connected in parallel with an uncharged capacitors of capacitance C_2. The final potential difference across each capacitor will be:

(a) $\frac{C_2V}{C_1+C_2}$ (b) $\frac{C_1V}{C_1+C_2}$

(c) $\left(1+\frac{C_2}{C_1}\right)V$ (d) $\left(1-\frac{C_2}{C_1}\right)V$

Q23

The mean free path of electrons in a metal is $4\times10^{-8}m$. The electric field that can give (On an average) energy of 2eV to an electron in the metal will be:

(a) $5\times10^{11}V-m^{-1}$

(b) $8\times10^{-11}V-m^{-1}$

(c) $5\times10^{7}V-m^{-1}$

(d) $8\times10^{7}V-m^{-1}$ **[CBSE PMT 2009]**

Q24

A 30V, 90 W lamp is to be operated on a 120V DC line. For proper glow, a resistor of ___ W should be connected in series with the lamp.

(a) 40Ω (b) 10Ω

(c) 20Ω (d) 30Ω

[IPUEE 2007]

Q25

In the balanced wheatstone'sbrigde circuit shown in Fig. 1.7. When the key is pressed, what will be the change in the reading of the galvanometer?

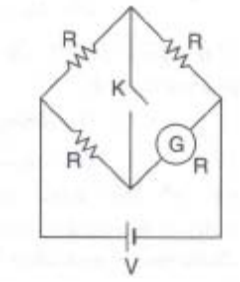


Fig. 1.7

(a) It remains the same

(b) It increases

(c) It decreases

(d) None of these

Q26

Resistances in the two gaps of a metre bridge are 10Ω and 30Ω, respectively. If the resistances are interchanged, the balance point shifts by:

(a) 33.3 cm

(b) 66.67 cm

(c) 25cm

(d) 50cm

Q27

A lead-acid battery of a car has an emf of 12V. If the internal resistance of the battery is 0.5Ω, the maximum current that can be drawn from the battery will be:

(a) 30A

(b) 20A

(c) 6A

(d) 24A

Q28

In a thermocouple, the neutral temperature is 270^0C and the temperature of inversion is 525^0C. The temperature of the cold junction would be:

(a) 30^0C

(b) 255^0C

(c) 15^0C

(d) 25^0C

Q29

Fig.1.8.shows the graph between current (I) and voltage (V). Identify the portion corresponding to negative resistance.

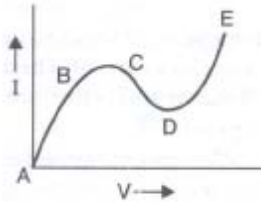


Fig. 1.8

(a) AB

(b) BC

(c) CD

(d) DE

Q30

When a wire of uniform cross-section a , length 1 and resistance R is bent into a complete circle, resistance between any two of diametrically opposite points will be:

(a) $\frac{R}{4}$

(b) 4R

(c) $\frac{R}{8}$

(d) $\frac{R}{2}$

[CBSE 2005]

Q31

Kirchhoff's First Law, i.e., Σ1=0 at a junction, deals with the conservation of:

(a) Charge

(b) Energy

(c) Momentum

(d) Angular momentum

Q32

What length of the wire (specific resistance $48 \times 10^{-8} \Omega - m$) is needed to make a resistance of 4.2Ω? The diameter of the wire is 0.4 mm.

(a) 1.1m

(b) 3.1m

(c) 2.1 m

(d) 4.1 m

Q33

A carbon resistance reads Red-Red-Black. What is its resistance?

(a) 2.2Ω

(b) 220Ω

(c) 22Ω

(d) 0.22 kΩ

Q34

The internal resistance of a cell:

(a) always acts in the cell in open circuit

(b) acts only in closed circuit it reduces the EMF

(c) acts only in closed circuit and reduces the current

(d) None of these

[DPMT 2006]

Q35

A hot electric iron has a resistance of 80W and is used on a 200V source. The electrical energy spent, if it is used for 2 hourse,is:

(a) 800 Wh

(b) 2000 Wh

(c) 1000 Wh

(d) 8000 Wh. **[VMMC 2002; DPMT 1998, 2001]**

Q36

A current I flows along the length of an infinitely long, straight and thin-walled pipe. Then , the magnetic field:

(a) at all points inside the pipe is the same but not zero

(b) at any point inside the pipe is zero

(c) is zero only on the axis of the pipe

(d) is different at different points inside the pipe **[IIT 1993]**

Q37

Two thin longparallel wires have been separated by a distance and carry current. There can be two unique cases of attraction and repulsion. Which one of the following is correct?

(a) Antiparallel currents attract and parallel currents repel

(b) Antiparallel currents repel and parallel currents attract

(c) Antiparallel and parallel currents do not affect another

(d) Need more data to predict.

Q38

A microammeter has a resistance of 100Ω and a full. Scale range of 50μ. It can be used as a voltmeter or as a higher range ammeter provided a resistance is added to it. Pick the correct range and resistance combination (s).

(a) 50 V range with 10Ω resistance in series (b) 10 V range with 200kΩ resistance in series

(c) 5 mA range with 1Ω resistance in parallel (d) 10mA range with 1Ω resistance in parallel

[IIT 1991]

Q39

A long straight wire of radius a carries a steady current I. the current is uniformly distributed across its cross-section. The ratio of the magnetic field at $\frac{a}{2}$ and 2a is:

(a) $\frac{1}{2}$

(b) 1

(c) 2

(d) $\frac{1}{4}$ **[AIEEE 2007]**

Q40

The time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of its:

(a) Speed

(b) mass

(c) charge

(d) magnetic induction **[AIEEE 2002]**

Q41

A bar magnet of magnetic moment M has been cut into two parts of equal lengths. The magnetic moment and pole strength of either part is:

(a) $\frac{M}{2}, \frac{m}{2}$

(b) $M, \frac{m}{2}$

(c) $\frac{M}{2}, m$

(d) M, m **[CBSE PMT 1997]**

Q42

Two bar magnets having same geometry with magnetic moments M and 2M are firstly placed in such a way that their similar poles are on the same side and its period of oscillation is T_1. Now the polarity of one of the magnets is reversed and its time period becomes T_1. Then,

(a) $T_1 < T_2$ (b) $T_1 > T_2$

(c) $T_1 = T_2$ (d) $T_2 = \infty$

Q43

A bar magnet having a magnetic moment of $2 \times 10^4 J - T^{-1}$ is free to rotate in a horizontal plane. A horizontal magnetic field $B = 6 \times 10^{-4} T$ exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60^0 from the field is:

(a) 12J

(b) 6J

(c) 2J

(4) 93J

Q44

If a diamagnetic substance is brought near north or South Pole of a bar magnet, it is:

(a) attracted by the poles

(b) replied by the poles

(c) repelled by the North Pole and replied by the South Pole.

(d) attracted by the North Pole and repelled by the South Pole.

Q45

According to Curie's law, the magnetic susceptibility of a substance at the absolute temperature T is proportional to:

(a) T (b) T^2

(c) $\frac{1}{T}$ (d) $\frac{1}{T^2}$

PART B: CLASS XII

CHEMISTRY

Q46

A solid has a sturucture in which W atoms are located at the corners of a cusic lattice. The orygen atoms are at the center of edges and Na atom is at the centre of the cube. The formula of this compound is :

(a) $NaWO_4$ (b) $NaWO_3$

(c) $NaWO_3$ (d) $NaWO_2$

Q47

The law stating that "the relative lowering of vapour pressure is equal to the mole fraction of a solute in the solution" is known as:

(a) Henry's Law

(b) van't Hoff's Law

(c) Raoult's Law

(d) Ostwald's Dilution Law

Q48

The excess pressure that is a applied to the solution for preventing the passage of solvent into it through a semipermeable membrance is referred to as:

(a) critical solution pressure

(b) normal pressure of the solvent

(c) osmetic pressure of the solution

(d) None of these

Q49

Which one of the following is a colligative property?

(a) Adsorption

(b) Absorption

(c) Elevation in boiling point

(d) Surface tension

Q50

Which disease involves mutation?

(a) Sickle cell anaemia

(b) Cancer

(c) Goitre

(d) Gout

Q51

What is chemotherapy?

(a) It is a branch of chemistry that deals with analegesics

(b) It is the application of organic chemistry in the field of medicine

(c) It is a set of chemicals used for curing disease and reducing pain of patients

(d) It is a new branch of biochemistry

Q52

The effect of dilution on conduction is as follows:

(a) Specific conductance increases, molar conductance decreases

(b) Specific conductance decrease, molar conductance increases

(c) Both of them increase with dilution

(d) Both of them decrease with dilution

Q53

The amount of electricity required to deposit 1 mol of aluminium from a solution of $AICI_3$ will be:

(a) 0.33 ampere

(b) 5 ampere

(c) 3 ampere

(d) 4.3 ampere **[C.E.ET.1991,A.I.IMS,1992]**

Q54

The following is not needed for the process of photosynthesis to occur

(a) Chlolophyll

(b) CO_2

(c) H_2O

(d) O_2

Q55

A current of 2.0A is passed for 5 hours through molten metal salt deposits 22.2 grams of metal (Atomic weight=177). The oxidation state of the metal in the metal salt is :

(a) +1

(b) +2

(c) +3

(d) +4

Q56

For the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$, the rate of reaction in terms of O_2 is $[O_2]/dt$. In terms of N2O5, it will be:

(a) $-d[N_2O_5]/dt$

(b)+ $d[N_2O_5]/dt$

(c) $-\frac{1}{2}\frac{d[N2O_5]}{dt}$

(d) $-2\frac{d[N2O_5]}{dt}$

Q57

For reaction $NO_2 + CO \rightarrow CO_2 + NO$, the expression is Rate = $k[NO_2]^2$

The number of molecules of CO involved in the slowest step will be:

(a) 0

(b) 1

(c) 2

(d) 3

Q58

The ionic reactions are usually very fast because:

(a) the energy of interaction between charged ions is greater than between neutral molecules.

(b) it does not involves bond breaking

(c) the number of collisions between ions per unit volume per second are very large.

(d) these reactions are highly exothermic.

Q59

In some photochemical reactions, there is a rise in the free energy because:

(a) reactions are unstable

(b) lightradration is UV

(c) light energy absorbed by reactants is converted into free energy products

(d) the reactions take place at high energy levels

Q60

In the first- order reaction,75 percent of the reaction disappeared in 1.388 h. The rate constant of the reaction is:

(a)$3.6 \times 10^{-3} s^{-1}$

(b) $2.8 \times 10^{-4} s^{-1}$

(c) $17.2 \times 10^{-3} s^{-1}$

(d) $1.8 \times 10^{-3} s^{-1}$

Q61

In the reversible reaction $2NO_2 \underset{k_2}{\overset{k_1}{\rightleftharpoons}} N_2O$ the rate of disappearance of NO_2 is equal to:

(a) $\frac{2k_1}{k_2}[NO_2]^2$

(b) $2k_1[NO_2]^2 - 2k_2[N_2O_4]$

(c) $2k_1[NO_2]2 - k2\ [N_2O_4]$

(d) $(2k_1 - k_2)\ [NO_2]$

Q62

Adsorption is a phenomenon in which the molecules of a gas:

(a) go into the body of the other substance

(b) remain close to the other substance

(c) form a thin film on the surface of a solid.

(d) None of these.

Q63

The diameter of the colloidal particle ranges between:

(a)$10^{-2} cm\ to\ 10^{-3} cm$

(b) $10^{-3} cm\ to\ 10^{-5} cm$

(c) $10^{-7} cm\ to\ 10^{-4} cm$

(d) $10^{-7} cm\ to\ 10^{-8} cm$

Q64

The protective action of different colloids can be expressed in terms of:

(a) Oxidation number

(b) Atomic number

(c) Gold number

(d) Avogadro's number

Q65

Ferric chloride is applied to stop the bleeding from a cut because:

(a) Fe^{3+} ion coagulates blood which is a negatively charged sol

(b) Fe^{3+} ion coagulates blood which is a positive charged sol

(c) Cl^{-} ion coagulates blood which is a positively charged sol

(d) Cl^{-} ion coagulates blood which is a negatively charged sol

Q66

Milk is:

(a) fat dispersed in oil

(b) fat dispersed in water

(c) water dispersed in fat

(d) water dispersed in oil

[C.P.M.T 1998]

Q67

As_2S_3 sol is:

(a) Positive colloid

(b) negative colloid

(c) neutral colloid

(d) None of these **[A.F.M.C 1992]**

Q68

In a chemical reaction, catalyst:

(a) alters the amount of the products

(b) alters the rate of reaction

(c) decreases the ΔH of the forward reaction

(d) Increases the ΔH of the forward reaction **[Pb. C.E.T.1993]**

Q69

The disease Phenylketone urea is due to the deficiency of:

(a) vitamin A

(b) carbohydrates

(c) Phenylalanine hydroxylase

(d) Lysine

Q70

Enzymes belong to the following class of compounds:

(a) Polysaccharidas

(b) Polypeptides

(c) Polynitro heterocyclic compounds

(d) Hydrocarbons

[C.E.E.T, Kurukshetra 1996]

Q71

In the nitration of benzene with a mixture of concentrated nitric acid and concentrated sulphuric acid, the active species involves is:

(a) Nitrite ion

(b) Nitrate ion

(c) Nitronium ion

(d) Nitric oxide

Q72

Refer Fig. 1.9. What is the product of this reaction?

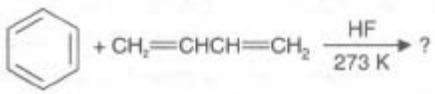
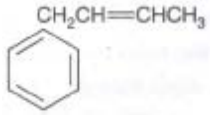
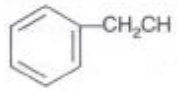


Fig. 1.9

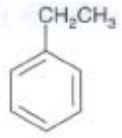
(a)



(b)



(c)



(d) none of these

Q73

Which one of the following compounds does not react with $NaNO_2$ and HCl?

(a) C6H5OH

(b) C6H5NH2

(c) (CH3)3CNO2

(d) (CH3)2CHNO2

Q74

The hydrolysis of esters with caustic alkalis is called:

(a) Esterification

(b) Ammonolysis

(c) Saponification

(d) Trans-esterofication

Q75

Carboxylic acids do not give reactions of the carbonyl group due to the:

(a) inactive effect

(b) absence of the CO group

(c) resonance effect

(d) electromeric effect

Q76

Upon heating, solution formate yields:

(a) Oxalic acid and H_2

(b) Sodium oxalate and H_2

(c) CO_2 and NaOH

(d) Sodium oxalate

Q77

Ethers are:

(a) Neutral

(b) Basic

(c) Acidic

(d) Amphoteric

Q78

Which one of the following cannot be made by using Williamson's synthesis?

(a) Methoxybenzene

(b) Benzyl-p-nitrophenyl ether

(c) Tert-butyl methyl ether

(d) Di-tert-butyl ether

Q79

The acidic strength of alcohols follows this sequence:

(a) Primary> secondary > tertiary

(b) Secondary> tertiary> primary

(c) Tertiary> secondary> primary

(d) Tertiary >primary>secondary

Q80

Phenol, when nitrated with concentrated HNO_3 in presence of concentrated H_2SO_4, forms:

(a) o- Nitrophenol

(b) m-Nitrophenol

(c) p-Nitrophenol

(d)Picric acid

Q81

Two ions X^+ and Y^- have radii 88 pm and 200 pm, respectively. In the close packed crystal of compound XY, what is the co-ordinate number of X^+?

(a) 3

(b) 6

(c) 8

(d) 4

Q82

Glycerol, upon warming with a small amount of Hydriodic acid, gets converted to:

(a) $CH_3-CHI-CH_3$

(b)$CH_2=CH-CH_2I$

(c) $ICH_2-CHI-CH_2I$

(d) $CH_3-CH=CH_2$

Q83

Glycerol is commercially prepared from:

(a) Ethylene

(b) Acetylene

(c) Propylene

(d) 1,3-Butadiene

Q84

When ethylene is heated at 723^0C in presence of chloride, it gives the following compound:

(a) Polyvinyl chloride

(b) No reaction

(c) 1, 2-Dichloropropane

(d) Ethylene chloride

Q85

Which reagent can be used for identifying the nickel ion?

(a) Reasorcinol (b) Dimethyl glyoxime

(c) Diphenylbenzidine (d) Potassium ferrocyanide

Q86

Which one of the following would exhibit coordination isomerism?

(a) $[Cr(NH_3)_6][Co(CN)_6]$ (b) $[Co(en)_2Cl2]$

(c) $[Cr(NH_3)6]Cl_3$ (d) $[Cr(en)2Cl_2]^+$

Q87

Which would exhibit ionisation isomerism?

(a) $[Co(NH_3)_4][Cr(C_2O_4)_3]$

(b) $[Co(NH_3)_5Br]_2^{+}SO_4^{2-}$

(c)$k_3[Fe(CN)_6]$

(d)$k_3[Fe(C_2O_4)_3]$

Q88

Which one of the following statements is correct?

(a) $[Cu(NH_3)_6]_2$+ is a colourless ion

(b)$[Ni(CN)_4]_2-$ ion has a tetrahedral shapes

(c)$[Zn(H_2O)_6]_2$+ ion is blue coloured

(d) Nickel dimethylglyoxime is red in colour

Q89

Which, from among the following complexes, has square pyramidal geometry?

(a) Tetracarbonyl nickel (O)

(b) Pentacarbonyliropn (O)

(c) Hexamminecobalt (II) nitrate

(d) Bis (acetylacetonate) oxovanadium (IV)

Q90

In copolymers, the repeating structure units are derived from:

(a) only one type of monomer unit

(b) two or more types of monomer unit

(c) Other polymers

(d) homopolymers

PART C: CLASS XII

BOTANY

Q91

In the parlance of the sexual reproduction of flower plants, the fusing nuclei are as follows:

(a) three polar nuclei and two male gametes

(b) three polar nuclei and one male gamete

(c) two polar nuclei and one male gamete

(d) None of these

Q92

If you have taken scion of desi mango and stock of dusserhri mango, what type of mango will be born?

(a) Dussehri

(b) Desi

(c)Hybrid

(d) None of these

Q93

The vegetative propagation in which a branch is injured, defoliated and pegged down in the ground is known as:

(a) Layering

(b) Grafting

(c) Cutting

(d) bud grafting

Q94

Grafting in sugarcane cannot be performed because:

(a) vascular bundles are scattered

(b) phloem in internal to xylem

(c)sugarcane plant is delicate

(d) it is unable to bear injury **[AFMC 1998]**

Q95

Vegetative propagation in mint occurs through:

(a) offset

(b) rhizome

(c) sucker

(d) runner **[CBSE PMT 2009]**

Q96

The egg apparatus of angiosperm comprises:

(a) an egg cell and two antipodals

(b) an egg cell and two synergids

(c) an egg cell and two polar nuclei

(d) an egg cell and the central cell **[DUMET 2010]**

Q97

The testa of a seed is produced from the:

(a) ovary wall (b) hilum

(c) outer integument of ovule (d)funicle

Q98

Anemophily occurs in:

(a) salvia

(b) vallisnaria

(c) coconut

(d) bottle brush **[CBSE 2001]**

Q99

Intraspecific incompatibility is overcome by:

(a) self-pollination (b) wetting of anthers

(c)wetting of stigmas (d) mixed pollination

[BHU 2002]

Q100

Cleistogamous flowers are:

(a) self-pollinated

(b) insect-pollinated

(c) bird-pollinated

(d) wind-pollinated **[KTET 2006]**

Q101

In angiosperms, functional megaspore develops into:

(a) endosperm

(b) pollen sac

(c) embro sac

(d) ovule **[CBSE Mains 2011]**

Q102

Crop improvement is possible through:

(a) a judicious combination of selection, introduction and hybridization

(b) selection

(c) the scientific improvement of cultivated plants

(d) introduction

Q103

In callus culture, roots can be induced through the supply of:

(a) auxin and no amount of cytokinin

(b) higher concentration of auxin and lower concentration of cytokinin

(c) higher concentration of cytokinin and lower concentration of auxin

(d) bothauxin and cytokinin in equal proportions

Q104

In tobacco callus, which one shall induce shoot differentiation in combination of auxin and cytokinin?

(a) higher concentration of auxin and lower concentration of cytokinin

(b) lower concentration of cytokinin and higher concentration of auxin

(c)Only cytokinin and no amount of auxin

(d) Only auxin and no amount of cytokinin **[DPMT 1997]**

Q105

Totipotency means:

(a) flowering in a culture medium

(b) development of fruit from a flowe in a culture

(c) development of an organ from a cell in culture medium

(d) All of these **[UPCPMT 2009]**

Q106

'Himgiri', a plant developed through hybridistion and selection for disease resistance against rust pathogens, is a variety of:

(a) chilli

(b) maize

(c) sugarcane

(d) wheat **[AIPMT (Prelims)2011]**

Q107

The term Molecular Scissors generally refers to:

(a) DNA polymerases

(b) RNA polymerases

(c) restrictionendouncleases

(d) DNA ligases

[AMU (Medical 2011) 2011]

Q108

A natural gentic engineer is :

(a) Bacillus subtilis

(b) Pseudomonas

(c) Escherichia coli

(d) Agrobacterium tumefaciens

Q109

Transgenic plants are the ones:

(a) generated by introducing foreign DNA into a cell and regenerating a plant from that cell

(b) produced after protoplast fusion in artificial medium

(c) grown in an artificial medium after hybridization in the field

(d) produced by a somatic embryo in an artificial medium. **[CBSE PMT 2009]**

Q110

Refer Fig.1.10. It is a sample of a portion of DNA strand giving the base sequence on the opposite strands. What is so special shown in it?

5'-------GAATTC'--------3'

3'-------CTTAAG-------5'

Fig.1.10

(a) Replication competed

(b) Deletion mutation

(c) start codon at the 5' end

(d) Palindromic sequence of base pairs **[AIPMT (Prelims) 2011]**

Q111

Silencing of mRNA has been used in producing transgenic plants that would be resistant to:

(a) bollworms (b) nematodes

(c) white rusts (d)bacterial blights

[AIPMT (Mains) 2011]

Q112

Restriction enzymes are used to cut:

(a) single- stranded RNA

(b) double –stranded DNA

(c) single –stranded DNA

(d)double stranded RNA **[West Bengal JEE 2011]**

Q113

c- DNA is:

(a) formed by reverse transcriptase

(b)cloned DNA

(c)circular DNA

(d)recombinant DNA **[Orissa JEE 2011]**

Q114

The enzyme extracted from the stomach of claf and used for making cheese is:

(a) lactase

(b) rennin

(c) calfine

(d) cheecin

Q115

The recombinant DNA (rDNA) technology can be used for producing quantities of biologically active form of which one of the following products in E. coli?

(a) Luteining hormone

(b) Ecdysome

(c) Rifamycin

(d)Interferon

Q116

The variable Number of Tandem Repeats (VNTRs) in the DNA molecule are highly useful in:

(a) recombinant DNA technology

(b) DNA finger printing

(c) monoclonal antibody production

(d) stem cell culture **[Karnataka CET 2006]**

Q117

What fraction of assimilated energy is used in respiration by herbivores?

(a) 20%

(b) 30%

(c) 40%

(d) 60%

Q118

Pick up the correct food chain:

(a) Grass→ Chamelion → Insect→ Bird

(b) Grass→ Fox → Rabbit → Bird

(c) Phytoplankton → Zooplankton →Fish

(d) Fallen Leaves → Bacteria →Insect → Larvae

Q119

Which one of the following is a correct food chain:

(a)Eagle →Snake → Grasshopper →Grass →Frog

(b) Frog →Snake → Eagle →Grasshopper →Grass

(c) Grasshopper →Grass →Snake →Frog → Eagle

(d) Grass → Grasshopper →Frog →Snake → Eagle

[AIIMS 1996]

Q120

Energy enters a food chain through:

(a) producers

(b) decomposers

(c) herbivores

(d) carnivores **[CPMT 2003]**

Q121

Lichen is a pioneer in the succession in:

(a) hydrosere

(b) lithosere

(c) psammosere

(d) xerosere **[BHU 2006]**

Q122

Which one of the following shows a detritus food chain:

(a) Grass → Insects → Snakes

(b)Plankton → Small fish → Large Fish

(c) Organic Waste → Bacteria→ Molluscs

(d) all of these **[DPMT 2008]**

Q123

The breakdown of detritus into small particles by enrthworm is a process , called

(a) Mineralisation

(b) Catabolism

(c) Humification

(d) Fragmentation **[CBSE Mains 2011]**

Q124

Which one is not an endangered species?

(a) Asiatic Wild Ass

(b) IdriIdri

(c) Lion-tailed Macaque

(d) Addax Antelopes **[AMU 2003]**

Q125

In the context of vital environmental issues, which habitat is carefully planned and managed for the in situ protection of fauna and flora species?

(a) Theme park (artificial)

(b) Ladakh region

(c) National Park

(d) All these are being managed **[Kerala 2005]**

Q126

An ex situ conversation method for endangered species is:

(a) National Park

(b) Cryopreservation

(c) Wildlife Sanctuary

(d) National Park, Sanctuary and Biosphere Reserve **[AIIMS 2008]**

Q127

Biodiversity of a geographic region represents:

(a) genetic diversity present in the dominant species of the region

(b) species that are endemic to the region

(c)endangered in species found in the region

(d) diversity in organisms living in the region

Q128

A biodegradable pollutant is:

(a) Mercury

(b) sewage

(c) Plastic

(d) asbestos

Q129

An indicator of water pollution is:

(a) Entamoeba histolytic

(b) Cholera vibrio

(c) Salmonella typhi

(d) Escherichia coli **[CBSE 1997, 1998, AFMO 2008]**

Q130

Photochemical smog comprises:

(a) SO2, CO2 and hydrocarbons

(b) O3, SO2 and hydrocarbons

(c) O3, PAN and NOx

(d) SO2, PAN and smoke **[AIIMS 2003, 2008]**

Q131

The following concentration level of Pb in the human blood is considered alarming:

(a) 4-6 µg per 100 ml

(b) 10 µg per 100 ml

(c) 20 µg per 100 ml

(d) 30 µg per 100 ml

[CBSE 2004]

Q132

The production of nonfunctional methemoglobin causes the blue baby syndrome. This is due to an/the:

(a) excess of arsenic in drinking water

(b) deficiency of iron in food

(c) increased methane content in atmosphere

(d) excess of nitrate in drinking water **[AIIMS 2005]**

Q133

A pollutant that produces a burning sensation in throat and eyes and generates a feeling of vomiting, is:

(a) Hydrogen sulphide

(b) sulpher dioxide

(c) Hydrogen cyanide

(d) Arsenic **[Gujarat 2007]**

Q134

The value of BOD in river waters:

(a) remains unchanged when algal bloom occurs

(b) increases when sewage gets mixed up with river waters

(c) has no relationship with concentration of oxygen in water

(d) None of these **[CBSE 2009]**

Q135

Consider the following statements about organic farming :(i) Utilizes genetically modified crops like Bt Cotton (ii) Uses only naturally produced inputs like compost (iii) Does not use pesticides and urea. (iv) Produces vegetables rich in vitamins and minerals. Which ones of these statements are correct?

(a) (ii) and (iii) only

(b) (i) and (ii)

(c) (ii),(iii) and (iv)

(d) (iii) and (iv) only. **[CBSE Mains 2011]**

PART D: CLASS XII

ZOOLOGY

Q136

The antidodies derived from a single clone of cells which recognize only one type of antigens are called:

(a) Interferons

(b) Monocotic Antigens

(c) Monoclonal cysts

(d) None of these

Q137

If a mammalian ovum fails to get fertilized, which one of the following is unlikely?

(a) Croups luteum will disintegrate

(b) Osetrogen secretion further decreases

(c) Primary follicle starts developing

(d) Progeterone secretin rapidly declines **[CBSE, PRE 2005]**

Q138

The embryo at the stage is known as:

(a) Morula

(b) Gastrula

(c) Blastula

(d) Blastomere **[BHU 2006]**

Q139

The inhibition of secretion of which one of the following hormones is necessary for the disintegration of corpus luteum?

(a) LH

(b) Progesterone

(c) LTH

(d)FSH **[Gujarat CET 2007]**

Q140

Which foetal membrane takes part in the formation of placenta in humans?

(a) HCg

(b) Uterns

(c) Chorion

(d) Any one of these

Q141

Which one of the following embryonic membrane structures is excretory in terms of function?

(a) Amnion

(b) Allantois

(c) Yolk sac

(d) Vitellinechorion **[Chhattisgarh PMT 2009]**

Q142

Menstruation is triggered by an abrupt decline in the amount of :

(a) oestrogen

(b) progesterone

(c) inhibin

(d) LH

[Orissa JEE 2009]

Q143

The signals for parturition originate from:

(a) placenta only

(b) placenta as well as fully developed foetus

(c) oxytocin released from material pituitary

(d) fully developed foetus only

Q144

Which one of the following is not a placenta genre if histology is the criterion?

(a) Haemochorial

(b) Syndesmocorial

(c) Yolk sac

(d) Endothelichorial

Q145

Column I contains terms and Column II contains definitions. Match them correctly and choose the right answer.

Column I	**Column II**
A. Parturition	1. Attachment of zygote to endometrium
B. Gestation	2. Release of egg from Graafian follicle
C. Ovulation	3. Delivery of baby from uterus
D. Implantation	4.Duration between pregnancy and birth
E. Conception	5. Formation of zygote by fusion of the egg and sperm
	6. Stoppage of ovulation and menstruation

(a) A-2, B-4, C-1, D-5, E-3

(b) A-4, B-3, C-1, D-5, E-2

(c) A-5, B-1, C-2, D-3, E-4

(d) A-3, B-4, C-2, D-1, E-5 **[Karnataka CET 2011]**

Q146

The main function of the fimbriae of the Fallopian tube in females is:

(a) the release of the ovum from the Graafian follicle

(b) making necessary changes in the endometrium for implantation

(c) helping in the development of corpus luteum

(d) helping in the collection of the ovum after ovulation **[Kerala PMT 2011]**

Q147

The following animal is the slowest breeder:

(a) Cod fish (b) Elephant

(c) Rabbit (d) Man

Q148

If the rate of addition of new members increases with respect to the individual host of the same population, in a graph obtained shows:

(a) declined growth

(b)exponential growth

(c) zero population growth

(d) None of these

Q149

What is correct about a test tube baby?

(a) Fertilization inside female genital tract and growth in test tube

(b) Rearing of prematurely born baby in incubator

(c) Fertilization outside and gestation inside womb of mother

(d) Both fertilization and development are effected outside the female genital tract

Q150

The first case of IVF-ET technique success was reported by:

(a) Bayliss and starling Taylor

(b) Roberts Steptoe and Gilbert Brown

(c) Louis Joy Brown and Banting Best

(d) Patrick Steptoe and Robert Edwards

Q151

Consider the statements given below regarding contraception and answer as directed thereafter:

(I) Medical Termination of pregnancy (MTP) during first trimester is generally safe

(II) Generally chances of conception are nil until mother breast –feeds the infant up-to two years

(III) Intrauterine devices lie copper-T are effective contraceptives

(IV) Contraception pills may be taken up-to one week after coitus to prevent conception.

Which ones of the two aforementioned statements are correct?

(a) III, IV (b) I, III (c) I, II (d) II, III

Q152

Amniocentesis is a process for:
(a) identifying any disease of the heart

(b) identifying any hereditary disease of the embryo

(c) learing about the disease of brain

(d) growing cell in a culture medium

Q153

A logistic growth curve depicting a population that is limited by a definite carrying capacity is shaped like the letter:

(a) J

(b) L

(c) M

(d) S **[DUMET 2010]**

Q154

The logistic population growth is expressed by the equation:

(a) $dt/dN = Nr\left(\frac{K-N}{K}\right)$

(b) $dN/dt = rN\left(\frac{K-N}{K}\right)$

(c) $dN/dt = rN$

(d) $dN/dt = rN\left(\frac{N-K}{N}\right)$ **[AIPMT (Mains) 2011]**

Q155

Some organisms produce more numbers of offspring and some others produce less number of offspring.

This phenomenon is called:

(a) Selective reproduction

(b) Differential Reproduction

(c) Rapid Multiplication

(d) Differential Selection

Q156

How many autosomes occur in the liver cells of a woman?

(a) 12

(b) 22

(c) 30

(d) 26

Q157

Meiosis in AaBb will produce the following gametes:

(a)Aa, Bb

(b)Aa, bb

(c)AB, ab

(d) AB, aB, Ab, ab **[BHU 2001]**

Q158

How many types of gamete are found in F_1 progeny of cross AA BB CC and aa bb cc:

(a) 3

(b) 8

(c) 27

(d) 68 **[AIIMS 2004]**

Q159

Test cross is the crossing between:

(a) Genotype with a dominant trait

(b) Genotype with a recessive trait

(c) F_1 hybrid with double recessive

(d) Two F_1 hybrids

Q160

Which condition describes the sex correctly:

(a) XO condition as in Turner's syndrome determines the female sex

(b) XX sex chromosomes produce male in drosophila birds

(c) ZZ sex chromosomes determine female sex in birds

(d) XO sex chromosomes determine male sex in Grasshopper **[CBSE 2011]**

Q161

Human blood grouping is called ABO instead of ABC because O signifies:

(a) No antigen

(b) Overdominance

(c) One antibody

(d) Other antigen **[CBSE 2009]**

Q162

Okazaki fragments are:

(a) RNA primers

(b) Short DNA fragments on leading strand

(c) Short DNA fragments on lagging strand

(d) DNA fragments from dimerization

(e) DNA fragments form from radiation action **[Kerala 2001]**

Q163

DNA molecules has small units called:

(a) purines

(b) adenine and thymine

(c) cistron, muton and recon

(d) adenine

[BHU 2002]

Q164

During transcription, RNA polymerase holoenzyme binds to gene promoter and assumes a saddle-like structure. The DNA binding sequence is:

(a) AATT

(b) TTAA

(c) TATA

(d) CACC

Q165

What is Antisense therapy?

(a) RNA polymerase production DNA

(b) A cell displaying foreign antigen

(c) Production of somaclonal variations

(d)An RNA complementary in sequence is used to stop expression of a specific gene.

[CBSE 2008]

Q166

DNA synthesis during the course of replication is:

(a) discontinuous

(b) continuous

(c) semi-discontinuous

(d) None of these **[MPPMT 2010]**

Q167

Darwin's finches are an excellent example of:

(a) seasonal migration

(b) brood parasitism

(c) connecting links

(d) adaptive radiation

[CBSE 2008]

Q168

Miller and Urey performed an experiment to prove the origin of life. They took the following gases:

(a) methane, ethane, ammonia, water vapour

(b) methane, ammonia, hydrogen, water vapour

(c) methane, ethane, hydrogen, ammonia

(d) ammonia, water vapour, butane, hydrogen **[UP CPMT 2009]**

Q169

The major cause behind the evolution of genes and protein is:

(a) point mutation

(b)chromosomal aberration

(c) sexual reproduction

(d) gene duplication and divergence **[DUMET 2009]**

Q170

Wine and beer are produced directly by fermentation. Brandy and whisky require both fermentation and distillation because:

(a) fermentation is inhibited at an alcohol level of 10-180%

(b) distillation prolongs storage

(c) distillation improves quality

(d) distillation purifies the beverage

Q171

Azolla is used as biofertilizer as it has:

(a) rhizobium

(b) cyanobacteria

(c) mycorrhiza

(d) large quantity of humans

Q172

Which one of the following is a correct statement?

(a) the term 'Bt' in "Bt-cotton" indicates that it is a genetically modified organism produced through biotechnology

(b) somatic hybridization involves the fusion of two complete plant cells carrying desired genes

(c) The anticoagulant Hirudin is produced from transgenic Brassica napes seeds

(d) "Flavrsavr", a variety of tomato has enhanced the production of ethylene which improves its taste

[AIIMS 2005]

Q173

In the root modules of Alnus, the process of nitrogen fixation is done by:

(a) clostridium

(b) azorhizobium

(c) bradyrhizobium

(d) frankia **[CBSE 2008]**

Q174

A free-living nitrogen nitrogen fixing cyanobacterium which can also form symbiotic association with aquatic fern Azolla is:

(a) Nostoc

(b) Anabaena

(c) Chlorella

(d) Tolypothrix

Q175

The sewage treatment process in which part of decomposer microbes is recycled into the starting process is:

(a) primary treatment

(b) activated sludge treatment

(c) catalytic treatment

(d) tertiary treatment **[DPMT 2009]**

Q176

Nowadays, the term'gene' is being replaced by a new term. What is the name of the new term?

(a) Polypeptide Chain

(b) r-RNA

(c) Cistron

(d) Hereditary Mass **[AMU 2009]**

Q177

The product of which one of the following organisms has been commercialised as an agent for lowering blood cholesterol?

(a) Trichodermapolysporum

(b) MonascusPurpureus

(c) Saccharomyces cerevisiae

(d) Aspergillusniger **[AMU 2009]**

Q178

A prominent example of endomycorrhiza is:

(a) Glomus

(b) Agaricus

(c) Nostoc

(d) Rhizobium **[CBSE Mains 2010]**

Q179

Which Transfer RNA constitutes nearly _____ of the total RNA:

(a) 8 percent

(b) 32 percent

(c) 40 percent

(d) 15 percent

Q180

Which one of the following has been wrongly matched:

(a) Clostridium butylicum – Lactic acid

(b) Aspergillushiner- Citric acid

(c) Yeast- Statins

(d) Acetobacteraceti- Acetic acid **[CBSE Mains 2011]**

Answers and Explanations

PART A: PHYSICS

Sol.1 (b) for equilibrium, charge q must be negative. Refer **Fig.1.11**

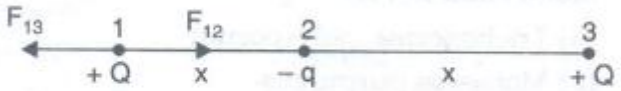


Fig. 1.11

Considering the equilibrium of charge 1,

$$F_{13} = F_{12}$$

$$\frac{kQ \times Q}{(2x)^2} = \frac{kQ \times 1}{x^2}$$

Or, $$q = \frac{Q}{4}$$

The right option is (b).

Sol. 2 (b)

The surface charge densities on the outer surfaces of the shells will be equal if the charges on the shells are proportional to the squares of their radii. Hence, the charge distribution will be as shown in **Fig.1.12**

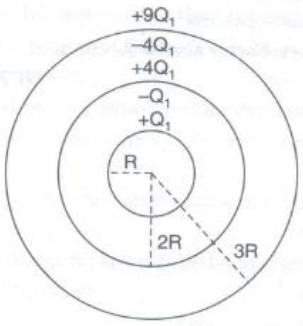


Fig. 1.12

$\therefore\ Q_2 = 4Q_1 - Q_1 = 3Q_1$

$Q_3 = 9Q_1 - 4Q_1 = 5Q_1$

$Q_1 : Q_2 : Q_3 = 1 : 3 : 5$

The right option is (b).

Sol. 3 (a) and (c) Refer Fig. 1.13

Let OP=z_0

Thus, the electric field at P is:

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Qz_0}{(R^2 + z_0^2)^{3/2}}$$

This field acts away from O.

The force on charge –q placed at point P is:

$$F = -\frac{1}{4\pi\varepsilon_0}\frac{Qqz_0}{(R^2 + z_0^2)^{3/2}}$$

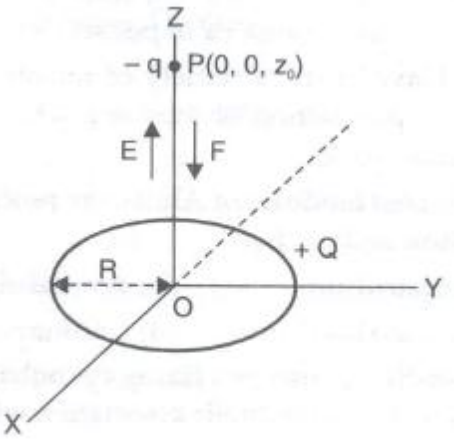


Fig. 1.13

This force acts towards the centre O.

So, the motion of the negatively charged particle is periodic in nature

For $z_0 \ll R, F\alpha z_0$

The motion of the particle P will be approximately simple harmonic.

The right options are (a) and (c).

Sol. 4 (a)

For the stationary oil drop, Force due to electric field = Weight of the oil drop

$qE = mg$

Or $q = \frac{mg}{E}$

$= \frac{9.9\times10^{-15}}{3\times10^{4}}$

$= 3.3 \times 10^{-18}$C.

The right option is (a).

Sol.5 (a)

At the centre of the square frame, E = a and V = a constant positive value. The charge -q held above the frame will be attracted towards the centre O. As it crosses O, a force begins to act on it in the upward direction. The charge -q begins to oscillate about 0 along the Z-axis.

The right option is (a).

Sol. 6 (c)

$E = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$

$= \frac{\sigma}{\varepsilon_0} V - m^{-1}$

The right option is (c).

Sol. 7 (c)

Inside a hollow conducing charged sphere, the electric field is zero.

The right option is (c).

Sol.8 (d)

$F_{liq} = \frac{F_{air}}{k} = \frac{F}{2}$

The right option is (d).

Sol.9 (b)

$$F = ma = Eq \; or \; a = \frac{Eq}{m}$$

$$v = u + at = 0 + \frac{Eq}{m}.t$$

$$K.E = \frac{1}{2}mv^2 = \frac{1}{2}m\,\frac{E^2q^2t^2}{m^2} = \frac{E^2q^2t}{m}$$

The right option is (b).

Sol. 10(d)

Electric field lines may not always from closed loops.

The right option is (d).

Sol. 11 (a)

Gauss's law is valid for any closed surface.

The right option is (a).

Sol.12 (c)

$$\Delta U = U_1 - U_2$$

$$= \frac{1}{2}(V_1^2 + V_2^2) - \frac{1}{2}(2C)\left(\frac{V_1 + V_2}{2}\right)^2$$

$$= \frac{1}{4}C(V_1 - V_2)^2$$

The right option is (c).

Sol.13. (a)

When switch S is closed, there is no transfer of charge from capacitor A to capacitor B because the charge -q of A is held by its charge +q.

The right option is (a).

Sol.14. (c)

Refer Fig. 1.14.

Electric field at

$$E = \frac{2q}{3} \times \frac{1}{4\pi\varepsilon_0 R^2}$$

$$= \frac{q}{6\pi\varepsilon_0 R^2}$$

Option *(a)* is wrong.

Potential energy of system,

$$U = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{3}\times\frac{q}{3}\times\frac{1}{2R} + \frac{q}{3}\times\left(-\frac{2q}{3}\times\frac{1}{BC}\right) + \left(-\frac{2q}{3}\right)\times\frac{q}{3}\times\frac{1}{AC}\right]$$

$AC = 2Rcos\ 60^0 = R$

BC = 2 R sin 60° = $\sqrt{3}R$

$$U = \frac{1}{4\pi\varepsilon_0}\left[\frac{q^2}{12R} - \frac{2q^2}{93\sqrt{R}} - \frac{2q^2}{9R}\right] \neq 0$$

Option *(b)* is wrong.

Electric force between the charges at *B* and C:

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q}{3}\times\frac{2q}{3(2Rsin\ 60^0)^2} = \frac{q}{54\pi\varepsilon_0 R^2}$$

Option (c) is correct.

Potential at point 0:

$$V = \frac{1}{4\pi\varepsilon_0}\left[\frac{q}{3R} + \frac{q}{3R} - \frac{2q}{3R}\right]$$

Choice (d) is wrong.

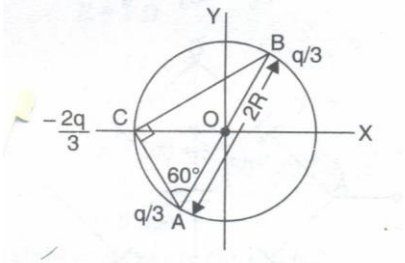


Fig. 1.14

The right option is (c).

Sol.15 (a)

Electric field is always perpendicular to the equipotential surface at any point.

The right option is (a).

Sol.16 (d)

Potential is same at every point of the conducting sphere.

$\therefore V_A = V_B = V_C$

The right option is (d).

Sol.17 (b)

Three 15 JlF capacitors on the left are connected in series. Their equivalent capacitance C' is given by

$$\frac{1}{C'} = \frac{1}{15} + \frac{1}{15} + \frac{1}{15} = \frac{1}{15}$$

Or $C' = 5\mu F$

Now C' is in parallel with fourth $15\mu F$ capacitor

$\therefore C_{eq} = C' + 15 = 5 + 15 = 20\mu F$

The right option is (b).

Sol.18 (b)

Initial energy stored in one capacitor:

$$U = \frac{q^2}{2C}$$

When the battery is disconnected, charge q remains the same i.e., q = constant. The capacitors form a parallel combination.

$C_{eq} = C + C = 2C$

Final energy stored by the combination.

$$U' = \frac{q^2}{2C_{eq}} = \frac{q^2}{2 \times 2C} = \frac{1}{2}U$$

The right option is (b).

Sol.19 (a)

Planes perpendicular to X-direction i.e., planes parallel to YZ-plane will be the equipotential surfaces.

The right option is (b).

Sol.20 (b)

Refer Fig. 1.15.

$$\frac{C_1}{C_5} = \frac{C_4}{C_3} = \frac{4}{4}$$

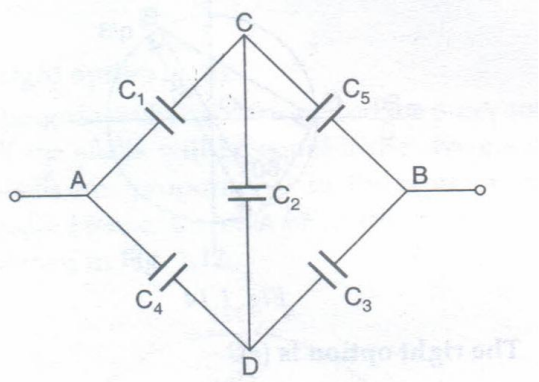


Fig. 1.15

The Wheatstone bridge is balanced, so C2 is of no use.

$$C_{ACB} = \frac{C_1 \times C_5}{C_1 + C_3} = \frac{4 \times 4}{4 + 4} = 2\mu F$$

$$C_{ADB} = \frac{C_3 \times C_4}{C_3 + C_5} = \frac{4 \times 4}{4 + 4} = 2\mu F$$

$$C_{AB} = C_{ACB} + C_{ADB} = 2 + 2 = 4\mu F$$

The right option is (b).

Sol.21(c)

Half diagonal of the tube:

$$r = \frac{\sqrt{b^2 + b^2 + b^2}}{2} = \frac{3\sqrt{b}}{2}$$

P.E.of the charge $+q$ at the centre due to eight charges (each = *-q)* at the comers of the cube is

$$U = 8 \times \frac{1}{4\pi\varepsilon_0} \frac{q \times (-q)}{r}$$

$$= -8 \times \frac{1}{4\pi\varepsilon_0} \frac{q^2}{\frac{\sqrt{3b}}{2}} = -\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 b}$$

The right option is (c).

Sol.22 (b)

The common potential difference across the parallel combination of two capacitors:

$$V' = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$$

But $V_1 = V, V_2 = 0$

$\therefore$ $V' = \frac{C_1V}{C_1+C_2}$

The right option is (b).

Sol.23 (c)

$$E = \frac{V}{d}$$

$$= \frac{2}{4 \times 10^{-8}}$$

$$= 0.5 \times 10^8 = 5 \times 10^7 V - m^{-1}$$

The right option is (c).

Sol.24 (d)

Resistance of the lamp is given by:

$$R = \frac{V^2}{P} = \frac{30 \times 30}{90}$$

Safe current through the lamp:

$$I = \frac{V}{R} = \frac{30}{10} = 3A$$

When the lamp is operated on the 120 V line, the current should not exceed 3 A. Then,

$$R' = \frac{V'}{I} = \frac{120}{3} = 40\Omega$$

Required resistance to be put in series

$$= R' - R = 40 - 10 = 30\Omega$$

The right option is (d).

Sol.25 (a)

This Wheatstone bridge is balanced. So, the pressing of key K makes no effect. The reading of the galvanometer G will remain the same.

The right option is (a).

Sol. 26 (d)

Case I: $\frac{R}{S} = \frac{l}{100-l} = \frac{10}{30}$

$\therefore$l=25cm

Case II: $\frac{S}{R} = \frac{l'}{100-l'} = \frac{30}{10}$

$\therefore l' = 75cm$

Shift-in the balance point:

$$= l' - l - 75 - 25 - 50cm$$

The right option is (d).

Sol.27 (d)

$I_{max} = \frac{\varepsilon}{r} = \frac{12}{0.5} = 24A$ **The right option is (d).**

Sol.28 (c)

$$T_n = \frac{T_i + T_c}{2}$$

$$\therefore \quad T_c = 2T_n - T$$

$$= 2 \times 270 - 525$$

$=15^0$C

The right option is (e).

Sol.29 (c)

In the portion CD, the current I decreases with the increase in voltage V. So, this portion corresponds to negative resistance.

The right option is €.

Sol.30 (a)

The semicircular parts, each one having resistance R, form a parallel combination.

$$\therefore \quad R_{eq} = \frac{\frac{R}{2} \times \frac{R}{2}}{\frac{R}{2} + \frac{R}{2}} = \frac{R}{4}$$

The right option is (a).

Sol.31 (a)

Kirchhoff's first law deals with the conservation of charge.

The right option is (a).

Sol.32 (a)

$$I = \frac{RA}{\rho} = \frac{R \times \pi D^2}{4\rho}$$

$$= \frac{4.2 \times 22 \times (0.4 \times 10^{-3})2}{7 \times 4 \times 48 \times 10^{-8}} = 1.1m$$

The right option is (a).

Sol. 33 (c)

$$\underset{\downarrow}{Red}\ \underset{\downarrow}{Red}\ \underset{\downarrow}{Black}$$
$$2 \quad 2 \quad 2$$

$R = 22 \times 10^0 = 22\Omega$ **The right option is (e).**

Sol.34 (c)

The internal resistance of a cell acts only in a closed circuit and it reduces the current.

The right option is (e).

Sol.35 (c)

$$H = \frac{V^2 t}{R} = \frac{200 \times 200 \times 2 \times 60 \times 60}{80} J$$

$$= \frac{200 \times 200 \times 2 \times 60 \times 60}{80 \times 3600} \text{ Wh}$$

=1000Wh.

The right option is (e).

Sol. 36 (b)

Take any point *P* inside the thin walled pipe. Consider a circular loop through this point and apply Ampere's circuital law. As net current inside the loop is zero, the magnetic field at any point inside the loop will be zero.

$$\oint \vec{B}.\vec{dl} = \mu_0 I = \mu_0 \times 0 = 0$$

The right option is (b).

Sol.37 (b)

Antiparallel currents repel and parallel currents attract. All other options are not correct.

The right option is (b).

Sol.38 (b) and *(c)*

For $S = 200\Omega$

$V = I_g(G + S)$

$= 50 \times 10^{-6}(100 + 200000) = 10V$

For R=1Ω

$$I = \left(\frac{G+S}{S}\right) I_g$$

$$= \left(\frac{100+1}{1}\right) 50 \times 10^{-6} \text{A}$$

The right options are (b) and (e).

Sol.39 (b)

$1B_1 = \frac{\mu_0 I}{2\pi a^2}.\frac{q}{2}$ and $B_2 = \frac{\mu_0 I}{2\pi(2a)}$

$\therefore \quad \frac{B_1}{B_2} = 1$

The right option is (b).

Sol.40 (a)

T is Andependent of speed v.

The right option is (a).

Sol.41 (c)

When a bar magnet is cut into two parts of equal lengths, pole strength of each part is same as that of original magnet' but magnetic moment is halved because length has been halved.

The right option is (e).

Sol.42 (a)

In the sum position, we have:

$$T_1 = 2\pi\sqrt{\frac{I_1 + I_2}{(M_1 + M_{2)B_H}}}$$

$$= 2\pi\sqrt{\frac{I + I}{M + 2M}}$$

$$= 2\pi\sqrt{\frac{2I}{3M}}$$

In the difference position, we have:

$$T_1 = 2\pi\sqrt{\frac{I_1 + I_2}{(M_1 - M_{2)B_H}}}$$

$$= 2\pi\sqrt{\frac{I + I}{2M - M}}$$

$$= 2\pi\sqrt{\frac{2I}{M}}$$

$\therefore \quad \frac{T_1}{T_2} = \frac{1}{\sqrt{3}} < 1$

Hence, we conclude that *T1* < *T2*·

The right option is (a).

Sol.43 (b)

$W = mB(cos\ \theta_1 - cos\theta_2)$

$= 2 \times 10^4 \times 6 \times 10^{-4}(\cos 0^0 - \cos 60^0)$

= 6 J

The right option is (b).

Sol. 44 (b)

A diamagnetic substance is feebly repelled by a magnet.

The right option is (b).

Sol.45 (c)

According to Curie's law,$x_m\, \alpha\, \frac{1}{T}$

The right option is (c).

PART B: CHEMISTRY

Sol.46(c)

The right formula of the compound is $NaWO_3$·

The right option is (c).

Sol.47(c)

Raoult's law states that the relative lowering of vapour pressure equals the mole fraction of a solute in a solution. Thus, we have:

$p_A = x_A \times p_A^0$

where

p_A= partial pressure of *A* in the solution

p_A^0 = partial pressure of *A* in the pure state

and x_A = mole fraction of *A* in the given solution **Thus, the right option is (c).**

Sol.48 (c)

Osmatic pressure can be defined as the equilibrium hydrostatic pressure of the column set up as a result of osmosis. The concept has been visualized in a sketch form in **Fig. 1.16.**

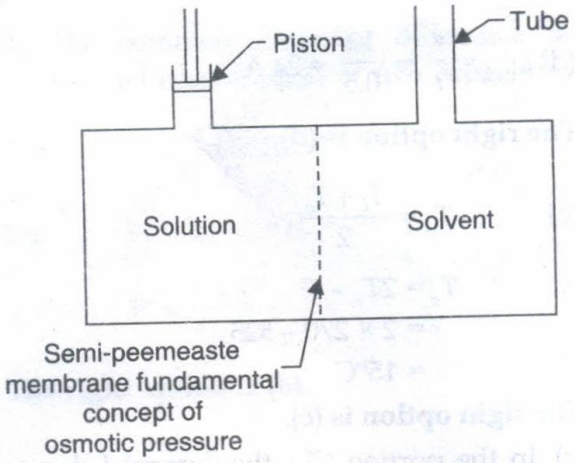


Fig. 1.16: Fundamental concept of osmotic pressure

The right option is (c).

Sol.49 (c)

The elevation in boiling point is essentially a colligative property. The list of colligative properties is as follows (in the context of solutions):

(i) Relative lowering of vapour pressure

(ii) Osmotic pressure.

(iii) Elevation in boiling point

(iv) Depression in freezing point.

Note that colligative properties depend only upon the number of particles of solute (molecules or ions) in a definite amount of solvent. They do not depend upon the nature of solute. Adsorption, absorption and surface tension are not colligative properties.

Hence, the right choice is (c).

Sol. 50 (b)

Sickle cell anaemia is a hereditary disease. Patients suffering from this disease experience physical exertion, heart murmuring and short breaths. This disease occurs due to a defective haemoglobin molecule in which one of the glutamic acid residues is replaced by valine.

Mutations occur in the case of cancer. When a carcinogen enters the human body, it is transformed into water-soluble chemical, Oihydroxy epoxide. It combines with purine bases like guanine and adenine present in DNA and RNA (in the human cell). Dihydroxy epoxide is a large hydrocarbon molecule. Its association with adenine or guanine prevents it from sticking to the double helix of 0 A. This damage triggers the process of mutation. The mutation, in turn, leads to cancer.

Goitre is the disease of the thyroid gland. It occurs due to the deficiency of iodine. Due to the lack of iodine, the thyroid gland gets enlarged so that it may extract iodine from blood to a large extent. Gout is a disease of the joints and urinary tract. It is caused by the deposition of Sodium urate in soft tissues, especially in or around joints. It leads to severe pain in joints. For the benefit of students, we are listing the disease types in **Fig. 1.17**. The topic covered is *Chemistry in Everyday Life*.

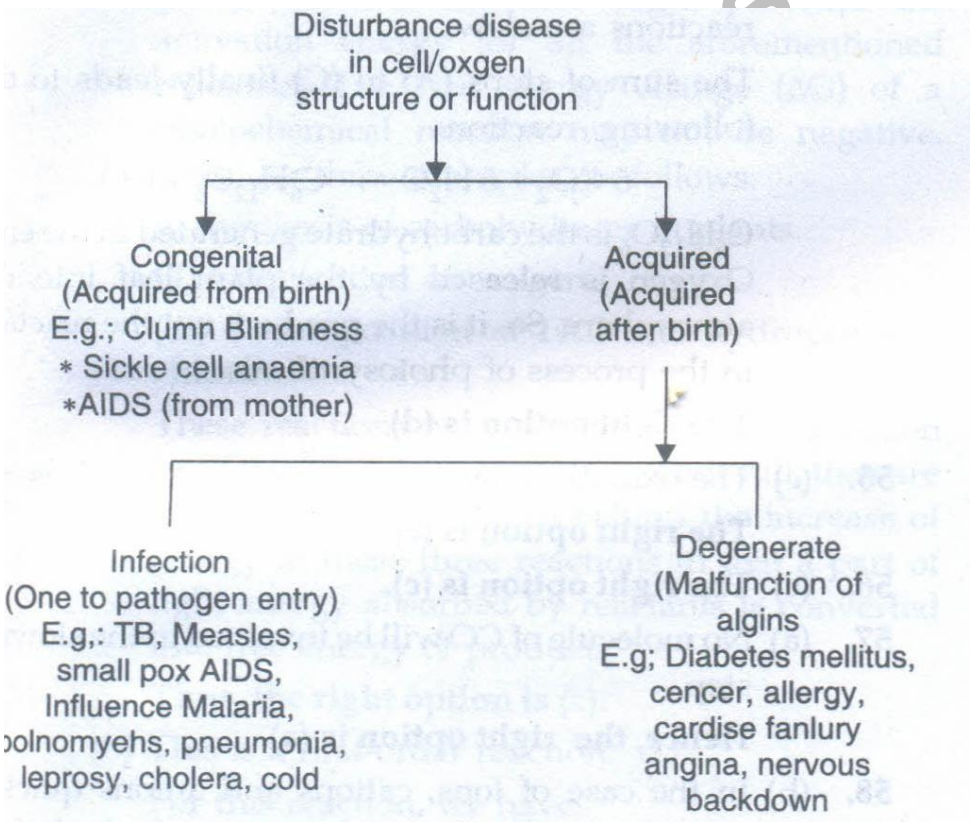


Fig. 1.17

The right option is (b).

(c) The branch of science that deals with the treatment of diseases using suitable chemical substances is called Chemotherapy. These chemical substances, called Drugs, are used for curing diseases and reducing the agony of patients. The elementary classification of drugs is as follows:

(A) **Antipyretics:** They are used for bringing down body temperature during high fever. E.g. paracetamole (4-Acetamidophenol), Phenacetin (p-Etoxyacetanilide), Aspirin (Acetysalicyclic acid), Analgin, novelgin, etc.

(B) **Antimalarials:** They are used for bringing down body temperature during the course of malaria fever. E.g.: Quinine (an alkaloid) is a natural drug. Synthetic drugs are-paraquine, prime quine and chloroquine.

(C) **Analgesics:** They kill pain in short durations to r sduce the suffering of patient. They have two sul types. The first subtype is Narcotics. They induce sleep. Most of them are opium products. Morphine acetate (Heroin) is used as an analgesic in operation theatres. These alkaloids are habitforming. The second subtype is **Non-narcotics.** The most important among them is Butazolidine.

(D) **Antiseptics and Disinfectants:** They prevent the growth of micro-organisms and .kill them. The examples of antiseptics are Dettol (which is a mixture of Chloroxylenol and Terpinol), Savlon, breath purifiers (in either spray form or liquid form), face powders, talc for removing itching (like Nycil), etc. Disinfectants kill micro-organisms but ought not to be applied on live tissues. Examples include Lyzol, Phenyl, Harpik, etc.

Refer **Fig. 1.18.** It shows Bithional, a popular antiseptic.

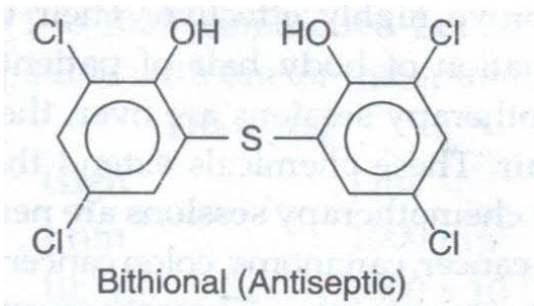


Fig. 1.18: Bithional (antiseptic)

The tincture of iodine (2-3 percent solution of iodine in water) is a good antiseptic. Further, iodoform (CHI_3) produces iodine when applied to skin; it is an antiseptic .

(E) **Tranquillizers:** They act on the central nervous system and reduce anxiety. Examples include Barbituric acid, Luminal, Seconal, Reserpine, etc.

(F) **Antibiotics:** They are produced from bacteria, fungi and moulds. They kill the micro-organisms that cause infection.

Examples: Penicillin, Amoxicillin, Ampicillin, Chloromycetin, Norflox TZ (brand name of antibiotic for remving stomach infection), Ofloxacin, Ornidazole, etc. Infection can be caused by gram positive or gram negative bacteria. The antibiotics used for treating the infection produced by these two bacteria genres are different. Broad-spectrum antibiotics kill a complete range of micro-organisms. Examples include tetracycline, Chlaro amphanicol and mixtures of antibiotics. For example; Novaclox LB is a mixture of two antibiotics and lactic acid bacillus has also been added to it. Antibiotic combinations are more effective for curing stomach and throat infection.

(g) **Sulpha Drugs:** They are the derivatives of sulphanilamide. Refer **Fig. 1.19.**

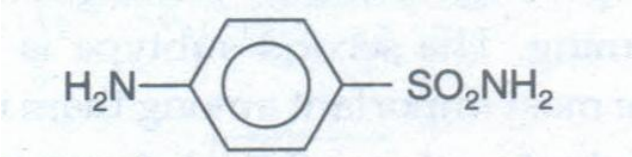


Fig. 1.19: Sulphanilamide (p-Aminobenzene sulphonamide)

Examples of these drugs are Sulphadiazine, Sulphapyridine, Sulpha guanidine and Sulphanilamide.

(H) **Chemotherapy Drugs for the Treatment of Cancer:** Nawadays, Chemotherapy refers to the drug and treatment regime used for treating and curing the patients of cancer. A host of synthetic drugs have been developed in the top laboratories of the world. These chemicals are prepared carefully, are costly and prove highly effective. Their use leads to the elimination of body hair of patient. But when the chemotherapy sessions are over, the patient regains his hair. These cherriicals extend the life of patient. Many chemotherapy ses-iionsare needed for treating blood cancer,carcinoma, coloncancer, stomach cancer, breast cancer, etc. Chemotherapy is safer than radiation therapy. A combination of chemotherapy, radiation therapy and surgery may be employed to save the patient or to extend his life by five to seven years.

The right option is (c)

Sol.52 (b)

When a solution is diluted, its specific conduction comes down but its molar conductance rises.

The right option is (b).

Sol.53 (c)

The amount of electricity needed to deposit 1mol of Al from a solution of AICl3is 3A.

The right option is (c).

Sol.54 (d)

The process of photosynthesis occurs through the following steps:

(A) Chlorophyll absorbs a photon or red light and becomes exited

$$\text{Chl} \xrightarrow[E=h\nu]{Photon} \text{Chl}^*$$

(B) In a few picoseconds, after absorbing light, the excited chlorophyll molecule loses an electron either to CO_2or to $H2_O$. Here, A represents CO_2 or H_2O. A is an electron acceptor in this reaction.

$$Chl^* + A \rightarrow Chl^+ + A^-$$

(C) Nearly 150 picoseconds later, the electron acceptor transfers an electron to another molecule After a few milliseconds, that molecule transfers the electron to yet another molecule. This chain of reactions release energy. All molecules act as electron acceptors

$$A + B \rightarrow A + B^-$$

$$B^- + C \rightarrow B + C^- + E$$

This energy produces the energy-rich molecules of CO_2, Many other reactions occur in a jffy. Some reactions are slow. The sum of steps (A) to (C) finally leads to the following reaction:

$6CO_2 + 6H_2O \rightarrow C6H_{12}O_6 + 6O_2$

$C_6H_{12}O_6$ is the carbohydrate generated in the end. Oxygen is released by the plant leaf into the atmosphere. So, it is the product, not the reactant in the process of photosynthesis.

The right option is (d).

Sol.55 (c)

The oxidation state of the metal in the salt is +3.

The right option is (c).

Sol.56 (c) The right option is (c).

Sol.57 (a)

No molecule of CO will be involved in the slowest step.

Hence, the right option is (a).

Sol58 (b)

In the case of ions, cations and anions quickly take part in the chemical reaction of which they are a part. The ionic reactions are thus quick and, at times, highly volatile. If reactants are already in an ionic state, the reaction is completed almost instantaneously when the reactants are mixed for effecting the reaction. Bonds are not to be broken which is the case with most reactions sans ions. Thus, ionic reactions give quick results because bonds are not to be broken and cations as well as anions are quick enough to form compounds (because they want to become stable).

The right option is (b).

Sol.59 (c)

Photochemical reactions take place in the presence of light or some other radiation. Read this reaction:

$$H_2(g) + Cl_2(g) \xrightarrow{h\nu} 2HCl(g)$$

This is the reaction of photosynthesis of HCl.

Read this reaction:

$$O_2 \xrightarrow{h\nu} O + O$$
$$O + O_2 \rightarrow O_3$$
$$O_3 \xrightarrow{\nu} O_2 + O + \Delta$$

This is the reaction of formation and break-up of ozone, a gas in the upper part of stratosphere. It takes place at a height of 11-50 km from the earth's surface.

Read this reaction now:

$$6CO_2 + 6H_2O \xrightarrow{h\nu} C_6H_{12}O_6 + 6O_2$$

This is the reaction of the photosynthesis of carbohydrades in plants. Chlorophyll acts as a catalyst in this reaction. Light provides the activation energy for all the aforementioned reactions. The free energy change (ΔG) of a photochemical reaction may not be negative. Consider three examples, as follows:

(i) Synthesis of carbohydrates in plants.

(ii) Ozonization of oxygen.

(iii) Decomposition of HCI into hydrogen and chlorine.

These reactions were discussed in this question itself. In these three cases $\Delta G > 0$ but still, they are spontaneous. The reason behind the increase of energy in these three reactions in that a part of light energy absorbed by reactants is converted into free energy of products.

Thus, the right option is (c).

Sol.60 (b)

This is a first-order reaction. For this reaction, we have:

$$k = \frac{2.303}{t}\log\frac{a}{a-x}$$

Here, $x = \frac{75}{100}a = 0.75a$

t =1.3884

= 1.388 ×3600

=4996.8 second

$$\Rightarrow \quad k = \frac{2.303}{t}\log\frac{a}{a-x}$$

$$=\frac{2.303}{4996.8}\log\frac{a}{a-0.75a}$$

$$=\frac{2.303}{4996.8}\log\frac{a}{0.25a}$$

$$=\frac{2.303}{4996.8}\log\left(\frac{1}{0.25}\right)$$

$$=\frac{2.303}{4996.8}0.6021$$

= 0.0002775

= 2.775 ×$10^{-4}s^{-1}$

= 2.8 ×$10^{-4}s^{-1}$

The right option is (b).

Sol. 61 (c)

The right option is (c).

Sol.62 (c)

In the process of adsorption, the molecules of a gas form a thin film on the surface of solid. Adsorption is the adhesion of atoms, ions or molecules from a gas, liquid or dissolved solid on to a surface. This process creates a film of adsorbate on the surface of the adsorbent. This process differs from absorption in which a fluid (absorbate) permeates or is dissolved by a liquid or solid (the absorbent). Beclear that adsorption is a surface-based process. On the contrary, absorption involves the entire volume of the materia!' Adsorption is a surface phenomenon. The term Sorption encompasses both processes while Desorption is the *reverse* of Adsorption.

The right option is (c).

Sol. 63 (c)

The diameter of a colloidal-sized particle ranges from 1 to 1000 nanometres. Let us try to make it compatible with one of the options given to us

	Diameter	
	High	**Low**
	1 nm	1000nm
⇒	10^{-9}m	1000 $\times 10^{-9}$m
⇒	$10^{-9}\times 100$cm	$1000\times 10^{-9}\times 100$cm
⇒	10^{-7}cm	10^{-4}cm

Now, 10^{-4} cm is more while 10^{-7} em is less. Range should be written as: Colloidal particle diameter H 10^{-7} em to 10^{-4} cm. The other options should have been written in the reverse order (to show the range). E.g.: 10^{-3} cm to 10^{-2} cm.

Here, the right option is (c).

Sol.64 (c)

The protective action of different protective colloids is expressed in terms of Gold Number. The protective action of a lyophilic colloid is expressed in terms of Congo Rubin Number. This term was discovered by Ostwald. Let us define Gold Number. The Gold Number of a protective colloid is the minimum weight of it in milligrams which must be added to 10 m1of a substance red gold sol so that no coagulation of the gold sol takes place when 1 m1of 10 percent NaCl solution is rapidly added to it. Note that smaller the Gold Number of "a protective colloid, the greater its protective action will be.

The right option is (c).

Sol. 65 (a)

Ferric chloride is used for stopping bleeding because Fe^{3+} ion coagulates blood, a negatively charged sol.

The right option is (a).

Sol.66 (b)

Nearly 87 percent of milk is water. Other NO_2 constituents are vital parts of it and are known to have contributed a lot towards its image as a 1 complete food. But milk fat is the chief constituent of milk, next only to H_2O. Hence, milk is considered to be a fat dispersed in water.

The right option is (b).

Sol.67 (b)

Arsenious sulphide (As25:J)is a colloidal solution. It is negatively charged. It is prepared through the process of laser ablation. It is a negative colloid. **The right option is (b).**

Sol.68 (b)

A catalyst itself is not affected during the course of a chemical reaction. It alters the rate of reaction. It lowers the activation energy. It facilitates the conversion of reactants into products. The greatest natural catalyst is chlorophyll present in green plant leaves. It helps in photosynthesi and ensures that leaves form food. Platinum, Nickel, Tungsten ~d ·many other metals are used as catalysts in industrial enterprises. Hydrogenation of vegetable oil is done in the presence of nickel.

The right option is (b).

Sol.69 (c)

This disease is caused due to the deficiency of Phenylanaline hydroxylase.

The right option is ©.

Sol.70 (b)

Enzymes are the biological substances that act as catalysts and facilitate complex reactions. They fall under the genre Polypeptides. They help in digestion in the human stomach. The formation of alcohols and many other beverages essentially involves the use of enzymes.

The right option is (b).

Sol.71 (c)

Benzene is treated with concentrated HNO_3 in the presence of concentrated H_2SO_4, The temperature is 50°C. The products are nitrobenzene and water. Refer **Fig. 1.20**

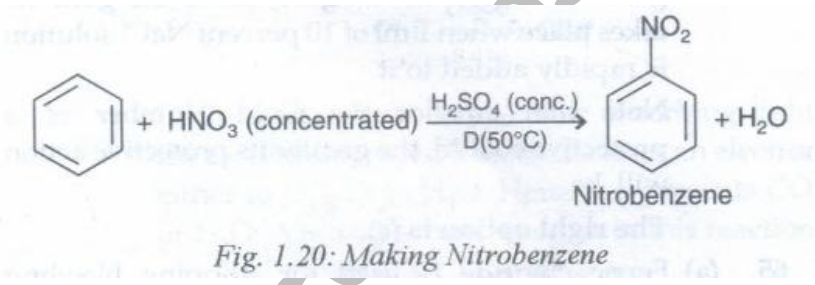


Fig. 1.20: Making Nitrobenzene

This can be nitrated further to give a meta-isomer. Refer **Fig. 1.21.**

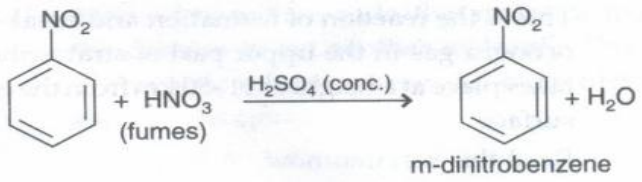


Fig. 1.21: Making m-dinitrobenzene

The active species involved in the first reaction is the nitronium ion.

The right option is (c).

Sol. 72 (a)

Refer **Fig. 1.22.** Benzene reacts with Hydrofluoric acid, as follows:

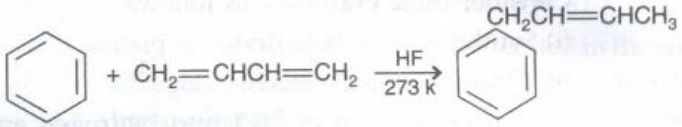


Fig. 1.22

The right option is (a).

Sol.73 (c)

$(CH_3)_3CNO_2$ does not react with NaN02 and HCI. All other compounds do react with these two chemicals.

The right option is (c).

Sol. 74 (c)

This is the saponification reaction. The reaction is as follows:

$$CH_3COOCH_3 + NaOH \rightleftharpoons CH_3COONa + CH_3OH$$

The right option is (c).

Sol. 75 (c)

Carboxylic acids do not show the properties of the carbonyl group. Refer **Fig. 1.2.** The reason behind this phenomenon is the resonance effect.

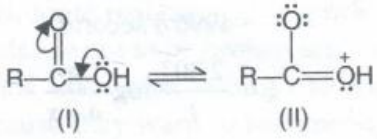


Fig. 1.23

Fig. 1.23 shows two resonating forms of carboxylic acid. The C=O double bond character is reduced to a considerable degree. The carbon-oxygen double bond length in carboxylic acids is slightly longer than the carbon-oxygen double bond length in carbonyl compounds. Further, the carbon-oxygen single bond length is slightly less than the standard carbon-oxygen bond length. Due to these reasons, carbonyl-group properties are missing in carboxylic acids.

The light option is (c).

Sol.76 (b)

When sodium formate is heated, it yields sodium oxalate and hydrogen gas.

The right option is (b).

Sol. 77(b)

Ethers are basic in nature.

The right option is (b).

Sol.78 (d)

Williamson's synthesis is a method for preparing ethers. When alkyl halide is heated with sodium alkoxide, we get ether.

$RX + RONa \rightarrow ROR + NaX$

$CH_3CH_2Br + CH_3ONa \rightarrow CH_3CH_2OCH_3 + NaBr$

Note that Di-tert-butyl ether cannot be prepared with the help of this reaction. Further, if tertalkyl halide is used in the reaction, ether is not obtained. Rather, an alkene is produced. Finally, aryl halides do not respond to this test due to higher C-CI bond dissociation energy.

The right option is (d).

Sol.79 (a)

The acid strength of alcohols follows this pattern:

Primary> Secondary> Tertiary

The right option is (a).

Sol. 80 (d)

With a nitrating mixture, phenol yields Picric acid (2, 4, 6-trinitro phenol). Refer **Fig. 1.24.**

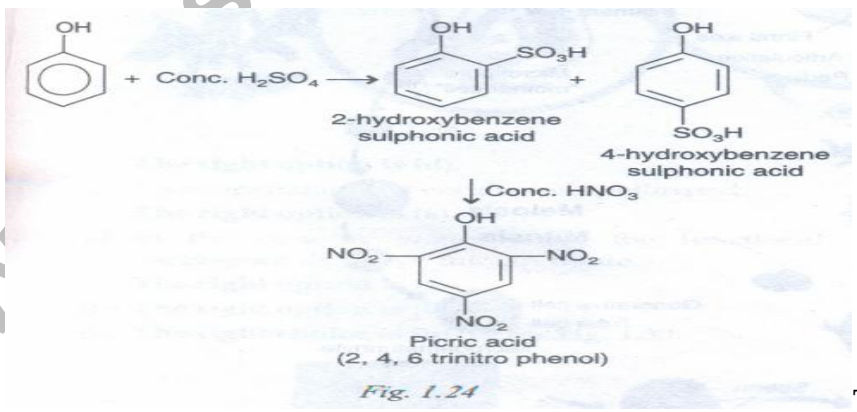


Fig. 1.24

The right option is (d).

Sol.81 (b)

We have:

$$\frac{r_+}{r_-} = \frac{r(X^+)}{r(Y^-)} = \frac{88}{200} 0.44$$

The ratio lies in the range of 0.414 to 0.732.

So, the co-ordination number of $X^+ = 6$.

The right option is (b).

Sol. 82 (b)

When glycerol is heated with a small quantity or hydro-iodic acid, we get an alkene, CH2CHCH2I.

The right option is (b).

Sol.83 (c)

Propylene is used in industrial units for the preparation of glycerol.

The right option is (c).

Sol. 84(d)

When Ethylene ($CH_2 = CH_2$) is heated at a temperature of 723 K in the presence of $C1_2$, it yields ethylene chloride.

$$CH_2 = CH_2 + Cl2 \xrightarrow{723k} CH2 = CHCL + \underset{EthyleneCholride}{HCl}$$

Ethylene

Note that carbon-carbon double bond is not broken in ethylene.

The right option is (d).

Sol.85 (b)

Dimethyl glyoxime is commonly used for identifying Nickel ions in solutions.

The right option is (b).

Sol.86 (a)

The right option is (a).

87. (b)

The right option is (b).

Sol. 88 (d) Option (d)

Gives a correct statement. Nickel dimethylglyoxima is red in terms of colour. All other options are incorrect.

The right option is (d).

Sol. 89 (d)

Bis (acetylacetonate) oxovanadium (IV) has pyramid-shaped geometry.

The right option is (d)

Sol.90 (b)

A copolymer takes its repeating structural units from two or more types of monomer units. Refer **Fig. 1.25.**

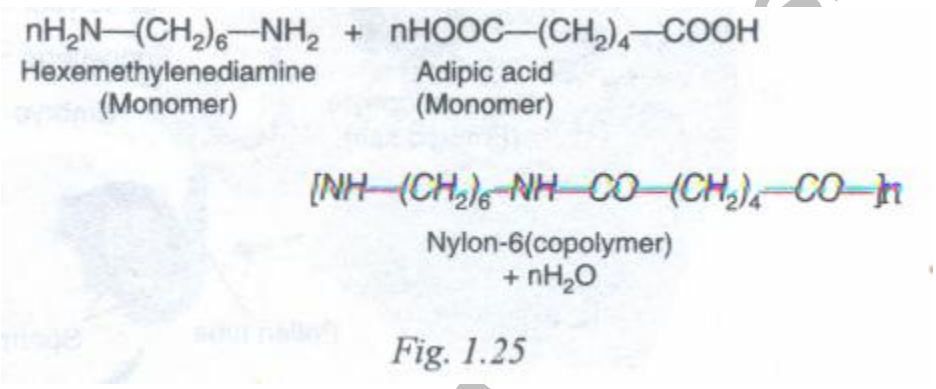


Fig. 1.25

Note that hompolymers take repeating structural units of only type of monomer. So, they are different from copolymers.

The right option is (b)

PART C: BOTANY

Sol.91 (c)

This is an example of vegetative fertilisation. It is also called Triple Fusion. In this type of fertilisation, three nuclei come together to get fused. Two polar nuclei and one male gamete are involved in the process of fusion.

The right option is (c).

Sol. 92 (b)

A desi variety of mango will be born and a hybrid will not be produced.

The right option is (b).

Sol.93 (a)

The branch is injured, defoliated and pegged down in the ground in the layering process.

The right option is (a).

Sol.94 (a)

The vascular bundles are scattered in sugarcane. Hence, grafting cannot be done in sugarcane.

The right option is (a).

Sol.95 (c)

In case of mint, vegetative propagation occurs through sucker. Refer **Fig. 1.26.**

Fig. 1.26: Sucker in mint

The right option is (c).

Sol.96 (b)

The egg apparatus of an angiosperm has an egg Pollination and fertilization Fig. 1.27: Egg apparatus of an angiosperm cell and two synergids. Refer **Fig. 1.27.**

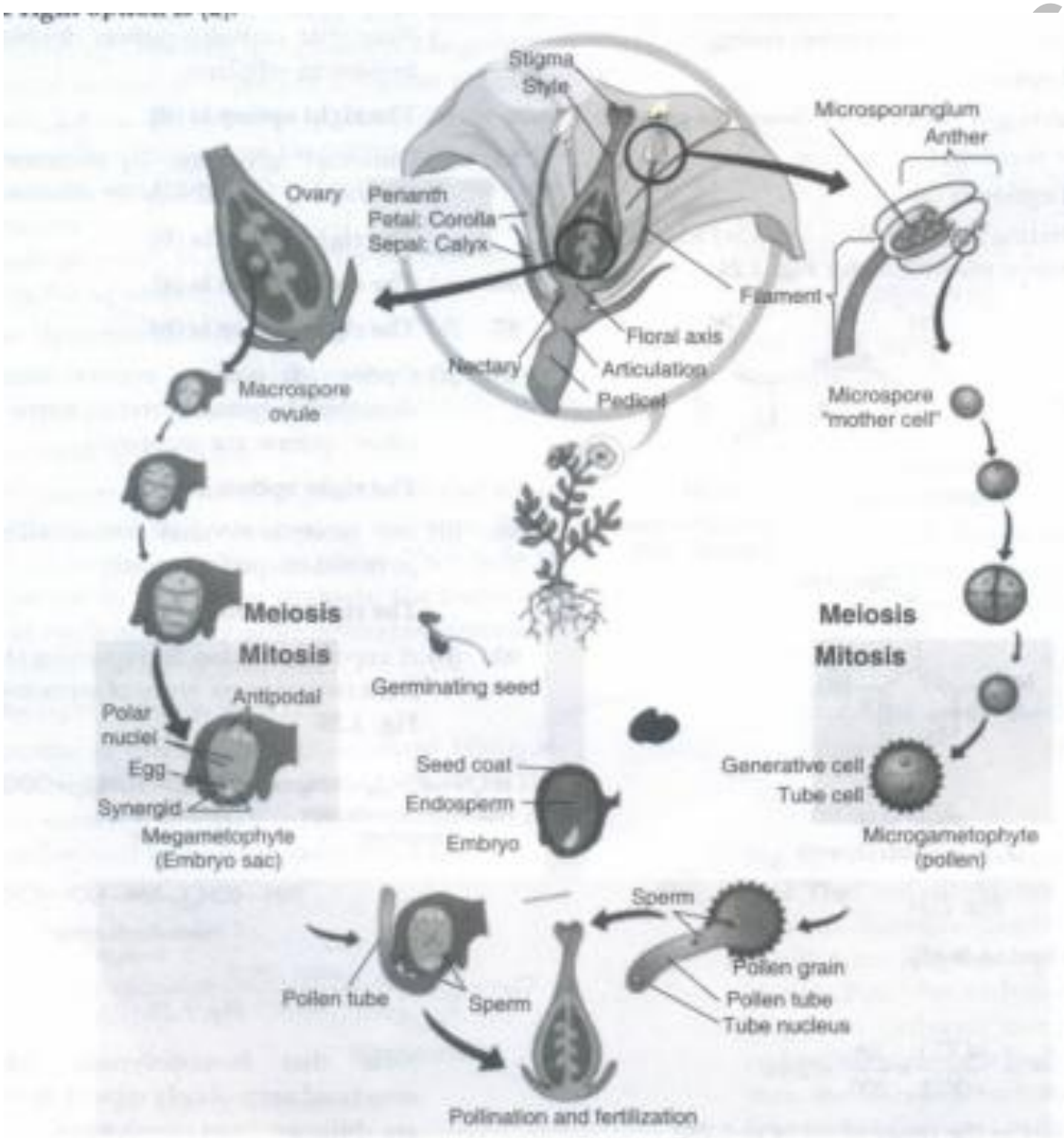


Fig. 1.27: Egg apparatus of an angiosperm

The right option is (b).

Sol. 97(c)

The right option is (c). Refer Fig. 1.28.

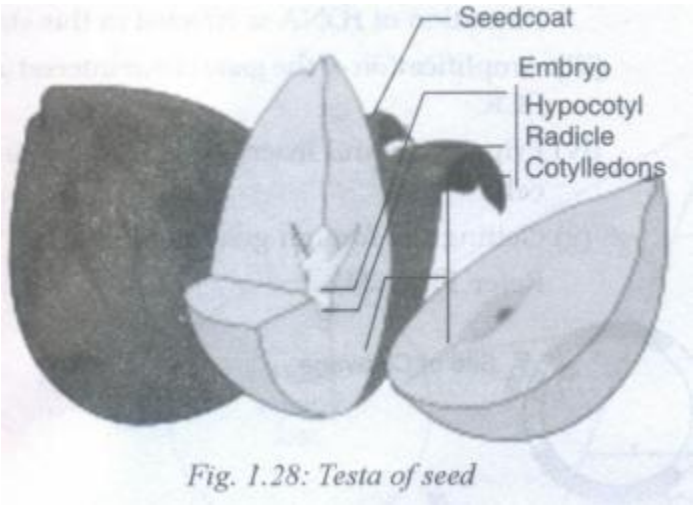


Fig. 1.28: Testa of seed

The right option is (c).

Sol.98 (c)

Anemophily occurs in coconut. Seed coat

The right option is (c).

Sol. 99 (d)

Mixed pollination is able to remove intra specific incompatibility. Refer **Fig. 1.29**

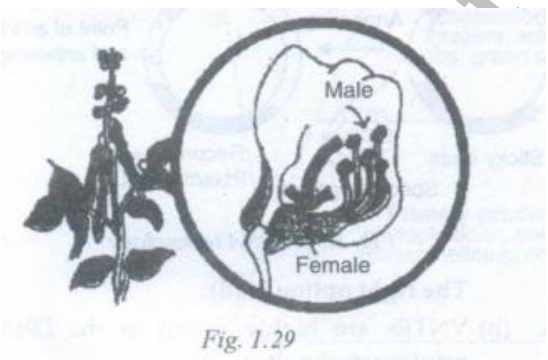


Fig. 1.29

The right option is (d).

Sol.100 (a)

Cleistogamous flowers are self-pollinated.

The right option is (a).

Sol.101 (d)

In the case or angiosperms, the functional megaspore develops into an ovule.

The right option is (d).

Sol.102 (b)

The right option is (b).

Sol.103 (b)

The right choice is (b). Refer **Fig. 1.30.**

Fig. 1.30

Sol.104 (a)

The right option is (a).

Sol.105 (c)

Totipotency refers to the development of an organ from a cell in a culture medium.

The right option is (c).

Sol.106 (d)

Himgiri is a variety of wheat. It is resistant to lust pathogens.

The right option is (d).

Sol.107 (c)

Restriction endonucleases act a molecular scissors. Refer **Fig. 1.31**

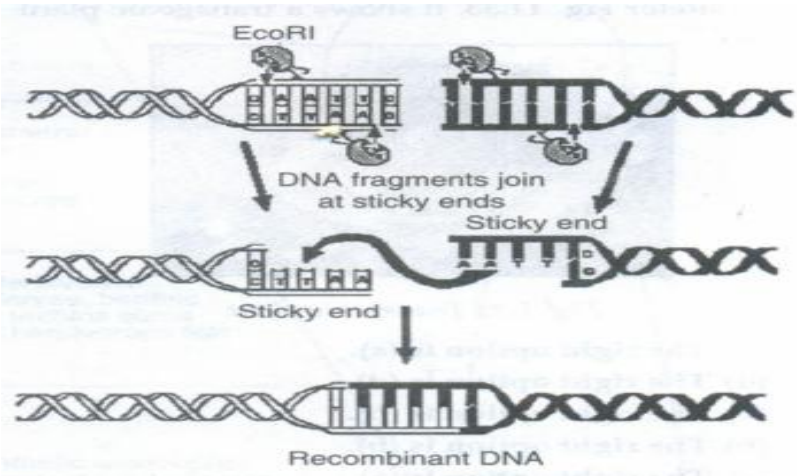


Fig. 1.31: Restruction enzyme

Sol. 108 (d)

Agrobacterum tumefaciens is a natural genetic engineer; that is what it is called by genetic researchers and botany connoisseurs. Refer **Fig. 1.32.**

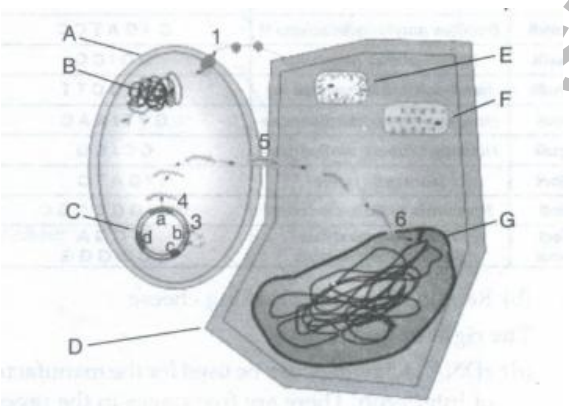


Fig. 1.32

The right option is (d).

Sol. 109 (a)

The plants in which foreign genes are introduces through the complex techniques of genetic engineering are called transgenic plants.

There are two techniques for introducing transgenes (foreign genes) into the plant cell genome, as follows:

(i) Through a vector

(ii) Through the direct introduction of DNA.

The foreign DNA is introduced into a plant cell (in technique (ii)) and the plant is regenerated from that cell.

Refer **Fig. 11.33.** It shows a transgenic plant.

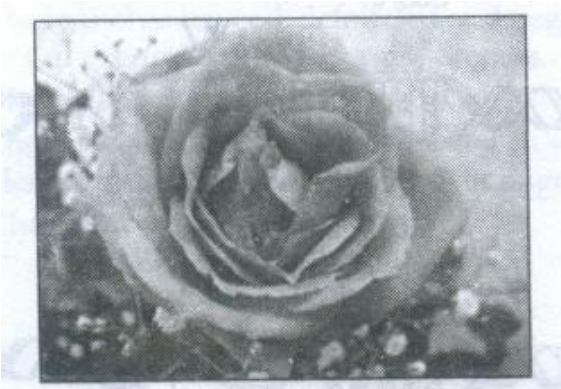


Fig. 1.33 Transgenic plant

The right option is (a).

Sol. 110 (d) The right option is (d).

Sol.111 (b) The right option is (b).

Sol.112 (b) The right option is (b).

Sol.113 (a)

The right option is (a).

Refer **Table 1-1.** It shows the recognition sites of a few restriction enzymes.

Table 1-1: Recognition Sites of Restriction Enzymes

Enzyme	Source	Recognition Sites
EcRol	*Escherichia coli* RY·13	G/AATTC
BamHI	*Bacillus amyloliquefaciens* H	G/GATCC
Haelll	*Haemophilus aegyptius*	*GG/CC*
HindiIII	*Haemophilus influenzae* Rd	A/AGCTT
Hpal	*Haemophilus parainfluenzae*	GTT/AAC
Hpall	*Haemophilus parainfluenzae*	*CC/GG*
Mbol	*Moraxella bovis*	/GATC
Notl	*Norcardia otitidis-caviarum*	*GC/GGCCGC*
Taql	*Thermus aquaticus*	T/CGA
Smal	*Serratia marcescans*	CCC/GGG

Sol.114 (b)

Rennin is used for making cheese.

The right option is (b).

Sol.115 (d)

rDNA technology can be used for the manufacture of Interferon. There are five stages in the process of rDNA, as follows:

(i) Isolation of the genetic material (DNA).
(ii) Cutting of DNA at specific locations. The formation of rDNA is effected in this step
(iii) Amplication of gene of our interest using PCR.
(iv) Priparation and insertion of RDNA into host cell.
(v) Getting the foreign gene product.

Refer **Fig.1.34**

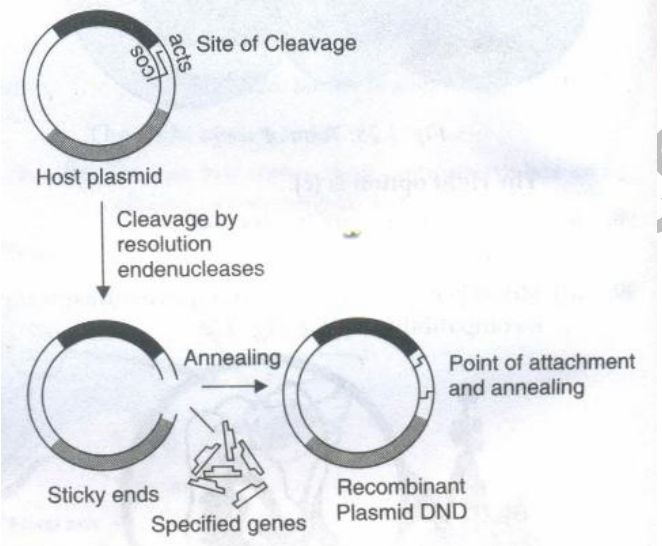


Fig. 1.34: rDNA technology

The right option is (d).

Sol.116 (b)

VNTRs are highly useful in the DNA finger printing technology.

The right option is (b).

Sol. 117 (b)

A herbivore uses up nearly 30 percent of the assimilated energy in the respiration process.

The right option is (b).

Sol.118 (c)

The right option is (c).

Sol. 119 (d)

The right option is (d).

Sol.120 (a)

Green plants are the producers in all eco systems. They use chlorophyll, sunlight, CO_2 and H_2O to produce basic carbohydrate (sugar). They are the primary consumers or sunlight, a form of energy. From producers, the food chain starts in a natural process that almost always involves the deletion of the weak species. Energy goes up to the top level of every food chain. However, the entire energy consumed by plants does not go up the food chain. Refer **Fig. 1.35.**

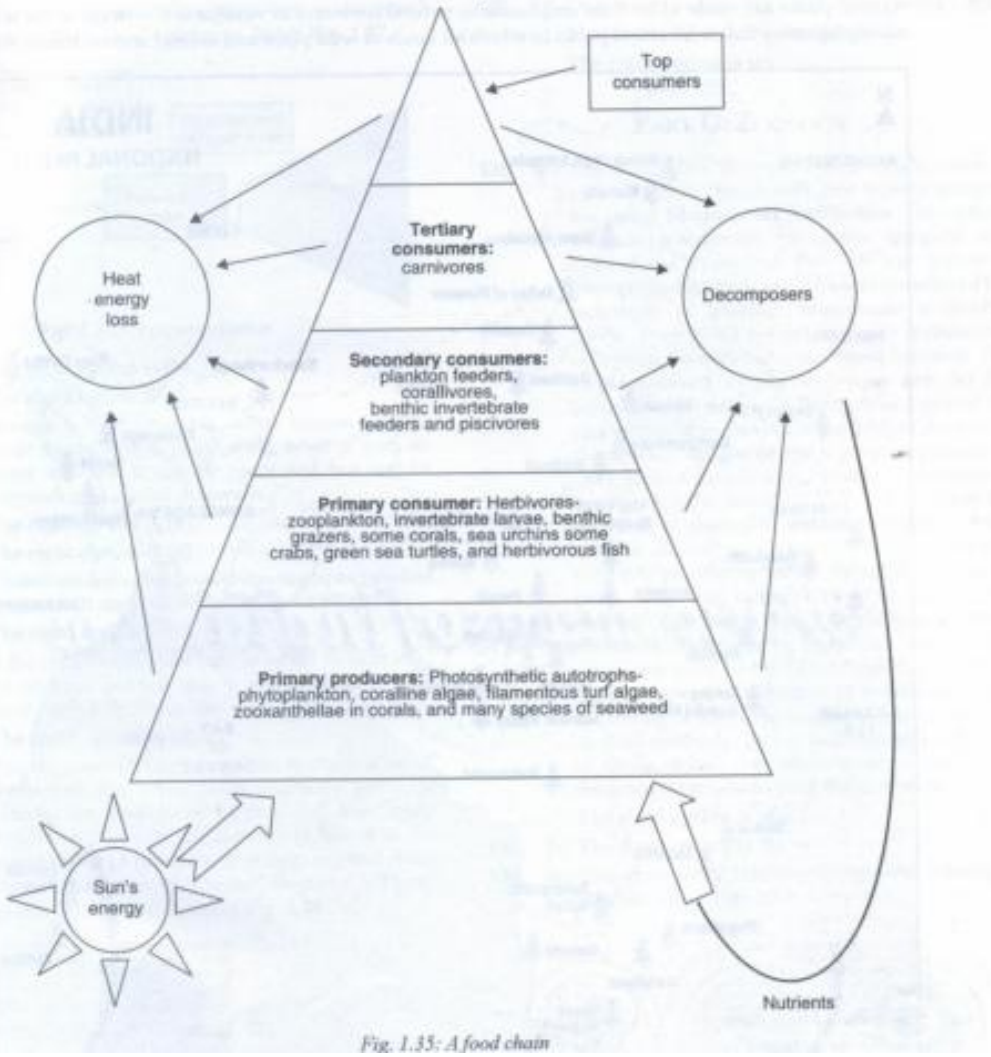


Fig. 1.35: A food chain

The right option is (a).

Sol. 121 (b)

The right option is (b).

Sol.122 (c)

The right option is (c).

Sol.123 (d)

The earthworm is a supporter of the former. It breaks down detutus into small particles. It upturns the soil too.

The right option is (d).

Sol.124 (d)

Addax antelopes are found in abundance and there is no threat to then survival. All other species are endangered.

The right option is (d).

Sol. 125 (c) Natural parks are made to let flora and fauna in natural harmony in various eco systems of the world. India is managing many bio-rich natural packs in which all kinds of wild plant and animal species thrive. Refer **Fig. 1.3**

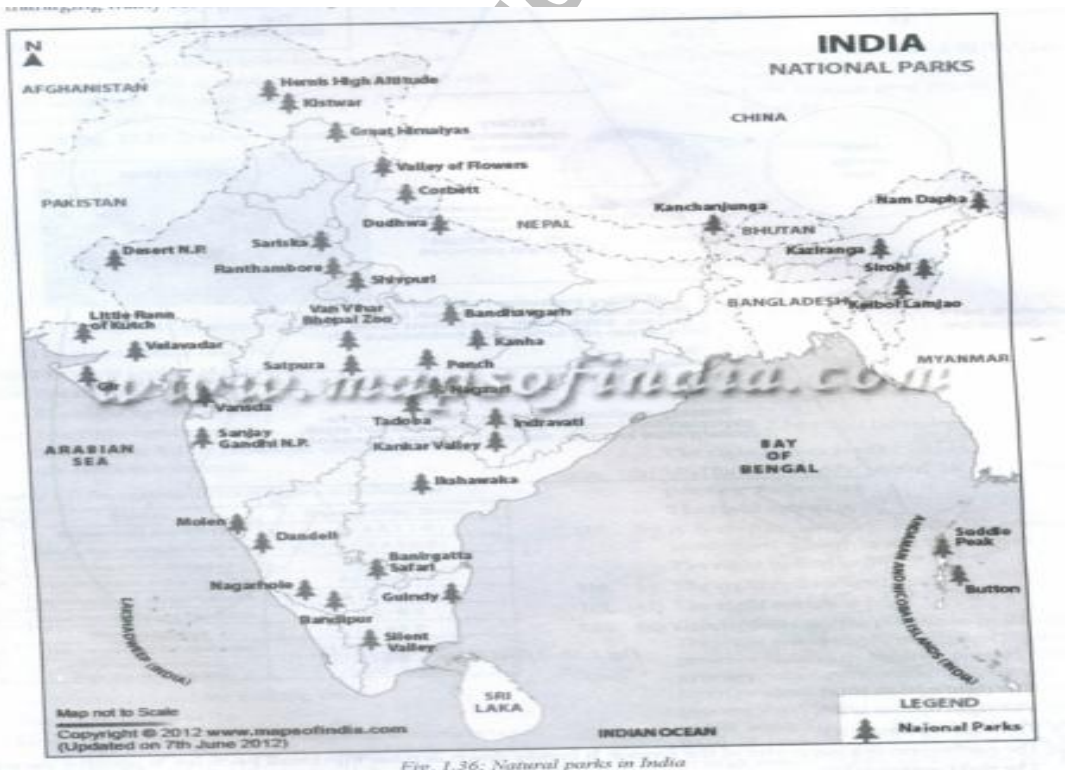


Fig. 1.36: Natural parks in India

The right option is (c).

Sol.126 (b)

Cryopreservation helps in saving endangered species from total extinction. Refer **Fig. 1.37.**

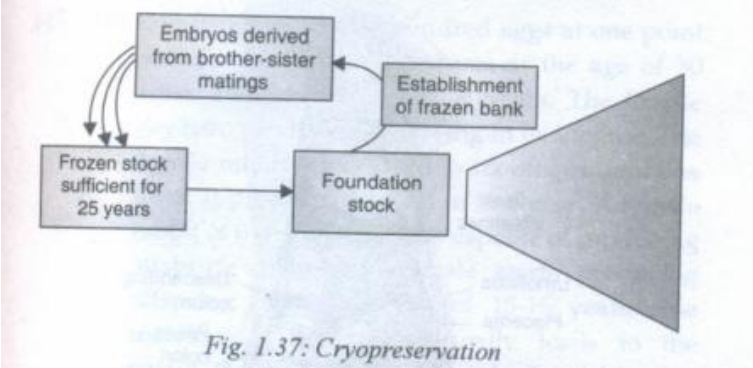


Fig. 1.37: Cryopreservation

The right option is (b).

Sol. 127 (d)

The right option is (d).

Sol.128 (b)

Sewage is biodegradable. It has human excreta, plant leaves, water, salts, urine, acids of various types and silt. It can be processed but cost of processing is a vital deterrent.

The right option is (b).

Sol. 129 (d)

The right option is (d)

Sol.130 (c)

Photochemical smog results due to photochemical reactions. It comprises 03' PAN and *NOx'*

The right option is (c).

Sol.131 (d)

If the concentration of lead in blood stream is 30 microgeans per ml, this is a sign of danger. A level higher than this can even prove to be fatal.

The right option is (d)

Sol.132 (d)

Nitrate concentration in water is dangerous. If we drunk the water with excessive levels of nitrate, we may have to face the blue body syndrome. itrates are commonly found in the waste water of factories. If people around these factories consume this water, they can fall prey to this killer disease. Refer **Fig. 1.38.**

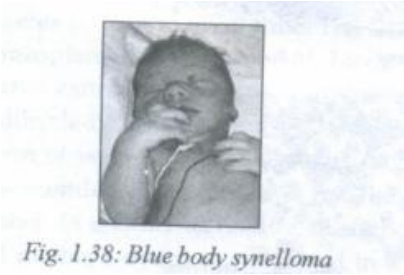


Fig. 1.38: Blue body synelloma

Sol.133 (a)

H_2S causes burning sensation in throat and eyes.

The right option is (a).

Sol.134 (b)

The biological oxygen demand would naturally go up when the sewage is mixed with river water. If BOD is high, It means that the liver water less oxygen content.

The right option is (b)

Sol.135 (a)

Only statements (ii) and (iii) are correct. Statements (i) and (iv) are incorrect.

The right option is (a).

PART D: ZOOLOGY

Sol.136 (d)

The antidodies derived from a single clone of cells which recognize only one type of antigens are called Monoclonal Antibodies. The options mention interferons, monocotic antigens and monoclonal cysts but they all are incorrect. Georges Kohler and cesar Milstein introduced the technique of making monoclonar antibodies (1970). They fused normal antibody –producting cells with the cells from cancerous tumours. The steps involved in this technique are: (a) the injection of an antigen in the body of a mouse; (b) production of antibodies in the body of the mouse the injected antigen (in the B-Iymphocyte cells in the spleen of the mouse); (c) removal of spleen of mouse and the isolation of B-lymphocytes; (d) isolation of myeloma cells (that produce bone marrow cancer); (e) fusion of myeloma cells and antibody-producing cells in suitable cultures (now, they are called Hybridomass); (f) the shifting of the entire culture to medium deficient in nuutrients needed by myecloma cells (so that myecloma cells die but hybridoma cells survive); (g) separate multiplication of hybridoma cells; (h) testing of the clone for its ability to produce a desired antibody; (i) the isolation and culturing of those clones that show positive results; G) commercial production of the antibody.

The right option is (d).

Sol.137 (b)

The right option is (b).

Sol.138 (a)

The embeyo of the 16-cell stage is known as morula. Refer **Fig. 1.39.**

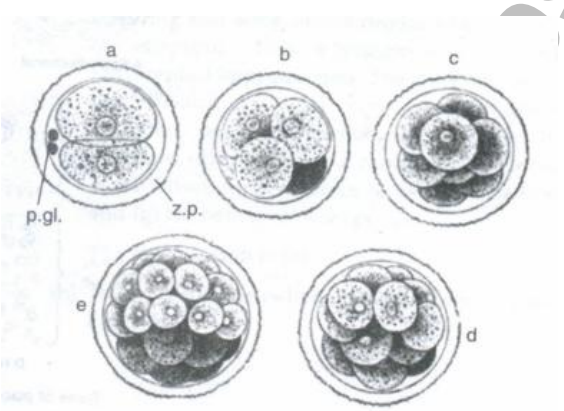


Fig. 1.39: Morula

The right option is (a).

Sol.139 (b)

The right option is (b).

Sol. 140 (c)

Chorion takes part in the process of formation of placenta in humans. Refer **Fig. 1.40.**

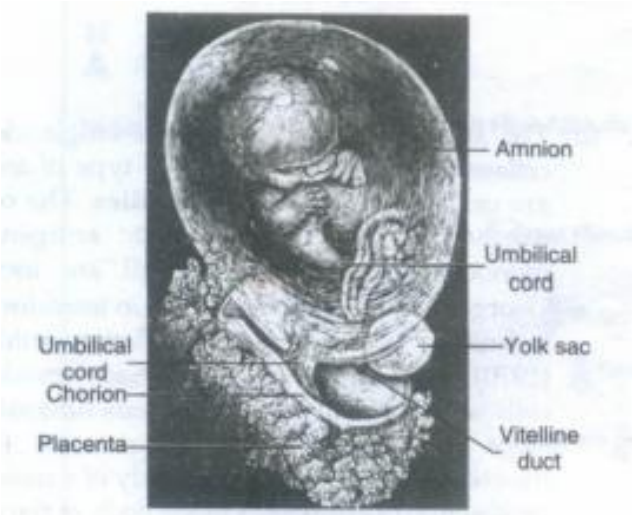


Fig. 1.40: Chorion

The right option is (c)

Sol. 141 (b)

The right option is (b)

Sol.142 (b)

The right option is (b)

Sol. 143 (b)

Both placenta and fully developed foetus give signals of parturition in the uterns of woman. The foetus is fully mature at nine months. It wants to come out of the uterns, head first. Placenta and foetus give signals to the doctor that the time has ome for delivery. The woman also feels excessive pain, called carbon pain. Refer **Fig. 1.41.**

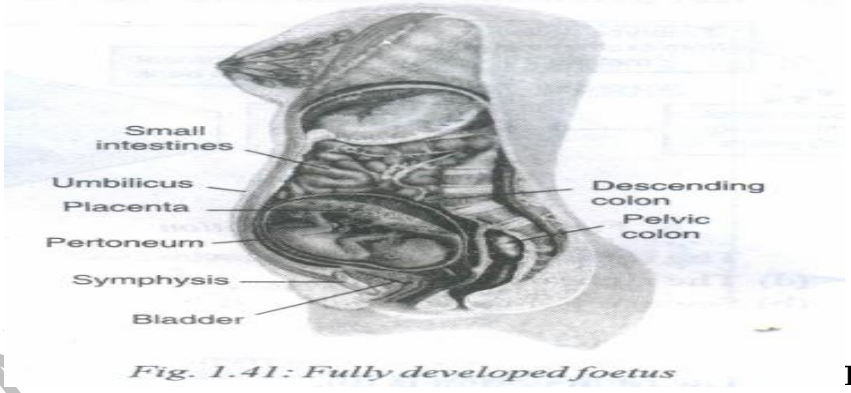


Fig. 1.41: Fully developed foetus

The right option is (b).

Sol.144 (c)

Yolk sac is a genre of placenta if the classification criterion is the nature of foetal membranes involved. All other genres are based on histology. Refer **Fig. 1.42.** It shows the classification of placenta based on histology (there are 5 classes in this classification).

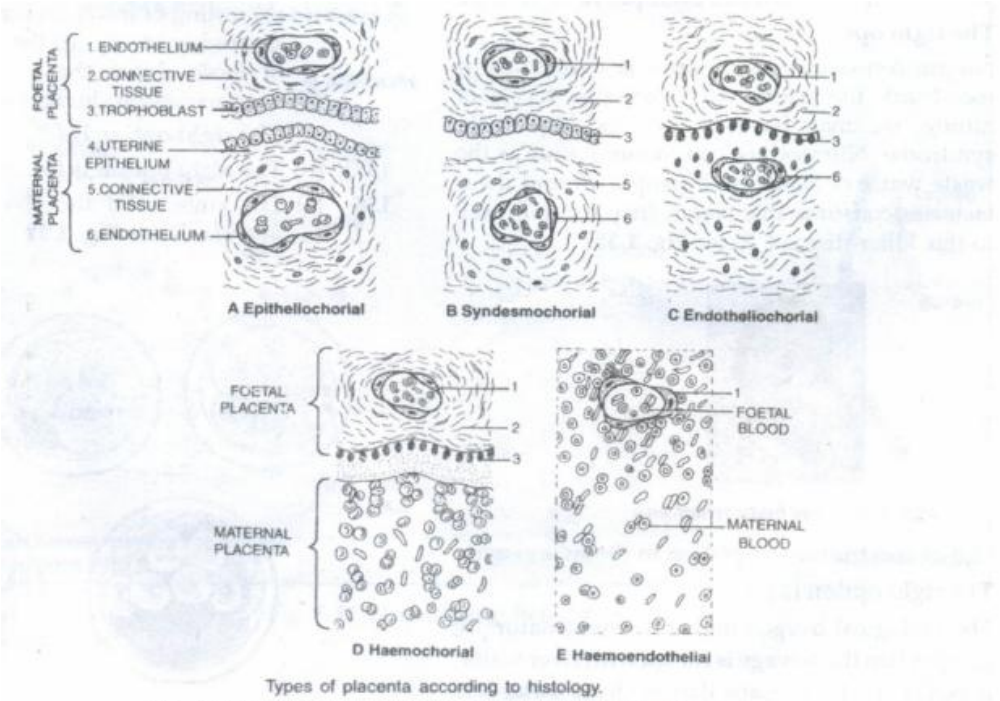


Fig. 1.42: Classification of placenta according to histology

The right option is (c).

Sol.145 (d)

The right option is (d).

Sol.146 (d)

The right option is (d).

Sol.147 (b)

Cod fish lays several hundred eggs at one point of time. An elephant matures at the age of 30 years. It lives for nearly 90 years. The female elephant produces 6 offspring in its lifetime. The female rabbit gives birth to six offspring in one litter. It produces 4 litters in one year. A female rabbit of 6 months of age is capable of producing offspring. A human female starts producing offspring from the age of 15-16 years. The marriage of humans normally leads to the production of 1 to 12 offspring in the productive period; some men have more than one wife.

Thus, the elephant is the slowest breeder among all the options given to us.

The right option is (b).

Sol.148 (b)

Such a graph would show an exponential growth. The case if India is also that of exponential growth. The lack of education, contraceptives and fresh outlook towards female children also led to high population growth. People do not want female children, for they are not their assets. They are supposed to be married off. The expenses incurred on them are deemed wastage. Many couples produce more children in the hope that the next child would be a male. But they end up producing many females. So, they are frustrated. The exponential growth of population in India is a reflection of our backwardness in both urban and rural centres.

The right option is (b).

Sol.149 (c)

In test tube baby pregnancy, the fertilization of gametes is done in a test tube. The fertilized egg is transplanted in the womb of the mother. If the mother cannot deliver ova, an ovum of another healthy lady is taken and got fertilized by the sperm of her husband. She holds the foetus for nine months, although she is not the biological mother. In another technique, the father's sperm and mother's ovum are fertilized in a test bube and fertilized egg is planted in a surrogate mother's womb. Upon birth, the child is given to true biological parents. The surrogate mother is compensated in terms of cash and kind. Refer **Fig. 1.43.**

The right option is (c).

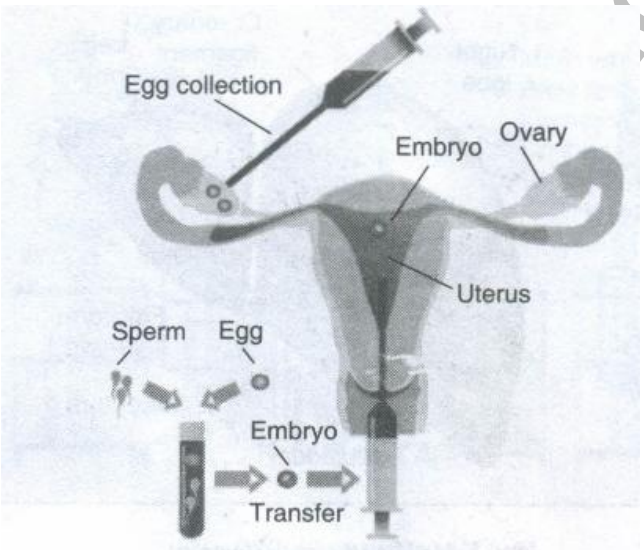


Fig. 1.43: Test tube baby

Sol.150 (d)

The right option is (d).

Sol.151 (a)

MTP during the first trimester of pregnancy is fine. But after this period, MTP can hurt the mother.

The right option is (a).

Sol.152 (b)

The right choice is (b).

Sol.153 (d)

The right option is (d).

Sol.154 (b)

We have:

Logistic population growth

$$= \frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

The right option is (b).

Sol.155 (b)

Some organisms produce more numbers of offspring and some others produce less number of offspring. This phenomenon is called Differential Reproduction. The chief features of this Theory are: (a) rapid multiplication: (b) differential reproduction; (c) struggle for Existence;(d)appearance ofvariations; (e)survival of the fittest; (f) inheritance of useful variations; and (g) formation of new species.

The right option is (b).

Sol.156 (b)

The female human's liver has 22autosomes. Refer **Fig. 1.44**

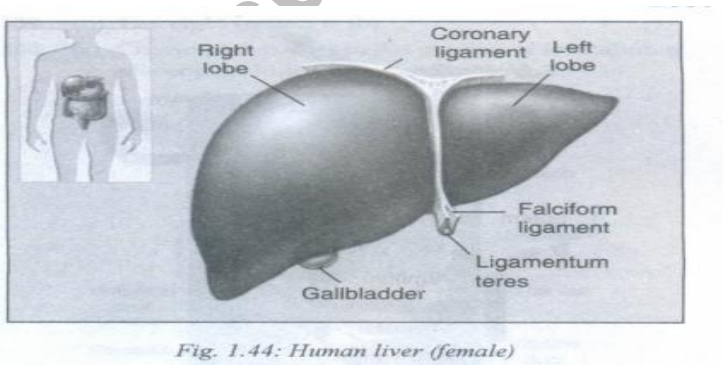


Fig. 1.44: Human liver (female)

The right option is (b)

Sol.157 (d)

The right option is (d).

Sol.158 (b)

There are eight types of gamete in the Fl progeny of cross AA BB CC and aa bb cc.

Sol.159 (c)

The right option is (c).

Sol.160 (d)

The right option is (d).

Sol.161 (a)

The symbol 0 in the human blood shows "no antigen."

The right option is (a).

Sol.162 (c)

The right option is (c). Refer **Fig. 1.45.**

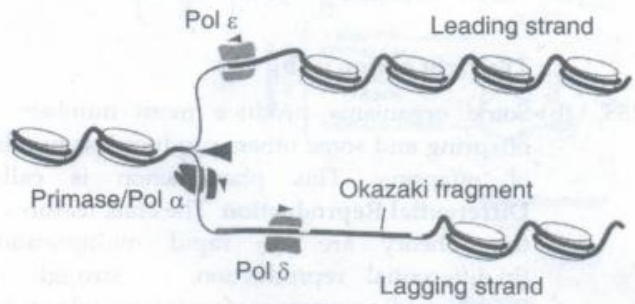


Fig. 1.45: Okasiki fragments

Sol.163 (c)

The three units of the D A molecule are: cistron mutton and recon. Refer **Fig. 1.46.**

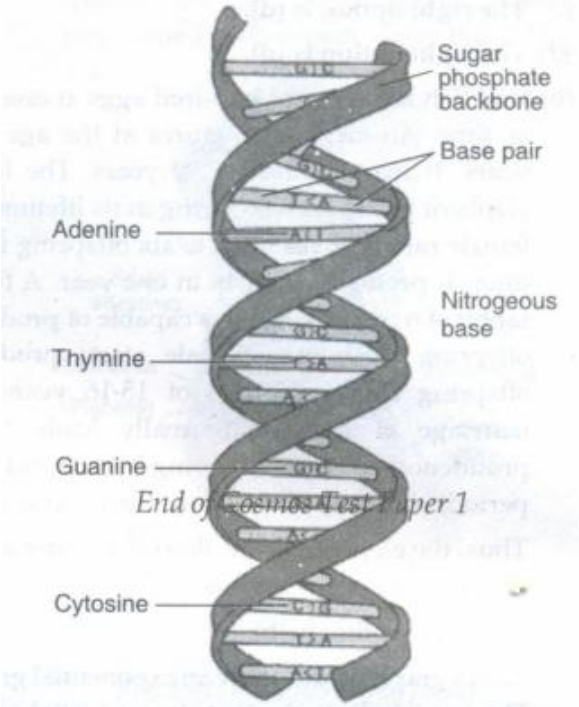


Fig. 1.46 Parts of DNA molecule

The right option is (c).

Sol.164 (c) The right option is (c). Refer **Fig. 1.47.**

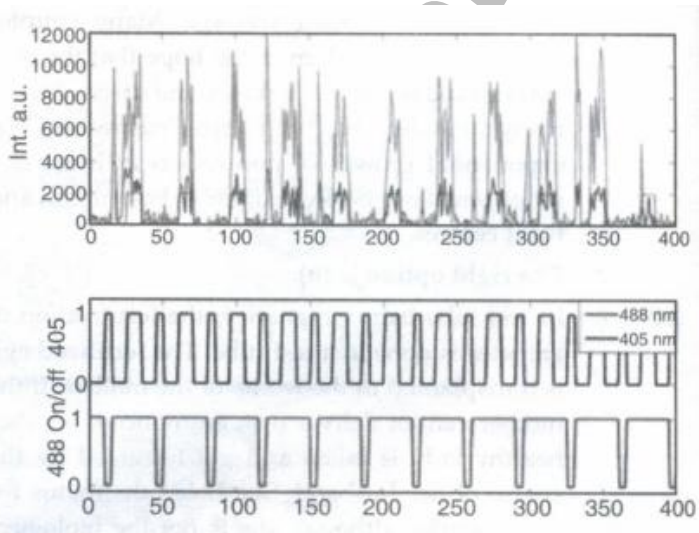


Fig. 1.47: TATA sequence of DNA binding

Sol.165 (d)

The right option is (d)

Sol.166 (c)

The right option is (c).

Refer **Fig. 1.48.**

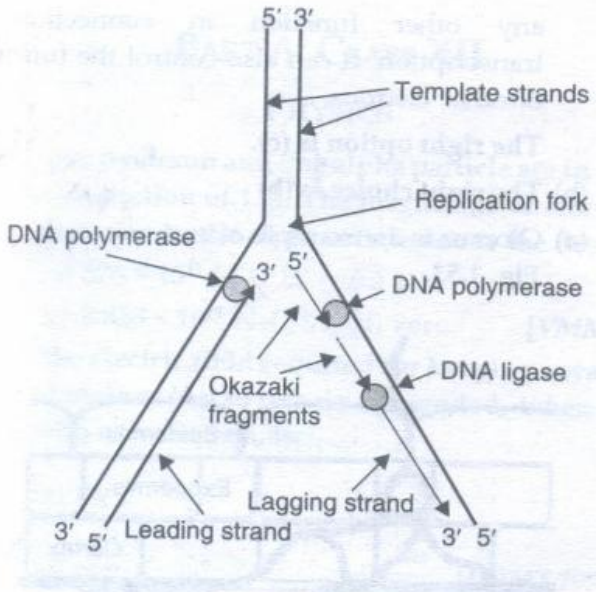


Fig. 1.48: DNA synthesis during replication.

The right option is (c).

Sol.167 (d) The right option is (d). Refer **Fig. 1.49.**

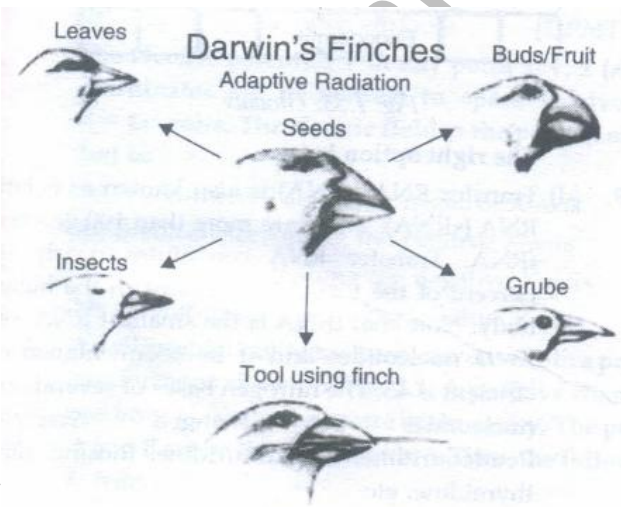


Fig. 1.49: Darwin's finches

Sol. 168 (b)

The right choice is (b).

Sol.169 (a)

The right choice is (a).

Sol.170 (a)

When alcohol level is between 10-18 percent, fermentation stops. Hence, fermentation and distillation both are needed for manufacturing brandy and whisky. Refer **Fig. 1.50.**

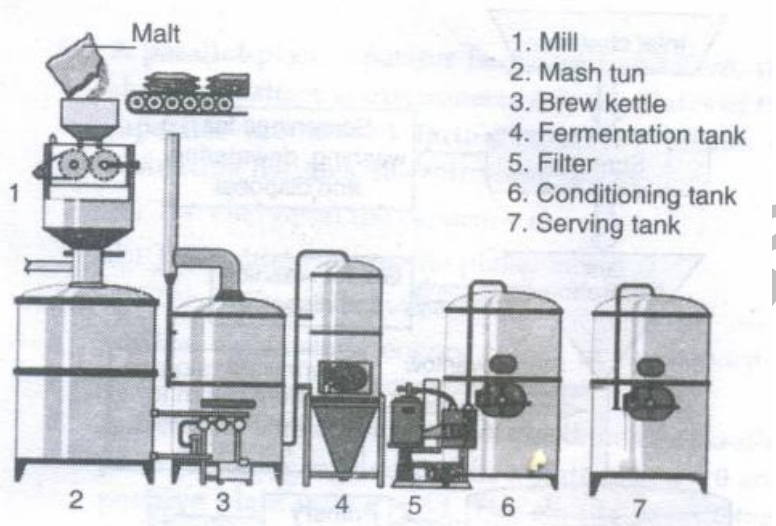


Fig. 1.50: Fermentation of beer

The right option is (a).

Sol.171 (b) Cyanobacteria are present in abundance in Azolla. So, It is an excellent biofertilizer. Refer **Fig. 1.51**

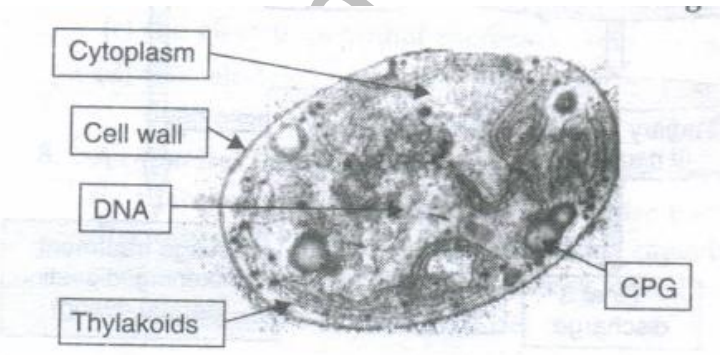


Fig. 1.51: Cyanobacteriom

The right option is (b).

Sol.172 (c)

The statement in option (c) is correct. All others are incorrect.

The right option is (c).

Sol. 173 (d)

itrogen fixation is done by Frankia in Alnus (in its root nodules).

The right option is (d).

Sol. 174 (b)

The right option is (b).

Sol. 175 (b)

The process of activated sludge treatment involves the recycling of decomposer microbes. Refer **Fig. 1.52.**

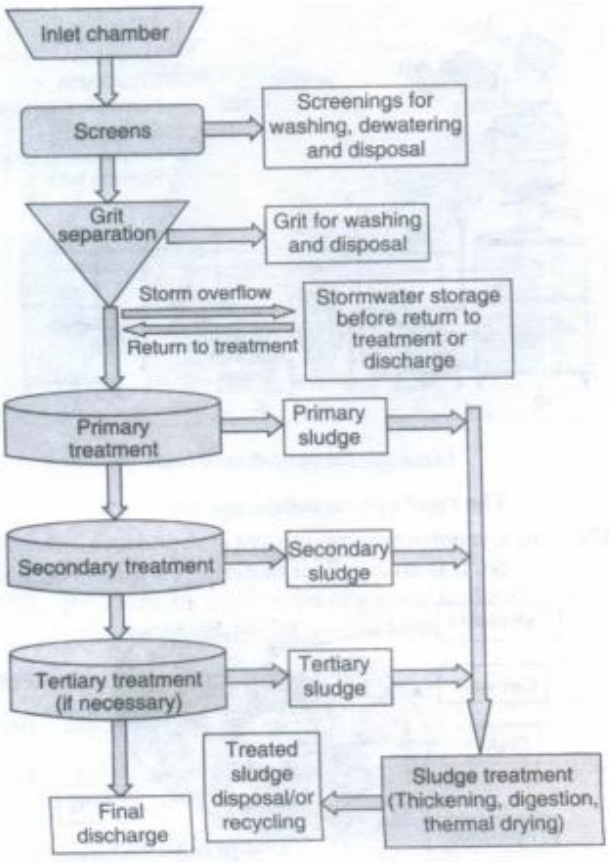


Fig. 1.52: Activated sludge treatment

The right choice is (b).

Sol. 175 (c)

Johannsen had decribed the gene as an elementar unit of inheritance which can be assigned to a particular character. Morganet. *al.* stated that gene is a segment of chromosome that can be separated through crossing over and is a unit of recombination. The latest term for the gene is Cistron. It is a segment of the D A that comprises a stretch of base sequences that codes for one polypeptide chain, one transfer-RNA (tRNA) or ribosomal-RNA (rRNA) molecule or performs any other function in connection with transcription. It can also control the functioning of other cistrons.

The right option is (c).

So.177 (b)

The right choice is (b)

Sol.178 (a)

Glomus is an example of endomycorrhiza. Refer **Fig. 1.53.**

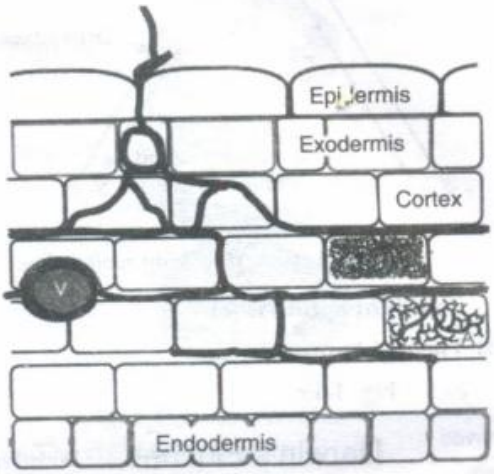


Fig. 1.53: Glomus

The right option is (a).

Sol.179 (d)

Transfer RNA (tRNA) is also known as Soluble RNA (sRNA). There are more than 100 genres of tRNA. Transfer RNA constitutes nearly 145 percent of the total RNA present in the human body. ote that tRNA is the smallest RNA with 73-93 nucleotides and it its sedimentation coefficient is 45. The nitrogen bases of several of its nucleotides get changed. Examples: Peudoouridine, Dihydrouridinc, Inosine, Ribo-thymidine, etc.

The right choice is (d).

Sol.180 (a)

The options (b), (c) and (d) have correct matches. Option (a) has the wrongly matched entries.

The right option is (a).

PART A : CLASS XII

PHYSICS

Q1

One deuteron and alpha particle are in the air at a separation of 1 $\dot{A}$. The magnitude of electric field intensity on the alpha – article due to the deuteron is:

(a) 576 x 10^{11} N- C^{-1}
(b) 1.44 x 10^{11} N- C^{-1}
(c) 20828 x 10^{11} N- C^{-1}
(d) Zero **[VMMC 2005]**

Q2

The electric field required for keeping a water drop of mass m just to remain suspended, when changed with one electron, is:

(a) mg
(b) $\frac{mg}{e}$
(c) emg
(d) $\frac{em}{g}$ **[DPMT 1999, 2001]**

Q3

Gauss's law is valid for:

(a) Any close surface
(b) Only regular closed surfaces
(c) Any open surface
(d) Only irregular open surfaces **[DPMT 1998]**

Q4

The electric potential V at any point x, y, z (all the coordinates are in meters) in space is given by $V = 4x^2$ volts. The electric field at the point (1m, 0m, 2m) is:

(a) 8 volt – $meter^{-1}$ along the negative X – axis
(b) 8 volt – $meter^{-1}$ along the positive X – axis
(c) 16 volt – $meter^{-1}$ along the negative X – axis
(d) 16 volt – $meter^{1}$ along the positive X – axis

Q5

An ellipsoidal cavity has been carved within a perfect conductor as shown in Fig. 2.1. A positive change q has been placed at the centre of the cavity. The points A and B are on the cavity. The points A and B are on the cavity surface. Then, the following is true:

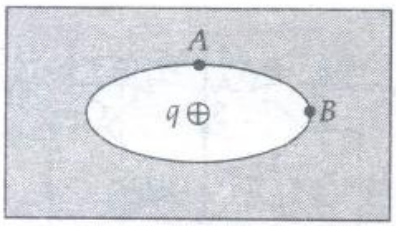


Fig. 2.1

(a) Electric field near A in the cavity = electric field near B in the cavity
(b) Charge at A = potential at B
(c) Potential at A = potential at B
(d) Total electric field flux through the surface of cavity is q/e_0 **[IIT 1999]**

Q6

A parallel – plate capacitor is charged and then, the charging battery is disconnected. If the plates of the capacitor are moved farther apart by means of insulating handles, the following is true:

(a) The charge on the capacitor increases
(b) The voltage across the plates increase
(c) The capacitance increases
(d) The electrostatic energy stored in the capacitor increases

Q7

A dielectric slab of thickness d is inserted in a parallel plate capacitor, whose negative plate is at x = 0 and positive plate is at x = 3d. The slab is equidistant from the plates. The capacitor is given some charge. As x goes from 0 to 3d:

(a) The magnitude of the electric field remains the same
(b) The direction of the electric field remains the same
(c) The electric potential increases continuously
(d) The electric potential increases at first, then decreases and again, it increases**[IIT 1998]**

Q8

A capacitor is charged by connecting a battery across its plates. It stores energy u. Now, the battery is disconnected and another identical capacitor is connected across it. Then, the energy stored by both capacitors of the system will be:

(a) u
(b) $\frac{u}{2}$
(c) $\frac{3u}{2}$
(d) $\frac{u}{4}$ **[CBSE 2004]**

Q9

The electric potential at a point (x, y, z) is given by $V = -x^2 y - xz^3 + 4$. The electric field $\vec{E}$ at that point is:

(a) $\vec{E} = \hat{\imath}\, 2xy + \hat{\jmath}\,(x^2 + y^2) + \hat{k}\,(3xz - y^2)$
(b) $\vec{E} = [(2xy + z^3)\,\hat{\imath} + x^2\hat{\jmath} + 3xz^2\hat{k}$
(c) $\vec{E} = \hat{\imath}\,(2xy - z^2)\,\hat{\jmath}\, xu^2 + \hat{k}\, 3z^2\, x$
(d) $\vec{E} = \hat{\imath}\,(2xy + z^3) + \hat{\jmath}\, x^2 + \hat{k}\, 3xz^2$ **[CBSE PMT 2009]**

Q10

Three concentric spherical shells have radii a, b and c (a < b < c) and have surface charge densities σ, -σ and σ, respectively. If V_A, V_B and V_C denote the potentials of the three shells, then c = a + b, we have

(a) $V_C = V_B \neq V_A$
(b) $V_C = V_B \neq V_A$
(c) $V_C = V_B = V_A$
(d) $V_C = V_A \neq V_B$ **[CBSE 2009]**

Q11

Three capacitors each of capacitance C and of breakdown voltage V have been joined in series. The capacitance and breakdown voltage of the combination will be:

(a) 3C, $\frac{V}{3}$
(b) $\frac{C}{3}$, 3V
(c) 3 C, 3V
(d) $\frac{C}{3}$, $\frac{V}{3}$ **[CBSE PMT 2009]**

Q12

The potential difference applied to an X – ray tube is 5 k V and the current passing through it is 3.2 m A. Then, the number of electrons striking the target per second is:

(a) 2×10^{16}
(b) 5×10^{16}
(c) 1×10^{17}
(d) 4×10^{15} **[IIT 2002]**

Q13

Refer Fig. 2.2. Three resistances of equal value have been arranged in the different combinations shown here. Arranged them in the increasing order of power dissipation:

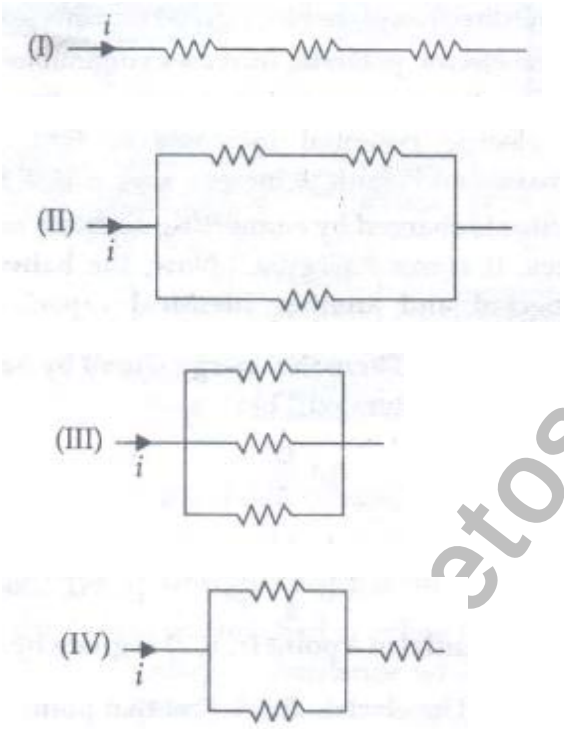


Fig. 2.2

(a) III < II < IV < I
(b) II < III < IV < I
(c) I < IV < III < II
(d) I < III < II < IV

Q14

A piece of copper and another of germanium have been cooled from room temperature to 80 K. The resistance of:

(a) Copper increases and of germanium decreases
(b) Copper decreases and of germanium increase
(c) Each one of them increases
(d) Each one of then decreases

Q15

The current (I) and voltage (V) curves for a given metallic wire at two different temperatures T_1 and T_2 are shown in the Fig. 2.3. Then:

(a) $T_1 > T_2$
(b) $T_2 < T_2$
(c) $T_1 = T_2$
(d) $T_1 = 2T_2$

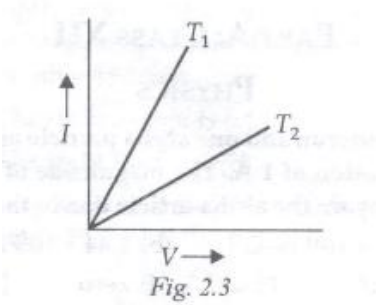


Fig. 2.3

[IIT 1989]

Q16

Calculate the value of current through the 2 – watt resistance for the circuit shown in Fig. 2.4.

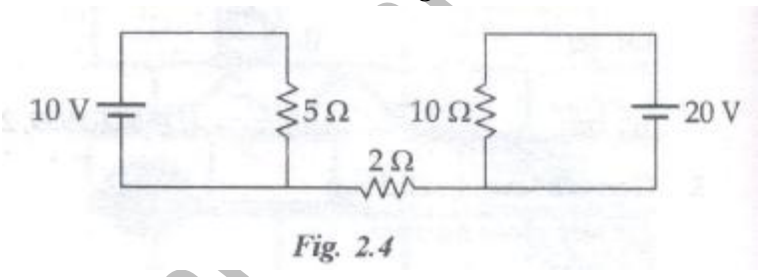


Fig. 2.4

(a) 0
(b) 2 A
(c) 5 A
(d) 4 A

[IIT 2005]

Q17

A wire of length L and three identical cells of negligible internal resistances have been connected in series. Due to the current, the temperature of the wire is raised by ΔT in time t. Now, N similar cells are connected in series with a wire of the same material and cross – section but of length 2L. The temperature of the wire is raised by the same amount ΔT in the same time. The value of N is:

(a) 4
(b) 6
(c) 8
(d) 9 **[IIT 2000]**

Q18

In the circuit shown in the Fig. 2.5, $P \neq R$. Then reading of the galvanometer is same with switch S open or closed. Then:

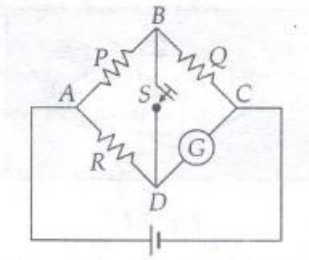


Fig. 2.5

(a) $I_R = I_G$
(b) $I_P = I_G$
(c) $I_Q = I_G$
(d) $I_Q = I_R$ **[DCE 2000]**

Q19

Refer Fig. 2.6. Identify this device. What is its possible application in the field of electronics?

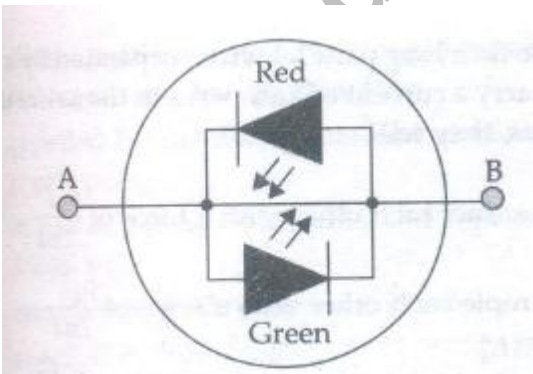


Fig. 2.6: Identify this device

(a) SCR; power rectifier
(b) LED; polarity indicator
(c) Solar cell; DC current generator
(d) Photodiode; lighting at traffic light signals

Q20

In the given circuit shown in Fig. 2.7, it is observed that the current I is independent of the value of the resistance R_6. So, the resistance vales must satisfy:

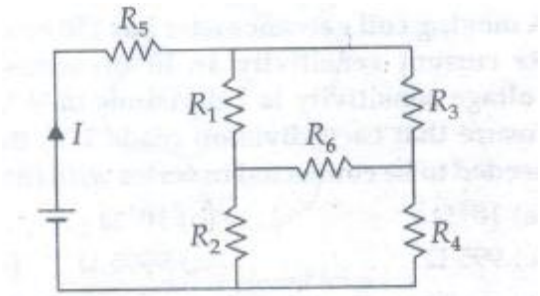


Fig. 2.7

(a) $R_1 R_2 R_3 = R_4 R_5 R_6$
(b) $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1+R_2} + \frac{1}{R_3+R4}$
(c) $R_1 R_4 = R_2 R_3$
(d) $R_1 R_3 = R_2 R_4 = R_5 R_6$

Q21

In the circuit shown in the Fig. 2.8, the current through the:

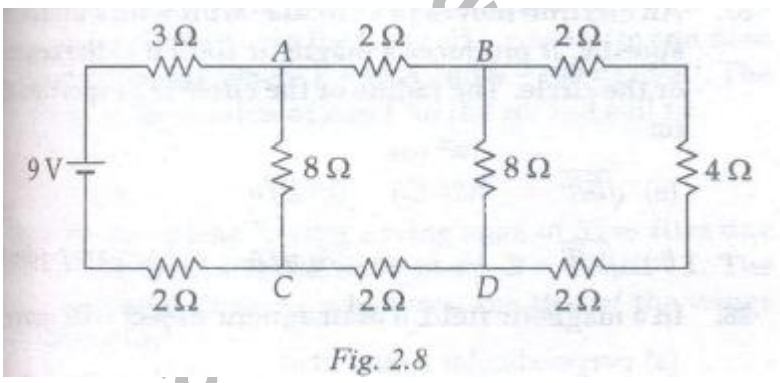


Fig. 2.8

(a) 3 – Ω resistor is 0.50 A
(b) 3 – Ω resistor is 0.25 A
(c) 4 – Ω resistor is 0.50 A
(d) 4 – Ω resistor is 0.25 A **[IIT 1998]**

Q22

A battery is charged at a potential of 15 V for 8 hours when the current flowing is 10 A for 15 hours. The mean terminal voltage during discharge is 14 V. The watt – hour efficiency of the battery is:

(a) 82.5%
(b) 80%
(c) 90%
(d) 87.5%

Q23

Refer Fig. 2.9. The total power dissipated in watts in the circuit is:

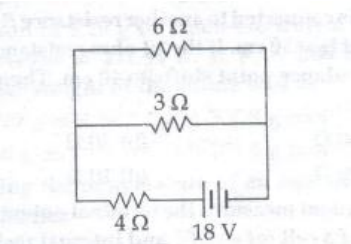


Fig. 2.9

(a) 24 W
(b) 54 W
(c) 48 W
(d) 36 W

Q24

Kirchhoff's First and Second laws of electrical circuits are the consequences of the law (s) of:

(a) Conservation of energy and electric charge, respectively
(b) Conservation of energy
(c) Conservation of electric charge and energy, respectively
(d) Conservation of electric charge

Q25

The resistance of each arm of a Wheatstone bridge is 10 Ω Now, a resistance of 10 Ω is connected in series with the galvanometer. Then, the equivalent resistance of the resistance of the bridge across the battery will be:

(a) 10 Ω
(b) 15 Ω
(c) 20 Ω
(d) 40 Ω **[CBSE 2001]**

Q26

In the network shown in Fig. 2.10, each resistance is 1 W. The effective resistance between the point A and B is:

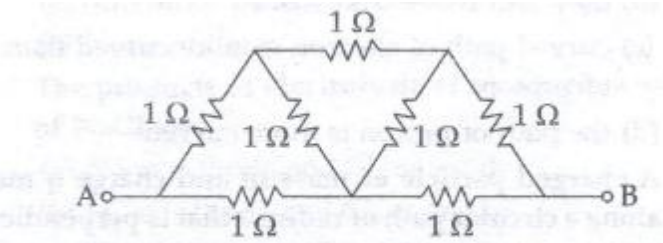


Fig. 2.10

(a) $\frac{4}{3}\ \Omega$
(b) $\frac{3}{2}\ \Omega$
(c) 7 Ω
(d) $\frac{8}{7}\Omega$ **[CBSE 2005]**

Q27

In a meter bridge, the balancing length from the left end (standard resistance of 1 W is in the right gap) is 20 cm. The value of the unknown resistance is:

(a) 0.8 Ω
(b) 0.5 Ω
(c) 1.4 Ω
(d) 0.25 Ω **[CBSE 1999]**

Q28

An unknown resistance R_1 has been connected in series with a resistance of 10 Ω This combination is connected to one gap of a meter bridge. The other gap of a meter bridge. The other gap is connected to another resistance R_2. The balance point is at 50 cm. If the 10 – ohm resistance is removed, the balance point shifts to 40 cm. Then, the value of R_1 is:

(a) 60 Ω
(b) 40 Ω
(c) 20 Ω
(d) 10 Ω **[CBSE 2009]**

Q29

A student measures the terminal potential difference (V) of a cell (of e. m. f ξ and internal resistance x) as a function of the current (I) flowing through it. The slope and intercept of the graph between V and I are, respectively, equal to:

(a) – r and ξ
(b) r and – ξ
(c) – ξ and r
(d) ξ and –r **[CBSE PMT 09]**

Q30

A charged particle moves through a magnetic field perpendicular to its direction. Then:

(a) kinetic energy changes but the momentum remains constant
(b) the momentum changes but the kinetic energy remains constant
(c) both momentum and kinetic energy of the particle are not constant
(d) both momentum and kinetic energy of the particle are constant

Q31

If an electron and a proton having same momenta enter a magnetic field perpendicularly, this:

(a) curved path of electron and proton will be same (ignoring the sense of revolution)
(b) they will move undeflected
(c) curved path of electron is more curved than that of proton
(d) the path of proton is more curved

Q32

A charged particle of mass m and charge q moves along a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle for completing one revolution is:

(a) $\frac{2\pi mq}{B}$
(b) $\frac{2\pi q^2 B}{m}$
(c) $\frac{2\pi qB}{m}$
(d) $\frac{2\pi m}{qB}$

Q33

Two thin long parallel wires, separated by a distance d, carry a current of I amperes in the same direction. Thus, they will:

(a) Attract each other with a force of $\frac{\mu_0 I^2}{2\pi d}$

(b) Repel each other with a force of $\frac{\mu_0 I^2}{2\pi d}$

(c) Attract each other with a force of $\frac{\mu_0 I^2}{2\pi d}$ (attractive)

(d) Repel each other with a force of $\frac{\mu_0 I^2}{2\pi d^2}$

Q34

The magnitude of the magnetic field (B) due to loop ABCD at the origin (O) is:

(a) 0

(b) 1

(c) $\frac{\mu_0 I}{24ab}$ (b – a)

(d) $\frac{\mu_0 I}{4\pi}$ [2 (b – a)$\frac{\pi}{3}$ (a + b)] **[AIEEE 2009]**

Q35

A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 divisions m – A^{-1} and voltage sensitivity is 2 divisions m – V^{-1}. In order to ensure that each division reads 1 V, the resistance needed to be connected in series with the coil will needed to be connected is series with the coil will be:

(a) 10^3 Ω

(b) 10^5 Ω

(c) 995 Ω

(d) 9995 Ω **[AIEEE 2005]**

Q36

Due to the presence of the current I_1 at the origin, the:

(a) Forces on AB and DC are zero

(b) Forces on AD and BC are zero

(c) Magnitude of the net force on the loop $\frac{\mu_0 I I_1}{4\pi}\left[2\,(b-a)+\frac{\pi}{3}(a+b)\right]$

(d) Magnitude of the net force on the loop is given by $\frac{\mu_0 I I_1}{24ab}$ (b – a) **[AIEEE 2009]**

Q37

An electron moves in a circular orbit with a uniform speed v. It produces a magnetic field B at the center or the circle. The radius of the circle is proportional to:

(a) $\sqrt{B}/v$
(b) B/v
(c) $\sqrt{v}/B$
(d) v/B **[IIT 1986]**

Q38

In a magnetic field, a diamagnetic object will move:

(a) perpendicular to the field
(b) from weaker to stronger parts
(c) from stronger to weaker parts
(d) in none of the after mentioned directions **[IIT 1991]**

Q39

If a diamagnetic substance is brought near the north or south pole of a bar magnet, it is:

(a) repelled by the north pole and attracted by the south pole
(b) attracted by the north pole and repelled by the south pole
(c) attracted by both poles
(d) repelled by both poles **[AIEEE 2007]**

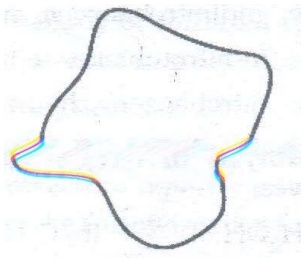
Q40

A metal ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is

(a) equal to g
(b) less than g
(c) more than g
(d) either (a) or (c) **[CBSE PMT 2005]**

Q41

As a result of change in the magnetic flux linked with the closed loop shown in Fig. 2.11, and e. m. f of



V volts is induced in the loop. The work done (in joule) in taking a charge Q coulomb once along the loop is:

(a) QV
(b) 2QV
(c) QV/2
(d) Zero **[CBSE PMT 2005]**

Q42

If N is the number of turns in a coil, the value of self-inductance varies as:

(a) N^0
(b) N
(c) N^2
(d) N^{-2} **[CBSE PMT 1993; DCE 2002]**

Q43

Two coils have mutual inductance 0.005 H. The current changes in the first coil according to equation $I = I_0 \sin \omega t$, where $I_0 = 10$ A and $\omega = 100\ \pi$ rad $-s^{-1}$. The maximum value of e. m. f. in the second coil is:

(a) 2π
(b) 5π
(c) 6π
(d) 12π

Q44

An aero plane having a wing span of 35 m flies due north with a speed of 90 m $-s^{-1}$. B = 4 x 10^{-5} T. The potential difference between the tips of the wings will be:

(a) 0.126 V
(b) 1.26 V
(c) 12.6 V
(d) 0.031 V

Q45

What is the co – efficient of mutual inductance if the magnetic flux changes by 2×10^{-2} weber and the change in current is 0.01 A?

(a) 2 H
(b) 4 H
(c) 3 H
(d) 8 H

PART B: CLASS XII

CHEMISTRY

Q46

Find the odd man out from among the following:

(a) Al
(b) Cu
(c) Wood
(d) Au

Q47

A solution of 1.25 g of a non – electrolyte in 20 g of water freezes at 271.94 K. If $K_f = 1.86$ K – m^{-1}, the molecular weight of the solute will be:

(a) 179.79 g – mol^{-1}
(b) 207.8 g – mol^{-1}
(c) 209.6 g – mol^{-1}
(d) 109.6 g – mol^{-1}

Q48

Increasing the temperature of an aqueous solution will cause the:

(a) Molality to increase
(b) Molarity to increase
(c) Mole fraction to decrease
(d) Percentage by weight to increase **[I. S. M. Dhanbad 1994]**

Q49

The molar freezing point constant of water is 1.86° C- M^{-1}. Therefore, the freezing point of 0.1 M Na solution in water is:

(a) -1.86° C
(b) -0.186° C
(c) -0.372° C
(d) +0.372° C

Q50

The effect of temperature rise on concentration is as follows:

(a) Metallic conduction increases, electrolytic conduction decreases
(b) Electrolytic conduction increases, metallic conduction decreases
(c) Both metallic and electrolytic conduction decrease
(d) Both metallic and electrolytic conduction increase

Q51

The EMF of a cell is the:

(a) Sum of two oxidation potentials
(b) Sum of two reduction potentials
(c) Difference of two electrode potentials
(d) None of these

Q52

The products of electrolysis of an aqueous solution of NaCI are:

(a) Na at cathode and Cl_2 at anode
(b) H_2 at cathode and Cl_2 at anode
(c) H_2 at cathode and O_2 at anode
(d) Na at cathode and O_2 at anode

Q53

Four alkali metals A, B, C and D are having respectively standard electrode potentials as -3.05, -1.66, -0.40 and 0.80 V. Which one will be most reducing?

(a) A
(b) B
(c) C
(d) D

Q54

The conductivity of a saturated solution of $BaSO_4$ is 3.06×10^{-6} ohm^{-1} and its equivalent conductance is 1.53 ohm^{-1}. The value of K_{sp} for $BaSO_4$ will be:

(a) 4×10^{-12}
(b) 2.5×10^{-9}
(c) 2.5×10^{-13}
(d) 4×10^{-6}

Q55

The role of catalyst in a chemical reaction is to change the:

(a) Heat of reaction
(b) Products of reaction
(c) Activation energy
(d) Equilibrium constant

Q56

The decomposition of NH_3 on the surface of tungsten is a reaction of:

(a) Zero order
(b) First order
(c) Second order
(d) Fractional order

Q57

In the presence of a catalyst, the heat evolved or absorbed during a reaction:

(a) Decreases
(b) Increases
(c) Remains unaffected
(d) None of these

Q58

The quantum yield of photosynthesis of:

(a) HCl is greater than that of HBr
(b) HCl is less than that of HBr
(c) HCl is equal to that HBr
(d) None of these

Q59

Diazonium salt decomposes as follows:

$$C_6H_5N_2^+Cl^- \longrightarrow C_6H_5Cl + N_2$$

At 0 ℃, the evolution of N_2 becomes two times faster when the initial concentration of the salt is doubled. Hence it is a/an:

(a) First order reaction
(b) Second order reaction
(c) Independent of the initial concentration of the salt
(d) Zero order reaction

Q60

The rate constant, activation energy and Arrhenius parameter of a chemical reaction at 25 ℃ are 3.0×10^{-4} s^{-1}, 104.4 kJ – mol^{-1} and 6.0×10^{14} s^{-1}, respectively. The value of the rate constant as $T \rightarrow \infty$ is:

(a) 2.0×10^{18} s^{-1}
(b) 6.0×10^{14} s^{-1}
(c) Infinity
(d) 3.6×10^{30} s^{-1}

Q61

The molecular formula of ethers is:

(a) $C_n H_{2n} O$
(b) $C_n H_{2n+1} O$
(c) $C_n H_{2n+2} O$
(d) $C_n H_{2n} O C_n H_{2n}$

Q62

Dehydration of alcohol into ethers is catalyzed by:

(a) Hot Concentrated H_2SO_4 at 413 K
(b) Hot NaOH
(c) Hot HBr
(d) HNO_3

Q63

Diethyl ether on heating with concentrated HI gives two moles of:

(a) Ethanol
(b) Iodoform
(c) Ethyl iodide
(d) Methyl iodide

Q64

Which one of the following compounds will show metamerism?

(a) $CH_3 COC_2 H_5$
(b) $C_2 H_5 SC_2 H_5$
(c) $CH_3 OCH_3$
(d) $CH_3 OC_2 H_5$

Q65

Which one of the following reduces Tollen's Reagent?

(a) $C_6 H_5 NO_2$
(b) $C_6 H_5 NO$
(c) $C_6 H_5 NH_2$
(d) $C_6 H_5 NHOH$

Q66

Phenol $\xrightarrow[distillation]{Zn}$ A $\xrightarrow[conc.H_2SO_4,333K]{conc.HNO_3}$ B $\xrightarrow[NaOH]{Zn}$ C

In this reaction sequence, A, B, and C are:

(a) Benzene, nitrobenzene, aniline
(b) Benzene, mdinitrobenzene, m – nitro aniline
(c) Toluene, m – nitro aniline, m – toluene
(d) Benzene, nitrobenzene, hydrazobenzene

Q67

The hydrolysis of $Ch_3 CH_2 NO_2$ with 85 percent $H_2 SO_4$ gives:

(a) $CH_3 CH_2 OH$
(b) $C_2 H_6$
(c) $CH_3 CH = NOH$
(d) $CH_3 COOH$

Q68

Refer fig. 2.12. The following reaction is a/an

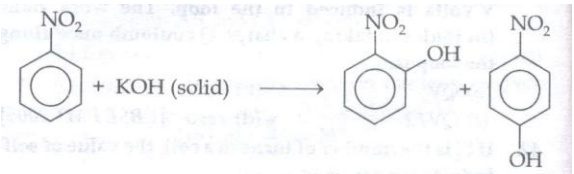


Fig. 2.12

(a) Nucleophilic substitution
(b) Rlectrophilic substitution
(c) Fee radical substitution
(d) Electrophilic addition

Q69

Which drug is recommended for regular use by heart patients?

(a) Vasograin
(b) Norfloxacin TZ
(c) Aspirin
(d) Ciplar 40

Q70

Which one of the following is not a complex compound?

(a) Potassium ferrocyanide
(b) Potassium ferrocyanide
(c) Ferrous ammonium sulphate
(d) Cuprammoniumsulphate

Q71

The molecular formula of glyceraldehyde is:

(a) $C_2 H_5 O_2$
(b) $C_3 H_6 O_3$
(c) $C_2 H_4 O_2$
(d) None of these

Q72

During the adsorption of oxalic acid on activated charcoal, the activated charcoal is known as:

(a) Adsorbent
(b) Adsorbate
(c) Adsorber
(d) Absorber

Q73

The presence of colloidal particles of dust in air imparts blue color to sky. This is due to the:

(a) Abortion of the light
(b) Scattering of the light
(c) Reflection of the light
(d) None of these

Q74

When the dispersion medium in a colloidal system is a gas, it is referred to as:

(a) Hydrosol
(b) Aquasol
(c) Aerosol
(d) Benzosol

Q75

Fog is an example of colloidal system of:

(a) Liquid dispersed in gas
(b) Gas dispersed in gas
(c) Solid dispersed in gas
(d) Solid dispersed in liquid

Q76

Which one of the following is a false statement?

(a) Colloidal sols are homogeneous
(b) Colloids carry positive or positive charge
(c) Colloid sols show Tyndalll Effect
(d) The size range of colloidal particles is 10 – 2000 $\dot{A}$

Q77

An emulsion is a colloidal solution in which both the dispersed phase and dispersion medium are:

(a) Solids
(b) Gases
(c) Liquids
(d) Suspensions

Q78

Which one of the following is a branched polymer?

(a) Low Density Polythene (LDP)
(b) Polyester
(c) Nylon
(d) Poly Vinyl Chloride (PVC)

Q79

Terylene is a polyester of:

(a) Hexamethylenediamine and adipic acid
(b) Vinyl chloride and formaldehyde
(c) Melamine and Formaldehyde
(d) Ethylene glycol and Terephthalic acid **[H. S. B. 1988]**

Q80

Chloroprene is the repeating until in:

(a) Polystyrene
(b) Neoprene
(c) PVC
(d) Polythene

Q81

A synthetic polymer prepared by using Caprolactam is known as:

(a) Terylene
(b) Teflon
(c) Nylon
(d) Neoprene

Q82

The carbohydrate which cannot be hydrolyzed by the human digestive system is:

(a) Starch
(b) Glycogen
(c) Cellulose
(d) All of these

Q83

Proteins are the polyimides of:

(a) ß – Amino acids
(b) α – Amino
(c) α – Hydroxy acids
(d) ß – Hydroxy acids

Q84

Which one of the following is a protein?

(a) Lecithin
(b) Glycogen
(c) Keratin
(d) Nucleic acid

Q85

Which ones of the following constitutes the genetic material of the cell?

(a) Nucleic acids
(b) Proteins
(c) Lipids
(d) Carbohydrates

Q86

Mutation in DNA occurs due to changes in the sequence of:

(a) Nitrogenous bases
(b) Ribose units
(c) Phosphate units
(d) None of these

Q87

Which one of the following has a branched chain structure?

(a) Amylopectin
(b) Amylose
(c) Cellulose
(d) Nylon

Q88

The main structural feature of proteins is:

(a) Ether linkage
(b) Ester linkage
(c) Peptide linkage
(d) All of these

Q89

Which one of the following is not a protein?

(a) Wool
(b) Nail
(c) Hair
(d) DNA

Q90

The helical structure of protein is stabilized by:

(a) Peptide bonds
(b) Di – peptide bonds
(c) Hydrogen bonds
(d) None of these

PART C: CLASS XII
BOTANY

Q91

Vegetative propagation plays a vital role in:

(a) Sericulture
(b) Apiculture
(c) Sylriculture
(d) Horticulture

Q92

A clone is a group of:

(a) Genetically similar organisms produced through asexual reproduction
(b) Genetically similar organisms produced through sexual reproduction
(c) Genetically dissimilar organisms produced as a result of asexual reproduction
(d) Genetically dissimilar organisms produced as a result of sexual reproduction

Q93

The technique of obtaining large number of plantlets through the tissue culture method is called:

(a) Plantlet Culture
(b) Organ Culture
(c) Micro Propagation
(d) Macro Propagation

Q94

In which plant, is bud grafting practiced?

(a) Apple
(b) Peach
(c) Rose
(d) All of these

Q95

What involves the fusion of gametes which differ in terms of size or motility?

(a) An isogamy
(b) Heterogamy
(c) Oogamy
(d) Both (a) and (b)

Q96

Which one of the following is not an item of bio piracy?

(a) Micro organisms
(b) Plants
(c) Animals
(d) Abiotic chemicals

Q97

Which one of the following is a transgenic plant?

(a) Flavrsarv
(b) Ashbyagossypii
(c) Meloidogyne incognita
(d) Gluconobacteroxidans

Q98

This kind of interferon is produced when leucocytes and lymphocytes are exposed to virus:

(a) Interferon – a
(b) Interferon – b
(c) Interferon – g
(d) None of these

Q99

A parasite can be defined as an organism which depends on others for:

(a) Food
(b) Shelter
(c) Both food and shelter
(d) Reproduction

Q100

A tropical rainforest is:

(a) Single – storeyed
(b) Double – storeyed
(c) Multi storeyed
(d) None of these

Q101

A tropical rainforest is:

(a) Littoral zone
(b) Limnetic zone
(c) Disphotic zone
(d) Benthic zone

Q102

Which horizon in soil profile is the area of illuviation?

(a) A – Horizon
(b) B – Horizon
(c) C – Horizon
(d) Bedrock horizon

Q103

Which type of water is absorbed or imbibed by the soil colloids?

(a) Hygroscopic water
(b) Water vapour
(c) Combined water
(d) Capillary water

Q104

Which type of age pyramid is made for stable population?

(a) Triangular Age pyramid
(b) Bell – shaped Age pyramid
(c) Urn shaped pyramid
(d) Inverted triangular age pyramid

Q105

The breakdown of detritus into small particles by bacteria is a process called:

(a) Mineralisution
(b) Catabolism
(c) Humification
(d) Fragmentation

Q106

Carnivores represent:

(a) Primary consumers
(b) Secondary consumers
(c) Secondary and tertiary consumers
(d) Reducers

Q107

The tip of an ecological pyramids occupied by:

(a) Producers
(b) Herbivores
(c) Carnivores
(d) None of these

Q108

The percentage of energy converted into biomass by a higher trophic level over the energy of food resources available at the lower trophic level is called:

(a) Photosynthetic efficiency
(b) Net production efficiency
(c) Assimilation efficiency
(d) Ecological efficiency

Q109

The management of forests or woodlands for the production of timber and other wood products is called:

(a) Apiculture
(b) Sericulture
(c) Silviculture
(d) Forestry

Q110

When was the first Earth Day celebrated?

(a) 1950
(b) 1970
(c) 1980
(d) 1955

Q111

Refer Fig. 2.13. Name the unlabeled area 'a' to 'e' of the pie chart representing biodiversity of vertebrates showing the proportionate number of species of major taxa:

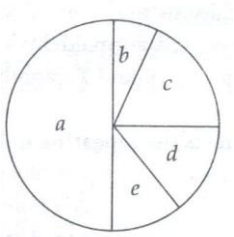


Fig. 2.13

(a) a – Fish, b – Mammals, c – Birds, d – Reptiles, e – Amphibians
(b) a – Mammals, b – Amphibians, c – Reptiles, d – Birds, e – Fish
(c) a – Birds, b – Amphibians, c – Fish, d – Mammals, e – Reptiles
(d) a – Fish, b – Reptiles, c – Amphibians, d – Birds, e – Mammals

Q112

The species listed in Red Data book are:

(a) vulnerable
(b) threatened
(c) endangered
(d) all of these

Q113

Which one is non - biodegradable?

(a) Sewage
(b) Market garbage
(c) Liver stock waste
(d) DDT

Q114

Which particulate size is biodegradable?

(a) 1.0 µm or less
(b) 1.5 µm or less
(c) 2.5 µm or less
(d) 5.2 µm - 2.5 µm

Q115

Shifting cultivation is:

(a) Agroforestry
(b) Social forestry
(c) Conservation forestry
(d) Industrial forestry

Q116

The global agreement for reducing the release of CFCs is:

(a) Vienna Convention
(b) Rio de Janeiro Conference
(c) Kyoto Protocol
(d) Montreal Protocol

Q117

Match the following:

A	Virus Free	1	Intact root
B	Root cutting	2	In vitro
C	Delbergia	3	Black berry
D	Mound layering	4	Jasmine

(a) A – 1, B – 3, C – 2, D – 4
(b) A – 2, B – 3, C – 1, D – 4
(c) A – 2, B – 1, C – 3, D – 4
(d) A – 2, B – 3, C – 4, D – 1

Q118

Which one of the following is a seasonal breeder?

(a) Mice
(b) Deer
(c) Poultry
(d) Rabbit

Q119

In vegetative propagation, when a branch is injured, defoliated and pegged down in the ground, this process is known as:

(a) Layering
(b) Grafting
(c) Cutting
(d) Bud Grafting

Q120

Bird pollination is:

(a) Chiropterophily
(b) Ornithophily
(c) Malacophily
(d) Myrmecophily

Q121

Ciesitogamous flowers are:

(a) Self – pollinated
(b) Insect – pollinated
(c) Bird – pollinated
(d) Wind – pollinated

Q122

Which one of the following is not and application Lactic acid?

(a) Food preservative
(b) Manufacture of cheese and yoghurt
(c) Fabric treatment in textile industry
(d) All of these

Q123

Double fertilization involves the fertilization of:

(a) An egg by two male gametes
(b) Egg and central cell by two sperms brought by two sperms brought by two sperms brought by two different pollen tubes
(c) Two eggs in the same embryo sac by two sperms brought by one pollen tube
(d) Egg and central call by two sperms brought by same pollen tube

Q124

Which one is a dominant trait out of the characters chosen by Mendel?

(a) Pod color – Yellow
(b) Seed Color – White
(c) Flower position – Axillary
(d) Plant height Dwarf

Q125

Heterozygous tall (Tt) is crossed with homozygous tall (TT). Percentage of heterozygous tall in the progency would be:

(a) 25%
(b) 50%
(c) 75%
(d) 100%

Q126

The 9 : 3 : 3 : 1 ratio is due to:

(a) Segregation
(b) Independent assortment
(c) Crossing over
(d) Homologous pairing

Q127

Variations observed during tissue culture of some plants are known as:

(a) Clonal variations
(b) Soma clonal variations
(c) Somatic variations
(d) Tissue culture variations

Q128

India's wheat yield revolution in the 1960s was possible primarily due to:

(a) Hybrid seeds
(b) The development of sem – dwarf variety of wheat
(c) Mutations resulting in plant height reduction
(d) Quantitative trait mutations

Q129

Which ones of the following have been included in the genre of bio – pesticides?

(a) Viruses and bacteria
(b) Viruses, bacteria and fungi
(c) Viruses, bacteria, fungi, protozoa and mites
(d) Viruses, bacteria, fungi and protozoa

Q130

Mycorrihiza promotes plant growth by:

(a) Absorbing inorganic ions from soil
(b) Helping the plant in utilizing atmospheric nitrogen
(c) Protecting the plant from infection
(d) Serving as plant growth regulator

Q131

Agarose extracted from seaweeds in used in:

(a) Spectrophotometry
(b) Tissue culture
(c) PCR
(d) Gel electrophoresis

Q132

The main objective of production/ use of herbicide – resistant GM crops is the:

(a) Elimination weeds from the field without the use of herbicides
(b) Promotion of eco – friendly herbicides
(c) Reduction of herbicide accumulation in food articles for health safety
(d) Elimination of weeds from the field without the use of manual labor

Q133

Which one of the following combinations is incorrect?

(a) Bean Seed: Endospermic and Monocotyledonous
(b) Maize Grain: Endospermic and Monocotyledonous
(c) Castor Seed: Endospermic and Dicotyledonous
(d) Bean Seed: Non – endospermic and Dicotyledonous

Q134

Xerophytes possess:

(a) Sunken stomata
(b) Deep roots
(c) Thick cuticles
(d) All of these

Q135

Green muffler is related to the pollution of:

(a) Soil
(b) Air
(c) Noise
(d) Water

PART D: CLASS XII

ZOOLOGY

Q136

Which extra embryonic membrane in humans prevents desiccation of the embryo inside the uterus?

(a) Allantois
(b) Yolk sac
(c) Amnion
(d) Chorion

Q137

Cryptorchidism is a condition in whish:

(a) Testis does not descend into scrotal sac
(b) Sperm is not found
(c) Male harmines are not reactive
(d) Ovaries are removed

Q138

Human egg is:

(a) Centrolecithal
(b) Alecithal
(c) Teloecithal
(d) Megalecithal

Q139

Saheli is:

(a) An oral contraceptive for females
(b) A surgical sterilization method for females
(c) A diaphragm for females
(d) A surgical method of sterilization in males

Q140

Chancroid is a sexually transmitted disease caused by:

(a) Treponema
(b) Haemophilus
(c) Neisseria
(d) Chlamydiae

Q141

What is correct about the test tube baby?

(a) Fertilization inside female genital tract and growth in test tube
(b) Rearing of prematurely born baby in an incubator
(c) Fertilization outside and gestation inside the womb of mother
(d) Both ferhilization and development are effected outside the female genital tract

Q142

Which one is related to males?

(a) Oral pills
(b) Tubectomy
(c) Vasectomy
(d) None of these

Q143

A test cross is:

(a) Tt x tt
(b) TT x tt
(c) Tt x Tt
(d) Tt x tt

Q144

Pleotropic effect is found in:

(a) Human skin color
(b) Night blindness
(c) Hemophilia
(d) Sickle cell anemia

Q145

The exon part of m – RNA has a code for:

(a) Polypeptides
(b) Carbohydrates
(c) Lipids
(d) Phospholipids

Q146

Which one of the following carries genetic messages to ribosomes?

(a) tRNA
(b) rRNA
(c) mRNA
(d) HnRNA

Q147

Refer Fig. 2.14. What do parts, a, b and c represent?

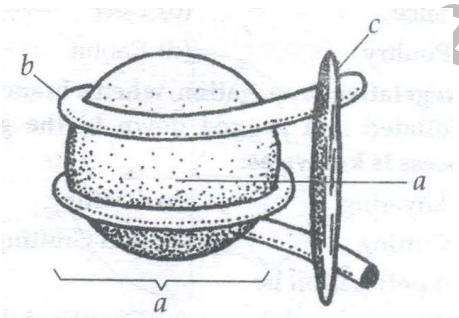


Fig. 2.14

(a) DNA, H1 Histone, core to histone molecule
(b) Core of Histone molecule, DNA, H1 Histone
(c) H1 Histone, core of Histone molecule, DNA
(d) H1 Histone, DNA, core of Histone molecule

Q148

Which one of the following is the correct sequence in the evolution of the horse?

(a) Mesohippus → Pliohippus → Merychippus → Equus
(b) Mesohippus → Eohippus → Merychippus → Equus
(c) Eohippus → Mesohippus → Merychippus → Pliohippus
(d) Eohippus → Merychippus → Mesohippus → Pliohippus

Q149

Palaentological evidence in favor of organic evolution can best be illustrated by:

(a) Duck – billed platypus
(b) Archaeopteryx
(c) Darwin's finches
(d) Bistonbetalaria

Q150

'Dexterity' in man means that:

(a) He has an erect posture
(b) He has binocular vision
(c) His brain volume is more
(d) His thumb is opposite to his fingers

Q151

In the immune system, interferon's are part of:

(a) Physiological barriers
(b) Cellular barriers
(c) Physical barriers
(d) Cytokine barriers

Q152

Emphysema is:

(a) A type of depression
(b) Insanity due to psychosis
(c) The tendency to take much water
(d) A respiratory disease

Q153

Macrophages are also known as:

(a) Tumor cells
(b) Natural killer cells
(c) Phagocyles
(d) B – cells

Q154

Which one is a Neem product and used as an insect repellent?

(a) Azadirachtin
(b) Rotenone
(c) Parathione
(d) Endrin

Q155

The sewage treatment process in which a part of decomposer microbes is recycled into the starting process is:

(a) Primary treatment
(b) Activated sludge treatment
(c) Catalytic treatment
(d) Tertiary treatment

Q156

The vector for t – DNA is:

(a) Thermos aquaticus
(b) Salmonella typhimurium
(c) Agrobacterium tumefaciens
(d) Escherichia coli

Q157

In which method, is foreign DNA directly injected into nucleus of animal cells or plant cell?

(a) Microinjection
(b) Electroporation
(c) Chemical Mediated Gene Transfer
(d) Gene Gun Method

Q158

The enzyme the degrades starches is:

(a) Lipase
(b) Amylase
(c) Lactase
(d) Protease

Q159

A patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome (AIDS). Which diagnostic technique will you recommend for its detection?

(a) ELISA
(b) MRI
(c) Ultrasound
(d) WIDAL

Q160

Which one of the following are hermaphrodites?

(a) Earthworm, Hydra and Leech
(b) Cockroach, Ascaris and Hydra
(c) Earthworm, Ascaris and Leech
(d) Ascaris, Cockroach and Hydra

Q161

Which cell organelle is absent in the human sperm:

(a) Endoplasmic Reticulum
(b) Mitochondria
(c) Nucleus
(d) Centrioles

Q162

The part of Fallopian tube closest to the ovary is:

(a) Isthmus
(b) Infunclibulum
(c) Cervix
(d) Ampulla

Q163

Sertoli cells are found in testis. These cells are:

(a) Nurse cells
(b) Reproductive cells
(c) Receptor cells
(d) None of these

Q164

Column I contains terms and Column II contains definitions. Match them correctly and choose the right answer:

Column I	Column II
A. Parturition	1. Attachment of zygote to endometrium
B. Gestation	2. Release of egg from Graafian follicle
C. Ovulation	3. Delivery of baby from uterus
D. Implantation	4. Duration between pregnancy and birth
E. Conception	5. Formation of zygote by fusion of egg and sperm
	6. Stoppage of ovulation and menstruation

(a) A – 2, B – 4, C – 1, D – 5, E – 3
(b) A – 4, B – 3, C – 1, D – 5, E – 2
(c) A – 5, B – 1, C – 2, D – 3, E – 4
(d) A – 3, B – 4, C – 2, D – 1, E – 5

Q 165

What is correct about amniocentesis?

(a) Intrauterine diagnosis
(b) Withdrawal of allantoic fluid from pregnant woman
(c) Chemical analysis of fluids of pregnant woman
(d) Culturing of amniotic cells and the study of metaphysics chromosomes for identifying chromosomal abnormality

Q166

Tubectomy, a method of population control, is performed on:

(a) Both males and females
(b) Males only
(c) Females only
(d) Only pregnant females

Q167

Medical termination of Pregnancy (MTP) is considered safe up to how many weeks of pregnancy?

(a) Eight weeks
(b) Twelve weeks
(c) Eighteen weeks
(d) Six weeks

Q168

Cri du chat is due to chromosomal aberration, called:

(a) Duplication
(b) Inversion
(c) Deletion
(d) Translocation

Q169

A sex – linked disorder is:

(a) Albinism
(b) Phenylketonuria
(c) Hemophilia
(d) Sickle Cell Anemia

Q170

Which one of the following Igs is nearly 0.2 percent of all antibodies in the human blood?

(a) IgD
(b) IgE
(c) IgM
(d) IgA

Q171

Hybrid cells proliferate into cells which are known as:

(a) Monoclonal antibodies
(b) Hybridisms
(c) Hybrid Structures
(d) None of these

Q172

Match the causative organisms with their diseases:

A.	Haemophilus influenza	1.	Malignant malaria
B.	Endameba histolytic a	2.	Elephantiasis
C.	Plasmodium falciparum	3.	Pneumonia
D.	Wuchereriabanacrofti	4.	Typhoid
E.	Salmonella typhi	5.	Amoebiasis

(a) A – 1, B – 5, C – 3, D – 2, E – 4
(b) A – 3, B – 5, C – 1, D – 2, E – 4
(c) A – 5, B – 1, C – 3, D – 4, E – 2
(d) A – 1, B – 3, C – 2, D – 5, E – 4
(e) A – 1, B – 3, C – 5, D – 2, E – 4

Q173

The most abundant immunoglobulin is:

(a) IgA
(b) IgE
(c) IgG
(d) IgD

Q174

Asthma is characterized by:

(a) Spasm in the bronchial muscle
(b) Alveolar wall degradation
(c) Pain in lungs
(d) Damage to diaphragm

Q175

Mule is produced by:

(a) Selection
(b) In – breeding
(c) Inter – specific hybridization
(d) Cross – breeding

Q176

The fish reared in culture fishery in India are:

(a) Salmon and Rohu
(b) Salmon and Catla
(c) Catla and Magur
(d) Rohu and Catla

Q177

The first ever hormone prepared by genetic engineering was:

(a) Oxytocin
(b) Somato – tropin
(c) Adrenalin
(d) Insulin

Q178

The reagent used in ELISA test is:

(a) Endonuclease
(b) Polymerase
(c) Ligase
(d) Peroxidase

Q179

Female mosquitoes sucking human blood at intervals are:

(a) Permanent parasites
(b) Endoparasites
(c) Hemi parasites
(d) Intermittent parasites

Q180

A food chain can have the following trophic level (s).

(a) Three or four
(b) Three
(c) Two
(d) One

Answers and Explanations

PART A : CLASS XII

PHYSICS

Sol 1.

(b) charge on deuteron = $^{+}e = 16 \times 10^{-19}$ C.

$E = \frac{1}{4\pi\varepsilon_0}.\frac{q}{r^2} = 9 \times 10^9 \times \frac{16x10^{-19}}{(1x10^{-10})^2}$

$= 1.44 \times 10^{11}$ NC^{-1}

The right choice is (b).

Sol 2.

(b) Force exerted by electric field. = Weight of water drop

eE = mg

or $E = \frac{mg}{e}$

The right choice is (b)

Sol 3.

(a) Gauss's low is valid for any closed surface.

The right choice is (a).

Sol 4.

(a) Given $V = 4x^2$ volt

i. e., electric potential changes only along the X – axis.

$\therefore E_x = \frac{dV}{dx} = -\frac{d}{dx}(4x^2) = -8x$

Electric field at point (1m, 0, 2 m) is

$E_x = -8 \times 1 = -8$ V – m^{-1} [put x = 1 m]

The right choice is (a).

Sol 5.

(c) and (d) Under electrostatic condition, all points lying on the conductor are at the same potential. Therefore, potential at A = potential at B. Hence option (c) is correct. From Gauss's theorem, total flux through the surface of cavity = $\frac{q}{\varepsilon_0}$

The right choices are (c) and (d).

Sol 6.

(b) and (c). Refer Fig. 2.15; options (b) and (c) are true.

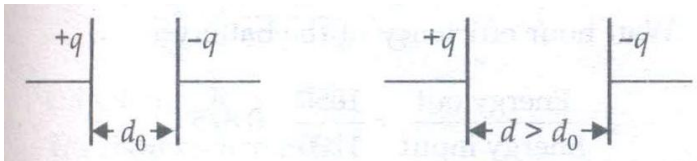


Fig. 2.15

The right choices are (b) and (c)

Sol 7.

(b) and (c) The section has been shown in Fig. 2.16. Options (b) and (c) are true.Due to polarization of the dielectric, a field E, is induced in the opposite direction of original field $\overrightarrow{E_0}$. But the field $\overrightarrow{E_{net}} = \vec{E}_0 - \overrightarrow{E_i}$ is the direction of $\overrightarrow{E_0}$.

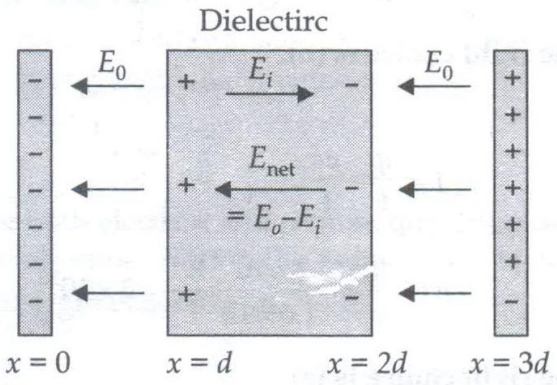


Fig. 2.16

The right choice is (b) and (c)

Sol 8.

(b) Initial energy stored in the capacitor,

$U = \frac{1}{2}CV^2 = \frac{q^2}{2C}$

When the battery is disconnected, charge q = constant. Another capacitor connected across the first capacitor in in parallel with is. So, the final energy stored by the system of two capacitors is:

$U' = \frac{q^2}{2C_{eq}} = \frac{q^2}{2x2C} = \frac{1}{2}U$

The right choice is (b).

Sol 9.

(b) $\vec{E} = -\frac{\partial V}{\partial r} = \left[-\frac{\partial V}{\partial x}\hat{\imath} - \frac{\partial V}{\partial y}\hat{\jmath} - \frac{\partial V}{\partial z}\hat{k}\right]$

$= [(2xy + z^3)\,\hat{\imath} + x^2\hat{\jmath} + 3xz^2\hat{k}]$

The right choice is (b).

Sol 10.

(d) $V_A = \frac{\sigma}{\varepsilon_0}(a - b + c)$

$V_B = \frac{\sigma}{\varepsilon_0}\left(\frac{a^2}{b} - b + c\right)$

$V_C = \frac{\sigma}{\varepsilon_0}\left(\frac{a^2-b^2}{c} + c\right)$

$= \frac{\sigma}{\varepsilon_0}\left[\frac{(a-b)(a+b)}{c} + c\right]$

$= \frac{\sigma}{\varepsilon_0}(a - b + c)$ $\quad [\because a + b = c]$

$\therefore V_A = V_C \neq V_B,$

The right choice is (d)

Sol 11.

(b) $V_{eff} = V + V + V = 3V$

$\frac{1}{C_{eff}} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C} = C_{eff} = \frac{C}{3}$

The right choice is (b)

Sol 12.

(a) $I = \frac{q}{t} = \frac{ne}{t}$

$\therefore n = \frac{It}{e} = \frac{3.2\ x\ 10^{-3}\ x\ 1}{1.6\ x\ 10^{-19}} = 2 \times 10^{16}$

The right choice is (a).

Sol 13.

(a) I $R_{eq} = R + R + R = 3R$, $P_1 = I^2 (3R)$

II $R_{eq} = \frac{2R\ x\ R}{2R+R} = \frac{2R}{3}$, $P_{II} = I^2\left(\frac{2R}{3}\right)$

III $R_{eq} = \frac{1}{\frac{1}{R}+\frac{1}{R}+\frac{1}{R}} = \frac{2R}{3}$, $P_{III} = I^2\left(\frac{R}{3}\right)$

IV $R_{eq} = \frac{R\ x\ R}{R+R} + R = \frac{3}{2}R$, $P_{IV} = I^2\left(\frac{3}{2}R\right)$

Clearly, $P_{III} < P_{II} < P_{IV} < P_I$

The right choice is (a).

Sol 14.

(b) The resistance of the metallic conductor copper decreases of the semiconductor germanium increases with the decrease in temperature.

The right choice is (b).

Sol 15.

(a) For the same potential V_0

At temperature T_1, R_1, $= \frac{V_0}{I_1}$

At temperature T_2, $R_2 = \frac{V_0}{I_2}$

As $I_2 < I_1 \therefore R_2 > R_1$

Since resistance of a metal increase with temperature so $T_2 > T_1$ or $T_1 < T_2$.

The right choice is (a)

Sol 16.

(a) The current through 2 Ω resistance will be zero because it is not a party of any closed loop.

The right choice is (a).

Sol 17.

(b) Let R and m be the resistance and mass of the first wire. Then the resistance of second wire would be 2R and mass is 2m.

Let ξ = emf each cell

And c = specific heat capacity of the material of the wire.

For the first wire, current $I_1 = \frac{3\xi}{R}$

And heat produced, I_1^2 (2R)t = mc ΔT

For the second wire, current $I_2 = \frac{N\xi}{2R}$

And heat produced, I_2^2 (2R)t = 2mc ΔT

Clearly, $I_1 = I_2$. Hence, N = 6

The right choice is (b)

Sol 18.

(a) whether the switch S is open of closed, the reading of the galvanometer G is not affected. This indicates that no flows through switch S. Therefore, $V_B = V_D$ and the Wheatstone bridge is balanced.

Hence, $I_P = I_Q$ and $I_R = I_G$

Only option (a) is correct

The right choice is (a).

Sol 19.

(b) This is the photograph of an LED. It is bicolor LED. It used as a polarity indicator.

The right choice is (b).

Sol 20.

(c) As I is independent of R_6, no current flows through R_6. Thus, the junction of R_1 and R_2 is at the same potential as the junction of R_3 and R_4. Hence, for a balanced Wheatstone bridge, we have:

$\frac{R_1}{R_2} = \frac{R_3}{R_4}$

Or, $R_1 R_4 = R_2 R_3$

The right choice is (c).

Sol 21.

(d) The right option is (d)

Sol 22.

(d) Input energy when the battery is charged

= VIt

= 15 V x 10 A x 8 h = 1200 Wh

Energy released when the battery is discharged

= 14 V x 5 A x 15 h = 1050 Wh

Watt hour efficiency of the battery

$= \frac{Energy\ \ out}{Energy\ \ input} = \frac{1050}{1200} = 0.875 = 87.5\%$

The right choice is (d).

Sol 23.

The parallel combination of 6 W and 3 W resistances in series with the 4 W resistance. The equivalent resistance is

$R = \frac{6x3}{6+3} + 4\ \Omega$

$\therefore P = \frac{V^2}{R} = \frac{18x18}{6} = 54\ W$

The right choice is (b).

Sol 24.

(c) Kirchhoff's first and second laws of electrical circuits are the consequences of the laws of conservation of electric charge and energy, respectively.

The right choice is (c).

Sol 25.

(a) Connecting a resistance in series with the galvanometer does not affect the balanced condition of the bridge. We just have (have 10 Ω + 10 Ω) and (10 Ω + 10 Ω) resistances in parallel.

$\therefore R_{eq} = \frac{20\ x\ 20}{20+20} = 10\ \Omega$

The right choice is (a).

Sol 26.

(d) Putting r = 1 Ω, we get:

$R_{AB} = \frac{8r}{7} = \frac{8x1}{7} = \frac{8}{7}\Omega$

The right choice is (d).

Sol 27.

(d) $\frac{R}{S} = \frac{1}{100-1}$

Or $\frac{R}{1\Omega} = \frac{20cm}{100\ cm - 20\ cm}$

Or R = $\frac{20}{80}$ x 1 Ω = 0.25 Ω

The right choice is (d).

Sol 28.

(c) Case I:

$\frac{R_1+10}{R_2} = \frac{50}{100-50}$

Or, $R_1 + 10 = R_2$

Case II:

$\frac{R_1}{R_2} = \frac{10}{100-60} = \frac{2}{3}$

On solving, $R_1 = 20\ \Omega$

The right choice is (c)

Sol 29.

(a) V = ξ – Ir Or V = -rI + ξ

On comparing with y = mx – c, we get: slope = -r and intercept = ξ

The right choice is (a).

Sol 30.

(b) The magnetic field exerts a force perpendicular at the direction of motion of the charged particle. It continuously deflects the particle from its path but does no work on it. Hence, the momentum of the particle changes but its kinetic energy remains same.

The right choice is (b)

Sol 31.

(a) Radius of the circular path of a charged particle in a perpendicular magnetic field.

$$r = \frac{mv}{qB}$$

For both electron and proton, quantities mv, q and B are all same. Hence, the radius r will be same.

The right choice is (a)

Sol 32.

(d) $r = \frac{mv}{qB}$

$\therefore T = \frac{2\pi r}{v} = \frac{2\pi}{v} \cdot \frac{mv}{qB} = \frac{2\pi m}{qB}$

The right choice is (d)

Sol 33.

(c) The force between two parallel wires carrying currents I_1 and I_2 in the same direction is

$F = \frac{\mu_0}{2\pi} \frac{I_1 I_2}{d}$ (attractive)

But $I_1 = I_2 = I$

$\therefore F = \frac{\mu_0 I^2}{2\pi d}$ (attractive)

The right choice is (c).

Sol 34.

(c) Refer Fig. 2.17. Net magnetic field due to loop ABCD at O is

$B = B_{AB} + B_{BC} + B_{CD} + B_{DA} = 0 + \frac{\mu_0 I}{4\pi a} \times \frac{\pi}{6} + 0 - \frac{\mu_0 I}{4\pi b} \times \frac{\pi}{6} = \frac{\mu_0 I}{24a} - \frac{\mu_0 I}{24b} = \frac{\mu_0 I}{24ab} (b - a)$

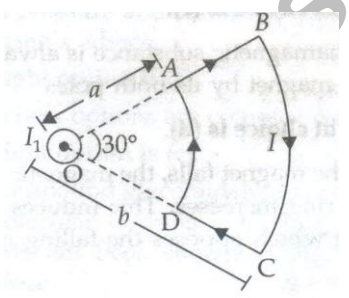


Fig. 2.17

The right choice is (c).

Sol 35.

(d) Resistance of the galvanometer.

$G = \frac{\text{Current sensitivity}}{\text{Voltage sensitivity}} = \frac{10}{2} = 5\ \Omega$

Number of division on the galvanometer scale, n = 150

Current required for full scale deflection,

$I_g = \frac{n}{\text{Current sensitivity}} = \frac{150}{10}$

$= 15\ mA = 15 \times 10^{-3}\ A$

Required range of voltmeter = 150 x 1 = 150 V Required series resistance,

$R = \frac{V}{I_g} - G = \frac{150}{15 \times 10^{-3}} - 5 = 9995\ \Omega$

The right choice is (d).

Sol 36.

(b) The forces on AD and BC are zero because magnetic field due to a straight wire on AD and BC is parallel to elementary length of the loop.

The right choice is (b).

Sol 37.

$T = \frac{2\pi R}{v}$

$\therefore I = \frac{q}{T} = \frac{qv}{2\pi R}$

$B = \frac{\mu_0 I}{2R} = \frac{\mu_0}{2R} \cdot \frac{qv}{2\pi R} = \frac{\mu_0 qv}{4\pi R^2}$

Or $R^2 = \frac{\mu_0 qv}{4\pi B}$

$\therefore R \propto \sqrt{\frac{v}{B}}$

The right choice is (c).

Sol 38.

(c) A diamagnetic material moves slowly from stronger to weaker parts in a magnetic field.

The right choice is (c).

Sol 39.

(d) A diamagnetic substance is always repelled by a bar magnet by its both poles

The right choice is (d).

Sol 40.

(b) As the magnet falls, the magnetic flux linked with the ring increases. This induces an e. m. f. in the ring which opposes the falling magnet.

Hence, a < g.

The right choice is (b).

Sol 41.

(a) Induced e. m. f.,

$$V = \frac{\text{Work done in taking charge Q once along the lop}}{\text{Charge Q}}$$

Or $V = \frac{W}{Q}$

$\therefore W = QV$

The right choice is (a).

Sol 42.

(b) self – inductance,

$L = \frac{\mu_0 N^2 A}{l}$

i.e., $L \propto N^2$

The right choice is (c).

Sol 43.

(b) $x = M \frac{dI}{dt}$

$= M \frac{d}{dt} (I_0 \sin \omega t)$

$= MI_0 \omega$ x o σ ω t

$\xi_{max} = MI_0 \omega$ [Max. value of $\cos\omega t = 1$] = 0.005 x 10 x 100 π = 5 π V

The right choice is (b).

Sol 44.

(a) $\xi = Blv$

$= 4 \times 10^{-5} \times 35 \times 90$

$= 126 \times 10^{-3}$ V

= 0.126 V

The right choice is (a).

Sol 45.

(a) $\phi = MI$, so $\Delta\phi = M\Delta I$

Or $M = \frac{\Delta\phi}{\Delta I} = = \frac{21\times10^{-2}}{0.01} = 2H$

The right choice is (a).

PART B

CHEMISTRY

Sol 46.

(c) All others are good conductors of electricity. Wood is and insulator, So it is the odd man out.

The right option is (c).

Sol 47.

(d) The right option is (d).

Sol 48.

(b) Molarity will increase if the temperature of and aqueous solution is raised.

The right option is (b)

Sol 49.

(c) The right option is (c).

Sol 50.

(b) When temperature rise, electrolytic conduction rises and metallic conduction rises and metallic conduction comes down.

The right choice is (b)

Sol 51.

(c) The right option is (c). Refer Fig. 2.18.

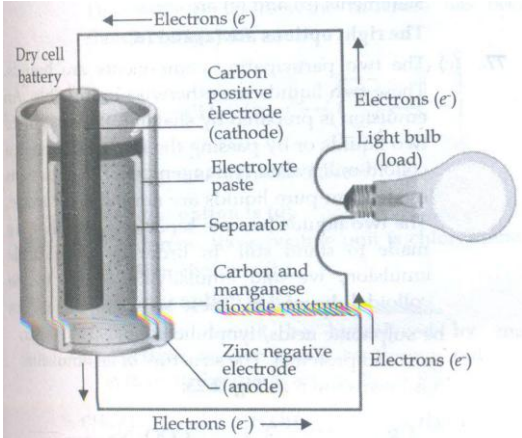


Fig. 2.18 : An electric (DC) cell

Sol 52.

(b) Hydrogen will be collected at cathode. Chlorine will be collected at anode.

The right choice is (b)

Sol 53.

(a) The right option is (a).

Sol 54.

(d) The right option is (d).

Sol 55.

(c) Catalyst enhances the activation energy of reactants. So, they react quickly to form products. Let us take an example, as follows.

$$CH_3.CH_2OH + HCl \xrightarrow[\Delta]{AnHyd.Zncl_2} CH_3CH_2Cl + H_2O$$

Here, anhydrous zinc chloride has been used as a catalyst. It converts reactants in products when heat is given to them. The activation energy is enhanced in this reaction by $ZnCl_2$.

The right option is (c),

Sol 56.

(a) The right option is (a).

Sol 57.

(c) The heat evolved or absorbed in a reaction is not affected by the catalyst in a reaction.

The right option is (c).

Sol 58.

(a) The right option is (a).

Sol 59.

(a) The right option is (a).

Sol 60.

(b) The right option is (b)

Sol 61.

(c) The general formula of ethers is as follow:

Ether $\leftrightarrow C_n H_{2n+2} O$

If the two alkyl groups attached to the oxygen atom are the same, then the ether is called Symmetrical Ether. If the alkyl groups attached to the oxygen atom are different, the ether is called Unsymmetrical Ether. Refer Fig. 2.19 which shows a symmetrical ether.

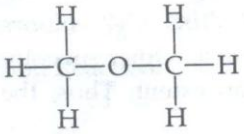


Fig. 2.19 Methoxy methane (Symmetrical ether)

Refer Fig. 2.20 which shows an unsymmetrical ether.

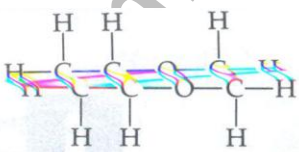


Fig. 2.20 Methoxy ethane (Unsymmetrical ether)

The right choice is (c).

Sol 62.

(a) The right option is (a).

Sol 63.

(c) The right option is (c).

Sol 64.

(b) $C_2 H_5 SC_2 H_5$ will show metamerism.

The right option is (b).

Sol 65.

(d) The right option is (d).

Sol 66.

(d) The right option is (d).

Sol 67.

(d) When $CH_3 CH_2 NO_2$ is hydrolyzed with 85 percent sulphuric acid, CH_3 COOH is produced.

The right choice is (d).

Sol 68.

(a) This is a Nucleophilic reaction

The right option is (a).

Sol 69.

(c) Aspirin must be taken by patient as per doctor's advice. It is recommended by doctors as it keeps human heart comfortable. So, aspirin is a good doing for heart patients. Vasograin is used for treating migraine. Nor TZ is an antibiotic that kills stomach infection. Ciplar 40 controls high blood pressure and cannot be taken without the physician's advice.

The right option is (c).

Sol 70.

(c) The others options are complex compounds.

The right choice is (c).

Sol 71.

The compound glyceraldehyde is a biomolecule. Its molecular formula is $C_3H_6O_3$. Its structural formula has been shown in Fig. 2.20. It is an aldoriose. (Image) page no. 51

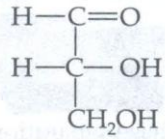


Fig. 2.20: D(+)—Glyceraldehyde

The right option is (b).

Sol 72.

(a) Activated charcoal acts as an adsorbent.

The right option is (a)

Sol 73.

(b) The white light is scattered and the violet color (out of 7 VIBGYOR) colors is scattered by the highest angle. Other six colors are not scattered to such an extent. Thus, sky appears to be blue.

The right option is (b).

Sol 74.

(c) When the dispersion medium in a colloid is a gas, the medium is called Aerosol. Refer Fig. 2.21.

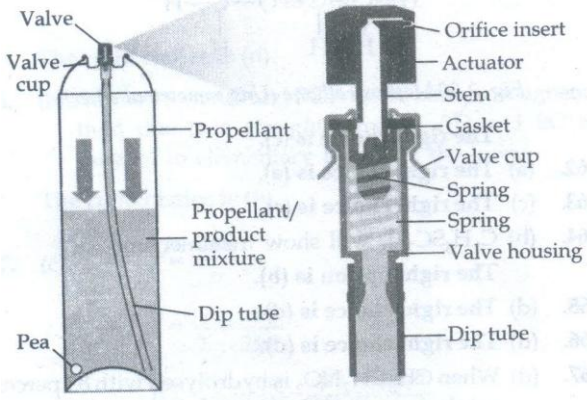


Fig. 2.21: Aerosol

Sol 75.

(a) Fog is a colloid. It is a liquid dispersed in a gas Refer the Fig. 2.22.

The right option is (a).

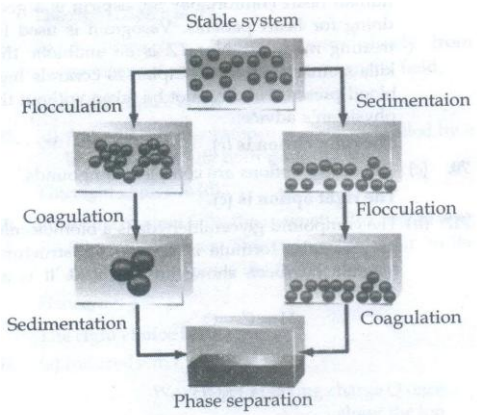


Fig. 2.22: Colloid

Sol 76.

(a) and (d). Both (a) and (d) are incorrect statement statements. Statements (b) and (c) are correct.

The right options are (a) and (d).

Sol 77.

(c) The two participating components are liquids. These two liquids are otherwise immiscible. An emulsion is prepared by shaking the mixture of two liquids or by passing the mixture through a colloid mill, called Homogenizer. The emulsions made from pure liquids are normally not stable,. The two liquids become separate when they are emulsion, we add emulsifying agents to the colloidal dispersion. These stabilizing agents to the colloidal dispersion, These stabilizing agents can be sulphonic acids, lyophilic colloids of an emulsifier has been shown in Fig. 2.23

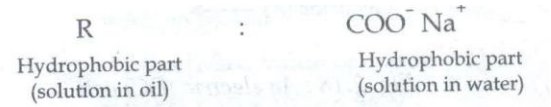


Fig. 2.23: Emulsifier structure

The soaps are potassium and sodium salts of higher fatty acids. Sodium palmitate ($C_{15}H_{31}COONa$) and Sodium stearate ($C_{17}H_{35}COONa$) are two examples in this context. The hydrocarbon part of the soap molecule (like $C_{15}H_{31}$ or $C_{17}H_{35}$) is soluble in oil. The polar group (COO^-Na^+) of the soap is soluble in water. So, the R – part of the soap remains in the oil and the COO^-Na^+ part remains in water. The soap molecules oil. Due to this, the interfacial tension between oil and water reduces. Thus, they mix up to yield an emulsion. Fig. 2.24 will make the concept clear.

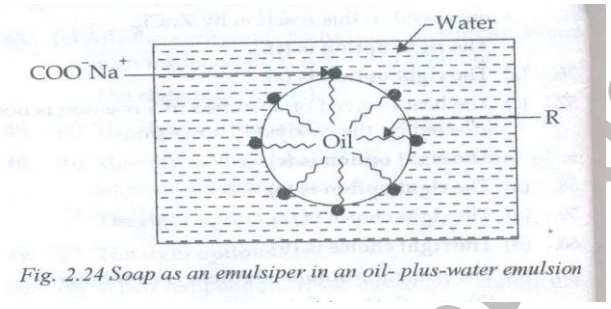


Fig. 2.24 Soap as an emulsiper in an oil- plus-water emulsion

The right option is (c).

Sol 78.

(a) Low Density Polythene (LDP) is a branched polymer,

The right option is (a)

Sol 79.

(d) Terylene is a polyester prepared from Ethylene glycol and terephthalic acid. The structure of Terylene (Dacron) has been shown in Fig. 2.25.

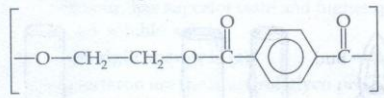


Fig. 2.25: Terylene (Dacron)

The right option is (d).

Sol 80.

(b) In neoprene, the repetitive unit is chloroprene.

The right choice is (b).

Sol 81.

(c) The right option is (c).

Sol 82.

(c) Cellulose cannot be hydrolyzed by man's digestive organs. It will be thrown out of the system without any action. Refer Fig. 2.26.

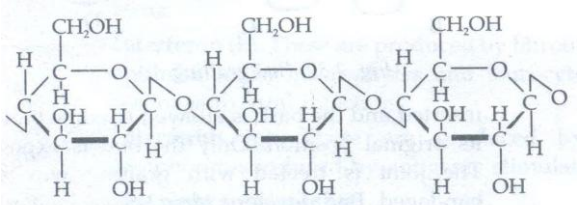


Fig. 2.26: Cellulose

The right option is (c).

Sol 83.

(b) The right option is (b).

Sol 84.

(c) Keratin is a protein. It is a type of fibrous protein. These proteins are the major structural material of animal tissue. Examples: Keratin (skin), Collagen (tendons), Fibroin (silk) and Myosin (muscles). The intermolecular forces of attraction are strong in such proteins. They are not soluble in water. They can withstand moderate changes in temperature and pH value. Refer Fig. 2.27.

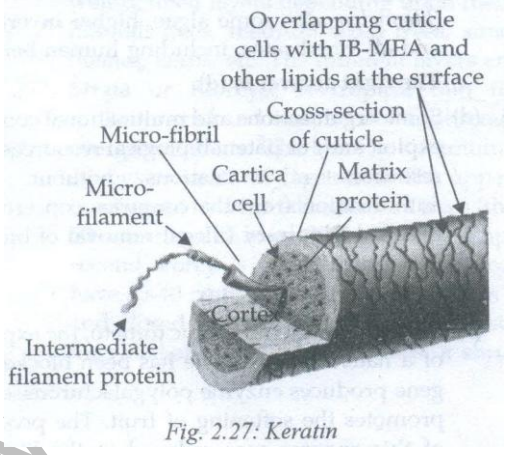


Fig. 2.27: Keratin

The right option is (c).

Sol 85.

(a) The right option is (a).

Sol 86.

(a) The right option is (a).

Sol 87.

(a) The right option is (a).

Sol 88.

(c) Peptide linkage is the chief structural feature of proteins. Refer Fig. 2.28.

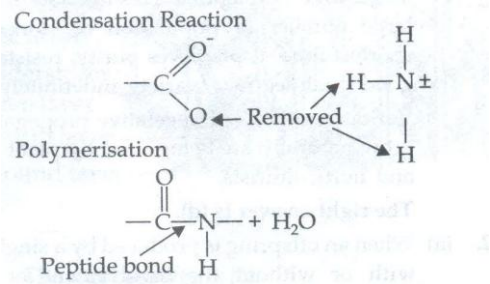


Fig. 2.28: Peptide linkage in proteins

The right option is (c).

Sol 89.

(d) DNA is the basic molecule of life. It is not a protein. Refer Fig. 2.29.

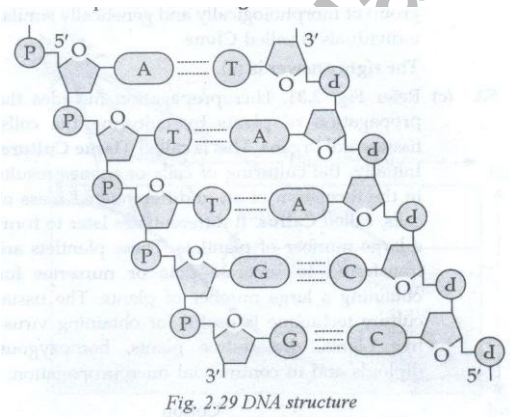


Fig. 2.29 DNA structure

The right option is (d).

Sol 90.

(b) The helical structure of protein is stabilized by dipeptide bonds. Refer Fig. 2.30. It shows dipeptide bonds.

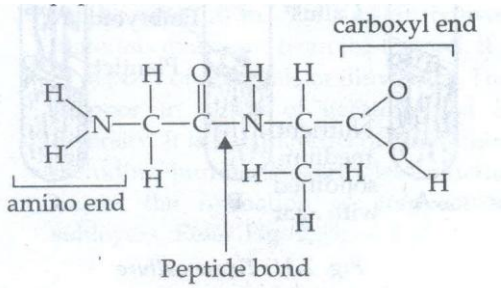


Fig. 2.30: Dipeptide bonds

The right option is (b).

PART C

BOTANY

Sol 91.
(d) Vegetative propagation is the formation of new plants from vegetative units such as buds, tubers,
rhizomes etc. These vegetative units are called Vegetative Prop gules. This method produces a large number of populations of clones in the shortest time. It preserves purity, resistance and good qualities
race/variety indefinitely.
Various methods of vegetative propagation that grow naturally are being used by plant growers and
horticulturists.
The right answer is (d).
Sol 92.

(a) When an offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is called Asexual Reproduction As a result, the offspring that are produced
are not only similar to one another but are also the exact copies of their parents. Such a group of morphologically and genetically similar individuals is called Clone.

The right answer is (a).

Sol 93.

(c) Refer Fig. 2.31. Hicropropagation includes the propagation of plants by culturing the cells, tissues and organs. This is called Tissue Culture. Initially, the culturing of cells or tissues results in the formation of an undifferentiated mass of cells, called Callus. It differentiates later to form a large number of plantlets. These plantlets are transferred to separate pots or nurseries for obtaining a large number of plants. The tissue culture technique is useful for obtaining virus- free plants, disease-free plants, homozygous diploids and in commercial micropropagation.

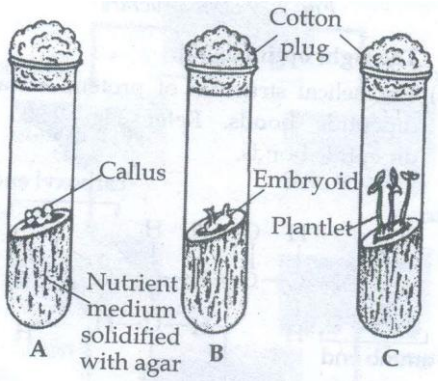


Fig. 2.31: Tissue culture

The right answer is (c).

Sol 94.

(d) Refer Fig. 2.32. Scion is a bud with a small piece of bark and cambium. The stock is given a T-shaped cut. Bark is lifted for exposing cambium

Bud is (image) page no. 54 inserted and the bark is allowed to come back to its original position. Only the bud is exposed. The joint is treated with grafting wax bandaged. Bud develops after 3-5 weeks. Leave and buds of the stock are removed. The stock cut above the graft. Bud grafting is practised Apple, Peach and Rose.

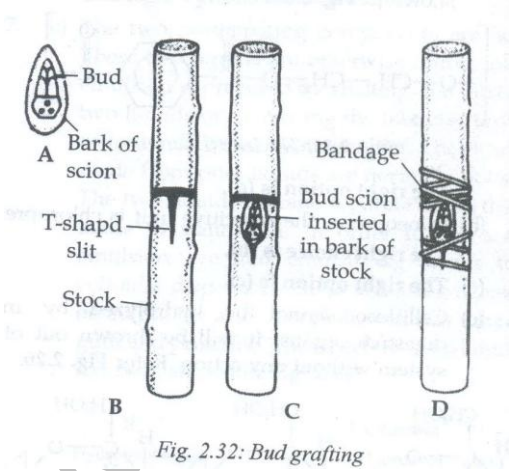


Fig. 2.32: Bud grafting

The right answer is (d).

Sol 95.
An isogamy (Heterogamy) involves the fusion of gametes which differ in size or motility. Such gametes are called an isogametes or heterogametes (e.g. microgametes or male gametes and macrogametes or female gametes, An isogamy(G. K. an = without, iso = equal, gamos = marriage) orheterogamy (G. K. hetero = different, gamos = marriage) occurs in (hlamydomonas, some algade, higher invertebrates and all vertebrates, including human beings).

The right answer is (d).

Sol 96.

(d) Some organizations and multinational companies exploit and/ or patent biological resources or bio-resources other nations without proper authorization from the countries concerned this is called Bio-piracy (illegal removal of biologic materials).

The right answer is (d).

Sol 97.

(a) In FlavrSarv, a transgenic tomato, the expression of a native tomato gene has been blocked. This gene produces enzyme polygalacturonase which promotes the softening of fruit. The production of this enzyme was reduced in the Flavrsarv transgenic tomato. The non-availability of this enzyme prevents over-ripening because the enzyme is essential for the degradation of cell walls. Thus fruit remains fresh for a longer period than the fruit of normal tomato variety. It retains flavor, has superior taste and higher quantity of total soluble solids.

The right answer is (a).

Sol 98.

(a) Interferon are the antiviral glycol proteins (called Lytokines) functioning as immune regulators as lymphokines produced by the infected cells in response to viral infections (discovered in 1957 by Alec Issacs and Jean Lindenmann). These proteins are produced by most body cells on exposure to viruses. There are three major classes of interferon, as follows:
(i) Interferon (a): This kind of interferon is produced when leucocytes and lymphocytes are exposed to virus. (ii) Interferon (b): These are produced by fibroblasts, epithelial cells, macrophytes and leucocytes in
response to viral infection. (iii) Interferon (g): These are produced by T- lymphocytes induced by antigenic stimulation.

The right answer is (a).

Sol 99.

(c) Parasitism is a relationship between two living organisms of different species in which one organism, called Parasite, obtains its food directly from another living organism, called Host. The parasite is smaller as compared to its host. It spends a part whole of its life on or in the body of the host.

The right answer is (c).

Sol 100.

(c) In a tropical rain forest, the vegetation shows stratification. Note that stratification is the grouping of plants in a forest into two or more well-defined layers depending upon their height like tall trees, medium sized trees, small tress, bushes, herbs, etc. The different layers are called Strata or Storeys. A tropical rain forest is multistoreyed and mainly contains broad-leaved evergreen plants. There are a minimum of five storeys or strata of vegetation. The upper storey is occupied by very tall emergent trees (they have 50 m or more of height). The canopy is open. The second storey is constituted by tall trees (they have 35-40 metres of height) which form a dense and closed canopy. There is an understorey or intermediate layer of small trees, a shrub layer and a ground layer of ferns, mosses and herbs. Refer Fig. 2.33.

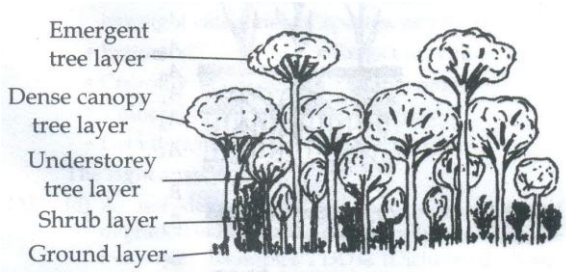


Fig. 2.33

The right answer is (c).

Sol 101.

(d) The Benthic zone is the bottom zone. In deep lakes and seas, the bottom is also in perpetual darkness. However, in shallow waters, light does penetrate. Refer Fig. 2.34.

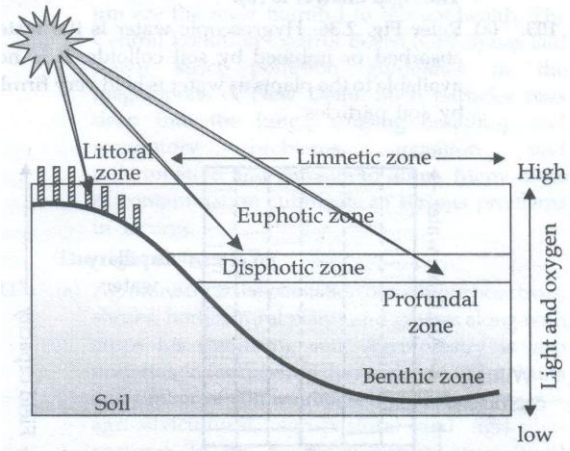


Fig. 2.34: Benthic zone is low-lying

The right answer is (d).

Sol 102.

(b) The B-horizon is also called Subsoil. Its thickness can be up to 1.0 m. The subsoil receives various materials that come from the top soil. It is an area of deposit of materials or illuviation. The horizon is poor in terms of aeration and biological diversity. It is rich in terms of plant nutrients and including humus. Nevertheless, illuviation also causes the formation of compact and hard sub layers. Refer Fig. 2.35.

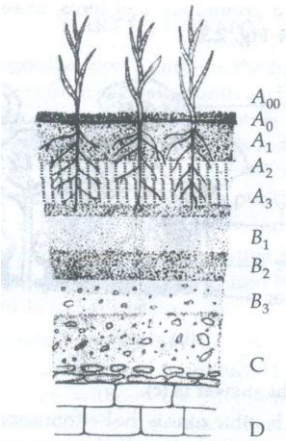


Fig. 2.35: Soil horizons

The right answer is (b).

Sol 103.

(a) Refer Fig. 2.36. Hygroscopic water is the water absorbed or imbibed by soil colloids. It is not available to the plants as water is held very firmly by soil particles.

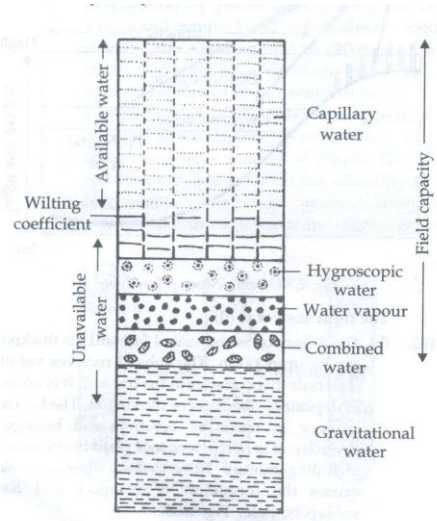


Fig. 2.36: Hygroscopic water

The right answer is (a).

Sol 104.

(b) Refer Fig. 2.37. For a stable population, the bell - shaped age pyramid is made. The number of pre-reproductive and reproductive individuals are almost equal. Post-reproductive individuals are comparatively fewer in terms of number. The population size remains stable; it neither grows nor diminishes.

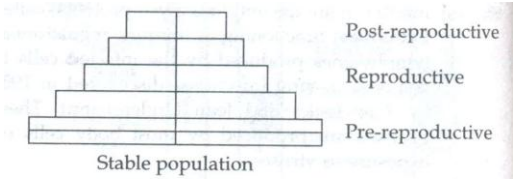


Fig. 2.37

The right answer is (b).

Sol 105.

(b) Refer Fig. 2.38. In catabolism, the decomposers (like bacteria and fungi) excrete digestive enzymes over the detritus. It changes soluble complex organic substances into simple and soluble organic compounds and inorganic mass. A part of the broken down food is taken up by decomposers and immobilized. Refer Fig. 2.38.

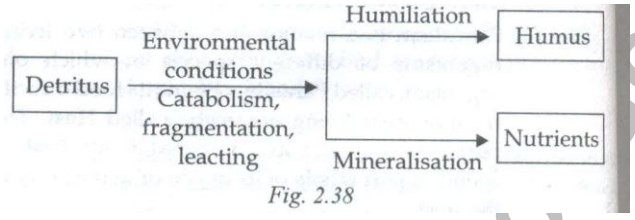


Fig. 2.38

The right answer is (b).

Sol 106.

(c) Refer Fig. 2.39.

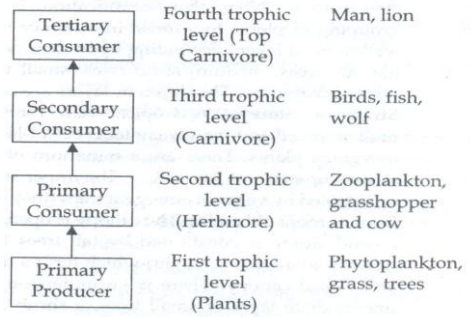


Fig. 2.39: Actors in a food chain

The right answer is (c).

Sol 107.

(c) Refer Fig. 2.40.

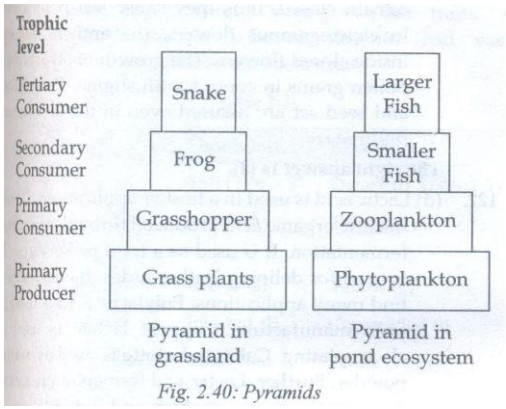


Fig. 2.40: Pyramids

The right answer is (c).

Sol 108.

(d) Ecological Efficiency

$$= \frac{\text{Energy Converted into Biomass at a Trophic level}}{\text{Energy Present in Biomass at Lower Trophic Level}} \times 100$$

The right answer is (d)

Sol 109.

(c) The management of forests or woodlands for the production of timber and other wood products is called Silviculture.

The right choice is (b).

Sol 110.

(b) The first Earth Day was celebrated in 1970 by a group of people of America to draw attention towards the increasing environmental problems caused by humans on the mother earth.

The right answer is (b).

Sol 111.

(a) Refer Fig. 2.41.

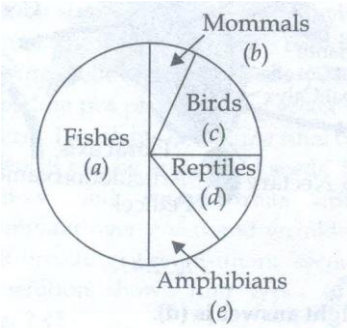


Fig. 2.41

The right answer is (a).

Sol 112.

(d) The Red Data Book or Red List is a catalogue of taxa that face the risk of extinction. The Red List has eight categories of species, as follows:

- Extinct
- Extinct in wild
- Critically endangered
- Endangered
- Vulnerable
- Lower risk
- Data deficiency
- Not evaluated

The right answer is (d).

Sol 113.

(d) A non-degradable pollutant does not get degraded or broken down naturally into harmless materials. Examples: DDT (Dichloro - diphenyltrichloro-ethane), BHC (Benzene hexachloride), empty cans, polythene bags, waste plastics, etc. No degradable pollutants are also called Persistent Pollutants. They are difficult to manage, for a natural method for degrading them is absent.

The right answer is (d).

Sol 114.

(c) The particles of diameter less than or equal to 2.5 urn are the most harmful to human health. The Central Pollution Control Board (CPCB) has laid down strict pollution guidelines in the megalopolis of New Delhi. Such particles pass deep into the lungs, causing breathing and respiratory problems, irritation and inflammation and damage to lungs. Many cases of contamination culminate in serious problems in victims.

The right answer is (c).

Sol 115.

(a) Agroforestry is the plantation of multipurpose trees, shrubs, horticultural plants and grasses along with crops for stabilizing soil. Agroforestry is also undertaken for meeting the needs of fodder, fruits and timber of communities. It is of three types- agri - Silviculture, agri - pastoral and agri – silvi -pastoral. In the Tanugya system, agricultural crops are grown in between the rows of planted trees like Sal and Teak. Jhum or Shifting Cultivation is also a traditional system of agroforestry; it allows the re-growth of forests after clearing and cultivating an area for a few years.

The right answer is (a).

Sol 116.

(d) Under the Montreal Protocol (September 16, 1987) 27 industrialized countries agreed to limit the production of ChloroFluoro Carbons (CFCs) to one half of the level present at that time.

The right answer is (d).

Sol 117.

(b) The right answer is (b).

Sol 118.

(b) Deer is a seasonal breeder. That is because it reproduces only at a particular period of the year. The other examples of tills genre are birds (most of them), lizard, frog, etc. Other animals reproduce throughout the year during the course of their sexual maturity. The other examples of tills genre are cattle, mice, rabbit, honey bee queen, poultry, etc.

The right answer is (b).

Sol 119.

(a) Layering is a type of root cutting technique in which adventitious roots are induced for developing on a soft stern while it is still attached to the plant. The process of layering is carried on one – year - old basal shoot branches generally during the early spring or early rainy season. A soft basal branch is defoliated in its middle where a small injury or cut is given. The cuts are of many types- Tonguing (oblique cut), Notching (V- shaped cut) and Ringing (removal of the ring of bark). The injured defoliated part is pegged in the soil so that an adventitious root is developed. The pegged down branch of the plant is called Layer. Later, as roots develop, tills layer is separated and planted.

The right answer is (a).

Sol 120.

(b) Refer Fig. 2.42. Ornithophily is the mode of allogamy performed by birds. Only a few types of bird are specialized for tills. They usually have small size and long beaks. Two common types of tropical pollinating birds are sun birds (Afro-Asia) and humming birds (America). Humming birds performs pollination while hovering over the flowers. Sun birds alight over the shoots supporting flowers or occasionally rest over flowers. Some other pollinating birds are - Crow, Bulbil, Parrot and Maynah.

Fig. 2.42: Ornithophily

The right answer is (b).

Sol 121.

(a) Cleistogamous flowers are intersexual. They remain closed, thus they cause self-pollination. In Cleistogamous flowers, the anthers dehisce inside closed flowers. The growth of style brings pollen grains in contact with stigma. Pollination and seed set are assured even in the absence of pollinators.

The right answer is (a).

Sol 122.

(d) Lactic acid is used in a host of applications. It was the first organic acid produced through microbial fermentation. It is used as a food preservative. It is used for de lining leather hides. Its derivatives find many applications. Polylactic acid is used in resin manufacture. Coppere lactate is used in electroplating. Calcium lactate is used as baking powder. Further, Lactic acid fermentation is used in for making cheese, yoghurt and butter.

The right answer is (d).

Sol 123.

(d) Refer Fig. 2.43. Double fertilization is the fusion of two male gametes brought by a pollen tube to two different cells of the same female gametophyte for producing two different structures. It is found only in angiosperms where it was first discovered by Nawaschch in 1898 in Fritillaria and Lilion. In angiosperms, the pollen tube bursts open in one of the two synergids for releasing two male gametes. One male gamete fuses with the egg or oosphere to form a diploid zygote or oospore. It is called Generative Fertilization. The second male gamete descends down and fuses with the diploid secondary nucleus of the central cell to form a triploid primary endosperm cell. It is known as Vegetative Fertilization.

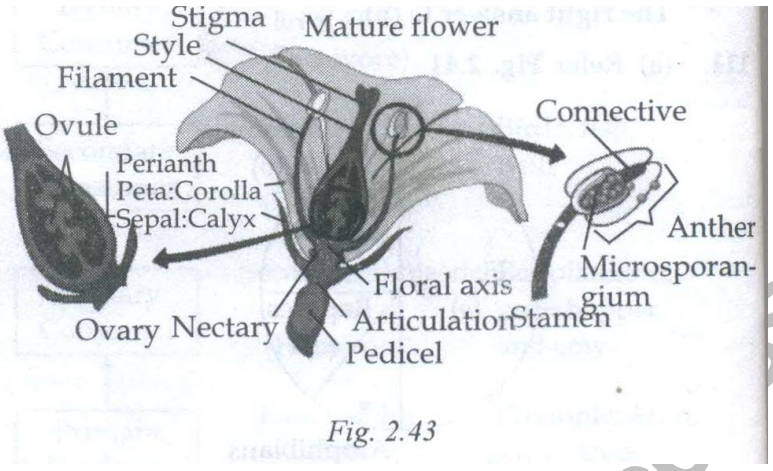


Fig. 2.43

The right answer is (d).

Sol 124.

(c) Refer Table 2-1. Mendel selected 7 pairs of pure or true breeding varieties of pea as the starting material for ills experiments. Upon Self - pollination or self - breeding, a pure variety gave rise to offspring having similar traits. All characters of selected varieties had easily distinguishable alternate traits.

Table 2-1

	Character	Dominant	Recessive
l	Plant Height	Tall (T) 6' - 7'	Dwarf (t) 3/4 -
2	Flower/pod position	Axial (A)	Terminal (a)
3	Pod color	Green (G)	Yellow (g)
4	Pod Shape	Inflated (I)	Constricted (i)
5	Flower color / Seed coat	Videt/red (V or R)/Grey	White (v or r)
6	Seed shape	Smooth/Round (R)	Wrinkled (r)
7	Seed color	Yellow	Green (y)

The right answer is (c).

Sol 125.

(b)Refer Fig. 2.44.

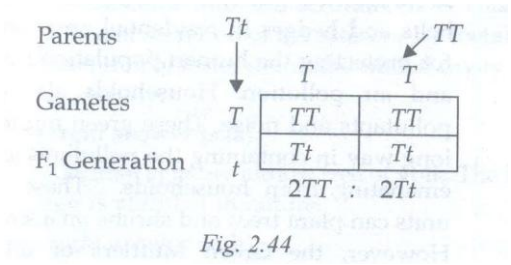


Fig. 2.44

Hence, percentage of heterozygous tall in the progeny would be 50 percent

The right answer is (b).

Sol 126.

(b) The principle or law of independent assortment can be studied by means of dihybrid cross. We can study it between pure breeding pea plants having yellow round seeds (YYRR) and pure breeding pea plants having green wrinkled seeds (yyrr). The plants of the first filial or F, generation have all yellow and round seeds (YyRr) because yellow and round traits are respectively dominant over green and wrinkled traits. Upon self-breeding, the resultant second filial or F2 generation shows four types of plants. Refer Fig. 2.45.

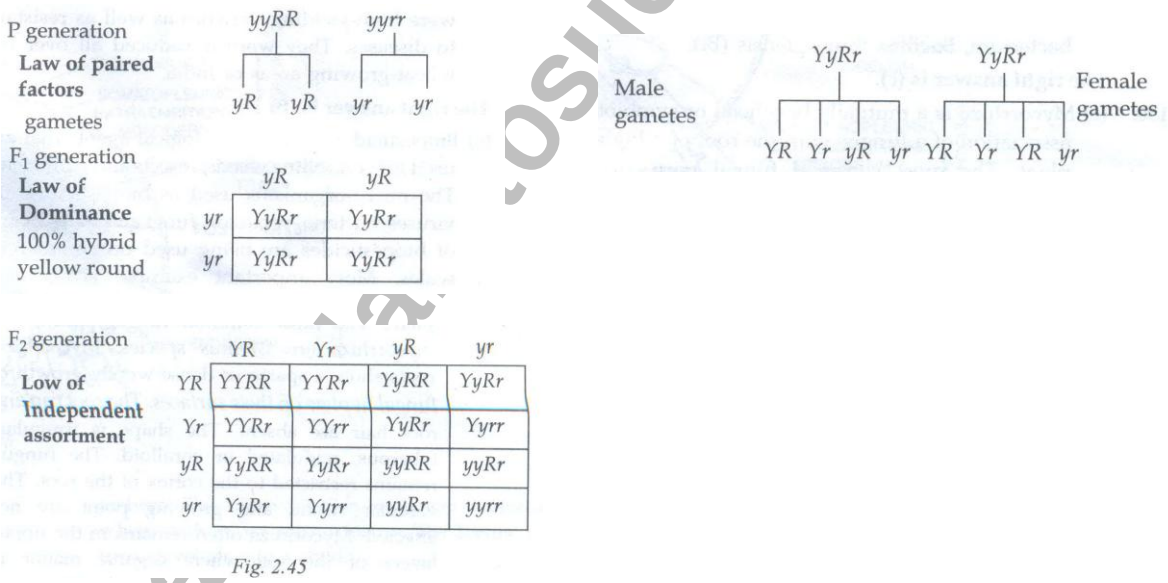


Fig. 2.45

(i) 9 Y-R (Yellow Round) (ii) 3yR (Green round) (iii) 3Yr (Yellow wrinkled) (iv) 1yr (Green wrinkled)

(v) Phenotypic Dihybrid Ratio = 9 : 3: 3 : 1.

The right answer is (b).

Sol 127.

(b) Genetic variation present among plant cells of a culture is a called Soma clonal Variation. The term soma clonal variation is also used for the genetic variation present in plant regenerated from a single culture. This variation has been used for developing several useful varieties.

The right answer is (b).

Sol 128.

(b) In 1960 to 2000 wheat production increased from 11 million tones to 75 million tones. It was due to the development of semi-dwarf varieties of wheat. Nobel prize winner Norman E. Borlaug of International Centre for Wheat and Maize Improvement (based in Mexico) developed semi - dwarf wheat. In 1963, many lines like Sonalika and KalyanSona were selected from these. They were high-yielding varieties as well as resistant to diseases. They were introduced all over the wheat-growing areas of India.

The right answer is (b).

Sol 129.

(c) Bio pesticides are those biological agents that are used for controlling weeds, insects and pathogens. The micro-organisms used as bio pesticides are viruses, bacteria, protozoa, fungi and mites. Some of bio pesticides are being used on commercial scales. Most important example is the soil bacterium, Bacillus thuringiensis (Bt).

The right answer is (c).

Sol 130.

(c) Mycorrhiza is a mutually beneficial or symbiotic association of a fungus with the root of a higher plant. The most common fungal partners of mycorrhiza are Glomus species. Mycorrhizal roots show a sparse or dense woolly growth of fungal hyphae on their surfaces. The root cap and root hair are absent. The shape is irregular, tuberous, nodulated or coralloid. The fungus remains restricted to the cortex of the root. The vascular strand and growing point are not affected Mycoriniza often remains in the upper layers of the soil where organic matter is abundant.

The right answer is (c).

Sol 131.

(d) Electrophoresis is a technique of separation of molecules such as DNA, RNA or protein under the influence of an electrical field so that they migrate in the direction of electrode bearing the opposite charge. Positively charged molecules move towards cathode (negative electrode) and negatively charged molecules travel towards anode (positive electrode) through a medium or matrix. Nowadays, the most commonly used matrix is agarose which is a polysaccharide extracted from sea weeds.

The right answer is (d).

Sol 132.

(c) The right answer is (c).

Sol 133.

(a) The option (a) gives wrong set of information about the bean seed. All other options are correct. Option (d) gives correct data about the bean seed.

The right answer is (a).

Sol 134.

(a) Xerophytes are plants of dry habitats where the environment favors higher rate of transpiration than the rate of absorption. In xerophytes, leaves may possess prickles and spines. Cuticle is thick Wax occurs stomata are sunken and restricted to lower surface of the leaves. Barks is thick and develop very early. The root system is very extensive. It may spread along the soil surface in order to absorb every drop of rain as well as dew.

The right answer is (a).

Sol 135.

(b) And (c) Green Muffler or Green belt vegetation refers to the long rows of green trees or shrubs that are grown and maintained for reducing noise pollution. These green trees and shrubs act as noise absorbers. They also reduce air pollution because trees and shrubs absorb polluting gases (emanated by vehilces and factories) and settle suspended particulate Matter (SPM). Green Muffler is created especially along highways and rails so that noise could be absorbed by green vegetation. Pollutants and gases are also absorbed by this long row of vegetation. It is also grown around industrial units and commercial enclaves. The green belts can be made much wider in such areas. These green belts protect residents from SPM, harmful gases, dust and sound. The green belts and hedges in residential areas are meant for protecting the human population from noise and air pollution. Households also generate pollutants and noise. These green mufflers go a long way in containing the pollutants and noise emanating from households. These dwelling units can plant trees and shrubs on a small scale. However, the Green Mufflers of urban and industrial areas are to be developed by forest authorities or other officials who look after this affair.

The right answers are (b) and (c).

PART D: ZOOLOGY

Sol 136.

(c) Amnion is composed of trophoblast inside and somatopleuric extraembryonic mesoderm outside. The space between embryo and amnion is called Amniotic Cavity which is filled with a clear, watery fluid secreted by embryo and membranes. The amniotic fluid prevents the desiccation of the embryo and acts as a protective cushion that absorbs shocks. Refer Fig. 2.46.

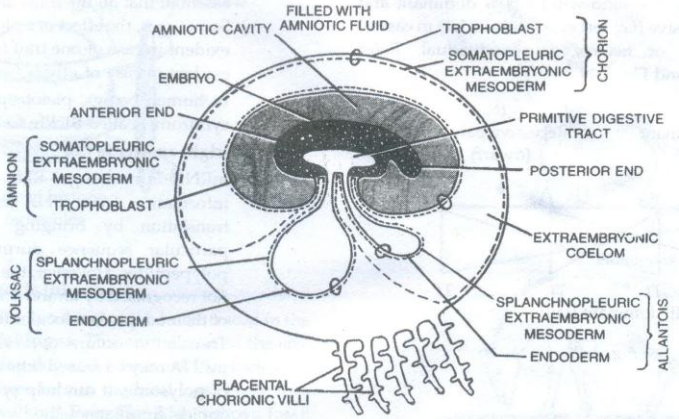


Fig. 2.46

The right answer is (c)

Sol 137.

(a) In cryptorchidism, crypto means hidden, orchid means testis. It is a condition in which testes do not descend into the scrotum. It is caused by deficient secretion of testosterone by foetal testes. Retention of testes in the abdominal cavity results in sterility.

The right answer is (a).

Sol 138.

(b) Alecithal eggs are almost free of yolk. The human egg is alecithal in nature.

The right answer is (b).

Sol 139.

(a) Mini pills contain progestin only (with no oestrogen).**Saheli** contains a Mon steroidal preparation, called **Centchroman** which is taken once a week after an initial intake of twice-a-week dose for 3 months (by females). It has high contraceptive value with very little side effects. The**Saheli** contraceptive has been developed at Central Drug Research Institute (CDRI), Lucknow.

The right answer is (a).

Sol 140.

(b) Haemophiliusducreyi is a pathogen that causes chancroid.

Symptoms of Chancroid: Ulcer appears at the site of infection generally over external genitalia. It is painful and bleeds easily. The lymph nodes near it swell up and become tender.

The right answer is (b)

Sol 141.

(c) In a test tube baby, the fusion of ovum and sperm is done outside the body of woman for forming a zygote which is allowed to divide to form embryo. This embryo is then implanted in uterus where it develops into a foetus. The foetus, in turn, develops into a child.

The right answer is (c).

Sol 142.

Surgical methods prevent pregnancy. Surgical methods block gamete transport and hence prevent fertilization. The sterilization procedure for males is termed **Vasectomy** and that for females **is termed Tubectomy** (tubal ligation). In vasectomy, a small part of the Vas deferens is removed or tied up through a small cut on the scrotum. Refer Fig. 2.47.

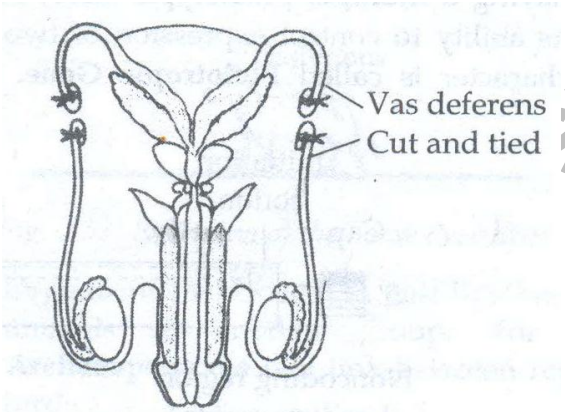


Fig. 2.47

The right answer is (c).

Sol 143.

(a) Test cross is a type of cross for knowing whether an individual is homgygous or heterozygous for the dominant character. The individual is crossed with a recessive parent. The offspring will be 100% dominant if the individual was homozygous dominant. The ration will be 50% dominant and 50% recessive (*i.e.*, test cross ratio of 1: 1) in case of a hybrid or heterozygous individual. Refer Fig. 2.48 and Fig. 2.49.

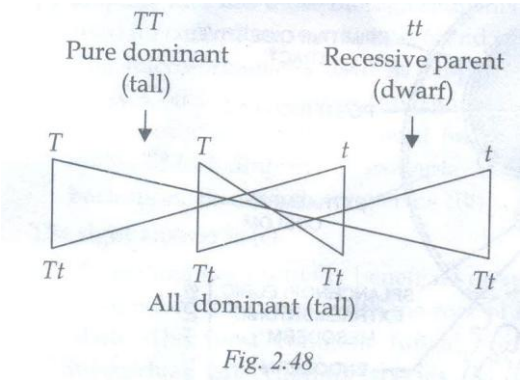


Fig. 2.48

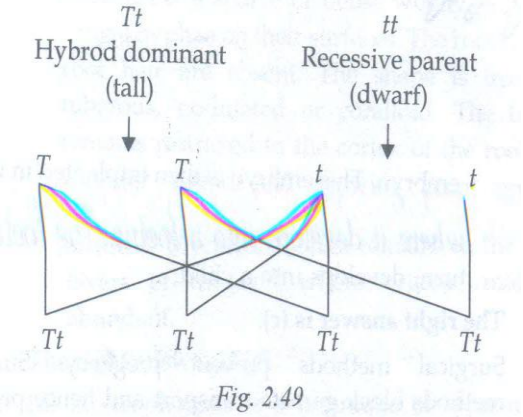


Fig. 2.49

Sol 144.

(d) The ability of a gene to have multiple phenotypic effect because it in flounces a number of characters simultaneously is known as **Pleiotropy**. The gene having a multiple phenotypic effect because of its ability to control expression of two or more character is called **Pleiotropic Gene**. It is not essential that all the traits are equally influenced. Sometimes, the effect of a pleiotropic gene is more evident in case of one (major effect) and less evident in case of others (secondary effect). In human beings, Pleiotropy is exhibited by a syndrome, called **Sickle Cell Anemia**.

The right answer is (d).

Sol 145.

(a) mRNA is messenger RNA which brings coded information from DNA and takes part in its translation by bringing amino acids in a particular sequence during the synthesis of polypeptides. However, the codons of mRNA are not recognized by amino acids but by anticodons of their adaptor molecules (tRNAs → aa – t RNAs). Translation occurs over ribosomes. The same mRNA may be reused time and again. In the form of polysome, it can help synthesize a number of copies simultaneously.

The right answer is (a).

Sol 146.

(c) The functions of mRNA are as follows: (Refer Fig. 2.50):

(i) MRNA carries coded information for translation into polypeptide formation.

(ii) Through reverse transcription it can form compact genes which are used in genetic engineering. The phenomenon also occurs in nature and has added certain genes to the genomes.

(iii) It has a cap region for attachment to ribosome.

(iv) Cap protects the nRNA from degradation by enzymes.

(v) mRNA has a tail region for protection from cellular enzymes and detachment from ribosome.

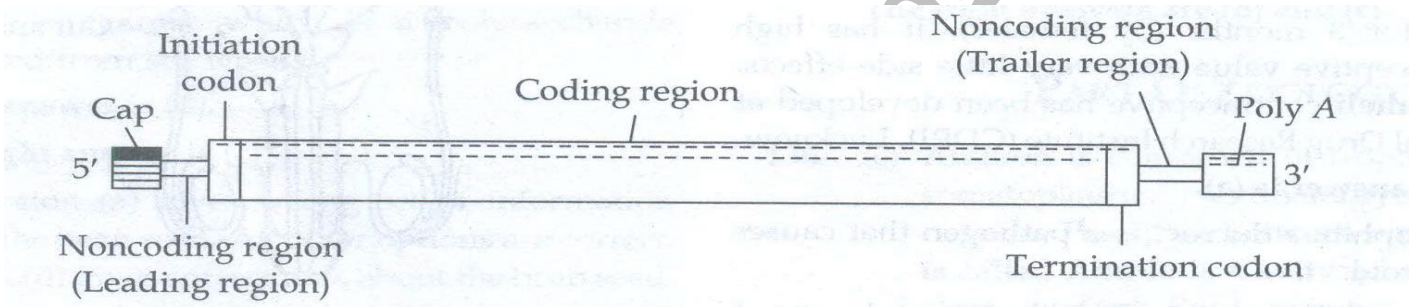


Fig. 2.50

The right answer is (c).

Sol 147.

(b) The diagram given below represents the nucleosome. Nucleosomes are spherical bodies formed by the coils of chromatin. The nucleosomes are coiled to form the fibres that make up chromosomes. Refer Fig. 2.51.

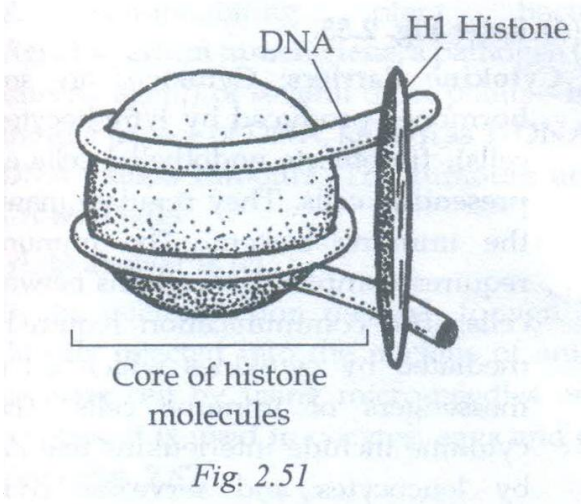


Fig. 2.51

The right answer is (b).

Sol 148.

(c) The earliest kno0wn fossil of the horse traced in the Eocene Era is **Eohippus**. This animal was of the size of the present – day dog and possessed four toes in its fore – legs and three toes in the hind legs. These toes were used for walking. Refer Fig. 2.52; it shows a fossil of horse.

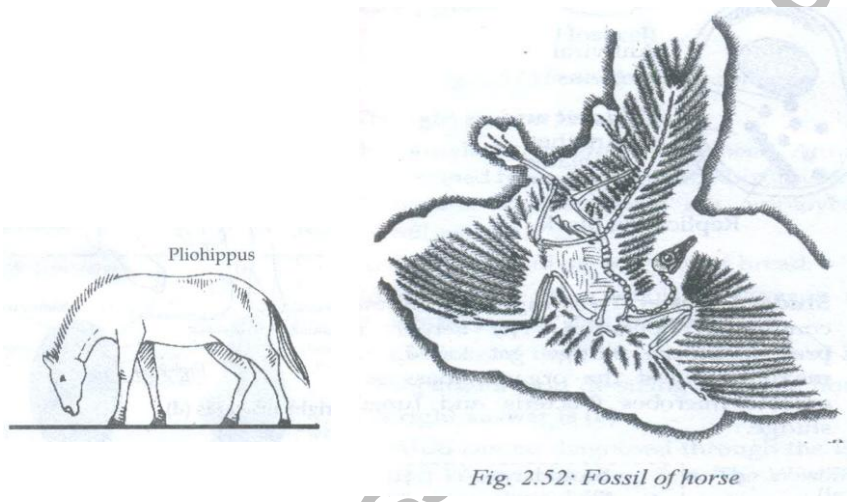


Fig. 2.52: Fossil of horse

Refer Fig. 2.53. It shows the evolution of the horse over Eras. The next horse to evolve from **Eohippus** was **Mesohippus**in the Oligocene Era. This animal was of the height of present – day sheep and possessed three toes in both fore – legs. **Mesohippus** gave rise to **Merychippus** of the Miocene Era. From it, **Pliohippus**of thePlioceneEra and **Pleistocene** Era evolved. This horse had all the usual characters similar to the modern horse, **Equus**.

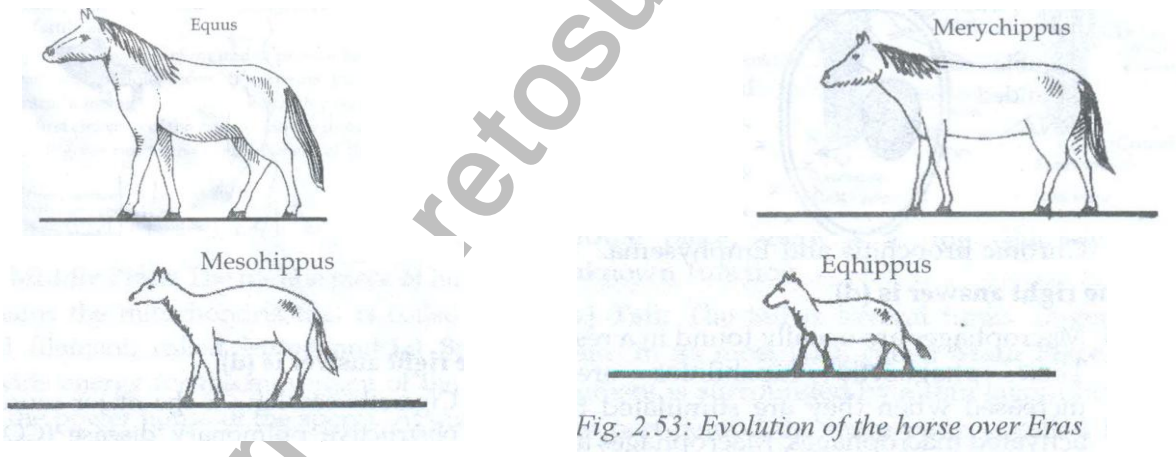


Fig. 2.53: Evolution of the horse over Eras

The right option is (c).

Sol 149.

(b) Organisms that existed in past link one group of animals to another group. For example, **Archaeopteryxes** is a link between reptiles and birds

The right answer is (b)

Sol 150.

(d) Refer Fig. 2.54. During the course of evolution, of man thumb has been brought opposite to the fingers thus enabling the hand for better grasping power. This advantage of man is often called **Dexterity.**

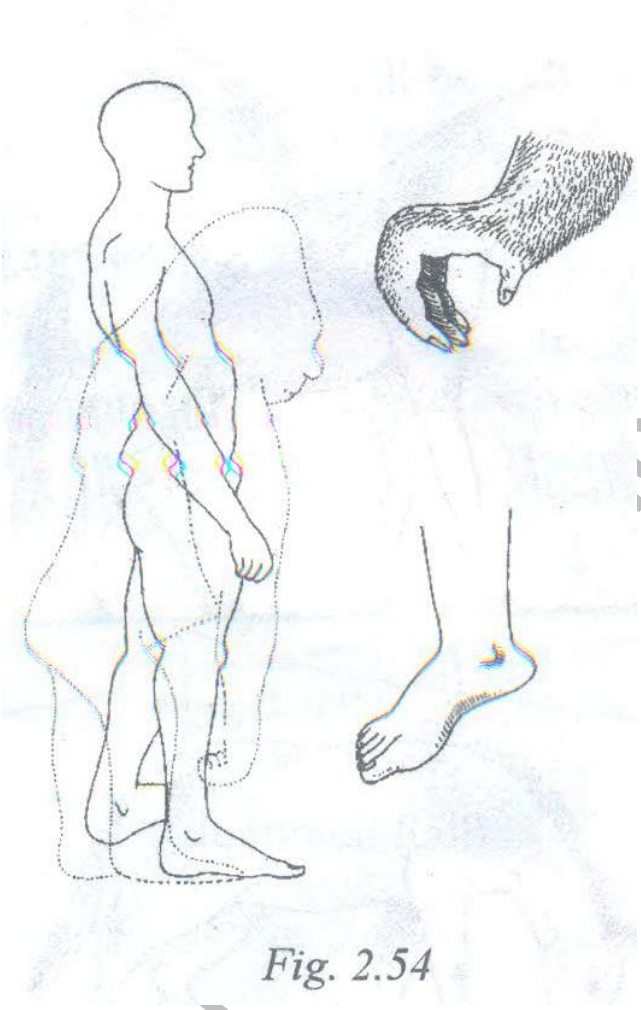


Fig. 2.54

The right answer is (d).

Sol 151.

(d) Refer Fig. 2.55.

Cytokine Barriers: Cytokines are small protein hormones produced by lymphocytes (helper T – cells), fibroblasts endothelial cells and antigen - requires complex interactions between different cells. The communication required for this is mediated by cytokines which act as chemical messengers of immune cells. The kinds of cytokine include interleukins that are produced cytokine include interleukins that are produced by leucocytes and serve as communicators between leukocytes, lymphokines produced by lymphocytes, tumour necrosis factor interferon's (IFNs). Interferons protect against viral infection of cells.

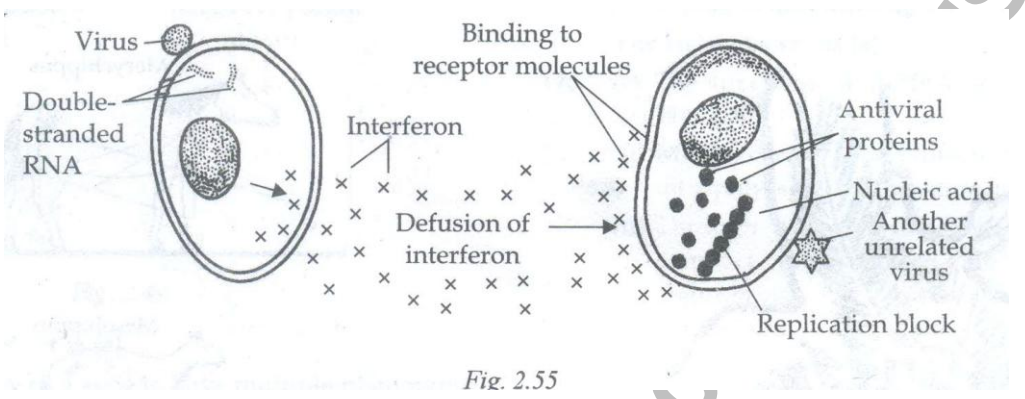


Fig. 2.55

The right answer is (d)

Sol 152.

(d) Cigarette smoking is the major cause of chronic obstructive pulmonary disease (COPD) that is Chronic bronchitis and Emphysema.

The right answer is (d).

Sol 153.

(c) Macrophages are usually found in a resting state. Their phagocytic capabilities are greatly increased when they are stimulated to become activated macrophages. Macrophages. Macrophages are present along with lymphocytes in almost all lymphoid tissues.

The right answer is (c).

Sol 154.

(a) Azadirachtin is extracted from Margosa or Neem (Azadirachtaindica). It occurs in Margosa extract. The spray of Azadirachtin keeps away Japanese beetles and other leaf – eating pests because of its antifeedant property.

The right answer is (a).

Sol 155.

(b) Refer Fig. 2.56.The sediment of settling tank is called **Activated Sludge**. A part of it is used as inoculum in aeration tanks. The remaining part is passed into a large tank, called **Anaerobic Sludge Digester**. These digesters are designed for continuous operation. The aerobic microbes present in the sludge get killed Anaerobic microbes digest the organic mass as well as aerobic microbes (bacteria and fungi) of the sludge. (image page no. 64)

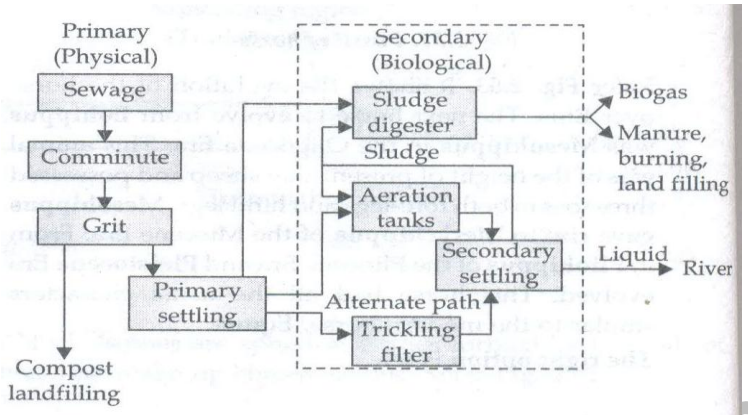


Fig. 2.56

The right answer is (b).

Sol 156.

(c) A soil – inhabiting plant bacterium – **Agrobacterium tumefaciens,** a pathogen (disease –causing agent) of several dicot plants – is able to DNA causes tumours. The tumours are called **Crown Galls**.

The right answer is (c).

Sol 157.

(a) In the microinjection method, foreign DNA is directly injected into the nucleus of animal cell or plant cell by using micro – needles or micropipettes. It is used in oocytes, eggs and embryo. Refer Fig. 2.57.

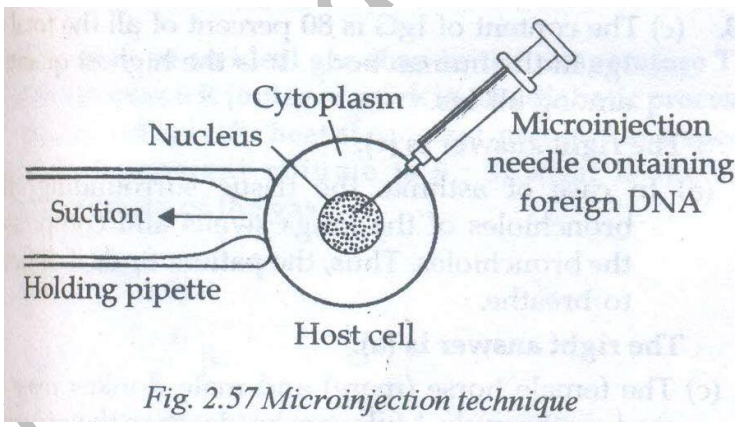


Fig. 2.57 Microinjection technique

The right answer is (a).

Sol 158.

(b) Amylases degrade starches. Amylases are obtained from Aspergillus, Rhizopus and Bacillus species. The enzymes are employed for the following:

(i) Softening and sweetening of bread.

(ii) Production of alcoholic beverages (*e,g.* beer, whisky) from starchy material.

(iii) Clearing of turbidity in juices caused by starch

(iv) Separation and de – sizing of textile fibres.

Sol 159.

(a) AIDS can be diagnosed through the ELISA Test and Western Blotting Test. The Western Blotting Test is employed for the confirmation of ELISA positive cases.

The right answer is (a).

Sol 160.

(a) In hermaphrodites, male and female gametes are formed in the same individual.

The right answer is (a).

Sol 161.

(a) A typical mammalian sperm consists of a head, neck, middle piece and tail. Refer Fig. 2.58.

(i) **Head:** It contains and anterior small acrosome and a posterior large nucleus. Acrosome is formed from the Golgi Body of the spermatid. Acrosome contains hyaluronidaseproteolytic enzymes which are popularly known as **Spermlysins** and are used for contacting and penetrating the egg (ovum) at the time of fertilization.

(ii) **Neck:** It is very short and is present between the head and middle piece. It contains the proximal centriole towards the nucleus which plays a role in the first cleavage of the zygote and the distal centriole which gives rise to the axial filament of the sperm. (image page no. 65

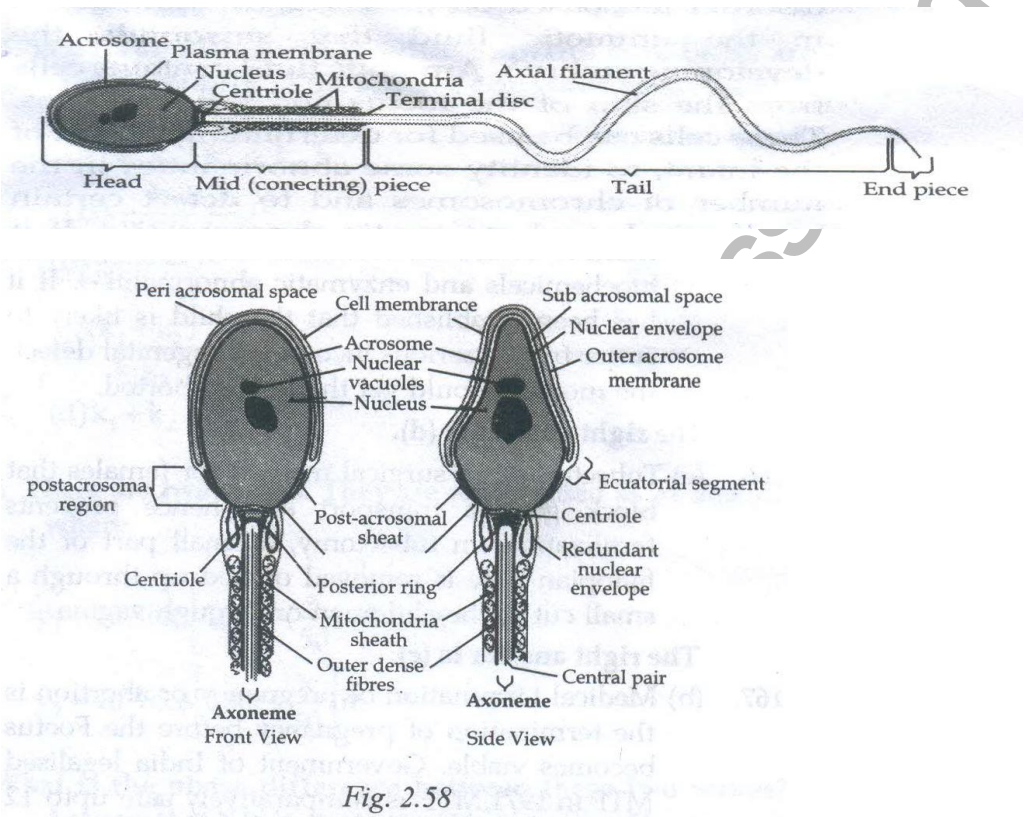


Fig. 2.58

(iii) **Middle Piece:** The middle piece of human sperm contains the mitochondria that is coiled round the axial filament, called **Mitochondrial Spiral.** They provide energy for the movement of the sperm. So, it is the power house of the sperm. At the end of the middle piece, there is a ring centriole with an unknown function.

(iv) **Tail:** The tail is several times longer than the head. In its most part, called **Main piece,** the axial filament is surrounded by a thin layer of cytoplasm. The part behind the main piece is called **End Piece** which consists of a naked filament alone. The sperm swims with the help of its tail in a fluid medium.

The right answer is (a).

Sol 162.

(b) Fallopian tube is about 10 -12 cm long and consists of the following parts – infundibulum, ampulla, isthmus and uterine part.

The infundibulum is a dilated trumpet – like portion that opens into the peritoneal cavity. The end of the tube has finger – like projections, called **Fimbriae** which help in collection of the ovum after ovulation.

The right answer is (b).

Sol 163.

(a) Sertoli cells support developing germ cells and provide them with nutrition, especially spermatids. Sertoli cells provide nutrition to the developing sperms. Thus, they are nurse cells.

The right answer is (a).

Sol 164.

(d) The right answer is (d).

Sol 165.

(d) Amniocentesis is a foetal sex determination and disorder test based on the chromosomal pattern in the amniotic fluid that surrounds the developing embryo. Amniotic fluid contains cells from the skin of the foetus and other sources. These cells can be used for determining the sex of the infant, to identity some abnormalities in the number of chromosomes and to detect certain biochemical and enzymatic abnormalities. If it has been established that the child is likely to suffer form a serious incurable congenital defect, the mother should get the foetus aborted.

The right answer is (d).

Sol 166.

(c) Tubectomy is a surgical method for females that block gamete transport and hence prevents fertilixation. In tubectomy, a small part of the fallopian tube is removed or tied up through a small cut in the abdomen or through vagina.

Sol 167.

(b) Medical termination of pregnancy or abortion is the termination of pregnancy before the Foetus becomes viable. Government of India legalized MTP in 1971.MTP is comparatively safe up to 12 weeks (the first trimester of pregnancy. It becomes more risky after the first trimester period of pregnancy as the foetus becomes intimately associated with maternal tissues.

The right answer is (b).

Sol 168.

(c) The new born affected with *Cri du chat* syndrome cries like mewing of a cat. It was first described by Lejeune (1963) in France. Hence, it was named *cri du chat* (cat cry). This condition is due to a deletion of one half part in the short arm of chromosome number 5. It is very rare. The affected person has a small head, widely spaced eyes, moon – like face, receding chin and congenital heart disease.

The right answer is (c).

Sol 169.

(c) Some genetic disorders are produced by changes (substitution) in the genes lying in the sex chromosomes. These are called **Sex – linked Disorders.** The transmission of sex – linked characters (traits) from parents to offspring is called **Sex – linked** Inheritance. Haemophilia, color blindness, night blindness and Duchenne's Muscular Dystrophy are the sex – linked disorders which are caused by recessive gene located in the X – chromosome. They affect males more than females.

The right answer is (c).

Sol 170.

(a) Amo0ng all Igs (antibodies), IgD is nearly 0.2 percent of all antibodies in the human blood. For other immunoiglobins, the values are as follows: other IgE: less than 0.1 percent. IgM: 5 – 10 percent,; IgA: 10 – 15 percent.

The right answer is (a).

Sol 171.

(b) Hybrid cells proliferate in proliferate into cells which are known as **Hybridomas.**

The right answer is (b).

Sol 172.

(b) The right answer is (b).

Sol 173.

(c) The content of IgG is 80 percent of all the total of Igs in the human body. It is the highest quantity among all Igs.

The right answer is (c).

Sol 174.

(a) In case of asthma, the tissue surrounding the bronchioles of the lungs swells and compresses the bronchioles. Thus, the patient finds it difficult to breathe.

The right answer is (a).

Sol 175.

The female horse (mare) and male donkey mate to produce the mule. Mules are harder than their parents and are well suited for hard work in mountainous regions. The name of the process is **Inter – specific Hybridization.**

The right answer is (c).

Sol 176.

(d) Rohu and Catla are being reared in India

The right answer is (d).

Sol 177.

The first ever hormone prepared by genetic engineering was insulin.

The right answer is (d).

Sol 178.

(d) ELISA is based on the principle of antigen – antibody interaction. It can detect very small smounts of protein (antibody or antigen) with the help of enzyme (like peroxidase or alkaline phosphatase). Infection by pathogen can be detected by the presence of antigens such as proteins, glycoproteins, etc., or by detecting the antibodies synthesized against the pathogen.

The right answer is (d).

Sol 179.

(d) Temporary parasites live in contact with host for only a part of their life or occasionally at the time of **Intermittent Parasites.** In fact, the female mosquito is not considered a parasite into human beings. So, it is a vector.

The right answer is (d).

Sol 180.

(a) A food chain can have three or four trophic levels.

The right answer is (a).

PART A: CLASS XI

PHYSICS

Q1

There are two balls. One has a mass of 2 kg and the other one has a mass of 4 kg. Both of them have been dropped from a tower whose height is 60 feet. When they cover one half of this distance downwards, the ration of their kinetic energies is:

(a)$\frac{1}{4}$ (b)$\frac{1}{2}$

(c)$\frac{3}{2}$ (d)$\frac{2}{3}$

Q2

One mole of an ideal gas at an initial temperature T (in K) performs 6 R joules of work in an adiabatic process. If the ratio of specific heat at constant pressure and specific heat at constant volume is 5: 3, what is the final temperature of the gas?

(a)$T_f = (T-6)k$ (b)$T_f = \left(\frac{T-6}{2}\right)k$

(c) $T_f = (T-4)k$ (d) cannot be determ in ed

Q3

Look at Fig.3.1 shown below. We have two blocks – A and B. The mass of A is 2kg. The co-efficient of static friction between A and the table is μ and the value of μ is 0.2. What is the maximum value of the mass of B so that two blocks do not move? Assume that the string and pulley are smooth. They do not have any mass either. The value of g is 10 m-s^{-2}.

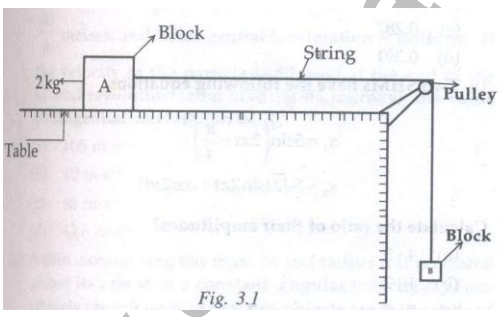


Fig. 3.1

(a) 0.4kg (b) 2.4 kg

(c) 1.4 kg (d) 4.0 kg

Q4

A particle is in SHM. Its speed v and its acceleration is a. Which one of the following is true?

(a) When the value of v is 0, the value of a is maximum

(b) When the value of v is maximum, the value of a is minimum.

(c) When the value of v is maximum, the value of a is zero

(d) Cannot be determined

Q5

We have two springs whose constants are k1 and k2, respectively. The spring constant of this combination is:

(a) $k_1k_2\ (k_1 + k_2)$

(b) $\frac{k_1k_2}{(k_1+K_2)}$

(c) $\frac{k_1+k_2}{k_1K_2}$

(d) $k_1 + K_2$

Q6

There are two waves. They are represented as y1 and y2, where

$$y_1 = 10^{-6} \sin\left[100t + \left(\frac{x}{50}\right) + 0.5\right] m$$

$$y_2 = 10^{-6} \cos\left[100t + \left(\frac{x}{50}\right)\right] m$$

What is the phase difference between these two waves?

Assume that X is in metres and t is in seconds.

(a) ΔΦ=0.07 rad

(b) ΔΦ=2.07 rad

(c) ΔΦ=3.07 rad

(d) ΔΦ=1.07 rad

Q7

A wheel has a moment of inertia of 2 kg- m^2 about its vertical axis. Its speed is 60 rpm (about its axis). What is the value of toque that will stop this wheel in 60 seconds?

(a) 15πN –m

(b) $\frac{15}{\pi} N - m$

(c) $\frac{\pi}{15} N - m$

(d) 15 N – m

Q8

Why is the reacting of a meccury barometer always less than actual pressure?

(a) Liquid metal: Hg is liquid metal, hence its reading of pressure is less

(b) Surface Tension: the Hg content in the barometer tube is depressed or squreezed

(c) Vicosity: Hg is gighly viscous

(d) Angle of content: θ is high for Hg

Q9

A wind-powered generator converts wind energy into electrical energy. The generator uses up a smallfraction of wind energy to do so. The wind speed is V m-s^{-1}. The electrical power output will be proportional to:

(a) V^3 (b) $V^{1/2}$

(c) 3V (d) $\frac{V}{3}$

Q10

Which one of the following is incorrect w. r. t. Bernouli's Principle?

(a) $P + \frac{1}{2}pv^2$ Constant (b) $\frac{P}{pg} + \frac{1}{2}\frac{v^2}{g} + h =$ Constant

(c) This Theorem is applicable to compressible liquids only(d) The sum of pressure head, velocity head and gravitational head remains constant in a streamlined flow

Q11

Refer Fig.3.2 shown here.

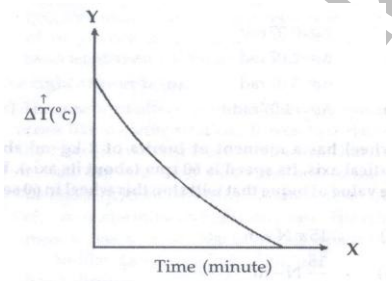


Fig 3.2

What does this curve indicate w. r. t. the cooling of a body?

(a) The body cools at a constant rate. (b) The rate of cooling of the body is higher to begin with.

(c) The rate of cooling of the body depends upon the mass the body (d) None of these

Q12

What is escape velocity of a body from a planet which is exactly similar to the earth in terms of shape and composition but whose radius is one fourth of that of the earth?

(a) 9.6 m–s^{-1}

(b) 7.8 m–s^{-1}

(c) 5.6 m–s^{-1}

(d) 2.8m–s^{-1}

Q13

The moment of Inertia (MI) of a disc about an axis passing through its centre and perpendicular to its plane is equal to$\frac{MR^2}{2}$. Then, what is the MI of the same disc about a tangent that is parallel to its diameter?

(a) $\frac{5}{4}MR^2$

(b) $\frac{4}{5}MR^3$

(c) $\frac{5}{4}MR$

(d) $\frac{1}{4}MR^3$

Q14

The time taken by a simple pendulum at Srinagar is 2 minutes. The time taken by the same pendulum at New Delhi is 1 minute and 15 seconds. Calculate the ratio the accelerations due to gravity at these two places:

(a) 0.29

(b) 0.3

(c) 0.287

(d) 0.391

Q15

Two SHMs have the following equations:

$x_1 = 5\sin\left(2\pi t + \frac{\pi}{4}\right)$

$x_2 = 5\sqrt{2}(sin2\pi t + \cos 2\pi t)$.

Calculate the ratio of their amplitudes?

(a) 4:3

(b) 1:2

(c) 2:1

(d) 3:4

Q16

Poiseuille's Equation is as follows:

$$V = \frac{\pi \text{pr}^4}{8\ \eta 1}$$

What are the dim ensions of V?

(a) LT

(b) L^3T^3

(c) L^3T^{-1}

(d) $L^{-1}T^3$

Q17

A body has mass m. It falls from a height h and collides with another body of mass m. The two bodies become one after this collision. They travel for some distance. This united body comes to the state of rest. What was the work done against the resistance offered?

(a) $\frac{1}{2}mg(h + 4d)$

(b) $\frac{mg}{4d}$

(c) $\frac{1}{2}g\ (m + 4d)$

(d) $2g\ (h\ +\ 4d)$

Q18

A man weights 80kg. He is standing on a weighing machine. The weighing machine is inside an elevator. This elevator is moving upwards in a skyscraper at a uniform acceleration of 5 $m\text{-}s^{-2}$. The value of g is $m\text{-}s^{-2}$. What is the reading of the weighting machine?

(a) 1020 N

(b) 1800 N

(c) 1205 N

(d) 1200 N

Q19

A particle is in a circular motion along a circle of radius $\frac{20}{\pi}$ metres. And its tangential acceleration is uniform. If the velocity of the particle is 80 m-s^{-1} at the end of the second revolution (after starting its journey), the value of tangential acceleration is:

(a) 105 m-s^{-2}

(b) 40 m-s^{-2}

(c) 48 m-s^{-2}

(d) 43.5 m-s^{-2}

Q20

A thin circular ring has mass M and radius r. It is rotated about its axis with a constant angular velocity ω. Four objects are put on its so that two objects are at the two ends of the other diameter. The two diameters are at an angle of 90^0 with respect to each other. What is the value of the angular velocity of this ring?

(a)$\frac{M\omega}{M+m}$

(b) $\frac{M\omega}{4M}$

(c) 4M$\omega(m+M)$

(d) $\frac{M\omega}{M+4m}$

Q21

A ball is thrown vertically upwards with a speed u. What is the distance covered by it during the last t seconds?

(a) $\frac{1}{2}t^2$

(b) $\frac{1}{2}gt^2$

(c) $2gt^2$

(d) 2gt

Q22

The vector sum of two forces is perpendicular to their vector difference. Hence the forces:

(a) are not equal to each other

(b) are equal to each other (in terms of magnitude)

(c) are in the same direction

(d) Cannot be determined

Q23

The coeeficient of static friction is equal to

(a) the sine value of the angle of friction

(b) zero in any case

(c) the tangent value of the angle of friction

(d) unity in any case

Q24

A man throws a ball upwards, one ball after the other. He sends the following ball 2 seconds after the previous one. What should be his throwing velocity (upwards) so that he may be able to throw more than two balls upwards at any point of time? Take the value of g as $9.8 m\text{-}s^{-2}$.

(a) $u = 19.4\ m\text{-}s^{-1}$

(b) $u < 19.6\ m\text{-}s^{-1}$

(c) $u > 19.6\ m\text{-}s^{-1}$

(d) $u > 19.4\ m\text{-}s^{-1}$

Q25

A particle is in one- dimensional motion. Then, which two out of the following statements are correct?

(a) If it is at zero speed, it may have non-zero velocity.

(b) If it has zero speed at an instant, it may have non-zero acceleration at that very instant

(c) When it reaches a height, its initial velocity is zero.

(d) If it has a constant speed, it means it must have zero acceleration

Q26

In the event of forced vibration, the resonance wave will become pretty sharp if the:

(a) applied periodic force is little

(b) damping force is small

(c) quality factor is little

(d) None of these

Q27

Refer Fig. 3.3.A solid cylinder has mass M and radius R. It rolls down an inclined surface. The length of the inclined surface is L and its height is h. Calculate the speed of the centre of mass of this cylinder when if reaches the bottom.

(a) 12 g h

(b) 3 g h

(c) 3 g h

(d) $\sqrt{\frac{4gh}{3}}$

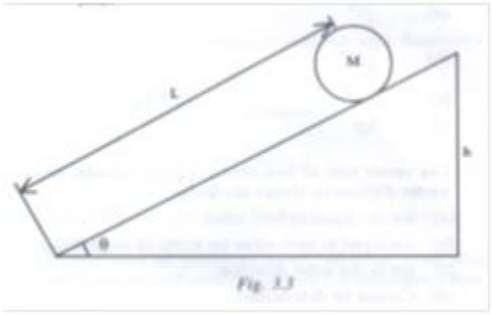


Fig. 3.3

Q28

A stationary particle is broken by a blast into two particles of masses m_1 and m_2, respectively. Now, they move in opposite directions with velocities v_1 and v_2 ,respectively. The ratio of their kinetic energies will be:

(a) m_2 : m1

(b) m_1: m_2

(c) $\frac{1}{2}$

(d) None of these

Q29

A gas engine is working on an ideal gas. It is operating between the temperature range of 227 degrees Celsius and 127 degrees Celsius in the carnot cycle. It takes in 6.0 kcal. The amount of heat converted into work is:

(a) 2.2 kcal

(b) 2.1 kcal

(c) 3.9 kcal

(d) 1.2 kcal

Q30

If a spring is stretched by 2 cm, its PE is E. If it is stretched by 10 cm, its PE would be:

(a) 5 E (b) 18 E

(c) 29 E (d) 25 E

Q31

A cable replaced by another of the same length and material. But the diameter of the new cable twicw that of the one it has replaced. If the elastic limit is not crossed, how much maximum load can the new cable support?

(a) 8 times the load that the order cable could support

(b) 16 times the load that the older cable could support

(c) 4 times the load that the order cable could support

(d) The same load that the order cable could support.

Q32

Which one of the following is not a valid condition for uploading stoke's Law?

(a) The size of the body is small, yet it is larger than the distance between the molecules of a liquid

(b) The body is not rigid and smooth

(c) The fluid has an infinite extension

(d) The motion of the body through the fluid does not give rise to turbulent motion and eddies

Q33

Find out the dimensions of p/q in the following equation:

$F = p\sqrt{x} + qt^2$ Here, F=Force

x= distance

t = time

(a) $L^{-1}T^{-2}$

(b) $L^{-2}T^{-1}$

(c) $L^{-\frac{1}{2}}T^2$

(d) $L^2T^{-\frac{1}{2}}$

Q34

The time of ascent for a body thrown upwards is equal to:

(a) $\frac{u^2}{2g}$ (b) $\frac{u}{3g}$

(c) $\frac{u}{g}$ (d) $\frac{2u}{g}$

Q35

A block of mass m is pulled along a horizontal surface by a rope of mass m. A force F is applied at the free end of the rope. Also, a force F is applied by rope on the block. If the surface is sans friction, what is the value of F?

(a) $\frac{m+m_1}{F}$ (b) $F\frac{(m+m_1)}{2}$

(c) $\frac{m.F}{m+m_1}$ (d) $(m+m_1)F$

Q36

Two trains are moving at velocities of 40 km-hr^{-1} and 70 km- hr^{-1} in the same direction. The net relative velocity between them is:

(a) 110 Km-hr^{-1} in the direction of the fast train (b) 30 Km-hr^{-1}in the direction of the fast train

(c) 70 Km-hr^{-1} in the direction of the slow train (d) 30 Km-hr^{-1} in the direction of the slow train

Q37

Fig.3.4 shows the vibrating modes of an air column. What is the ratio of frequencies of the two modes?

(a) 5:3 (b) 1:3

(c) 3:1 (d) 3:5

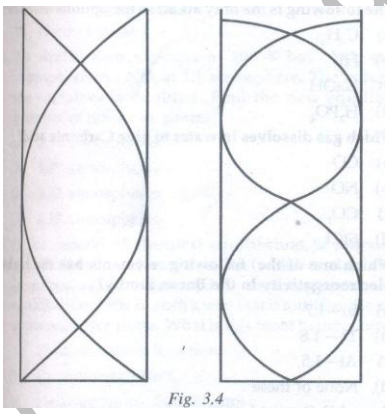


Fig. 3.4

Q38

If the value of Re (Reynold's Number) is 3120, the flow of the liquid in question is:

(a) turbulent

(b) laminar

(c) unstable

(d) Cannot be determined

Directions (Valid for Q. Nos.39 to 45):

In the questions that follow, an Assertion has been given for each question. This Assertion is followed by a Reason. You have to mark the correct choice as:

(a) if both the Assertion and Reason are true and the Reason is the correct explanation of the Assertion;

(b) if both the Assertion and Reason are true but the Reason is not the correct explanation of the Assertion;

(c) if the Assertion is true but the Reason is false; and

(d) if both the Assertion and Reason are false.

Q39

Assertion: The RMS and most probable speed of the molecules of a gas are the same.

Reason: The Maxwell Distribution for the speed of molecules in a gas is symmetrical.

Q40

Assertion: Air pressure in a car tyre increases during driving.

Reason: Absolute Zero temperature is not the zero-energy temperature.

Q41

Assertion: The average kinetic energy per molecules per degree of freedom is $KE = \frac{1}{2}k_B T$.

Reason: A diatomic molecule has 7 degrees of freedom if it vibrates.

Q42

Assertion: The ratio $\frac{C_p}{C_v}$ for a diatomic gas is more than that for a monoatomic gas.

Reason: The molecules of a monotomic gas have more degrees of freedom than those of a diatomic gas.

Q43

Assertion: For an ideal gas, the internal energy can only be the translational kinetic energy.

Reason: Gravity does not make any impact on the molecules of an ideal gas.

Q44

Assertion: The RMS speed and energy speed of the molecule of a gas are the same.

Reason: $V_{RMS} = \sqrt{V_1^2} + V_2^2 + V_3^3 = \bar{V}$

Q45

Assertion: The mean free path of the molecules of a gas is inversely proportional to the square of the molecular diameter.

Reason: $\bar{\lambda} = \frac{K_B T}{\sqrt{2}\pi d^2 p}$

PART B: CLASS XI

CHEMISTRY

Q46

Which one of the following is not an assumption of Nell Bohr's theory?

(a) Electrons revolve around the nucleus in stable circular orbits or shells.

(b) The centripetal force needed for the circular motion of electrons is provided by the electrostatic attraction between the negatively charged electrons and positively charged nucleus

(c) An electron can revolve in any arbitrary orbit around the nucleus

(d) If an electron is revolving in a stationary orbit, it cannot radiate energy. The energy release will take place only if the electron jumps to a lower orbit and $\Delta E = E_1 - E_2 = hv$

Q47

The presence of spaces in frozen ice is a result of the phenomenon of :

(a) covalent bonding

(b) ionic bonding

(c) hydrogen bonding

(d) None of these

Q48

When do gases act as ideal ones?

(a) When P is high and T is Low

(b) When both P and T are high

(c) When both P and T are Low

(d) When P is Low and T is high

Q49

The algebraic sum of the oxidation numbers of all atoms in a compound is equal to:

(a) 1

(b) 0

(c) 10

(d) 1/10

Q50

Which one of the following is not a balanced reaction?

(a) $Cr_2O_7^{2-} + 14\ H^+ + 6Cl^- \rightarrow 2\ Cr^3 + 3Cl^2 + 7H_2O$

(b) $IO^-_3 + Cl_2 + 2OH^- \rightarrow IO_4^- + 2Cl^- + H_2O$

(c) $NO_3 + S^2 \rightarrow NO + S$

(d) $4P + 3OH^- + 3H_2O \rightarrow 3H_2PO_2^- + PH_3$

Q51

The total KE of 1 mol of a gas is given by:

(a) $\frac{3}{2}\frac{R}{T}$

(b) $\frac{3}{2}RT$

(c) $\frac{2}{3}RT$

(d) $3\ RT^2$

Q52

The total number of electrons in 1.6 grams of CH_4 is equal to:

(a) 6.023×10^{20}

(b) 6.023×10^{10}

(c) 6.023×10^{23}

(d) 6.023×10^{22}

Q53

When one of the following is the correct reaction for preparing NH_3 from H_2?

(a) $N_2 + 3H_2 \rightarrow 2NH_3$

(b) $N_2 + 3H \rightarrow 2NH_3$

(c) $N_2 + H_2 \xrightarrow{Fe-Mo} NH_3$

(d) $N_2 + 3H_2 \xrightarrow[200-900atm]{Fe-Mo} 2NH_3$

Q54

What is clark's Method?

(a) It is a method for determining the pH value of water

(b) This method removes permanent hardness of water

(c) this method uses slaked lime for removing the temporary hardness of water

(d) None of these

Q55

How can we obtain Boron from B_2O_3?

(a) By heating it

(b) By treating it with Mg

(c) By oxidizing it

(d) None of these

Q56

The following is the only alkali in the options listed here,

(a) C_6H_6

(b) HF

(c) NaOH

(d) H_3PO_4

Q57

Which gas dissolves in water to give carbonic acid?

(a) CO

(b) NO

(c) CO_2

(d) $SiCl_4$

Q58

Which one of the following elements has the highest electronegativity in the Boron family?

(a) In−1.7

(b) TI− 1.8

(c) Al−1.5

(d) None of these

Q59

Na and H_2O meet in a vigorous reaction to produce:

(a) Oxygen

(b) Hydrogen

(c) Na_2O

(d) H_2O

Q60

What is the chemical formula for Epsom salt?

(a) $MgCO_3$

(b) $MgSO_4$

(c) $MgSO_4.7H_2O$

(d) $CaSiO_3.3Mg\ SiO_3$

Q61

Which one of the following is not true about Potassium?

(a) It is an an alkaline earth metal

(b) It is used in photoelectric

(c) It is used for making Na-K alloy that has applications in special thermometers for measuring high temperature

(d) It is a black metal that is header than Na.

Q62

What would happen if we heat limestone?

(a) We get quick lime

(b) We get carbon (black particles)

(c) We got CO

(d) This reaction is not feasible

Q63

What are the uses of slaked lime?

(a) For the preparation of coal gas

(b) In the recovery of NH_3 in the solvay process

(c) For the production of bleaching powder

(d) All of these

Q64

The stability of free radicals has the following order.

(a) Primary < Secondary < Tertiary

(b) Tertiary > Secondary > Primary

(c) Secondary > Primary >tertiary

(d) None of these

Q65

An equilibrium mixture at 300 K has N_2O_4 at 0.28 atmosphere and NO_2 at 1.1 atmosphere. The volume of the container is doubled. Find the new equilibrium pressure of these two gases.

(a) 2.34 atmospheres

(b) 4.39 atmospheres

(c) 3.32 atmospheres

(d) 4.32 atmospheres

Q66

In the context of chemical equilibrium, if a system at equilibrium is subjected to stress (which can be change in pressure, concentration or temperature), the equilibrium shifts in such a way that it nullifies the effects of the causative stress. What is this tenet better known as?

(a) Zimmermann's Reaction

(b) Electromeric Effect

(c) Heterogeneous Equilibrium

(d) Le Chatelier's principle

Q67

Read the following reaction: A_2 (g) + B_2 (g) f 2AB (g)

The temperature of the reaction is 100 degrees Celsius. The equilibrium constant of this reaction is 50. A flask having the capacity of 1 litre and containing 1 mole of a gas $A_2$is connected to another flask having a capacity of 2 litre and containing 2 moles of a gas B_2. How many moles of AB will be formed at 373 K?

(a) 1.780 (b) 1.870

(c) 2.870 (d) 0.870

Q68

Nitrogen and Oxygen react to form Nitric oxide (NO). The value of H= +21.5 kcal. The formation of NO is favoured by a/an:

(a) decrease in temperature

(b) increase in N_2 concentration

(c) increase in pressure

(d) All of these

Q69

The heat of formation of a substance is the:

(a) input heat

(b) enthalpy of the substance

(c) heat generated in the reaction

(d) None of these

Q70

Bond energy is the average amount of energy needed to dissociate:

(a) 1.0 kg of bonds

(b) 1.0 mole of solid bonds

(c) 1.0 mole of bonds present in different gaseous compounds in gaseous atoms

(d) None of these

Q71

For an isochoric process:

(a) $\Delta V = 0$

(b) $\Delta H = 0$

(c) $\Delta T = 0$

(d) None of these

Q72.

The following elements are causing the maximum harm to our environment by helping in the production of acid rain.

(a) Ca and Mg

(b) S and Ca

(c) N and H

(d) S and N

Q73

When one of the following is not an electrophile?

(a)NO^{+}_{2}

(b) SO_3

(c) R_3C

(d) HSO_3^-

Q74

When one of the following is not a nucleophile?

(a) OH^-

(b) OR^-

(c) Cl^+

(d) Br^-

Q75

The union of two or more molecules of the same substance or of different substance to give rise to a single large molecule is called:

(a) Saturation

(b) Electrophilic Addition

(c) Free Radical Substitution

(d) Polymerisation

Q76

How does H_2O_2 protect old oil painting?

(a) It produces PbS

(b) It removes PbS

(c) It removes 2 $PbCO_3$, Pb $(OH)_2$

(d) None of these

Q77

Phenol is an acid, yet it does not react with sodium bicarbonate, a base. Why is that so?

(a) Phenol is a strong acid

(b) Sodium bicarbonate is inert towards all phenols

(c) Phenol is a weak acid

(d) None of these

Q78

In the reaction shown ahead, identify the acid and its conjugate base.

$H_2O + H_2O \leftrightharpoons H_3O^+ + OH^-$

(a) There is no acid in it

(b) Acid – H_2O, Base – H_2O

(c) Acid – H_2O, Base − OH^-

(d) None of these

Q79

Why do the salts of strong acids and bases not undergo hydrolysis?

(a) Their structure does not allow them to react

(b) Their solutions are highly acidic or basic

(c) Their solutions cannot be formed

(d) It is difficult to break up their radicals.

Q80

(a) Cl> Br > F

(b) F > Br >Cl

(c) Cl> F > Br

(d) None of these

Q81

Why is H_2O_2 a better oxidizing agent than h_2O?

(a) It is more reactive

(b) It gives O_2 easily upon decomposition

(c) Water is neutral but H_2O_2 is not

(d) All of these

Q82

Read this reaction:

$$CH_3 – CH = CH_2 \xrightarrow[Peroxide]{Benzoyl} CH_2CH_2CH_2Br$$

What type of reaction is this?

(a) Elimination

(b) Electrophilic

(c) Nucleophilic

(d) Free Radical

Q83

If the value of ΔH is negative, the reaction is:

(a) endothermic

(b) exothermic

(c) neutral

(d) no reaction at all

Q84

The first law of thermodynamics states that:

(a) $E = \frac{q}{w}$

(b) $\Delta E = \Delta\, q \cdot \Delta w$

(c) $\Delta E = \frac{1}{2}(\Delta q \cdot \Delta w)^2$

(d) $\Delta E = q + w$

Q85

Which activity would lead to the reduction of pollutants in major water bodies of world?

(a)Removal of leather processing units from river banks

(b) Creation of separate sewage disposal thanks for urban areas

(c) Dredging of lakes and river beds

(d) All of these

Q86

It is possible to cool a gas below absolute zero?

(a) No

(b) Yes

(c) Need to create conditions for this cooling

(d) None of these

Q87

A reducing agent is a compound or ion in which there is a /an:

(a) decrease in the oxidation state of one of its constituent elements

(b) constant state in the oxidation state of one of its constituent elements

(c) increase in the oxidation state of one of the constituent elements

(d) None of these

Q88

Note this reaction:

$2FeCl_3 \rightarrow 2FeCl_2 + Cl_2$

In this reaction, ferric chloride is being:

(a) reduced

(b) oxidation

(c) nether oxidation nor reduced

(d) both oxidation and reduced

Q89

Read this reaction

$Ag^+ (aq) + Cl (aq) \rightarrow AgCl(s)$

Were Ag^+ ions oxidation or reduced in this reaction?

(a) Oxidized

(b) Reduced

(c) Neither oxidation nor reduced

(d) Cannot be determined

Q90

Balance this equation through the oxidation state method.

$HI + HNO_3 \rightarrow I_2 + NO + H_2O$

(a) $HI + HNO_3 \rightarrow 3I_2 + 2NO + 4H_2O$

(c) $6HI + HNO_3 \rightarrow I_2 + 3NO + 2H_2O$

(d) None of these

PART C: CLASS XI

BOTANY

Q91

Which one of these represents the zone of differentiation?

(a) Zone of elongation

(b) Root hair zone

(c) Zone of mature cells

(d) Region of elongation.

Q92

The stems of Maize and Sugarcane have supporting roots coming out of the lower nodes of the stem. So, they are called:

(a) Stilt Roots

(b) Prop Roots

(c) Pneumatophores

(d) Adventitious

Q93

Phloem is made up of:

(a) Sieve tubes

(b) companion cells

(c) phloem parenchyma

(d) All of these

Q94

Kranz Anatomy is found in

(a) wheat leaf

(b) sugarcane leaf

(c) maize leaf

(d) hydrilla leaf

Q95

Osmotic pressure is measured by:

(a) Ganong's photometer

(b) photometer

(c) auxonometer

(d) osmometer

Q96

Water potential of pure water and its solution are:

(a) 0 and 1

(b) 0 and 0

(c) 0 and more than one

(d) 0 and less than 0

Q97

Hydroponics refers to growing plants in:

(a) tissue culture medium

(b) water

(c) solution of mineral nutrients

(d) soil culture

Q98

Succulents carry out photosynthesis:

(a) CAM pathway

(b) C-4 pathway

(c) C-3 pathway

(d) C-2 pathway

Q99

The value of RQ is more than 1.0 is case the substrate is a/an:

(a) fat

(b) glucose

(c) protein

(d) organic acid

Q100

Which one of the following is cytokinin?

(a) Phytochchrome

(b) Leucine

(c) Ethylene

(d) Zeatin

Q101

Which one of the following is not a short-day plant?

(a) Spinach

(b) Aster

(c) Chrysanthemum

(d) Xanthium

Q102

Oxidative phosphorylation is the:

(a) anaerobic production of ATP

(b) critic acid production of ATP

(c) production of ATP by chemiosmosis

(d) alcoholic fermentation

Q103

Thread –like branches of Mycelium are called:

(a) Filaments

(b) Hyphae

(c) Sporangiophores

(d) Haustoria

Q104

Bread mould is:

(a) Saccharomyces

(b) Rhizopus

(c) Clostridium

(d) Erysiphe

Q105

Upon germination, moss spores produce:

(a) Annulus

(b) Theca

(c) Peristome

(d) Protonema

Q106

The kidney-shaped covering of sorus in Dryopteris is:

(a) Indusium

(b) Ramentum

(c) Placenta

(d) Sporophy II

Q107

A plant that produces seeds but lacks flowers is:

(a) Gymnosperm

(b) Bryophyte

(c) Angiosperm

(d) Pteridophyte

Q108

Which one of the following is monocarpic?

(a) Annual plants

(b) Biennial Plants

(c) Perennial plants

(d) All of these

Q109

Pit canals are found in:

(a) Collenchyma

(b) Sclerenchyma fibres

(c) Sclereids

(d) Paraenchyma

Q110

Lacunate collenchyma occurs in the stem of:

(a) Leucas

(b) Cucurbita

(c) Sunflower

(d) Sambucus

Q111

Quiescent centre is found in a plant at its:

(a) root tip (b) shoot tip

(c) cambium (d) leaf tip

Q112

The right order for the instrument used for measuring:

(i) transpiration;

(ii) stomatal size;

(iii) atmospheric pressure; and

(iv) osmosis

Is as follows:

(a) Potometer, porometer, manometer and osmometer

(b) Porometer, manometer, Potometer and osmometer

(c) Potometer, manometer, porometer and osmometer

(d) Manometer, potometer, porometer and osmometer

Q113

Denitrification is carried out by:

(a) pseudomonas and Nitrosomonas

(b) Nitrosomonas and Nitrobacter

(c) Nitrosomonas and Nitrococcus

(d) Pseudomonas and Thiobacillus

Q114

The function of leg-heamoglobin during the course of biological nitrogen fixation in root nodules of legumes is the:

(a) conversion of N_2 into NH_3 (b) conversion of ammonia into nitrite

(c) transporatation of oxygen for thenitro-genase activity (d) protection of nitrogenase from oxygen

Q115

Hill used a dye for his famous Hill reaction. It was

(a) Sulphur green

(b) Eosine

(c) Methylene blue

(d) Dichlorophenol indophenol

Q116

Photosynthesis is continuous under:

(a) Green Light

(b) red light

(c) continuous light

(d) very high light

Q117

Cell respiration is carried out by:

(a) Mitochondria

(b) Glogi bodies

(c) ribosomes

(d) continuous

Q118

Which one of the following acts as an energy currency of cell?

(a) AMP

(b) ADP

(c) ATP

(d) NAD

Q119

A hormone that breaks the dormancy of seeds and vegetative organs is:

(a) ABA

(b) Gibberellin

(c) IAA

(d) Indole and lactic acid

Q120

Which one of the following is also called stress hormone?

(a) ABA

(b) Gibberellin

(c) IAA

(d) Indole and lactic acid

Q121

Black rust of wheat is caused by:

(a) Pucciniagraminis

(b) Ustilagonuda

(c) Alternariasolani

(d) Xanthomonasoryzae

Q122

Red rot of sugarcane is caused by:

(a) Colletorichum

(b) Fusarium

(c) Pythium

(d) Albugo candida

Q123

Archegoniophore occurs in:

(a) Chara

(b) Funaria

(c) Adiantum

(d) Marchantia

Q124

The phloem of angiosperms differs from those of other vascular plants due to the presence of:

(a) Tylosoides

(b) Secretion cells

(c) Companion cells

(d) Albuminious cells

Q125

Which ones of the following are also called Humus Plants?

(a) Saprophytes

(b) Holoparasites

(c) Hemiparasites

(d) Insectivores

Q126

Which one of the following has whorled phyllotaxy?

(a) Shoe flower

(b) Quisqualis

(c) Zinnia

(d) Nerium

Q127

Casparian thickenings occur in the cells of:

(a) Pericycle of stem

(b) endodermis of stem

(c) pericycle of root

(d) endodermis of root

Q128

Motor cells take part in the process of:

(a) guttation

(b) transpiration

(c) inrolling

(d) All of these

Q129

The Cohesion Tension theory is related to the:

(a) respiration

(b) ascent of sap

(c) transpiration

(d) photosynthesis

Q130

The oozing of water drops from an injured leaf's edges is referred to as:

(a) Bleeding

(b) Guttation

(c) Transpiration

(d) Oozation

Q131

Its deficiency produces leaf Necrosis and stunned growth in rice. It is:

(a) Silicon

(b) Sodium

(c) Zinc

(d) Aluminium

Q132

The most abundant element found in plants is:

(a) Carbon

(b) Nitrogen

(c) Iron

(d) Manganese

Q133

Pigments of PS1 occur in the

(a) appressed part of granal thylakoids

(b) stromal thylakoids and non-appressed parts of granal thylakoids

(c) bothappressed and non-appressed parts of granal thylakoids

(d) stroma

Q134

Carbon dioxide is fixed in a/an:

(a) Light reaction

(b) dark reaction

(c) aerobic respiration

(d) anaerobic respiration

Q135

Fermentation is a/an:

(a) anaerobic respiration

(b) incomplete oxidation

(c) excretory process

(d) None of these

PART D: CLASS XI

ZOOLOGY

Q136

Which one of the following is not true about kingdom Monera?

(a) The Kingdom comprises prokaryotic organisms

(b) The organisms of this Kingdom are unicellular, colonial, mycelial and filamentous

(c) The cell size of this Kingdom Varies from 10 to 100 μm

(d) None of these is true.

Q137

The incubation period of Plasmodium vivax is:

(a) 14 days

(b) 20 days

(c) 30 days

(d) 45 days

Q138

In Amoeba, the contractile vacuole is present:

(a) near the trailing end (b) near the advancing end

(c) at the middle of the body (d) anywhere inside the body

Q139

Tooth-shaped scales are:

(a) Cycloids

(b) Ctenoids

(c) Ganoids

(d) Placoids

Q140

Column I contains Larval Stages and Column II contains the groups to which they belongs. Match them correctly and choose the right from the options given below:

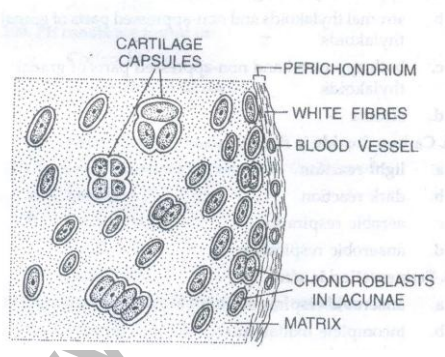
Column I	**Column II**
A. Planula	1. Annelida
B. Tornaria	2. Mollusca
C. Trochophore	3. Arthopoda
D. Bipinnaria	4. Hemichordata
E. Glochidium	5. Echinodermata
	6. Coelenterata

(a) A-6, B-4, C-1, D-5, E-2

(b) A-2, B-5, C-1, D-4, E-6

(c) A-5, B-4, C-3, D-2, E-6

(d) A-4, B-3, C-2, D-1, E-5



(a) phagocytosis of pathogens

(b) cell mediated and antibody immunity

(c) inhibition of allergic reactions

(d) heparin secretion for preventing thrombosis

Q141

Refer Fig. 3.5. This is the diagram of a section of hyaline cartilage. The different parts have been indicated by alphabets. Choose the correct match.

(a) a- cartilage, b-white fibers, c- lacuna, d- capsular matrix, e-perichondrium

(b) a- chondrin, b- lacuna, c- chondrocyte, d- capsular matrix, e-chondrin

(c) a- perichondrium, b- chondrocyte, c- lacuna, d- capsular matrix, e- chondrin

(d) a- capsular matrix, b- chondrocyte, c- lacuna, d- perichondrium, e- chondrin

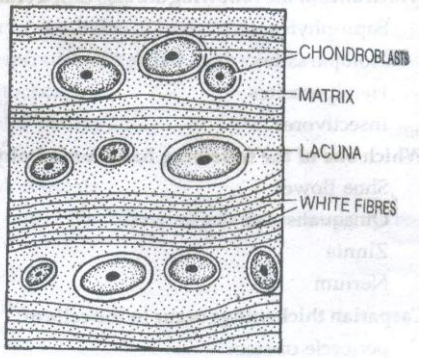


Fig. 3.5 *(ii)*

Q143

The 9th pair of cranial nerve in the frog is:

(a) Hypoglossal

(b) Glassopharyngeal

(c) Vagus

(d) Trigeminal

Q144

In pheretima, gizzard, buccal cavity, pharynx, oesophagus, pharyangealnephirdia receive the blood from this blood vessel:

(a) Supra oesophageal

(b) Lateral oesophageal

(c) Dorsal blood

(d) Subneural

Q145

Which technique was successfully demonstrated by wilmut and Campbell when they cloned the first mammal (sheep), Dolly?

(a) Totipotency

(b) Marphogenesis

(c) Embryoids

(d) De-differentiation

Q146

Lysosomes are produced by:

(a) Mitochndria

(b) Endoplasmic reticulam

(c) Golgi bodies

(d) Both (b) and (c)

Q147

Chitin occurs in the cell wall of:

(a) bacteria

(b) algae

(c) fungi

(d) yeast

Q148

Benedict's Solution is used for detecting:

(a) sucrose

(b) glucose

(c) fat

(d) starch

Q149

The main digestive function of Enterokinase is the:

(a) conversion of casein into paraeasein

(b) conversion of pepsinogen into pepsin

(c) conversion of trypsinogen into trypsin

(d) conversion of trypsin into trypsinogen

Q150

Pernicious anaemia results due to the deficiency of:

(a) Vitamin B

(b) Vitamin A

(c) Vitamin B_{12}

(d) Iron

Q151

Emphysema is a:

(a) cardiovascular disease

(b) disease of alveolar sacs

(c) neural disease

(d) renal disease

Q152

The condition characterized by the ill-effect of hypoxia (shortage of oxygen) in tissues at high attitudes is called:

(a) Mountain Sickness

(b) Bronchitis

(c) Asthma

(d) Emplysema

Q153

In a standard ECG, which one of the following alphabets is the correct representation of the respective activity of the human heart?

(a) S-Start of systole

(b) T-end of diastole

(c) P-depolarisation of the atria

(d) R- repolarization of ventricles

Q154

Mitral value is present between the:

(a) right atrium and right ventricle

(b) left atrium and left ventricle

(c) right ventricle and left ventricle

(d) left ventricle and aorta

Q155

A person with an unknown blood group under ABO system has suffered much blood loss in an accident. He needs immediate blood transfusion. His friend, who has a valid certificate of his own blood type, offers to donate blood without delay. What could have been the type of blood group of the donar friend?

(a) Type B

(b) Type AB

(c) Type O

(d) Type A

Q156

The animals that excrete urea are called:

(a) Ammonotelic

(b) Ureotelic

(c) Uricotelic

(d) Aminotelic

Q157

It is the pressure exerted by plasma proteins in the glomeruli. It is called:

(a) Glomerular Hydrostatic Pressure

(b) Blood Colloidal Osmotic Pressure

(c) Capsular Hydrostatic Pressure

(d) Effective Filtration Pressure

Q158

A deltoid ridge occurs in:

(a) radius

(b) ulna

(c) femur

(d) humerus

Q159

Acetabulum is present in the :

(a) hip joint

(b) knee joint

(c) elbow joint

(d) shoulder joint

Q160

Which one of the following options shows the correct matching pair?

(a) Man-ureotelic

(b) Bird-ammonotelic

(c) Fish- uricotelic

(d) Frog-uricotelic

Q161

This muscle pulls a limb away from the mid- line of the body.

(a) Adductor

(b) Abductor

(c) Supinator

(d) Sphincter

Q162

Which neural system comprises brain and spinal cord?

(a) Central neutral system

(b) Peripheral neural system

(c) Somatic neural system

(d) Automatic neural system

Q163

The cytoplasm of neuron has the following.

(a) Neurofibrils

(b) Neurotubles

(c) Nissl's granules

(d) All of these.

Q164

Which neuron's body has only one exam?

(a) Non-polar neuron

(b) Uniplar neuron

(c) Pseudounipolar neurons

(d) Bipolar neurons

Q165

Which one of the following is not a function of cerebrospinal fluid?

(a) Protection of the brain and spinal cord

(b) Buoyancy to the brain

(c) Digestion

(d) Endocrine medium for the brain

Q166

Meissner's Corpuscles occur in the:

(a) brain

(b) nerve cells

(c) skin

(d) tongue

Q167

The following disorder is caused due to the deficiency of the thyroid hormone in infants.

(a) Cretinism

(b) Gull's Disease

(c) Simple Goitre

(d) Hashimoto's Disease

Q168

This is the outer zone that lies just below the capsule in the adrenal cortex.

(a) Zone glomerulosa

(b) Zone fasciculate

(c) Zone reticularis

(d) None of these

Q169

The correct sequence in the Linnaean hierarchy is:

(a) Species, genus, family, order, class

(b) Species, genus, phylum, family, class

(c) Class, family, Species, genus, order

(d) Phylum, class, family, species, order

Q170

The Adiopose tissue is a:

(a) fat-storing connective tissue

(b) dense connective tissue

(c) specialised connective tissue

(d) None of these

Q171

Which one of the following does not possess nucleic acid?

(a) Prion

(b) Viroid

(c) Virus

(d) Mycoplasma

Q172

The shape of staphylococcus bacteria is:

(a) Oval

(b) curved rod

(c) elongated

(d) cubical

Q173

Spirulina belongs to the following kingdom.

(a) Plantae

(b) Monera

(c) Protista

(d) Fungi

Q174

Phylum protozoa has been classified on the basis of:

(a) mode of reproduction

(b) locomotory organelles

(c) mode of nutrition

(d) None of these

Q175

From the option given below, identify the alga known for a biological activity, called Bioluminescence.

(a) Chlorella

(b) Spirogyra

(c) Cyclotella

(d) Noctiluca

Q176

In the life cycle of plasmodium, man is a:

(a) primary host (b) secondary host

(c) tertiary host (d) None of these

Q177

The phenomenon of torsion occurs in:

(a) Gastropoda (b) Pelecypoda

(c) Cephalopoda (d) Amphineura

Q178

Which one of the following is multinucleated?

(a) Non-striated muscle

(b) Striated muscle

(c) Renal tissue

(d) Nervous tissue

Q179

In the earthworm:

(a) integumentary and pharyngeal nephridia are exonephric

(b) pharyngeal and septalnephridia are enteronephric

(c) pharyngeal and septalnephridia are exonephric

(d) integumentary and septalnephridia are enteronephric

Q180

The stink gland is found in the:

(a) 4^{th} and 5^{th}terga of cockroach

(b) 5^{th} and 6^{th}terga of cockroach

(c) 5^{th} and 6^{th} sterna of cockroach

(d) 4^{th} and 5^{th} sterna of cockroach

ANSWER WITH EXPLANATIONS

PART A: PHYSICS

Sol.1 (b)

In a free fall, two balls of different mass will acquire the same velocity after falling through some height. Now v_1 =v2=v at 30 feet from the falling point.

Here, m_1 = 4 kg Thus, $\frac{K_1}{K_2} = \frac{\frac{1}{2}m_1v^2}{\frac{1}{2}m_2v^2} = \frac{m_1}{m_2} = \frac{2}{4} = \frac{1}{2}$

The right option is (b).

Sol.2 (c)

In an adiabatic process, heat transfer into or out of a system=Q=0.

From the first Law of Thermodynamics we have:

$A = -\Delta U$

$-nC_v\Delta T$

$-\left(\frac{R}{\gamma - 1}\right)(T_f - T_i)$

$\frac{nR}{\gamma - 1}(T_i - T_f)$

Here: W=6RJ, n=1 mol,

R=8.31J mol^{-1} –K^{-1}

$\gamma = \frac{5}{3}, T_i = TK$

Put these values in eqn.(i):

$\therefore 6R = \frac{R}{\left(5\frac{}{3} - 1\right)}(T - T_f)$

$\Rightarrow 6R = \frac{3R}{2}(T - T_f)$

$\Rightarrow T - T_f = 4$

$\therefore T_f = (T - 4)K$

The right choice is (c).

Sol.3 (a)

The tension in the string is equal to static frictional force between the blockand the surface. Refer Fig. 3.6. Let the mass of the block B be M.

At equilibrium:

T-Mg =0

T=Mg…. (i)

If blocks do not move:

T=f_s=Fractional force

$f_s = \mu_s R = \mu_s mg$

$T = \mu_s$ mg …. (ii)

From Eqns. (i) and (ii), we get

Mg =μ mg

M = μ m

M=0.2 × 2.0 = 0.4 kg

The right option is (a).

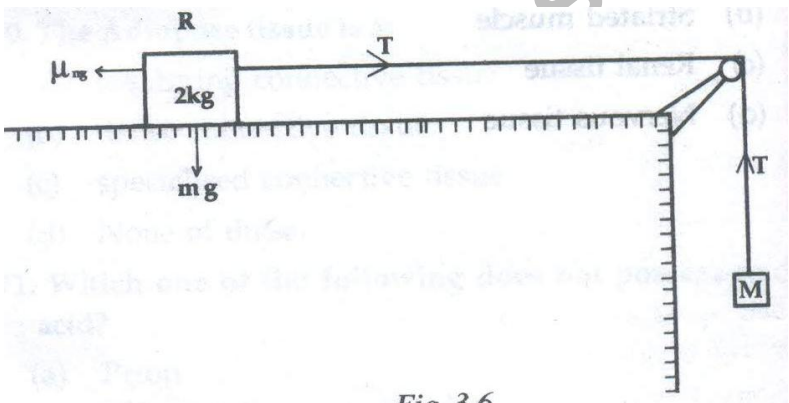


Fig. 3.6

Sol4. (b)

In simple harmonic motion, the displacement equation is y=A sin ωt, where A is amplitude of the motion.

Velocity, $v = \frac{dy}{dt} = A\omega \cos \omega t$

$v = A\omega\sqrt{1 - \sin^2 \omega t}$

$v = \omega\sqrt{A^2 - y^2}$ Acceleration, $a\ \alpha \frac{dv}{dt} = \frac{d}{dt}(A\omega \cos \omega t)$

$\alpha = -A\omega^2 \sin\omega t$

$a = -\omega^2 y \ldots$ (ii) When $y = 0; v = A\omega = v_{max}$

$a = 0 = a_{min}$ When $y = A, v = 0 = v_{min}$

$a = -\omega^2 A = a_{max}$

When v is maximum, a is minimum (zero). The vice versa of this statement is also true. The right choice is (b).

Sol.5 (b)

Let us consider two springs of spring constants k_1 and k_2, respectively, joined in series as shown in Fig-3.7.

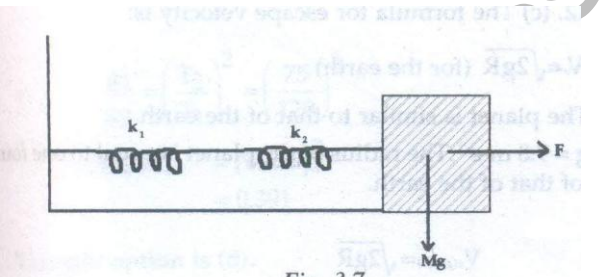


Fig. 3.7

Under a force F, they will stretch by y_1 and y_2

So, $y = y_1 + y_2$ Or $\frac{F}{k} = \frac{F_1}{k_1} = \frac{F_2}{k_2}$

The springs are massless. Therefore, the force on them must be the same.

Thus, $F_1 = F_2 = F$

So, $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2}$ or, $k = \frac{k_1 k_2}{k_1 + k_2}$

The right option is (b).

Sol.6 (d)

The waves are:

$$y_1 = 10^{-6} \sin\left[100t + \left(\frac{x}{50}\right)0.5\right] m$$

$$y_2 = 10^{-6} \cos\left[100t + \left(\frac{x}{50}\right)\right] m$$

$$y_2 = 10^{-6} \sin\left[100t + \left(\frac{x}{50}\right) + \frac{\pi}{2}\right]$$

That is because $\sin(90^0 + A) = \sin A$

Phase different = $\Delta\Phi = \left(\frac{\pi}{2} - 0.5\right)$

$$= \left(\frac{22}{7\times 2} - 0.5\right)$$

$$= \left(\frac{\pi}{7} - 0.5\right) = 1.566 - 0.5$$

$$= 1.066$$

$$= 1.01 rad$$

The right answer is (d).

Sol.7 (c)

$$I = 2\ kg - m^2$$

$$\omega_0 = \frac{60}{60}.2\pi\ rad - s^{-1}$$

$$\omega = 0$$

$t = 60s$ The torque needed to stop the wheel = τ

$\tau = I\alpha$

$$\tau = I\left[\frac{\omega_0 - \omega}{t}\right]$$

Sol.8 (b)

Due to the surface tension of Hg, this metal (liquid) gets depressed in the barometer tube. So, the observed height of Hg in the barometer tube is less than its actual height. So, the reading of an Hg barometer is always less than the actual pressure.

The right option is (b)

Sol. 9 (a)

$\text{Force} = V\frac{dm}{dt} = V\frac{d}{dt}(\text{Volume} \times \text{Density}) = V\frac{d}{dt}(A \times p) = VA_p\ \frac{dx}{dt}$

$= A_p V^2$

Power = Force × Velocity $= A_p V^2 . V$

$A_p V^3$

Thus, power is proportional to V^3 **The right option is (a).**

Sol.10

David Bernoulli, a Swiss physicist, derived a relationship between the height and speed of a fluid. His principle (propounded in 1738) states that the some of pressure energy, kinetic energy and potential energy per unit volume of an incompressible non-viscous fluid in an irrotational flow remains constant along a streamline.Thus, we have:

$P + \frac{1}{2}pv^2 + pgh = \text{Constant}\ldots.$ (i)

Refer Fig.3.8 which was used for deriving this equation:

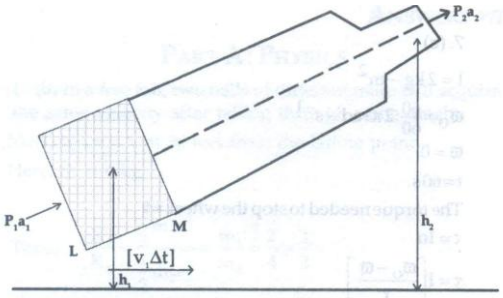


Fig. 3.8

Bernouli also proved that energy per unit volume remains constant. Hence Eqn. (i) can be written as follows:

$\frac{P}{pg} + \frac{1}{2}\frac{v^2}{g} + h = \text{Constant}\ldots$ (ii)

Where the terms have their usual meanings. So, the sum of pressure head, velocity head and gravitational head is constant. This theorem is applicable only to incompressible liquids, for it does not take into account the elastic energy of fluids. Further, it is applicable only if the fluid flow is streamlined. It is redundant when the fluid flow is turbulent. It also does not consider the angular momentum of the fluid. So, it does not apply to fluids that traverse curved paths. All other options are correct.

The right option is (c).

Sol. 11 (b)

Newton's law of cooling states that the cooling rate of a body is directly proportional to the temperature difference between the body and its surroundings, provided the temperature difference is small. Thus, we have:

$T = T_0 + Ce^{-kt}$

Where, C= constant of integration = e^c

C=specific heat of the body,

M= mass of body

T= temperature of surroundings and

$k = \frac{k}{mc}$ = constant

Clearly, $\Delta T = T - T_0$(degree Celsius)

Time is in minutes. These two variables were plotted to deliver the curve shown in Fig.3. The figure clearly shows that the rate of cooling is high to begin with since the value of Δ T is high. As ΔT is reduced gradually, the body loses comparatively less heat to its surrounding.

The right option is (b).

Sol.12 (c)

The formula for escape velocity is:

$V_e = \sqrt{2gR}$ (for the earth)

The planet is similar to that of the earth.

G=9.8m-s^{-2}. The radius of the planet is equal to one fourth of that of the earth.

$V_{e(\text{Planet})} = \sqrt{2gR}$

$R = 6400\text{km} = 6.4 \times 10^6 \text{m}$

$V.(\text{planet}) = \sqrt{2 \times 9.8 \times \frac{6.4 \times 10^6}{4}}$

$=5.6 \text{ km} - s^{-1}$

Thus the right option is (c).

Sol.13 (a)

The MI of the disc about a tangent parallel to its diameter is given by the following equation (refer Fig. 3.9).

MI about XX=$\frac{5}{4}$ MR^2

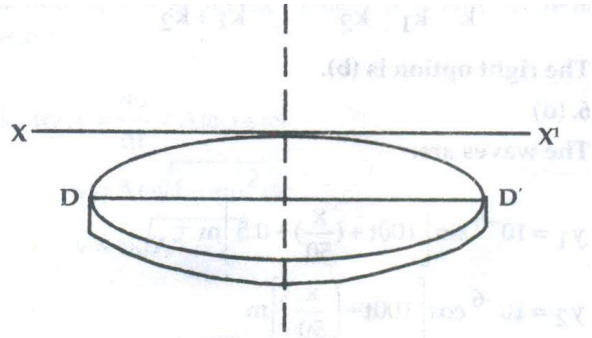


Fig. 3.9

The right option is (a)

Sol.14 (d)

Time at Srinagar=2 minutes

T_1 =120 seconds

Time at New Delhi = 1 hour 15 minutes

$\Longrightarrow T_2 = 75$ seconds

$$\frac{T_2}{T_1} = \left(\sqrt{\frac{g_1}{g_2}}\right)^2$$

$$\Longrightarrow \left(\frac{T_2}{T_1}\right)^2 = \left(\sqrt{\frac{g_1}{g_2}}\right)^2 \Longrightarrow \left(\frac{T_2}{T_1}\right)^2 = \frac{g_1}{g_2}$$

$$\Longrightarrow \frac{g_1}{g_2} = \left(\frac{T_2}{T_1}\right)^2 = \left(\frac{75}{120}\right)^2$$

$= (0.625)^2$

=0.391

The right option is (d).

Sol.15 (b)

$X_1 = 5\sin\left(2\pi t + \frac{\pi}{4}\right)$

$\Rightarrow A_1 = 5$

$X_2 = 5\sqrt{2}(\sin 2\pi t + \cos 2\pi t)$

$= 10\sin\left(\sin 2\pi t \cos\frac{\pi}{4} + \cos 2\pi t.\sin\frac{\pi}{4}\right)$

$= 10\sin\left(2\pi t + \frac{\pi}{4}\right)$

$\Rightarrow A_2 = 10$

$\Rightarrow \frac{A_1}{A_2} = \frac{10}{5} = \frac{1}{2} = 1:2$

The right choice is (b).

Sol.16 (c)

We have:

$V = \frac{\pi}{8}\frac{Pr4}{\eta 1}$

Put the dim ensions of physical quantities:

Dimensions of $V = \frac{ML^{-1}T^{-2}L^4}{ML^{-1}T^{-1}\quad L} = L^3T^{-1}$

The right choice is (c).

Sol.17 (a)

Final velocity of the first having mass m and falling through a height h is given by: $v^2 = 0 + 2gh$
$\Rightarrow v = \sqrt{2gh}$

Let us apply the law of conversation of momentum. Initial Momentum = Final momentum

$mv + 0 = (m + m)v'\ m\sqrt{2gh} = 2mv' \Rightarrow v' = \frac{\sqrt{2gh}}{2} = \sqrt{\frac{gh}{2}}\ W = \left(\frac{1}{2} \times 2mv'^2\right) + (2mgd)$

Now d is the distance through which the total mass moves on the ground. Also, v' is the velocity of this single body.

Work done = $m\left(\frac{gh}{2}\right) + 2mgd = \frac{1}{2}mg(h + 4d)$

The right option is (a).

Sol.18 (d)

When the lift moves up, it weighs more than the actual weight of man. The multiplication factor in this case is (ma). Refer Fig. 3.10.

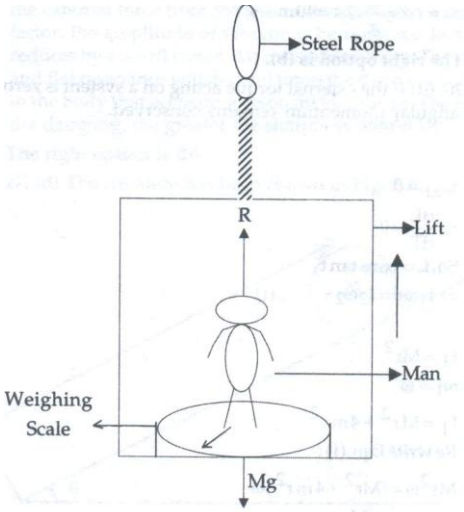


Fig. 3.10: Man in a lift

Mass of man =M=80 kg, Acceleration of lift = a =5, m-s^{-2}

When the lift moves up, the reading of the weighing scale is R. Thus, we have:

R-M .g=M. a Or, R=M .g +M .a =M (G + a) =80 (10 + 5) =1200 N

The right option is (d).

Sol.19 (b)

Tangential acceleration in a circular path = (Radius of circular path) × (Angular acceleration).

$a_T = \tau\alpha$….. (i)

$\omega = \omega_0^2 + 2\alpha\theta$

$\omega_0 = 0$

$\omega = \frac{v}{r} = \frac{80}{20/\pi} = 4\pi \text{rad} - s^{-1}$

$\theta = 2.2\pi \text{radius}$

$\alpha = \frac{\omega^2}{2\theta} = \frac{(4\pi)^2}{2.(2\pi)} = 2\pi$ From Eqn. (i), weget:

$a_T = r\alpha = \frac{20}{\pi} = 40\text{m} - s^{-2}$

The right option is (b).

Sol.20 (d)

If the external torque acting on a system is zero, the angular momentum remains conserved.

$\tau_{ext} = 0 \Rightarrow \frac{dL}{dT} = 0$

So, L=cons tan t $\Rightarrow I_1\omega_1 = I_2\omega_2$ ….. (i)

$I_1 = Mr^2$

$\omega_1 = \omega$

$I_1 = Mr^2 + 4mr^2$ Rewrite Eqn. (i):

$Mr^2\omega = (Mr^2 + 4mr^2)\omega \Rightarrow \omega_2 = \frac{M_\omega}{(M+4m)}$

The right option is (d).

Sol. 21(b)

Assume that the ball takes T seconds to reach a maximum height H. Refer Fig. 3.11. Here, B is the point of maximum height.

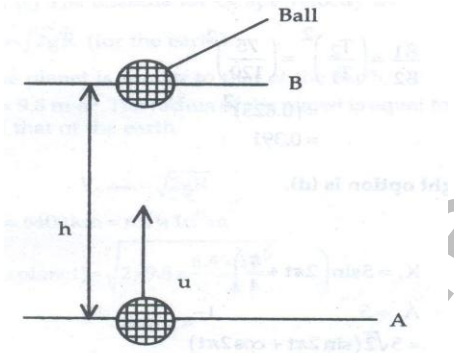


Fig. 3.11: At the maximum height, v = 0

$v = u - gT$ Now, v=0 when the ball is at height H So, u=0-gT In (T-t) seconds, the velocity attained by the ball is:

$v' = u - g(T - t)$ = u-gT +gT =u $- g\frac{u}{g} -$ +gT u − u + gT =gT Thus, the distance travelled in last t seconds: CB $= v't - \frac{1}{2}gt^2 = (gt).t - \frac{1}{2}gt^2 = gt^2 - \frac{1}{2}gt^2$

$= \frac{1}{2}gt^2$

The right option is (b).

Sol.22 (b)

If the dot product of two vectors is zero, they must be perpendicular to each other.

$\overrightarrow{F_1} = \vec{A} + \vec{B}$ …… (i)

$\overrightarrow{F_2} = \vec{A} - \vec{B}$ …….(ii)

The sum of two forces is perpendicular to their difference.

Thus, we have:

$\overrightarrow{F_1}.\overrightarrow{F_2} = 0$

$(\vec{A} + \vec{B}).(\vec{A} - \vec{B}) = 0$

$A^2 - \vec{A}.\vec{B} + \vec{B}.\vec{A} - B^2 = 0$

Hence, $A^2 = B^2$

Hence, $|\vec{A}| = |\vec{B}|$

So, the forces are equal in terms of magnitude.

The right option is (b).

Sol.23 (c)

The co- effective of static friction is equal to the tangent of the angle of friction.

$\frac{f_s max}{R} = \mu_s$

μ_s = Co –efficient of static friction. =tan θ

The right option is (c).

Sol. 24 (c)

We have the formula (for gravitation):

$v = u - gT$(ball is going up)

When the ball reaches the maximum height during its upward journey, its final velocity becomes zero.

So, v=0

So, 0 = u-gT

Thus, u=gT

If T =2 s and g=9.8 m-s^{-2}, we have

U=9.8.2 =19.6 m-s^{-1}

The man is throwing a ball; it would reach its maximum height in 2 seconds. Now, he throws the second ball. At that point the first ball has already reached the maximum height and is stationary for a precise time frame. When he throws the third ball, the first one comes to the ground (time taken =2 seconds). The second one would reach the maximum height by this time (time taken =2seconds). Thus, only two balls remain in the air. If the man wants to throw more than two balls in the air, he would have to throw the balls with a speed greater than 19.6m-s^{-1}.

The right option is (c).

Sol.25 (b) and (d)

(a) If the particle is at zero speed, its velocity is zero. Speed is the magnitude of velocity. If the magnitude is zero, velocity is also zero. The magnitude of non-zero velocity is non-zero. Hence, option (a) is incorrect.

(b) If the particle has zero sped at an instant, it may have non-zero acceleration at that very instant. Take an example. A body is falling freely. The value of g=9.8m-s^{-2}. So, its speed is zero. However, its acceleration is non-zero. Hence, option (b) is correct.

(c) When it reaches a height, its final velocity is zero, not initial velocity. When a ball gooes up, it becomes stationary at one particular instant due to the pull of the gravity. The initial velocity (While throwing it up) was non-zero but final velocity is zero (at the maximum height). Hence, option (c) is incorrect.

(d) If the particle has a constant speed, it must have zero acceleration. The speed (magnitude) should remain the same. The direction should also remain the same. Hence, option (d) is correct.

Hence, option (b) and (d) are correct.

Sol.26 (b)

In resonant vibrations of a body, the frequency of external force applied on the body is equal to its natural frequency. If we increase and decrease the frequency of the external force from the natural frequency by a certain factor, the amplitude of vibrations becomes too less. If it reduces by a small factor, flat resonance occurs. The sharp and flat resonance will depend upon the damping present in the body that is creating resonant vibrations. The lower the damping, the greater the sharpness would be.

The right option is (b).

Sol.27 (d)

The situation has been shown in Fig. 3.12.

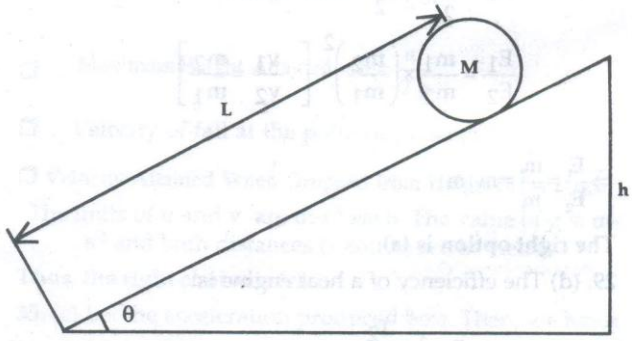


Fig. 3.12

The potential energy of the cylinder at the top will be converted into rotational kinetic energy and translational kinetic energy when it would start rolling down the inclined slope. Thus, energy remains conserved.

$$Mgh = \frac{1}{2}Mv^2 + \frac{1}{2}I\omega^2 = \frac{1}{2}Mv^2 + \frac{1}{2}\frac{MR^2}{2}\frac{v^2}{R^2}\left(\because I_{cylinder} = \frac{MR^2}{2}\right)$$

So, $Mgh = \frac{1}{2}Mv^2 + \frac{1}{4}Mv^2$

$$Mgh = \frac{3}{4}Mv^2$$

$$v^2 = \frac{4}{3}gh$$

$$v = \sqrt{\frac{4gh}{3}}$$

The right option is (d).

Sol.28 (a)

For a body, its linear momentum is conserved. From the law of conversation of linear momentum, we have:

$P_{initial} = P_{final}$

Or $0 = m_1v_1 - m_2v^2$

So, $m_1v_1 = m_2v^2$

Or $\frac{v_1}{v^2} = \frac{m_2}{m_1}$….. (i)

The ratio of their kinetic energies is as follows:

$$\frac{E_1}{E_2} = \frac{\frac{1}{2}m_1v_1^2}{\frac{1}{2}m_2v_2^2} = \frac{m_1}{m_2} \times \left(\frac{v_1}{v_2}\right)^2$$

$$\frac{E_1}{E_2} = \frac{m_1}{m_2} \times \left(\frac{m_2}{m_1}\right)^2 \left[\because \frac{v_1}{v_2} = \frac{m_2}{m_1}\right]$$

$\Rightarrow \frac{E_1}{E_2} = \frac{m_2}{m_1} = m_2 : m_1$

The right option is (a).

Sol.29 (d)

The efficiency of a heat engine is:

$$\eta = 1 - \frac{T_2}{T_1}$$

$\Rightarrow \frac{W}{Q_1} = 1 - \frac{T_2}{T_1}$

Q_1 = Heat absorbed from heat source = 6 kcal

T_1= Temperature of sin K = 127+273=400K

Put these values in Eqn. (i):

$$\frac{W}{6} = 1 - \frac{400}{500}$$

$\Rightarrow \frac{W}{6} = \frac{100}{500}$

$\Rightarrow W = 1.2$ Kcal

The right option is (d).

Sol. 30 (d)

The potential energy in a stretched spring is given by:

$$E = \frac{1}{2}kx^2$$

$$\Rightarrow \frac{E_1}{E_2} = \left(\frac{x_1}{x_2}\right)^2$$

x_1= 2cm=0.02m

x_2 =10cm=0.1m

$$\frac{E_1}{E_2} = \left(\frac{0.02}{0.1}\right)^2 = \left(\frac{1}{5}\right)^2 = \frac{1}{25}$$

$$\frac{E_1}{E_2} = \frac{1}{25}$$

Cross – multiplying, weget:

$25E_1 = E_2$

$E2 = 25E_1$

Here, $E_1 = E$

$\Rightarrow E_2 = 25\ E$

The right option is (d).

Sol.31 (c)

Young's Modulus is as follows: $y = \frac{Mgl}{\pi r^2 \Delta l} = \frac{Mgl}{\pi\left(\frac{D}{2}\right)^2 \Delta l} = \frac{4Mgl}{\pi D^2 \Delta l}$

D= Diameter of wire Elongation $=\Delta l = \frac{4Mgl}{\pi D^2 y} \Rightarrow \Delta l \alpha \frac{\alpha 1}{D^2}$

For new cable, $\Delta l\ \alpha \frac{1}{D^2}$

So, elongation will become one fourth of that for the new cable.

Load = $Mg = \frac{\pi D^2 \Delta l y}{4l} \Rightarrow Mg\ \alpha\ D^2$

For new cable, $Mg\ \alpha\ 4D^2$

So, if the diameter is doubled, the (new) cable can support four times the load that the old cable could.

The right answer is (c).

Sol. 32 (b)

All other conditions are true for Stoke's Law, except the condition given in option (b). The body must be perfectly rigid and smooth if Stoke's Law is to be applied to it. As per this law, the backward viscous flow acting on a small spherical body of radius moving a velocity v through a fluid having a viscosity **η** is given by:

$F=k\eta\ r\ v$

For small spheres, we have:

$K=6\pi$

$\Rightarrow F=6\pi\ \eta rv$

Hence, the right choice is (b).

Sol. 33 (c)

We have:

$F = p\sqrt{x} + qt^2$

$\left[p\sqrt{x}\right] = [F]$

$[P] = \frac{[F]}{[\sqrt{x}]}$

$= \frac{MLT^{-2}}{L^{\frac{1}{2}}}$

$=ML^{1-\frac{1}{2}}T^{-2}$

$=ML^{\frac{1}{2}}T^{-2}$

$[qt^2] = [F]$

$q = \frac{[F]}{t^2} = \frac{MLT^{-2}}{T^2} = MLT^{-2-2} = MLT^{-4}$

$\Rightarrow\left[\frac{p}{q}\right] = \frac{ML^{\frac{1}{2}}T^{-2}}{MLT^{-4}}$

$=L^{\frac{1}{2}-1}T^{-2+4}$

$=L^{-\frac{1}{2}}T^{2}$

Hence, the right option is (c).

Sol. 34 (c)

Some important equations must be kept in mind. They are as follows. For a body that is thrown vertically upwards, we have the following standard equations:

- Time of Flight = $\frac{2u}{g}$
- Time of Ascent = $\frac{u}{g}$
- Time of Descent = $\frac{u}{g}$
- Maximum Height Attained = h= $\frac{u^2}{2g}$
- Velocity of fall at ten point of projection= u
- Velocity Attained when Dropped from Height (h) = $2\sqrt{gh}$

The units of u and v are m-s^{-1} each. The value of g is m-s^{-2} and both distances (s and h) are in metres.

Thus, the right choice is (c).

Sol. 35 (c)

Let the acceleration produced be a. then, we have: $F = (m + m_1)a$

$\Rightarrow a=\frac{F}{m+m_1}$ So, the force exerted by the rope on the block= F'

$F' = ma = m\frac{F}{(m+m_1)} = \frac{mF}{(m+m_1)}$

Thus, the right option is (c).

Sol. 36 (b)

If the trains are moving in the same direction, the slow speed will be subtracted from the high speed and the net relative velocity will be in the direction of the fast train. Refer **Fig.3.13**

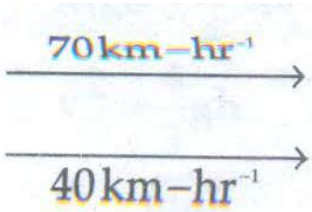


Fig. 3.13

Relative velocity = 70- 40 =30 km – hr^{-1}

It is in the direction of the first train.

Thus, the right choice is (b).

Sol. 37 (d)

Refer Fig.3.14

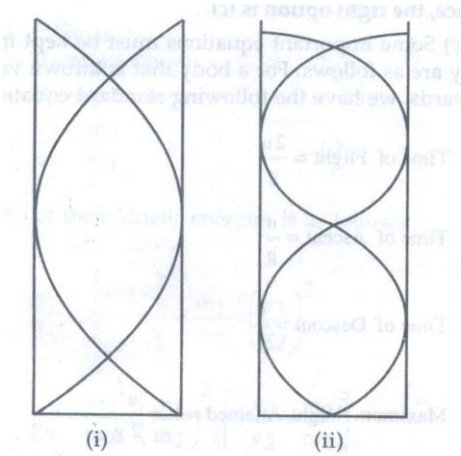


Fig. 3.14

Let the length of air columns be 1 each. Thus, we have

For mode (i) ↔ Part (i) of figure:

$1 = 3$

$\lambda = \frac{41}{3}$….. (i)

Frequency $= v_1 = \frac{v}{\lambda} = \frac{3v}{41}$

For mode (ii) ↔Part (ii) of figure:

$L = \frac{5\lambda}{4}$

$\Rightarrow \lambda = \frac{41}{5}$

Frequency = $v_2 = \frac{v}{\lambda} \Rightarrow v_2 = \frac{5v}{41}$

$\frac{v_1}{v_2} = \frac{3v}{\frac{41}{\frac{5v}{41}}}$

$= \frac{3v}{41} \times \frac{41}{5v}$

$= \frac{3}{5}$

$\Rightarrow v_1 : v_2 :: 3 : 5$

The right option is (d).

Sol.38 (a)

Reynolds's number is dimensionless. It determines the nature of the flow of liquid. The formula is as follows:

$$R_e = \frac{\rho v D}{\eta},$$

Where, R_e= Renold's Number,

$\boldsymbol{\rho}$ = density of fluid,

D= diameter of pipe and

$\boldsymbol{\eta}$ = Viscosity of liquid.

If $R_e < 2000 \Rightarrow$ la min ar flow

If $R_e > 3000 \Rightarrow$ turbulent flow

If $2000 < R_e < 3000 \Rightarrow$ unstable flow

The flow may change from laminar to turbulent and vice-versa. Also note that:

$$R_e = \frac{\text{Inertialforce per unit area}}{\text{Viscous force per unit area}}$$

Given, R_e = 3120 Hence, the flow of the liquid is turbulent. Thus, the right choice is (a).

Sol. 39 (d)

The **Assertion** is false. The RMS speed and average speed of molecules are different from each other. The Reason is false. The Maxwell distribution for the speed of molecules in a gas is asymmetrical.

The right option is (d).

Sol. 40 (b)

The **Assertion** is true. When a car moves ahead, its tyres face the frictional force exacted by the road. This friction causes the heating of tyres. A part of this heat goes inside the tyres and heats up the inner air, albeit only partially. The fast – moving air outside the tyres keeps cooling them. But a small part of heat does reach the air trapped inside the radial tyre and rubber tube. The air pressure inside each tyre increases due to this small heating effect. Continuous driving can increase the pressure further, for the tyre does not get many an opportunity to lose its heat.

The reason is not a correct explanation of the Assertion. This reason is not, in any way, contributing to tyre heating during the course of driving.

The right option is (b).

Sol.41 (b)

The Assertion is true. The average kinetic energy per molecule per degree of freedom is $\frac{1}{2}K_n$ T.

This result was given by Boltzmann. It is also known as Law of Equipartition of Energy.

The Reason is true but it is not a correct explanation of the Assertion. A diatomic gas has 7 degrees of freedom.

The right option is (b)

Sol.42 (b)

The Assertion is true.

For a monatomic gas (say Helium), we have $\gamma = \frac{C_p}{C_v} = \frac{3}{5}$

For a diatomic gas (say Hydrogen), we have $\gamma = \frac{C_p}{C_v} = \frac{3}{5}$

The Reason is true. But this fact does not affect the Assertion; nor does it give any explanation for proving the supremacy of Assertion.

The right choice is (b).

Sol.43 (c)

The Assertion is true. For an ideal gas, the molecular forces among them. There can neither be internal PE nor internal energy due to their rotation or vibration. Thus, the molecules of an ideal gas can have translational KE.

The Reason is false. Gravity affects all gases. An ideal gas, which does not exist Prima Facie, would also be deemed under the influence of gravity.

The right choice is (c).

Sol.44 (d)

The Assertion is false. The RMS speed of the molecules of a gas is the square root of the mean of squared velocities of gas molecules in questions:

$V_{RMS} = \sqrt{\frac{v_1^2+v_2^2+v_3^2}{3}}$

The average speed of gas molecules is ad different concept. Thus we have: $\bar{v} = \frac{v_1+v_2+v_3}{3}$

It is evident that$V_{RMS} \neq \bar{v}$. In actual practice, the formulae of both these speeds are different. Therefore, the Reason is also false. The formula states that $V_{RMS} = \bar{v}$. In actual practice, the formulae for both these speeds are different. So, the Reason is false. **The right option is**

Sol.45 (a)

The Assertion is true. The mean free path $(\bar{\lambda})$ is inversely proportional to the square of molecular diameter.

$\Rightarrow(\bar{\lambda})\alpha\frac{1}{d^2}$

The Reason is true and a correct explanation of the Assertion. We have: $\Rightarrow(\bar{\lambda})\alpha\frac{k_B T}{\sqrt{2}\pi d^2\rho}$

We conclude that:

(a) $\bar{\lambda}\alpha$ m (mass of gas molecules)
(b) $\bar{\lambda}\,\alpha\frac{1}{\rho}$ (density of gas)
(c) $\bar{\lambda}\,\alpha\frac{1}{d^2}$ (square of molecule diameter)
(d) $\bar{\lambda}\alpha$ T (absolute temperature of gas) and
(e) $\bar{\lambda}\alpha\frac{1}{P}$ (pressure of gas)

Thus, the mean free path is inversely proportional to the square of molecule diameter.

The right option is (a).

PART B: CHEMISTRY

Sol. 46 (c)

All assumptions are correct, except (c). An electron cannot revolve around the nucleus in any arbitrary orbit. Rather, it can revolve only in an orbit in which its total angular momentum is equal to an integral multiple of $\frac{h}{2\pi}$. Here, h is Planck's constant. These orbits are stationary.

Refer Fig. 3.15

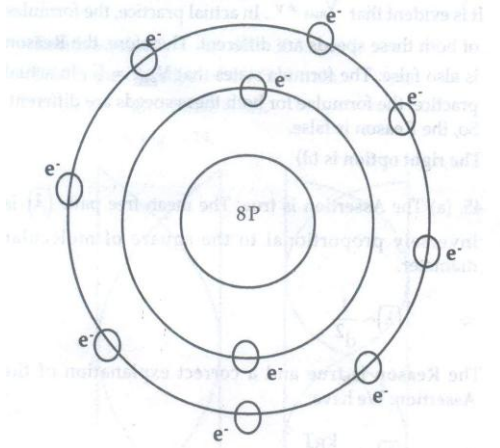


Fig. 3.15 Atoms are stable only if elements revolve in stationery orbits

The right option is (c).

Sol.47 (c)

Water molecules form weak hydrogen bonds. Refer Fig.3.16. The strong oxygen atom gets a slightly negative charge (δ−) and hydrogen gets a slight positive charge (δ+). That is because oxygen atom exerts more pull over electrons than hydrogen. Due to these polarities, the molecules form weak hydrogen bonds. Thus, spaces are trapped when water is frozen to form ice. When ice melts, the hydrogen bonds break. The space between molecules is eliminated and the volume of water becomes less than that ice had. That is why water or beer bottles are not kept in deep freezers. The empty spaces between molecules of water exert pressure. The ice blocks so formed may even explode.

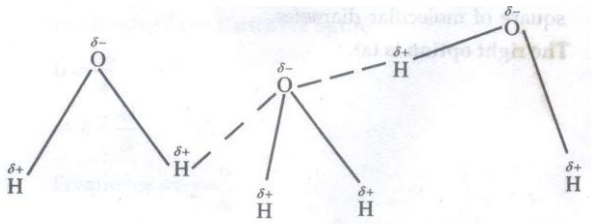


Fig. 3.16: Hydrogen barding in water molecules

The right option is (c).

Sol. 48 (d)

A gas that obeys gas laws at all temperatures and pressures is called Ideal Gas. At very low pressure and very high temperature, gases have known to be obeying gas laws and thus we can assume that they act like ideal gases under such conditions.

The right option is (d).

Sol. 49 (b)

The algebraic sum of the oxidation numbers of all atoms in a compound is equal to zero. Let us take the example of H_2SO_4 (Sulphuric acid).

Oxidation number of 2 H=2× (+1) =+2

Oxidation number S= +6

Oxidation number of 4 O= 4× (-2) =-8

Sum of oxidation numbers = +2 +6 – 8 = 0

The right option is (b).

Sol. 50 (c)

Only reaction (c) has not been properly balanced. Let us balanced it.

Step 1:

$$\overset{+5}{NO^-_3} \rightarrow \overset{-2}{S^{-2}} \rightarrow \overset{+2}{NO} + \overset{0}{S}$$

Step 2: Oxidation

$$\overset{2-}{S} \rightarrow S$$

Step 3: Reduction

$$NO^-_3 \rightarrow NO$$

Step 4:

$$\overset{2-}{S} \rightarrow S$$

Step 5:

$$NO^-_3 + 4H^+ + 3e^- \rightarrow NO + 2H_2O$$

Step 6:

$$S^{2-} \rightarrow S + 2e^-$$

$$NO^-_3 + 4H^+ + 3e^- \rightarrow NO + 2H_2O$$

Step 7:

$$3S^{2-} \rightarrow 3S + 6e^-$$

$$2NO^-_3 + 8H^+ + 6e^- \rightarrow 2NO + 4H_2O$$

Step 8:

$$2NO^-_3 + 8H^+ + 3S^{-2} \rightarrow 3S + 2NO + 4H_2O$$

This right option is (c).

Sol. 51 (b)

The total KE of 1 mol of a gas is given by:

$KE = \frac{3}{2}RT$

Also note that KE per molecule is:

$= \frac{3}{2}KT$

Boltzmann Constant = $K = \frac{R}{N}$

And R = Gas constant

N = Avogadro 's number

$=6.02 \times 10^{23}$ atoms

The mean KE of a gas is independent of the nature of the gas and directly proportional to the temperature of the gas.

The right choice is (b).

Sol. 52 (c)

The total number of elements in 1.6 grams of CH_4 can be calculated as follows.

No. of mol of CH_4 $= \frac{1.6g}{10g-mol^{-1}}$

$=0.1$ mol

1 mol of CH_4 has $=6.023\times10^{23}$ molecules

0.1 mol of CH_4 has $= 6.023\times10^{23} \times 0.1$

$=6.023\times10^{22}$ molecules

No. of electrons in 1 molecules = 6+4=10

(Six from carbon, four from hydrogen)

No. of electrons in 0.1 mol = $6.23\times10^{22}\times10$ or 1.6 f of CH_4

$=6.023\times10^{23}$

The right option is (c).

Sol. 53 (d)

Nitrogen and hydrogen combine to form ammonia at high temperature and pressure. The Fe-Mo catalyst is present. Thus, we have:

$$N_2 + 3H_2 \xrightarrow[200-900\,atm]{Fe-Mo} 2NH_3$$

The right option is (d).

Sol. 54 (c)

Clark's method uses slaked lime for removing the temporary hardness of water. In this reaction, insoluble carbonate is precipipated. Thus, we have: $Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2\ CaCO_3 + 2H_2O$

The right option is (c).

Sol. 55 (b)

Boron can be obtained by reducing B_2O_3 with Mg at high temperatures: $B2O3 + 3Mg \xrightarrow{High\,\triangle} 2B + 3\ MgO$

The right choice is (b).

Sol. 56 (c)

NaOH is an alkali in the choice (c). It is widely used in industry. Upon mixing it with water, it gives Na^+ ions and OH^- ions.

The right option is (c).

Sol. 57 (c)

Carbon dioxide dissolves in water to give Carbonic acid. However, this is not a stable compound. Thus, we have: $CO_2 + H_2O \rightleftharpoons H_2CO_3$

The right option is (c).

Sol. 58 (c)

Boron has the highest electronegativity in the boron family. The data has been shown in Table 3-I.

S. No.	Element	Electronegativity
1.	B	2.0
2.	Al	1.5
3.	Ga	1.6
4.	In	1.7
5.	TI	1.8

The right option is (d).

Sol. 59 (b)

This is very violent reaction. Hydrogen gas is produced in this reaction.

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

The right option is (b).

Sol. 60 (c)

The correct formula for Epsom salt is Epsom Salt: $MgSO_4.7H_2O$

It is a salt of MG which is an s-block element. The atomic number of Mg is 12 and its electronegativity is 1.2. It has two electrons in its 3 s orbit.

The right option is (c).

Sol.61 (d)

Potassium is a silvery white metal. It is softer than sodium. All other properties regarding potassium are true.

The right option is (d).

Sol.62 (a)

Lime stone, when heated at high temperature, yields CaO or Quick Lime.

$$CaCO_3 \xleftrightarrow{900^0 C} CaO + CO_2$$

The right option is (a).

Sol. 63 (d)

Water can be added to quick lime for preparing slaked lime. Thus, we have:

$$CaO + H_2O \rightarrow Ca(OH)_2$$

Slaked lime []$Ca(OH)_2$] has all the uses mentioned n the question statement.

The right option is (d).

Sol. 64 (b)

A free radical has one unpaired electron. It is paramagnetic in nature. The stability of free radial follows this order:

Tertiary > Secondary > Primary

The right option is (b).

Sol. 65 (d)

We have:

$N_2O_4(g) \rightleftarrows 2\,NO_2(g)$

At the point equilibrium, we have:

$PN_2O_4 = 0.28\,\text{atm}$ (given)

PNO_2 = 1.1 atm (given)

$$Kp = \frac{(PNO_2)^2}{PN_2O_4} = \frac{(1.1)^2}{0.28} = 4.32\ \text{atm}$$

The right option is (d).

Sol.66 (d)

If a system at equilibrium is subjected to stress, its equilibrium shifts in such a way that it mollifies the effects of the stress causing it. the stress can be a change in pressure, concentration or temperature. This is the renowned **Le Chatelier's Principle.**

The right option is (d).

Sol. 67 (b)

$A_2 + B_2 \underset{\longleftarrow}{\overset{100^0 C}{\longrightarrow}} 2AB$ Let x mol of A_2 react. At equilibrium, we have:

$A_2 = \frac{(1-x)}{3}\ B_2 = \frac{(2-x)}{3}\ AB = \frac{2x}{3}$

$K = \frac{[AB]^2}{[A_2][B_2]} = \frac{(2x/3)^2}{\left[\frac{1-x}{3}\right]\left[\frac{2-x}{3}\right]}$

But k=50, Solve for x, we get x =0.935

Hence, number of mol of AB formed in the reaction =2×0.935=1.870

The right option is (d)

Sol. 68 (b)

We have: $N_2 + O_2 \rightleftarrows 2NO \quad \triangle H = +21.5\,\text{kcal}$

If the concentration of N_2 is increased in this reaction, NO is formed easily and at a faster rate.

The right option is (b).

Sol. 69 (b)

Let us take the example of cane sugar to explain the concept. The heat of formation of cane sugar is the heat of the following reaction.

$$12C(s)+11H_2(g)+5.5O_2(g)\rightarrow C_{12}H_{22}O_{11}(s)$$

The heat of formation is the change in enthalpy when one mole of a substance is formed from its elements. But the enthalpies of substances in their chemical state are assumed to be zero. At all temperatures, the heat of formation is given by:

$$\triangle H_f = H_2 - H_1 = H_2 - 0 = H_2$$

Hence, the heat of formation of a substance is the enthalpy of that substance.

The right choice is (b).

Sol.70 (c)

Bond energy of H_2O can be discussed as an example. The energy needed to break each O-H bond in water is different.

$$H-O-H(g)\rightarrow OH(g)$$

$$\Rightarrow \triangle H_1 = 500kJ$$

$$OH(g)\rightarrow H(g)+O(g)$$

$$\Rightarrow \triangle H_2 = +428kJ$$

Bond Energy of $O-H$ Bond in H_2O:

$= \frac{\Delta H_1+\Delta H_2}{2}$

$= \frac{500+428}{2}$

$= \frac{928}{2} = 464J$

The right option is (c).

Sol.71 (a)

For an isochoric process, the value of Δ V is zero.

The right choice is (a).

Sol. 72 (d)

In the recent times, Environmental Chemistry has become a key branch of the chemical sciences in the wake of growing threats to our environment. Chemical engineers and chemists devoted to environmental protection aver that sulphur (s) and nitrogen (N) are the chief culprits that contribute towards the production of acid rain. Sulphur finally yields H_2SO_4. Nitrogen finally yields HNO_3. Both these acids fall on the earth in the form of acid rain. They destroy crops, soil fertility, building edifices, marble statues and micro-organisms present in soil.

The right option is (d).

Sol. 73 (d)

An electron- loving species is called Electrophile.

E.g: Br^+, Cl^+, NO_2^+,, NO^+, SO_3, R_3C, BF_3, $AlCl_3$, $ZnCl_2$, etc.

The right option is (d)

Sol.74 (c)

A nucleus- loving species is called Nucleophile.

E,g: Cl^-, Br^-, OH^-, SH^-, OR^-, HsO_3^-, $RC{\equiv}C^-$, $CH_3COCH_2^-$

The right option is (c).

Sol. 75 (d)

Inpolymerisation simple molecules that take part in the reaction are called Monomers.

Polymerisation can be of two types – Addition Polymerisation and Condensation Polymerisation.

The right option is (d).

Sol.76 (b)

Oil paintings contain a white pigment which is 2 $PBCO_3Pb(OH)_2$. In the earth's atmosphere, H_2S (g) is present in small traces. It reacts with this white pigment and forms PbS. The white pigment is discoloured due to this reaction. When restoration experts use H_2O_2 on these paintings, H_2O_2 oxidizes PbS into $PbSo_4$ which is white in terms of colour. Thus, the original colours and white shades of the painting in question are restored.

The right option is (b).

Sol. 77 (c)

Phenol is a weak acid and it is weaker than carbonic acid.

The right option is (c).

Sol.78 (c)

In this reaction, H_2O acts as an acid and OH acts as a base.

The right option is (c).

Sol.79 (b)

The salts of strong acids and strong bases, when dissolved in H_2O, gave strong acids and bases, respectively. The presence of high ionic concentration does not allow them to undergo hydrolysis.

The right option is (c)

Sol. 80 (c)

The decreasing order of electron affinity is:

Cl> F > Br

The right option is (c).

Sol.81 (b)

When H_2O_2 is discomposed, it easily gives nascent oxygen. Thus, H_2O_2acts as a better oxidizing agent than H_2O because it is not easy to decompose H_2O through simple physical means.

The right option is (b).

Sol.82 (d)

This is a free radical reaction. It is known as free Radical Reaction because in this reaction, the free radical attacksfirst. It is catalyzed by light or high temperature. Non-polar solvents are used too.

The right option is (d).

Sol. 83 (b)

$\Delta H = H_{Products} - H_{Reactants}$ if Δ H is negative, heat will be evolved during the course of reaction. Such a reaction is called Exothermic Reaction.

The right option is (b).

Sol.84 (d)

The first law of thermodynamics states that$\Delta E = q + w$

So, the entire energy is to be accounted for by heat (q) or work (w) in case an interaction takes place between a system and its surroundings.

The right option is (d).

Sol.85 (d)

The water bodies of the world have high levels of Hg, As, Cr, Sr, Cu and Pb. All these metals can harm marine life as well as humans. The steps mentioned in options (a), (b) and (c) are correct suggestions.

The right choice is (d).

Sol.86 (a)

At absolute zero, the molecular motion comes to a standstill. The KE of molecules is zero at this stage. So , it is impossible to cool a gas below a temperature of absolute zero. That is because there is no heat left in the gas that could be removed.

The right choice is (a).

Sol.87 (c)

We can take an example here:

$MnO_4^- + 8\ H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 5Fe_{3+} + 4\ H_2O$

Fe^{2+} is oxidized to Fe^{3+} because its oxidation number increases from +2 to +3. MnO_4^- is reduced to Mn^{2+} because its oxidation number decreases from +7 to +2. So, MnO_4^- is an oxidizing agent in this reaction. Further Fe^{2+} is acting as a reducing agent in this reaction.

Note that the concept of oxidation number is used for identifying the species that have undergone oxidation or reduction in a Redox reaction.

E.g.: $\overset{+1}{K}_2\ \overset{+6}{Cr}_2\ \overset{-2}{O}_7$

Here, oxidation number of K = +1

Oxidation number of Cr = +6

Oxidation number of O = -2

These number have been written above their respective elements.

The right choice is (c).

Sol. 88 (a)

Note that $FeCl_3$ is being reduced in this reaction. It has faced a reduction in its oxidation state.

$2FeCl_3 \rightarrow 2\ FeCl_2 + Cl_2$

The right option is (a).

Sol.89 (c)

Ag+ ions were neither oxidized nor reduced in this reaction.

$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

The right option is (c).

Sol. 90 (b)

Step 1: Oxidation $2\overset{-1}{I^-} \rightarrow 2\overset{0}{I_2} + 2e^-$

Step 2: Reduction $\overset{+5}{N} + 3e^- \rightarrow \overset{+2}{N}$

Step 3 $6\overset{-1}{I^-} \rightarrow 3\overset{0}{I_2} + 6e^-$ $\overset{+5}{2N} + 6e^- \rightarrow 2\overset{+2}{N}$ $6\overset{-1}{I^-} + 2\overset{+5}{N} \rightarrow 3\overset{0}{I_2} + 2\overset{+2}{N}$

Step 4: $6HI + 2\,HNO_3 \rightarrow 3I_2 + 2\,NO + 4\,H_2O$

The right option is (b).

PART C: BOTONY

Sol.91 (b)

The root hair zone also represents the zone of differentiation or maturation because different types of primary tissues differentiate or mature in this region (Viz. xylem, phloem, pericycle, endoderm's, cortex, epiplema, etc.)**Refer Fig.3.17**

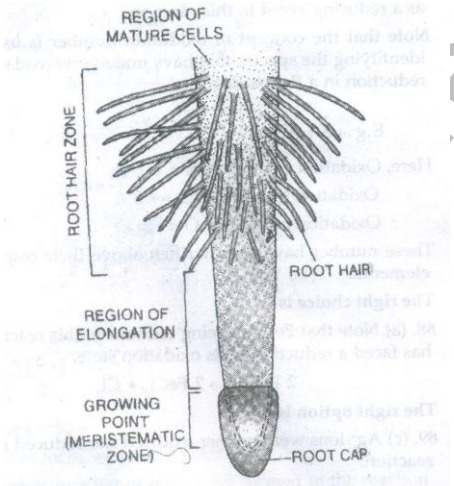
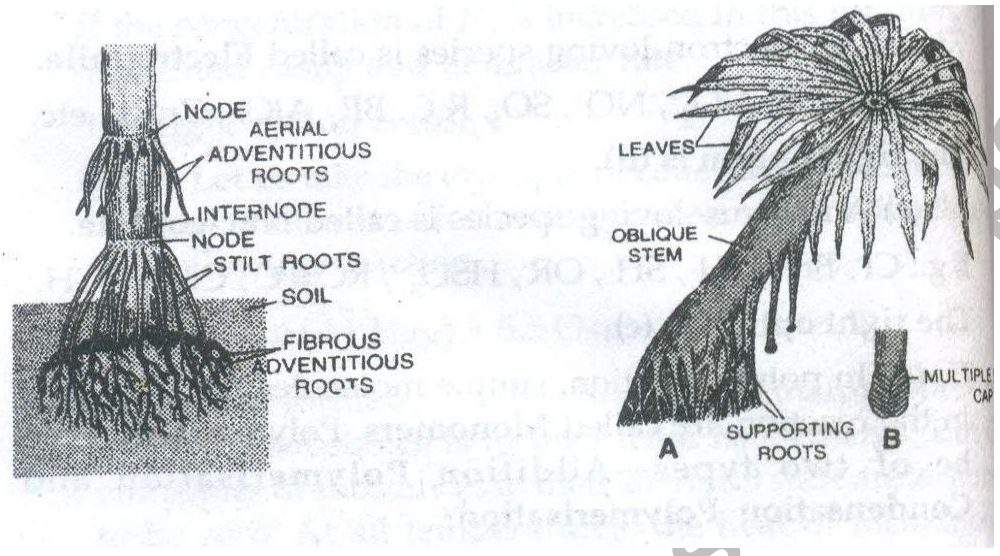


Fig. 3.17: Root hair zone (differentiation)

The right option is (b).

Sol.92 (a)

Stilt roots are short but thick supporting roots which develop obliquely from the basal nodes of the stem.
Refer Fig. 3.18



The right answer is (a)

Sol. 93 (d)

Phloem is made up of sieve tubes, companion cells and phloem parenchyma. Sieve tubes conduct organic food. Phloem paraenchyma cells store food and help in the lateral conduction of food. Companion cells are supposed to control the function of sieve tubes.

The right answer is (d).

Sol. 94 (c)

In Maize leaf the undifferentiated mesophyll occurs in concentric layers around vascular bundles having large centrifugal chloroplasts in its large bundle sheath cells. Such as arrangement is called **Kranz Anatomy**.

The right answer is (c).

Sol.95 (d)

Osmotic pressure can be defined as the pressure required to completely stop the entry of water into an osmotically active solution across a semi-permeable membrane. It is numerically equal to osmotic potential (=solute potential, ψ). Osmotic potential has a negative value but osmotic pressure (Ti, Pi) has a positive value (P =-Ti). The instrument used for measuring osmotic pressure is called Osmometer.

The right answer is (d).

Sol. 96 (d)

The chemical potential of pure water at normal temperature and pressure is zero. In solutions, the value of water potential is always negative (less than zero).

The right answer is (d).

Sol. 97 (c)

Solution culture is being used for raising flowers and vegetables at home. This production of plants sans soil is called Hydroponics. Plants are raised in small thanks of concrete or metal. The upper covering has support for plants. Narrow tanks are filed up with nutrient solutions. A pump circulates air as well as nutrient solutions. Roots of the plants are, therefore, regularly supplied aerated nutrient solutions, Hydroponics is useful in areas having thin, infertile and dry soil. They conserve water.

Additionally hydroponics can regulate pH for a particular crop, control soil-borne pathogens, avoid problems of weeding and obtain consistently better yield. **Refer Fig. 3.19**

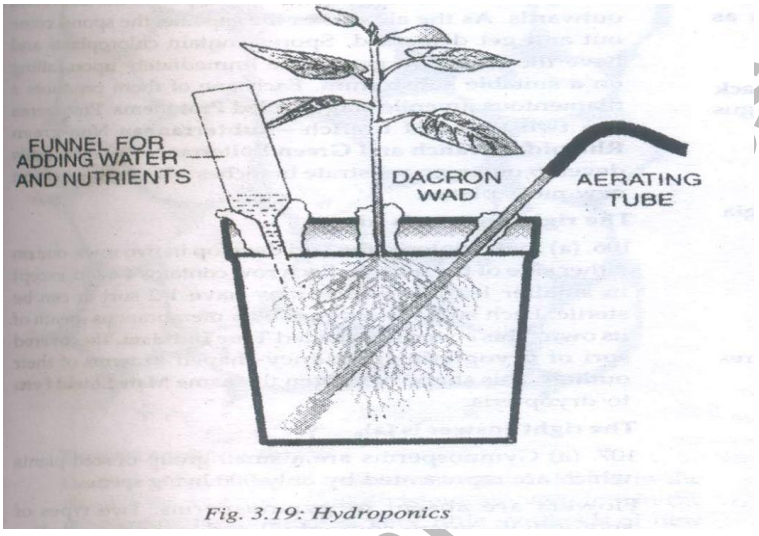


Fig. 3.19: Hydroponics

The right answer is (c)

Sol. 98 (a)

Crassulacean acid Metabolism (CAM) is a mechanism of photosynthesis involving the double fixation of CO_2which occurs in succulents belonging to crassulaceae, cacti, euphorbias and some other plants of dry habitats. In these habitats, stomata remain closed during the day and open only at night.

The right answer is (a).

Sol.99 (d)

A value of slightly more than unity is found in RQ when organic acids are broken down as respiratory substrates under aerobic conditions. Read this reaction; here, Oxalic acid is being treated with oxygen:

$2(COOH)_2 + O_2 \rightarrow 4CO_2 + 2H_2O$

RQ = $\frac{4CO_2}{O_2}$=4.0

The right answer is (d).

Sol.100 (d)

The first natural cytokinin was obtained from unripe maize grains or kernels by Lethamet. Al (1964). It is known as Zeatin (6- hydroxyl 3-methyl trans 2-butenyl amino-purine). It is also found in coconut milk. **Refer Fig.320.**

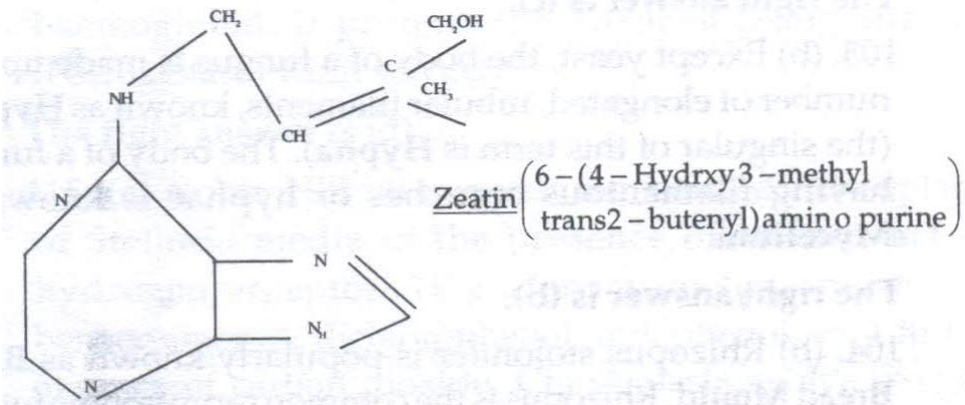


Fig. 3.20: Zeatin

The right answer is (d).

Sol. 101 (a)

Short- day plants flower when the photo period or day length is below a critical period. Most of winter flowering plants to this category. E. g: Xanthium, Chrysanthemum, Cosmos bipinnatus, Aster, Dahila, Rice and sugarcane.

The right answer is (a).

Sol. 102 (c)

Oxidative phosphorylation is the synthesis of energy-rich ATP molecules with the help of energy liberated during the oxidation of reduced co- enzymes (NADH, $FADH_2$) produced in the respiration process. The enzyme required for this synthesis is called ATP synthase. It is considered to be the fifth complex of electron transport chain. ATP synthase is located in F_1 or head –piece of F_0-F_1 or elementary particles. These particles are present in the inner mithochondrial membrane. ATP synthase becomes active in ATP formation only where there is a proton gradient having higher concentration of H^+ ions or protons on the F_0 sickle as compared to F_1 side (Chemiosmotic Hypothesis of peter Mitchell). Refer Fig. 3.21

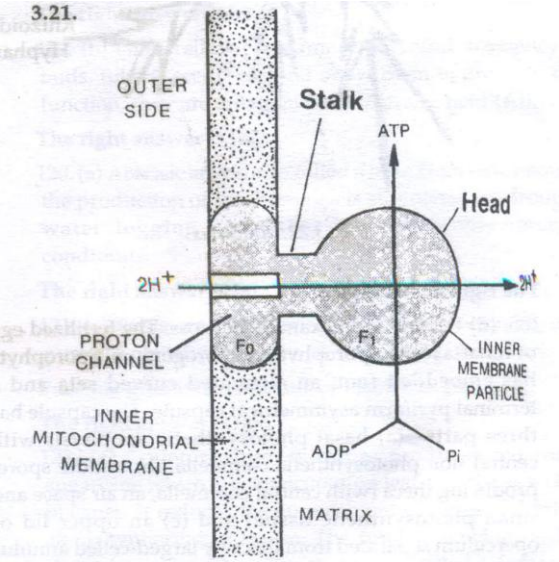


Fig. 3.21: Oxidative phosphorylation

The right answer is (c).

Sol.103 (b)

Except yeast, the body of a fungus is made up of a number of elongated, tublar filaments, known as Hyphae (the singular of this term is **Hypha**). The body of a fungus having filamentous branches or hyphae is known as **Mycelium.**

The right answer is (b).

Sol.104 (b)

Rhizopusstolonifer is popularly known as **Black Bread Mould.** Rhizopusis the common saprotrophic fungus that attacks a variety of food items. **Refer Fig. 3.22**

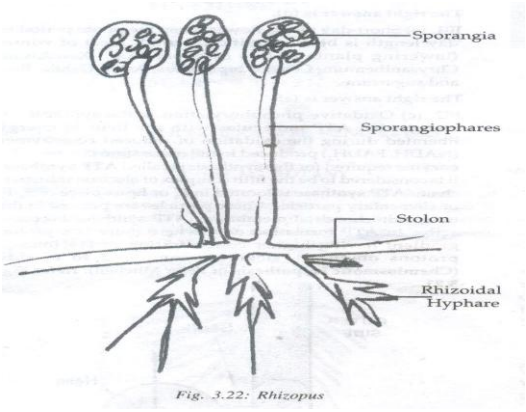


Fig. 3.22: Rhizopus

The right answer is (b).

Sol. 105 (d)

Funaria is an example of moss. The fertilized egg of funaria forms sporophyte or sporogonium. Sporophyte has embedded foot, an elongated curved seta and a terminal pyriformasymmertrical capsule. The capsule has three parts – (a) basal photosynthetic apophysis with central non photosynthetic columella, (b) middle sporeproducing theca (with central columella, an air space and small photosynthetic tissue) and (c) an upper lid or operculum seprated from theca by large – celled annulus on the outside and peristome on the inner side. Peristome consists of 32 acellular teeth that are arranged in two whorls – an outer hygrosocopic and an inner non- hygroscopic. As spores become mature, annulus shrivels and operculum falls down. The outer peristome teeth bend outwards. As the air shakes the capsule, the spores come out and get dispersed. Spores contain chloroplasts and have the ability to germinate immediately upon falling on a suitable substratum. Each one of them produces a filamentous juvenile stage, called **Protonema. Protonema**has two types of branch - **subterraneanNon –green** Rhizoidal Branch and Green Epiterranean Branch. Buds develop on green prostrate braches which grow to form new moss plants.

The right answer is (d).

Sol. 106 (a)

In dryopeteris, the sori develop in two rows, one on either side of the midrib. Each row contains 4-6 sori, except in smaller leafets which may have 1-2 sori or can be sterile. Each sorus is covered by a membranous sheath of its own. This covering is called True Indusim. The covered sori of dryopertis are kidney- shaped in terms in terms of their outline. This shape has given the name Male Shield Fern to dryopteris.

The right answer is (a).

Sol.107 (a)

Gymnosperms are a small group of seed plants which are represented by only 900 living species.

Flowers are absent in gymnosperms. Two types of sporophyll – **microsporophyll** and mega sporophyll- are usually aggregated to form distinct cones or strobili. The pollen cones are male cones and seed cones are female cones. Seeds do not occur inside a fruit. They are naked.

The right answer is (a).

Sol. 108 (c)

The flowers and fruits are found only once after a vegetative growth of several years in monocarpic plants. Thus, perennial plants are monocarpic.

The right answer is (c).

Sol. 109 (c)

Sclereids are highly thickend dead sclerenchyma cells with very narrow cavities. Sclerieds are broader as compared to fibres, being isodiametric polyheadral, spherical, oval short or cylindrical. They may also be branched. The thick cell walls have branched or unbranched simple pits. Since they are elongated, the pits of sclereids are also known as **Pit Canals.**

The right answer is (c).

Sol. 110 (b)

The thickenings are found on the walls bordering intercellular spaces (language thickenings) are called **LacunateCollenchymas**. Example: Cucurbita stem has been shown here. **Refer Fig. 3.23**

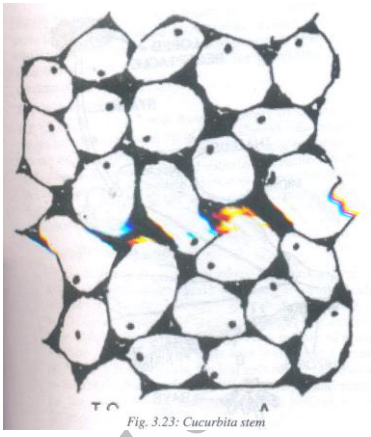


Fig. 3.23: Cucurbita stem

The right answer is (b).

Sol. 111 (a)

In many cases, a quiescent centre is found in the centre of the root apex. Cell divisions are very few in the quiescent centre as there is very little synthesis of new proteins, RNA and DNA. The quiescent centre may function as a reserve meristem. Due to the presence of a quiescent centre, the root apical meristem appears cup- shaped or hemispherical.

The right answer is (a).

Sol. 112 (a)

Transpiration is measured with the help of the photometer. The size of stomata is measured with the help of the porometer. Atmospheric pressure is measured with the help of the manometer. Finally, osmotic pressure is measured with the help of the osmometer.

The right answer is (a).

Sol. 113 (d)

Under anaerobic conditions, some micro- organisms use nitrate and other oxidized ions as sources of oxygen. In this process, nitrate are reduced to gaseous compounds of nitrogen. The latter escape from the soil. The common bacteria that cause denitrification of soil are Pseudomonas denitrificans and Thiobacillusdenitrificans.

$2\ NO_3^- \rightarrow 2\ NO_2^- \rightarrow 2\ NO \rightarrow N_2O \rightarrow N_2$

The right answer is (d).

Sol. 114 (d)

In an infected cell, bacteriods occur in groups surrounded by a host membrane. The host cell

Develops a pinkish pigment, called **Leg haemoglobin** (Lb). It is an oxygen scavenger and is related to blood pigment, haemoglobin. It protects the nitrogen – fixing enzyme (Nitrogenase) from oxygen.

The right answer is (d).

Sol. 115 (d)

Robin Hill illuminated the isolated chloroplasts of Stellaria media in the presence of leaf extract or hydrogen acceptors (E.g :ferricyancicles, chromates, benzoquinones, dichlorphenol, indophenol, etc.) in the absence of carbon dioxide. Chloroplasts evolve oxygen gas.

$2A \rightarrow 2H_2O \rightarrow \xrightarrow{Light, Cholroplasts} 2\ Ah_2 \rightarrow O_2\ (g)$

Here, A is a nitrogen acceptor.

The right answer is (d).

Sol. 116 (c)

Continuous photosynthesis can occur in continuous illumination without any harm to the plant through the root of photosynthesis may slightly decline after six days.

The right answer is (c).

Sol. 117 (a)

Food reaches every cell of an organism so that respiration may take place. It is called Cellular Respiration. During the course of cellular respiration, food substances are oxidized. This phenomenon occurs in cytoplasm and mitochondria.

The right answer is (a).

Sol. 118 (c)

ATP is broken down to release energy whenever and whenever energy is to be utilized. This energy (stored in ATP) is utilized for carrying out different cellular activities, thus, ATP acts as the energy currency of the cell.

The right answer is (c).

Sol. 119 (b)

Gibberellins overcame the natural dormancy of bunds, tubers , seeds etc. and allow them to grow. In this function, they are antagonsistic to Abscisic acid (ABA)

The right answer is (b).

Sol. 120 (a)

Abscisic acid is also called Stress Hormone because the production of this hormone is stimulated by drought, water logging and after adverse environmental conditions.

The right answer is (a).

Sol. 121 (a)

Rusts are characterized by the formation of rusty pustules containing spores. A basidiocarp is absent. Pucciniagraministritici causes black rust in wheat.

Sol. 122 (c)

Colletorichumfalcatum produces red rot of sugarcane which is conspicuous on leaf midribs as well as in canes. It reduces the juice content of canes and brings about withering of leaves. The fungus develops sickle shaped conidia. The perfect stage is called **Glomerellatuccumanensis.** Refer Fig. 3.24

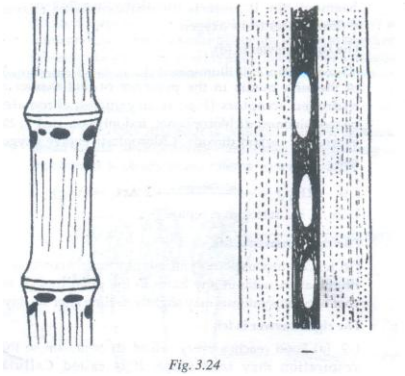
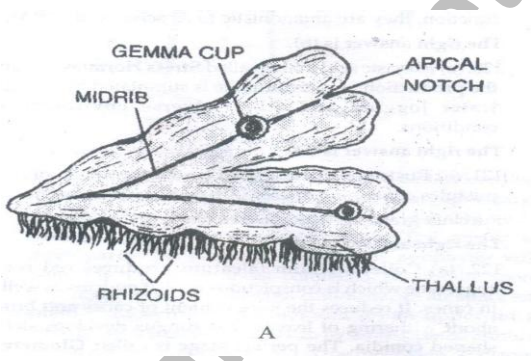


Fig. 3.24

The right answer is (a).

Sol. 123(d)

Sexually, Marchanita is dioecious with sex organs borne on stalked upright receptacles or gametopphores. The gametophore of female thallus is called Archegoinophore. Its receptacle has nine cylindrical processes or rays. The upper surface of the female receptacle is convex and bears only air chambers. Each lobe of the receptable has a patch of hanging archegonia on the under surface, with younger archegonia towards the stalk and older archegonia towards the periphery. A two- lipped hanging membrous covering or perichetium occurs around each archegonial patch. **Refer Fig. 3.25.**



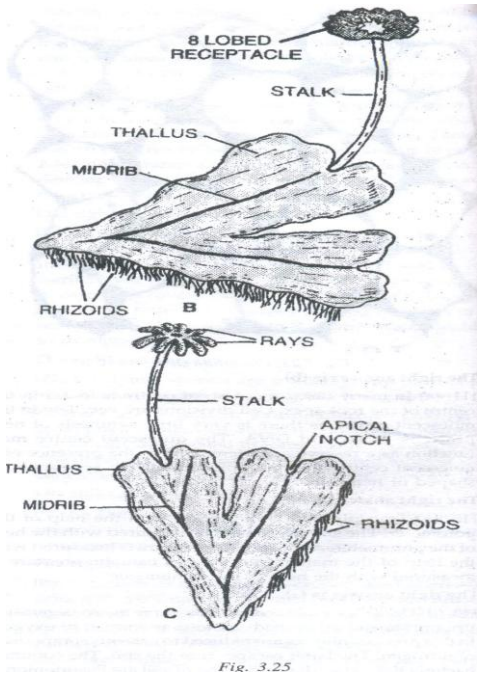


Fig. 3.25

The right answer is (d).

Sol. 124 (c)

The phloem of angiosperms possesses sieve tubes and companion cells.

The right answer is (c).

Sol. 125 (a)

Saphrophytes obtain their nourishment from dead decaying organic matter. They are also called **Humus Plants. E. g:**Monotropa andNeottia**.**

The right answer is (a).

Sol. 126 (d)

Three leaves (as in Nerium and vernkaner)or more than three leaves (as in Alstonia)develop from a single node. The leaves of one whorl generally alternate with those of the adjacent whorls for providing the maximum exposure.

The right answer is (d).

Sol. 127 (d)

Endodermis or the inner boundary of Cortex is single- layered. It is made up of barrel-shaped cells which do not enclose intercellular spaces. The young endoderm cells possess an internal strip of suberin and lignin which is known as **Casparian Strip.** However, it soon becomes indistinguishable due to the additional thickening of the endodermal cells.

The right answer is (d).

Sol.128 (c)

At places, the upper or adaxial epidermis contains groups of larger thin- walled protruding and turgid cells over the region of venis. They are called **Bulliformsor Motor Cells.** These cells are highly vacuoalte and can store water if it is available. However, in case of water deficiency, the bulliform cells lose water and become flaccid. As a result of this, the leaf gets rooled up so as to reduce the exposed surface. Bulliform cells are also useful for the unrolling of leaf during the course of its development.

The right answer is (c).

Sol. 129 (b)

Cohension- Tension and Transpiration Pull Theory was put forward by Dixon and Jolly (1894). It was further improved by Dixon (1914). Therfore, this theory has named after him as Dixon's theory of Ascent of Sap. Today, most scientists believe in this theory.

The right answer is (b).

Sol. 130 (a)

Bleeding is the exudation of sap or watery solution from the cut or injured poarts of a plant. E.g: Agave, Acer, Vitis, toddy palm, etc. it occurs due to root pressure, phloem pressure, local pressure in xylem (stem pressure) and latex or resin. **The right answer is (a).**

Sol. 131 (a)

Silicon is required by most grasses and cereals. Its deficiency produces **Leaf necrosis** and stunted growth in rice.

The right answer is (a).

Sol.132 (a)

The essential elements derived from soil are termed as **Mineral Elements.** Essential elements obtained from air or water are known as Non-mineral Elements. E.g: Carbon, Hydrogen and Oxygen. They are the building blocks of macromolecules that form the bulk of plant body. Carbon is the most abundant element in plants.

The right answer is (a).

Sol.133 (b)

Photosystem I is a photosynthetic pigment system along with some electron carriers. It is located on both the non-appraised part of Grana thylakoids and stroma thylakoids. PS 1 has more of chlorophyll b and carotenoids are comparatively less.

The right answer is (b).

Sol.134 (b)

Carbon dioxide can be fixed in the dark. The biosynthetic phase or dark reaction catalyses the assimilation of CO_2 to form carbohydrates. These reactions are called Carbon Reactions. They occur in stroma or matrix of chloroplasts. These reactions do not require light. Instead, an assimilatory power (ATP and NADPH) produced during the photochemical phase is used up in the processes of fixation and reduction of carbon dioxide. All enzymes required for the process are present in the matrix or stroma of the chloroplast.

The right answer is (b).

Sol. 135 (a)

In micro- organism, the term fermentation is more commonly used where anaerobic respiration is known after the name of the product like alcoholic fermentation, lactic acid fermentation, etc. Carbon dioxide is evolved in some cases. It gives a frothy appearance (Latin – Fermentum means "to boil") to the medium. Buchner (1897) was the first to find that fermentation can be caused without the living yeast cells by grinding them underpressure and mixing the extract was named as Zymase. Fermentation can be defined as the anaerobic breakdown of carbohydrates and other organic compounds into alcohols, organic acids, gases, etc. with the help of micro- organism or their enzymes.

The right answer is (a).

PART D: ZOOLOGY

Sol. 136 (c)

The cell size of kingdom Monera varies from 0.1 to 5μm. Thus, option (c) is incorrect in the context of Kingdom Monera.

The correct answer is (c).

Sol.137 (a)

The interval between the entry of the sporozoite into the human blood and first appearance of fever is called **Incubation Period**. It is about 14 days in the case of Plasmodium vivax. During this period, parasites multiply to increase their number so that they are able to produce enough toxins to cause malaria.

The correct answer is (a).

Sol. 138 (a)

A contractile vacuole is present for osmoe- regulation. The excess of water is passed out by one or more contractive vacuoles. Refer Fig. 3.26.

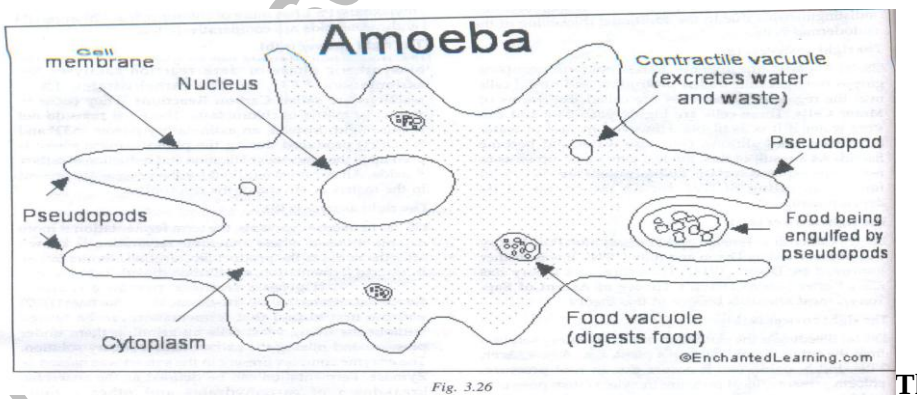


Fig. 3.26

The correct answer is (a).

Sol. 139 (d)

Numerous dermal placoid scales are embedded in the skin of cartilaginous fish and form the exoskeleton of the fish.

The correct answer is (d).

Sol. 140 (a)

The correct answer is (a).

Sol.141 (a)

The hyline cartilage contains clear and large amounts of translucent slightly elastic matrix with less fibres. The matrix often has very fine white fibres which are difficult to observe. It is the most prevalent cartilage.

The correct answer is (a).

Sol. 142 (d)

The nucleus of basophils is usually three-lobed. They have less number of coarse granules. Their granules take basic starch (like methylene blue)strongly. Both mast cells and basophils liberate Histamine and Heparin as well as smaller quantities of Bradykinin and Serotonin. They are probably like the mast cells of connective tissues.

The correct answer is (d).

Sol. 143 (b)

The glossopharyngeal nerve supplies the taste buds of tongue and muscles of the pharynx. Somefibres carry impulses from tongue, while the other fibres are responsible for pharynx movement as they are concerned with the swallowing reflex. Thus, both sensory and motor nerve fibres are present in this nerve. The nature of this nerve is mixed.

The correct answer is (b).

Sol. 144 (b)

Lateral oesophageal blood vessels is a pair of blood vessles lying one on either ventrolatral side of the alimentary canal in the first fourteen segments. Both these lateral oesophageal vessels collect blood from the buccal cavity, pharynx, osoephagus and the vody wall through oesophageo- tegumentaries and carry this blood to the supraoesophageal vessel through two pairs of anterior loops situated in the 10^{th} and 11^{th} segments.

The correct answer is (b).

Sol. 145 (a)

Totipotancy or cellular totipotency is the ability of a living somatic nucleated cell to form a complete organism.

The correct answer is (a).

Sol. 146 (d)

Lysosomes are believed to be formed through the joint activity of endoplasmic reticulum endosomes and the golgi complex (GERL system). The precursors of hydrolytic enzymes are mostly synthesized at the rough endoplasmic reticulum. The latter transfers them to the forming face of the golgi complex either directly or form the smooth endoplasmic reticulum through its vesicles. In the golgi complex, the precursors are changed into enzymes. The enzymes are then packed in larger vesicles which are pinched off from the maturing face. Golgian vesicles are joined by endosomes for producing lysosomes.

The right answer is (d).

Sol. 147 (c)

Chitin is a complex carbohydrate of heteropolysaccharide type which is found as the structural component of fungal walls, chitin is often known as **Fungus Cellulose.**

The right answer is (c).

Sol. 148 (b)

Some disaccharides possess the reducing groups. The reaction is used for detecting glucose in urine. Benedict's solution comprises a blue – coloured alkaline solution of copper (cupric) sulphate. The reducing sugar changes into insoluble reddish cuprous oxide upon gentle heating. Crprous oxide separates as a precipitate. The final precipitate may appear green, yellowish, Orange to brick red, depending upon the amount of reducing sugar.

The right answer is (b).

Sol. 149 (c)

$$\text{Trypsinogen} \xrightarrow[\text{of Intestinal Juice}]{\text{Enterokinase}} \text{Trypsin (Proenzyme)}$$

The right answer is (c).

Sol.150 (c)

Vitamin B_{12} (cyanocobalamin, cobalamin) causes Pernicious anaemia. It is reported in spirulina (anolga).

The right answer is (c).

Sol.151 (b)

Emphysema is an inflation or abnormal distension of the bronchioles or alveolar sacs of lungs.

The right answer is (b).

Sol.152 (a)

Mountain sickness is commonly developed in persons who visit high- altitude places for the very first time. In case of mountain sickness, symptoms occur mostly in the digestive and nervous system of the human body.

The right answer is (a).

Sol.153 (c)

A normal Electro Cardio Gram (ECG) is composed of a P-ware, a QRS wave (complex) and a T-wave. The letters are arbitrarily selected and do not stand for any particular words.

The P wave is a small upward wave that represents electrical excitation or atrial depolarization which leads to contraction of both the atria (atrial contraction). It is caused by the activation of S node. The impulses of contraction start from the SA node and spread throughout the atria.

The QRS wave (complex) begins after a fraction of second of the P-wave. It begins as a small downward deflection (Q) and continues as large upright (R) and triangular wave, ending as a downward wave (S) at its base. It represents ventricular deploarisation (ventricular contraction). It is caused by the impulses of contraction from the AV node through the bundle of His and Purkinje fibres and the contraction of ventricular muscles. Thus, this wave is due to the spread of electrical impulses through ventricles.

The T- Wave is dome-shaped which represents ventricular repolarization (ventricular relaxation). The potential generated by the recovery of the ventricular from the depolarization state is called Repolarisation Wave.

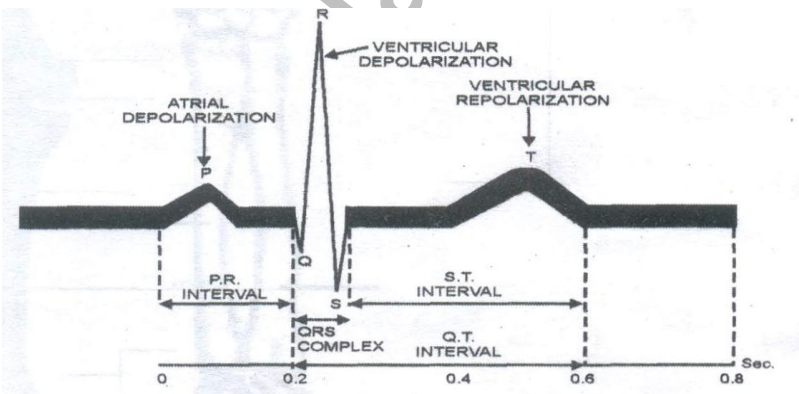


Fig. 3.27

The right answer is (c).

Sol.154 (b)

The atrioventricular opening between the left atrium and the left ventricle is guarded by the bicuspid value, also called **Mitral Valve.** It has two flaps.

The right answer is (b).

Sol.155 (c)

Individuals with blood group O can donate blood to anyone. This is the most important blood group for transfusion.

The right answer is (c).

Sol. 156 (b)

The excretion of urea is known as **Ureotelism** and the animals which excrete urea are called **Ureotelic Animals.**

The right answer is (b).

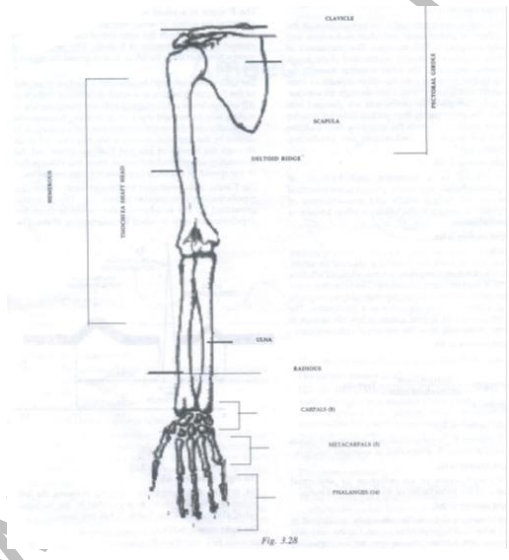
Sol. 157 (b)

Plasma proteins are not filtered through the glomerular capillaries. Blood Colloidal Osmotic Pressure (BCOP)opposes filtration. It is about 32 mm of Hg.

The right answer is (b).

Sol.158 (d)

The shaft of the humerus has a V- shaped deltoid ridge at about its middle. **Refer Fig. 3.28.**



The right answer is (d).

Sol. 159 (a)

The pelvis or pelvic girdle is formed by two innominate bones (hip bones). The sacrum and coccyx also take part in the formation of the pelvis. Each innominate bone comprises three separate bones – **Ilium**, **Ischium** and **Pubis.** On its outer surface, it has a deep depression, called **Acetabulum** to which the head of femur is articulated thus forming the hip joint. The acetabulum is formed by Ilium, Ischium and Pubis. **Refer Fig. 3.29.**

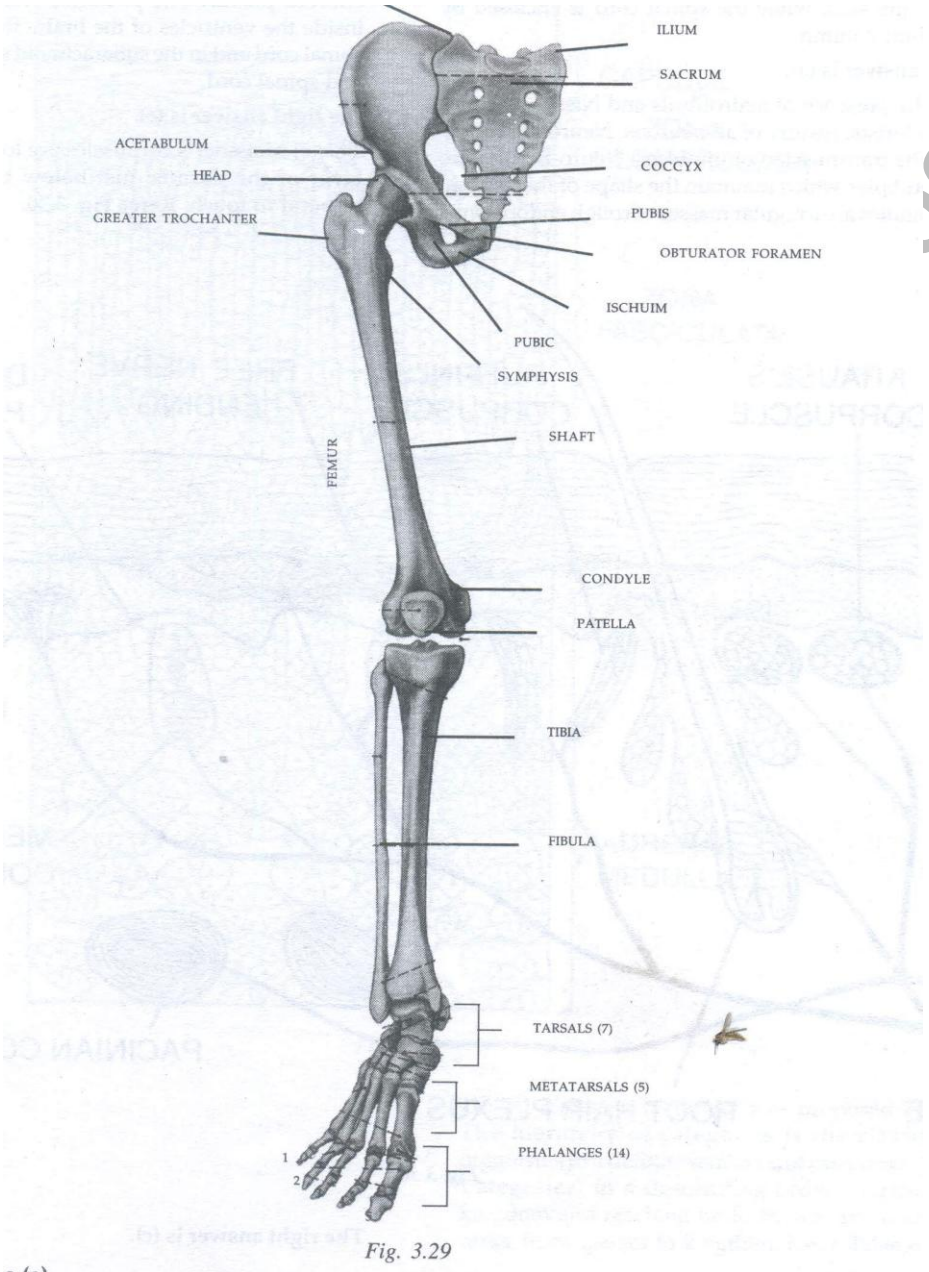


Fig. 3.29

The right answer is (a).

Sol.160 (a)

Man is ureotelic. It releases urea through his urine.

The right answer is (a).

Sol.162 (b)

The central neural system is a hollow, dorsally placed structure lining along the mid-dorsal axis of the body. It comprises brain and spinal cord. The brain is lodged in the skull while the spinal cord is enclosed by the vertebral column.

The right answer is (a).

Sol. 163 (d)

The presence of neurofibrils and Nissl's granules is a characteristics feature of all neurons. Neurofibrils play a role in the transmission of impulses. Neuro- tubules are the microtubules which maintain the shape of the neuron. Nissl's granules are irregular masses of rough endoplasmic reticulam, with numerous attached and free ribosomes and polysomes. Nissl's granules probably synthesise proteins for the cell.

The right answer is (d).

Sol. 164 (b)

Unipolar neurons are found usually in the embryonic stage.

The right answer is (b).

Sol.165 (c)

The cerebrospinal fluid is secreted by anterior choroid plexus. The posterior choroid plexus is found inside the ventricles of the brain, the central canal of the spinal cord and in the subarachnoid space around the brain and spinal cord.

The right answer is (c).

Sol.166 (c)

Meissner's corpuscles are located in the papillary layer of the dermis, just below the epidermis which respond to rouch. **Refer Fig. 3.30.**

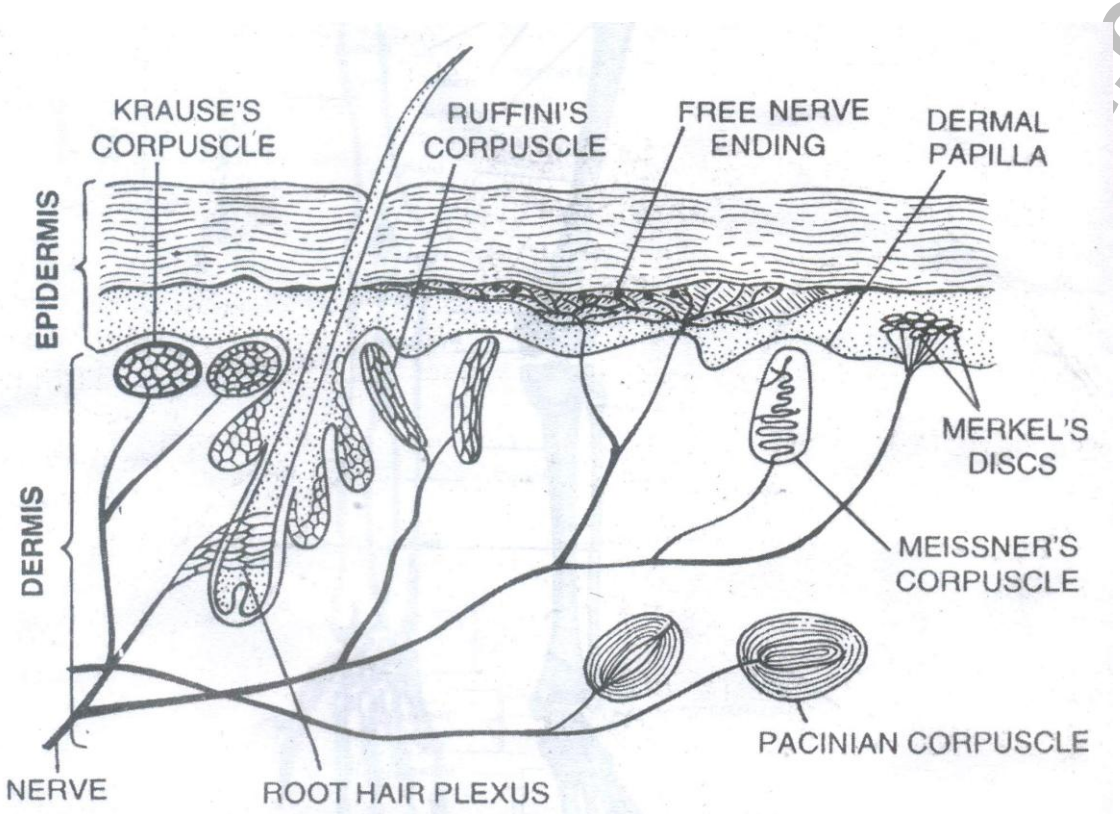


Fig. 3.30

Sol.167 (a)

An infant has slow body growth and mental development of reduced metabolic rate. This disease can be treated by an early administration o thyroid harmones.

The right answer is (a).

Sol. 168 (a)

Zonaglomerulosa constitutes about 15 percent of the gland. Its cells are closely packed and arranged in spherical clusters and arched columns secrete harmones called mineralo corticoids because they effect mineral homeostasis. Refer Fig. 3.31.

The right answer is (a).

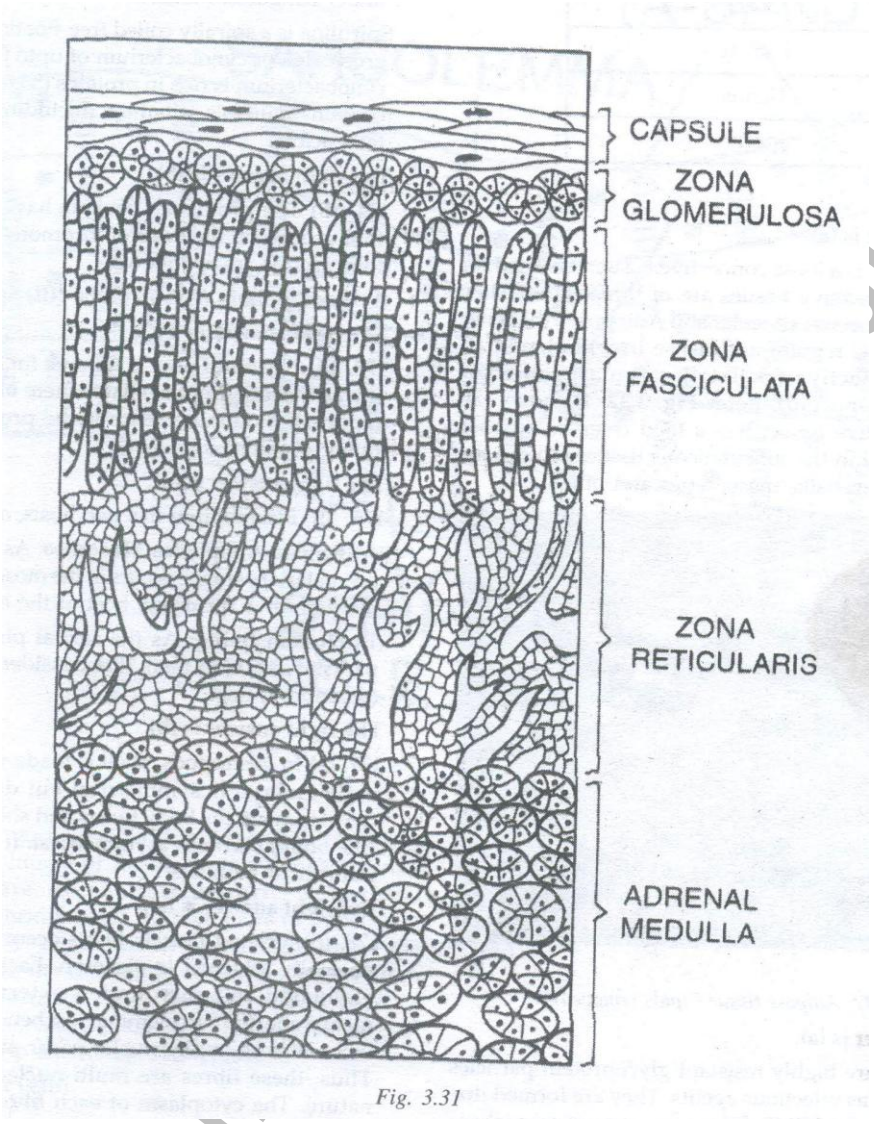


Fig. 3.31

Sol.169 (a)

Linnaean hierarchy was proposed by Linnaeus. The hierarchy of categories is the classified of organisms in a definite sequence of categories (**Taxonomic Categories**) in a descending order, starting from the kingdom and reaching up to the species in an ascending order from species to kingdom. Refer **Table 6-II**

Table 6-II

Kingdom
Phyum or Division
Class
Order
Family
Genus
Species

The right answer is (a).

Sol. 170 (a)

Adiopose is a loose connective tissues. It is used for storing fat. Connective tissues are of three types. They are: (a) loose connective (Areolar and Adiopose); (b) dense connective (dense regular and dense irregular); and (c) specilised connective (skeletal, vascular, reticular, pigmented and mucoid). Refer Fig. 3.32. it shows the Adipose connective tissues. It is a food reserve. Adipose tissues are found in the subcutaneous tissues around the heart, kidneys, eyeballs, mesenteries and omenta.

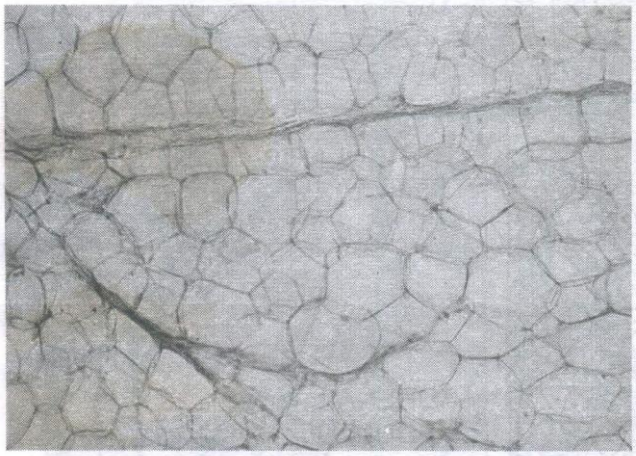


Fig 3.32: Adipose tissue (lipids removed)

The right answer is (a).

Sol. 171 (a)

Prions are highly resistant glycoprotein particles which function as infectious agents. They are formed due to mutation in gene PRNP. Prions can also act as catalysts to convert normal protein into the prion state. Prions are not affected by proteases, nucleases, temperature of up to 800^0C, ultraviolet radiation and Formaldehyde. Prions accumulate in the nervous tissue and bring about its degeneration. Some common diseases caused by them are – scrapie of sheep, mad cow diseases, CruetzfeldtJakob Disease (CJD) and Kuru.

The right answer is (a).

Sol. 172 (a)

Coccus bacteria are spherical or ovoid in terms of their outline. Staphylococcus are irregular grape- like clusters. Their shape can be termed oval.

The right answer is (a).

Sol. 173 (b)

Spirulina is a common cyanobacteria which comes under Kingdom Monera.

Spirulina is a spirally coiled free- floating filamentous blue green alga or cynobacterium of upto 0.5mm length. This cynobacterium is rich in proteins (55 to 68 percent). It also contains minerals, vitamins (including B_{12}) and essentials fatty acids.

The right answer is (b).

Sol. 174 (b)

The protozoan protists have been divided into four groups on the basis of locomotory organelles. These four groups are as follows:

(I) Mastigophora (II) Sarcodina (III) Sporozoa (IV) Ciilate

The right answer is (b).

Sol. 175 (d)

Noctiluca alga is famous for bioluminescence as it was the first dinoflafellate where bioluminescence was reported. Bioluminescence is the production of light by living organisms.

The right answer is (d).

Sol.176 (b)

Plasmodium has two hosts, as follows:

(A) **Female Anopheles Mosquito:** as the sexual phase of the malarial parasite occurs in the mosquito it is considered the definitive (primary) host of the malarial parasite.

(B) **Human Beings:** As the sexual phase of the malarial parasite occurs in man, it is considered the intermediate (secondary) host.

The right answer is (b).

Sol. 177 (b)

In gastropods, shell is made up of one piece. The early embryo is symmetrical but during the course of development, the body twists and shows torsion so that it (the body) becomes asymmetrical. It includes the largest number of molluscs.

The right answer is (a).

Sol. 178 (b)

Striated muscle fibres occur in bundles and are normally attached to skeleton. Each muscle fibre is an elongated cell surrounded externally by a delicate membrane, the Sarcolemma. Just beneath the Sarcolemma, in each fibre, many nuclei occur at irregular intervals. Thus, these fibres are multi-nucleated or cyncytial in nature. The cytoplasm of each fibre (sacroplasm) has a large number of myofibrils which are tightly packed. Each myofibril shows dark bands (A-bands) and light bands (I-bands) of strips alternating with each other. That is why they have been named striped Muscle Fibres. **Refer Fig. 3.33**

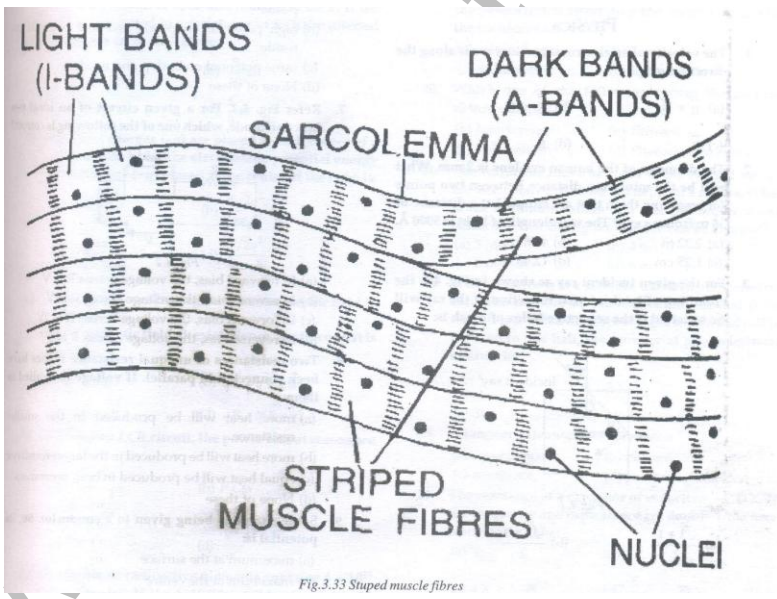


Fig.3.33 Stuped muscle fibres

The right answer is (b).

Sol. 179(b)

The septalnephridia discharge their excretory matter into the lumen of the alimentary canal / enteron. Hence, they are called **EnternehricNephridia**. Pharyngeal nephridia occur in three pairs of bunches in the 4^{th}, 5^{th} and 6^{th} segments. Lying on each side of the alimentary canal, the ducts carry excretory matter from pharyngeal nephridia into the gut (buccal cavity / pharynx). Thus, like septalnephridia, pharyngeal nephridia are also enteronephricnephridia.

The right answer is (b).

Sol.180. (b)

A pair of stink glands is present between the fifith and sixth abdominal terga. These glands produce a secretion that gives a characteristic stinky (foul) smell.

The right answer is (b).

PART A: CLASS XII

PHYSICS

Q1

The velocity of an electromagnetic wave is along the direction of:

(a) $\vec{B} \times \vec{E}$
(b) $\vec{E} \times \vec{B}$
(c) $\vec{E}$
(d) $\vec{B}$

Q2

The diameter of the human eye lens is 2 mm. What will be the minimum distance between two points for resolving them that are situated at a distance of 50 m from an eye? The wavelength of light is 5000 Å.

(a) 2.32 m
(b) 4.28 mm
(c) 1.25 cm
(d) 12.48 cm

Q3

For the given incident ray as shown in Fig. 4.1, the condition of total internal reflection of the ray will be satisfied if the refractive index of block is:

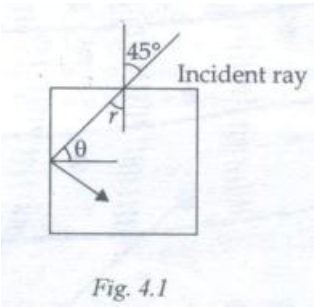


Fig. 4.1

(a) $\frac{\sqrt{3}+1}{2}$
(b) $\frac{\sqrt{2}+1}{2}$
(c) $\sqrt{\frac{3}{2}}$
(d) $\sqrt{\frac{7}{6}}$

Q4

Which one of the following is not a property of cathode rays?

(a) They produce a heating effect
(b) They are not deflected by electric fields
(c) They cast shadows
(d) They produce fluorescence

Q5

For a transistor, $\frac{I_C}{I_E}$ = 0.96. Thus, the current gain in the Common Emitter (CE) configuration is:

(a) 6
(b) 12
(c) 24
(d) 48

Q6

For conduction in a p – n junction, the biasing is done through:

(a) High potential on n – side and low potential on p – side
(b) High potential on p – side and low potential on n – side
(c) Same potential on both p and n sides
(d) None of these

Q7

Refer Fig. 4.2. For a given a circuit of an ideal P – n junction diode, which one of the following is correct?

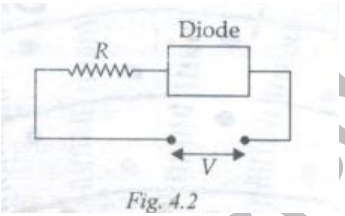


Fig. 4.2

(a) In forward bias, the voltage across R is V
(b) In reverse bias, the voltage across R IS V
(c) In forward bias, the voltage across R is 2V
(d) In reverse bias, the voltage across R is 2V

Q8

Two resistances of unequal resistance values have been connected in parallel. If voltage is applied to them:

(a) More heat will be produced in the smaller resistance
(b) More heat will be produced in the larger resistance
(c) Equal heat will be produced in both resistances
(d) None of these

Q9

Some charge is being given to a conductor, So, its potential Is:

(a) Maximum at the surface
(b) Maximum at the centre
(c) The same throughout the conductor
(d) Maximum between its surface and centre

Q10

In order to convert a galvanometer into a voltmeter, we should connect a:

(a) High resistance in series with the galvanometer
(b) Low resistance in series with the galvanometer
(c) High resistance in parallel with the galvanometer
(d) Low resistance in parallel with the galvanometer

Q11

A capacitor of capacitance C_1 has been charged up to a potential V volt and connected in parallel with an uncharged capacitor of capacitance C_2. The final potential difference across each capacitor will be:

(a) $\frac{C_2 V}{C_1+C_2}$
(b) $\frac{C_1 V}{C_1+C_2}$
(c) $\left(1+\frac{C_2}{C_1}\right) V$
(d) $\left(1-\frac{C_2}{C_1}\right) V$

Q12

For a cell, the terminal potential difference is 2.2 V when the circuit is open and reduces to 1.8 V. If the cell is connected to a resistance of 5 Ω, the internal resistance (r) of the cell is:

(a) $\frac{10}{9}\Omega$
(b) $\frac{9}{10}\Omega$
(c) $\frac{11}{9}\Omega$
(d) $\frac{5}{9}\Omega$

Q13

Identical charges (-q) are placed at each corner of a cube of side b. So, the electrostatic potential energy of the charge (+q) placed at the centre of the cube is:

(a) $-\frac{4\sqrt{2q^2}}{\pi\mathcal{E}_0}$
(b) $\frac{8\sqrt{2q^2}}{\pi\varepsilon_0 b}$
(c) $-\frac{4q^2}{\sqrt{3\pi}\varepsilon_0 b}$
(d) $\frac{8\sqrt{2q^2}}{4\pi\varepsilon_0 b}$

Q14

A charge q moves in a region where an electric field $\vec{E}$ and a magnetic field $\vec{B}$ exist. Hence, the force on it is equal to:

(a) q $\vec{v} \times \vec{B}$
(b) q $\vec{E}$ + q $\vec{v} \times \vec{B}$
(c) q $\vec{B}$ + q $\vec{B} \times \vec{v}$
(d) q $\vec{B}$ + q $(\vec{E} \times \vec{v})$

Q15

For a series LCR circuit, the power loss at resonance is:

(a) $\frac{V^2}{\omega L - \frac{1}{\omega L}}$
(b) $I^2C\omega$
(c) I^2 R
(d) $\frac{V^2}{\omega C}$

Q16

A sample of radioactive elements contains 4×10^{10} active nuclei. If the half – life of this element is 10 days, the number of decayed nuclei after 30 days is:

(a) 0.5×10^{10}
(b) 2×10^{10}
(c) 3.5×10^{10}
(d) 1×10^{10}

Q17

Which one of the following are suitable for the fusion process?

(a) Light nuclei
(b) Heavy nuclei
(c) Elements lying in the middle of the periodic table
(d) Elements lying in the middle of the binding energy curve

Q18

When a deuterium particle is bombarded on a_8O^{16} nucleus, an α – particle is emitted. The product so obtained is:

(a) ${}_7N^{13}$
(b) ${}_5B^{10}$
(c) ${}_4Be^{9}$
(d) ${}_7N^{14}$

Q19

When ultraviolet rays are incident upon a metal plate, the photoelectric effect does not occur. It occurs by the incidence of:

(a) Infrared rays
(b) X – rays
(c) Radio waves
(d) Light waves

Q20

Which one of the following proves the particle nature of light?

(a) Interference
(b) Diffraction
(c) Polarization
(d) Photoelectric effect

Q21

The refractive index of water is 5/3. A light source has been placed in water at a depth of 4 meters. What is the minimum radius of a disc put on the water surface so that the light of source can be stopped?

(a) 3 m
(b) 4 m
(c) 5 m
(d) 6 m

Q22

A light source is at a distance d from a photoelectric cell. The number of photoelectrons emitted from the cell is n. If the distance of light source and cell is reduced to one half, the number of photoelectrons emitted is:

(a) $\frac{n}{4}$
(b) 6 n
(c) 6 n
(d) 4 n

Q23

A tangent galvanometer measures:

(a) Capacitance
(b) Current
(c) Resistance
(d) Potential difference

Q24

The reactance of a capacitor of capacitance C is X. If the frequency and capacitance are doubled, the new reactance will be:

(a) X
(b) 2 X
(c) 4 X
(d) $\frac{X}{4}$

Q25

In a parallel – plate capacitor, the distance between tha plates is d and potential difference across the plates V. The energy stored per unit volume between the plates of this capacitor is:

(a) $\frac{Q^2}{2V^2}$
(b) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$
(c) $\frac{1}{2}\frac{V^2}{\varepsilon_0 d^2}$
(d) $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$

Q26

A charge q of micro – coulombs is at the centre of a cube of side 0.1 m. So, the electric flux emanating from each face of this cube is:

(a) $\frac{q\times10^{-6}}{24\varepsilon_0}$
(b) $\frac{q\times10^{-4}}{\varepsilon_0}$
(c) $\frac{q\times10^{-6}}{6\varepsilon_0}$
(d) $\frac{q\times10^{-4}}{12\varepsilon_0}$

Q27

In which type of material does magnetic susceptibility not depend upon temperature?

(a) Diamagnetic
(b) Paramagnetic
(c) Ferromagnetic
(d) Ferrite

Q28

The torque acting on an electric dipole of dipole moment $\vec{P}$ placed in a uniform electric field $\vec{E}$ is:

(a) $\vec{P}\times\vec{E}$
(b) $\vec{P}\,.\,\vec{E}$
(c) $\vec{P}\times\vec{E}\times\vec{P}$
(d) $\frac{\vec{E}.\vec{p}}{p^2}$

Q29

The current is flowing in a coil of area A and number of turns N. So, the magnetic moment of the coil (M) is equal to:

(a) NiA
(b) $\frac{Ni}{A}$
(c) $\frac{Ni}{\sqrt{A}}$
(d) N^2 Ai

Q30

In a Wheatstone's bridge, the resistance of each side is 10Ω. If the resistance of the galvanometer is 10Ω, the effective resistance of the bridge is:

(a) 6 Ω
(b) 10 Ω
(c) 18 Ω
(d) 12 Ω

Q31

In an inductor of self – inductance L = mH, current changes with time according to equation $I = t^2e^{-t}$. At what time will the emf be zero?

(a) 1 second
(b) 5 seconds
(c) 3 seconds
(d) 2 seconds

Q32

The resistivity of a potentiometer wire is 10^{-7} ohm – meter and its area of cross – section is $10^{-6}m^2$. When a current of 0.1 A flows through the wire, its potential gradient is:

(a) 10^{-4} V –m^{-1}
(b) 10^{-3} V –m^{-1}
(c) 10^{-2} V –m^{-1}
(d) Zero

Q33

In a Common Base (CB) configuration of a transistor, $\frac{\Delta i_C}{\Delta i_E}$ = 0.98. The current gain in the transistor is:

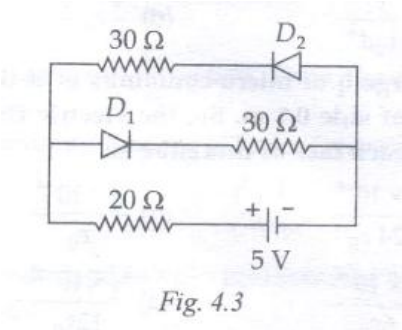


Fig. 4.3

(a) 51
(b) 50
(c) 52
(d) 49

Q34

If the internal resistance of a cell is negligible, the current flowing through the circuit of Fig. 4.3.is:

(a) 2.1 A
(b) 0.1 A
(c) 1.1 A
(d) 2 A

Q35

The truth table given in Table 4 – I represents a/an:

Input			Output
A	B		Y
1	1		0
0	1		1
1	0		1

(a) Not gate
(b) OR gate
(c) XOR gate
(d) NAND gate

Q36

The half – life period of a radioactive substance is 6 hours. After 24 hours, the activity is 0.01 μC, what was the initial activity?

(a) 0.04 μC
(b) 0.08 μC
(c) 0.24 μC
(d) 0.16 μC

Q37

Calculate the resistance of the resistive element shown in **Fig. 4.4**.

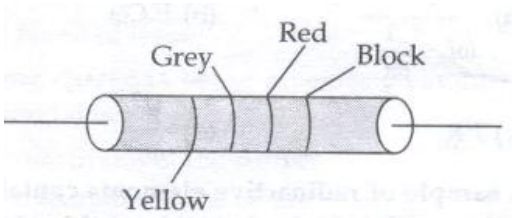


Fig. 4.4

(a) $84 \times 10^3\ \Omega \pm 10\%$
(b) $36 \times 10^3\ \Omega \pm 10\%$
(c) $48 \times 10^2\ \Omega \pm 20\%$
(d) $84 \times 10^2\ \Omega \pm 5\%$

Q38

The magnetic dipole moment of a revolving electron is given by the following relationship:

(a) $\mu = \frac{eVr}{8}$
(b) $\mu_1 = \frac{el}{2} m_e$
(c) $\mu_1 = n\left(\frac{eh}{4\pi\ m_e}\right)$
(d) $\mu = \frac{2m_e}{el}$

Q39

The direction of a current loop, acting as a magnetic dipole, is given by the:

(a) right hand thumb rule
(b) left hand thumb rule
(c) either of these two rules
(d) Fleming's left hand rule

Q40

The wavelength range of microwaves varies from:

(a) 600 m to 0.1 m
(b) 0.3 m to 10^{-3} m
(c) 300 m to 600 m
(d) None of these

Q41

The wavelength range of visible light is:

(a) 1 mm to 700 nm
(b) 0.1 m to 1.0 mm
(c) 700 nm to 400 nm
(d) 1 nm to 10^{-3} nm

Q42

Two identical circular coils of radius 0.6 m each have 30 turns each. They have been mounted coaxially and are at a distance of 0.8 m from each other. A value of magnetic field (a) when the current flows through both of them. The values of magnetic field (a) when the current flows through them in the same direction and (b) when the current flows through them in the opposite direction are as follows:

(a) 4.3×10^{-6} tesla, 4.0×10^{-6} tesla
(b) 4.3×10^{-4} tesla, 3.96×10^{-4} tesla
(c) 4.3×10^{-7} tesla, 3.96×10^{-7} tesla
(d) None of these

Q43

If the potential difference applied across a conductor is tripled, what would be the impact on the drift velocity of electrons present in it?

(a) It would be doubled
(b) It would be halved
(c) It would be tripled
(d) It would be reduced to one fourth of its initial value

Q44

A potentiometer wire should not receive current for a long period because of:

a. The poor material of the wire
b. Bad circuit design of most potentiometer
c. The back of resistance of the wire
d. None of these

Q45

In a circuit L, C and R have been connected in series. The power source is AC and its frequency is f(HZ). The current leads the voltage by an angle of 45°. The value of C is:

(a) $C = \frac{1}{2\pi f\ (2\pi\ fL - R)}$
(b) $C = \frac{2\pi f}{(L+R)}$
(c) $C = \frac{2\pi fL}{R}$
(d) $C = \frac{1}{2\pi f\ (L+R)}$

PART B: CLASS XII

CHEMISTRY

Q46

1 M and 2.5 – liter NaOH solution is mixed with another 0.5 M and 3 – liter NaOH solution. What is the molarity of the resultant solution?

(a) 0.80 M
(b) 1.0 M
(c) 0.73 M
(d) 0.50 M

Q47 Which has the highest pH value?

(a) CH_3COOK
(b) Na_2CO_3
(c) NH_4Cl
(d) $NaNO_3$

Q48

The solution of 0.1 N NH_4 OH and 0.1 N NH_4Cl has a pH value of 9.25. What is the value of pK_b of NH_4 OH?

(a) 9.28
(b) 4.75
(c) 3.75
(d) 8.25

Q49

Read the reaction: **3A ⟶ B + C**

If would be a zero – order reaction when the rate of reaction:

(a) Is proportional to the square of concentration of A
(b) Remains the same at any concentration of A
(c) Remains unchanged at any concentration of B and C
(d) Doubles if the concentration of B doubled

Q50

Which one of the following has the maximum number of molecules?

(a) 7 grams of N_2
(b) 2 grams of H_2
(c) 16 grams of NO_2
(d) 16 grams of O_2

Q51

A solution contains a nonvolatile solute of molecular mass M_2. Which one of the following can be used for calculating the molecular mass of the solute in terms of osmotic pressure?

(a) $M_2 = \left[\frac{m_2}{\pi}\right] V R T$
(b) $M_2 = \left[\frac{m_2}{V}\right] \frac{RT}{\pi}$
(c) $M_2 = \left[\frac{m_2}{V}\right] \pi R T$
(d) $M_2 = \left[\frac{m_2}{V}\right] \frac{\pi}{RT}$

Q52

A solution containing components A and B follow Raoult's law. Which one of the following statements is correct?

(a) A – B attraction force is greater than that of A – A and B – B
(b) A – B attraction force is less than that of A – A and B – B
(c) A – B attraction force remains the same as that between A – A and B – B
(d) The volume of solution is different from the sum of volumes of solute and solvent

Q53

In the electrolysis of NaCl, when a Platinum electrode is taken, H_2 is liberated at cathode. But with the Hg cathode, it forms a sodium amalgam. The reason behind this is as that:

(a) Hg is more inert than Pt
(b) More voltage is required for reducing H^+ at Hg than at Pt
(c) Na is dissolved in Hg while it is not dissolved in Pt
(d) The concentration of H^+ ions is larger when the Pt electrode is taken

Q54

Which one of the following statements is true?

a. Silicon exhibits coordination number in its compounds
b. Bond energy of F_2 is less than that of Cl_2
c. Mn (III) oxidation state is more stable than Mn(II) aqueous state
d. The elements of 15^{th} group show only + 3 and + 5 oxidation states

Q55

Which one of the following orders is wrong?

(a) $NH_3 < PH_3 < AsH_3$ – acidic
(b) Li < Be < B < C 1stIP
(c) $Al_2O_3 < MgO < Na_2O < K_2O$ – basic
(d) $Li^+ < Na^+ < K^+ < Cs^+$ - ionic radius

Q56

The general electronic configurat6ion of lanthanides

(a) $(n-2)\ f^{1-14}(n-1)\ s^2\ p^6\ d^{0-1}\ ns^2$
(b) $(n-2)\ f^{10-14}\ (n-1)\ d^{0-1}\ ns^2$
(c) $(n-2)\ f^{0-14}\ (n-1)\ d^{10}\ ns^2$
(d) $(n-2)\ d^{0-1}\ (n-1)\ f^{1-14}\ ns^2$

Q57

An atom has an electronic configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3\ 4s^2$. Hence, we will place it in the:

(a) Fifth group
(b) Fifteenth group
(c) Second group
(d) Third group

Q58

Which one of the is iso – electronic?

(a) CO_2, NO_2
(b) CO^-_2, CO_2
(c) CN^-, CO
(d) SO_2, CO_2

Q59

In NO_3^-, the ion number of bond pair and lone pair of electron on the nitrogen atom are (respectively):

(a) 2, 2
(b) 3, 1
(c) 1, 3
(d) 4, 0

Q60

In the process of silver plating of copper, K [Ag $(CN)_2$] has been used in place of $AgNO_3$. The reason behind this is that:

(a) A thin layer of Ag od formed on Cu
(b) More voltage is required
(c) Ag^+ ions are completely removed from solution
(d) There is less availability of Ag^+ ions, for Cu cannot displace Ag from the [Ag $(CN)_2]^-$ ion

Q61

Zn gives H_2 gas with H_2 SO_4 and HCl but not with HNO_3. The reason behind this is that:

(a) Zn acts as an oxidizing agent when it reacts with HNO_3
(b) HNO_3 is a weaker acid than H_2 SO_4 and HCl
(c) In the electrochemical series, Zn is above H_2
(d) NO^-_3 is reduced in preference to the hydronium ion

Q62

n – propyl alcohol and isopropyl alcohol can be chemically distinguished through this chemical or process:

(a) PCl_5
(b) Reduction
(c) Oxidation with potassium dichromate
(d) Ozonolysis

Q63

When phenol is treated with $CHCl_3$ and NaOH, the product is:

(a) Benz aldehyde
(b) Salicylaidehyde
(c) Salicylic acid
(d) Benzoic acid

Q64

In the following reaction, the product T is:

(a) RCH_2OH
(b) RCOOH
(c) RCHO
(d) RCH_3

Q65

The percentages of C, H and N in an organic compound are 40%, 13.3% and 46.7%, respectively. So, the empirical formula is:

(a) $C_3\ H_{13}\ N_3$
(b) $CH_2\ N$
(c) $CH_4\ N$
(d) $CH_6\ N$

Q66

Enzymes are made up of:

(a) Edible proteins
(b) Proteins with specific structures
(c) Nitrogen – containing carbohydrates
(d) Carbohydrates

Q67

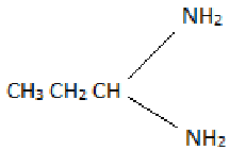
Geometrical isomers are differ in terms of the:

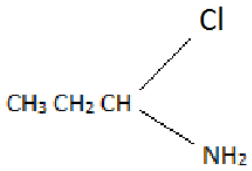
(a) Position of functional group
(b) Position of atoms
(c) Spatial arrangement of atoms
(d) Length of carbon chain

Q68

When $CH_3\ CH_2\ CHCl_2$ is treated with $NaNH_2$, the product formed is:

(a) $CH_3 - CH = CH_2$
(b) $CH_3 - C \equiv CH$

(c) 

d. 

Q69

Which one of the following is not true?

(a) α – carbon of α – amino acid is asymmetric
(b) All proteins are found in the L – form
(c) The humans body can synthesize all proteins it needs
(d) At pH = 7, both amino and carboxylic groups exist in an ionized form

Q70

During the course of preparation of alkane from alcohol using $Al_2\ O_3$ which one of the following is an effective factor?

(a) Porosity if $Al_2\ O_3$
(b) Temperature
(c) Concentration
(d) Surface area of $Al_2\ O_3$

Q71

Which one of the following is correct about hydrogen – bonding in nucleotides?

(a) A – T, G – C
(b) A – G, T – C
(c) G – T, A – C
(d) A – A, T – T

Q72

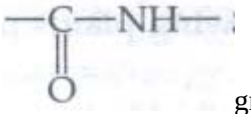
Which one of the following is a correct statement?

a. Starch is a polymer of α – glucose
b. Amylose is a component of cellulose
c. Proteins comprise only one type of amino acid
d. In the cyclic structure of fructose, there are four carbon atoms but only one oxygen atom

Q73

Refer Fig. Which statement is not true about the peptide bond?

Fig. 4.5: Peptide bond

(a) C – N bond length in proteins is longer than usual bond length of the Nitrogen bond
(b) Spectroscopic analysis shows a planar structure of the  group
(c) C – N bond length in proteins is less than the usual bond length of the C – N bond
(d) None of these

Q74

A compound of molecular formula $C_2 H_{16}$ shows optical isomerism. Hence, the compound is:

(a) 2, 3 – dimethyl pentane
(b) 2, 2 – dimethyl butane
(c) 2 – methyl hexane
(d) None of these

Q75

When a biochemical reaction is carried out in laboratory from outside the human body in the absence of an enzyme, the rate of reaction the is 10^{-6} times. Hence, the activation energy of the reaction in the presence of that enzyme is follows:

(a) $\frac{6}{RT}$
(b) $K = e^{-Ea}$
(c) It is different from E_a obtained in laboratory
(d) None of these

Q76

The density of HCl solution is 1.17 g – cc^{-1}. The molarity of liquid HCl is:

(a) 36.5
(b) 18.25
(c) 32.05
(d) 42.10

Q77

Pure water can be obtained from seawater through:

(a) Centrifugation
(b) Plasmolysis
(c) Reverse osmosis
(d) Sedimentation

Q78

Which one of the following is not correct regarding the adsorption of a gas on the surface of a solid?

(a) Upon increasing temperature, adsorption increases continuously
(b) Enthalpy change and entropy change are negative
(c) Adsorption is more for a few substances
(d) It is reversible

Q79

Which ones of the following are is structural?

(a) XeF_2, IF^-_2
(b) NH_3, BF_3
(c) CO_3^{2-}, SO_3^{2-}
(d) PCL_5, ICl_5

Q80

Which one of the following statements is not correct?

(a) La $(OH)_3$ is less basic than Li $(OH)_3$
(b) In the lanthanide series, ionic radius of the Ln^{3+} ion decreases
(c) La is actually an element of transition series and not a lanthanide
(d) The atomic radii of Zn and Hf are the same because of lanthanide contraction

Q81

The correct order of the first ionization potential among the following elements is:

(a) B < Be < C < O < N
(b) Be < B < C < O < N
(c) Be < B < C < N < O
(d) Be < B < C < O < N

Q82

What are complete proteins?

(a) The molecules that give all essential nutrients through the process of digestion
(b) The proteins that provide all essential amino acids in the right proportion for human nutrition
(c) The proteins that have long chains and thus are difficult to break
(d) The proteins that are deficient in essential amino acids.

Q83

Adsorption is a _____ phenomenon whereas absorption is a _____ phenomenon.

(a) Bulk, surface
(b) Surface, molecular
(c) Molecular, bulk
(d) Surface, bulk

Q84

Which one of the following statements is incorrect?

(a) Ni $(CO)_4$: Tetrahedral, paramagnetic
(b) Ni $(CN)_4^{2-}$: Square planar, diamagnetic
(c) Ni $(CO)_4$: Tetrahedral, diamagnetic
(d) $[Ni(CO)_4]^{2-}$: Tetrahedral, paramagnetic

Q85

In X – H – Y, X and Y both are electronegative elements. Therefore:

(a) The electron density on X will increase and on H, it will decrease
(b) In both, electron density will increase
(c) In both, electron density will decrease
(d) On X, electron density will decrease and on H, it will increase

Q86

The main axis of a diatomic molecule is z. So, the molecular orbitals p_x and $p_y$overlap to form the following orbital:

(a) π – molecular orbital
(b) σ – molecular orbital
(c) δ – molecular orbital
(d) none of these

Q87

In HS^-, I^-, RNH_2 and NH_3, the order of proton acceptance tendency is:

(a) $I^- > NH_3 > RNH_2 > HS^-$
(b) $NH_3 > RNH_2 > HS^- > I^-$
(c) $RNH_2 > NH_3 > HS^- > I^-$
(d) $HS^- > RNH_2 > NH_3 > I^-$

Q88

Ferrocene is a:

(a) Sigma – bonded organometallic compound
(b) Pie – bonded organometallic compound
(c) Hydrogen – bonded organometallic compound
(d) None of these

Q89

The ionization constant of CH_3 COOH is 1.7×10^5 and concentration of H^+ions is 3.4×10^{-4}. Calculate the initial concentration of CH_3 COOH molecules.

(a) 3.4×10^{-4}
(b) 3.4×10^{-3}
(c) 6.8×10^{-4}
(d) 6.8×10^{-3}

Q90

The solubility of a M_2 S salt is 3.5×10^{-6}. Calculate the solubility product:

(a) 1.7×10^{-6}
(b) 1.71×10^{-16}
(c) 1.7×10^{-18}
(d) 1.7×10^{-12}

PART C: CLASS XII
BOTANY

Q91

The factor behind the fast speciation in the present day crop plants is:

(a) Mutation
(b) Isolation
(c) Polyploidy
(d) Sexual reproduction

Q92

When parthenogenesis occurs in larva, it is called:

(a) Obligatory Parthenogenesis
(b) Complete Parthenogenesis
(c) Incomplete Parthenogenesis
(d) Paedogenetic Parthenogenesis

Q93

Which one of the following is absent in polluted water?

(a) Hydrilla
(b) Water hyacinth
(c) Larva of stone fly
(d) Blue – green algae

Q94

During its formation, bread becomes porous due to release of CO_2 by the action of:

(a) Yeast
(b) Bacteria
(c) Virus
(d) Protozoa

Q95

Which bacteria are utilized in a gober gas plant?

(a) Methanogens
(b) Nitrifying bacteria
(c) Ammonifying bacteria
(d) Denitrifying bacteria

Q96

Trench layering is observed in:

(a) Clematis
(b) Mulberry
(c) China Rose
(d) Jasmine

Q97

Which fungal disease spreads through seed and flowers?

(a) Loose smut of wheat
(b) Corn smut
(c) Covered smut of barley
(d) Soft rot of potato

Q98

Which one of the following plants produces seeds but not flowers?

(a) Maize
(b) Mint
(c) Peepal
(d) Pinus

Q99

Which type of association is found in between entomphilous flower and pollinating agent?

(a) Mutualism
(b) Commensalism
(c) Co – operation
(d) Co – evolution

Q100

What is the direction of micro Pyle in anatropous ovule?

(a) Upwards
(b) Downwards
(c) Right
(d) Left

Q101

The maximum amounts of Green House Gases (GHGs) are being released by:

(a) India
(b) France
(c) The USA
(d) Berlin

Q102

In angiosperms, pollen tubes liberate their male gametes into the:

(a) Central cell
(b) Antipodal cell
(c) Egg cell
(d) Synergids

Q103

In composite fish farming:

(a) Rohu and Tuna are bred separately
(b) Selected species of fish are kept together in a proper proportion in a pond
(c) The number of fish per pond is less
(d) The number of reptiles is restricted in a fish pond

Q104

Which one o9f the following is an incorrect match?

(a) Catlacatla: surfaces feeder
(b) Lobeo – rohita: column feeder
(c) Cirrhinamrigala: bottom feeder
(d) Options (a), (b) and (c) are correct matches

Q105

Choose the correct match:

(a) Nepenthes, Dionea, Drosera
(b) Nepenthes, Utricularia, Vanda
(c) Utricularia, Drosera, Dionea
(d) Dionea, Trapa, Vanda

Q106

The development of disease in a plant depends upon:

(a) Host genotype
(b) Pathogen's genotype
(c) Environment
(d) All of these

Q107

Which one of the following statements is incorrect in the parlance of ecosystems?

(a) The flow of energy is uni9directional
(b) There is no dissipation of nutrients at any level
(c) All nutrients belong to the earth
(d) Microorganisms play a major role in the flow of energy

Q108

What is Pyrolysis?

(a) Generation of electric power by burning sludge
(b) Aerobic combustion of waste matter at 900-1300degrees C
(c) Combustion in chambers in the absence of oxygen at 1650 degree C
(d) Dumping of waste matter in low lying areas

Q109

Bamboo plant is growing in a forest. So, what will be the trophic level for level for the same?

(a) First trophic level (T_1)
(b) Second trophic (T_2)
(c) Third trophic (T_3)
(d) Fourth trophic level (T_4)

Q110

Which one of the following is a correct pair?

(a) Cuscuta – parasite
(b) Dischidia – insectivorous
(c) Opuntia – predator
(d) Capsella – hydrophyte

Q111

High- level radiations of nuclear power plants and reactors can produce:

(a) Genertic deformation
(b) Cancer of vaious types
(c) Subcutaneous bleeding
(d) All of these

Q112

A mining quarry is an example of a/an:

(a) Fixed source pollution
(b) Line source pollution
(c) Area source pollution
(d) Mobile source pollution

Q113

A plant of F_1 generation has genotype AABbCC. On selfing of the thisplant, phenotypic ratio in F_2-generation is:

(a) 3:1
(b) 1:1
(c) 9:3:3:1
(d) 27:9:9:9:3:3:1

Q114

What is the reason behind the formation of embryoid from pollen grain in a tissue culture medium?

(a) Cellular totipotency
(b) Organogenesis
(c) Double fertilization
(d) Test tube culture

Q115

If you are using a motor car, what type of pollution type are you?

(a) Point source
(b) Mobile source
(c) Lines source
(d) Diffuse source

Q116

Which ones of the following crops have been brought to india from the New World?

(a) Cashewnut, potato, rubber
(b) Mango, tea
(c) Tea, rubber, mango
(d) Coffee

Q117

The introduction of food plants developed by genetic engineering is not describable because the:

(a) Economy of developing countries may suffer
(b) These products are less tasty as compared to the existing products
(c) This method is costly
(d) There is the danger of introduction of viruses and toxins through the introduced crop

Q118

Which one of the following leads to organ formation?

(a) Gametogenesis
(b) Embryogenesis
(c) Parthenogenesis
(d) Any one of these

Q119

Which one of the following is not exalbuminous?

(a) Pea
(b) Sunflower
(c) Castor
(d) Bean

Q120

The difference between in – breeding and out – breeding is that:

(a) Inbreeding is done between the animals of different breeds whereas outbreeding is done between the animals of the same breed
(b) Inbreeding involves outcrossing whereas outbreeding involves the superior male
(c) Inbreeding is done between the animals of the same breed for 4 – 6 generations whereas outbreeding is done between the unrelated animals which may be between individuals of the same breed (or between different breeds)
(d) Inbreeding is controlled but outbreeding is not.

Q121

Which one of the following is not a Broadly Utilarian reason behind man's resolve of conserving biodiversity?

(a) Pollination
(b) Nutrient cycling
(c) Flood and frosion control
(d) Bio prospecting

Q122

Where would you find xerophytes?

(a) In lakes
(b) In dry land areas
(c) In oceans
(d) In lush green gardens

Q123

The number of trophic levels in a food chain varies from:

(a) 8 to 10
(b) 11 to 12
(c) 1 to 4
(d) 3 to 6

Q124

The residual nucleus does not persist in this seed:

(a) Coffee
(b) Castor
(c) Nymphaea
(d) Groundnut

Q125

Which one of the following is not an application of the Polymerase Chain Reaction (PCR)?

(a) DNA finger print
(b) Cutting of DNA at particular spots
(c) Prenatal diagnosis
(d) Detection of particular micro – organisms

Q126

The first animal that was genetically modified and had the honor of becoming the first transgenic animal for food production was the:

(a) Transgenic sheep
(b) Transgenic cow
(c) Transgenic chicken
(d) Transgenic Salmon fish

Q127

What is Germ line Gene Therapy?

(a) It is a process of introducing genes in somatic cells
(b) It is a process of modifying sperms or eggs by introducing functional genes
(c) It is the process of isolating a healthy gene
(d) All of these

Q128

The first step in the process of producing human insulin is as follows:

(a) Production if multiple copies id rDNA
(b) Screening of transformed cells
(c) Isolation of DNA segment
(d) Formation of rDNA

Q129

The process of exploiting and/or patenting biological resources of other countries without proper anthorization is called:

(a) Bio deformation
(b) Bio piracy
(c) Bio – war
(d) Bio – transfer

Q130

What is the limitation of time under the Indian patents act?

(a) 5 years
(b) 6 – 18 years
(c) 7 or 14 years
(d) 20 years (maximum)

Q131

The ozone layer is being formed and photo dissociated in the following layer of atmosphere:

(a) Stratosphere
(b) Ionosphere
(c) Exosphere
(d) Troposphere

Q132

What is greenhouse flux?

(a) The release of CFCs from refrigerators and air conditioners
(b) The fall in global temperature at two polls
(c) The transformation of any Green House Gas (GHG) into a being component
(d) The reflection of a part of energy received by GHGs back to the earth

Q133

Who was closely associated with the Chipko Movement?

(a) MedhaPatker
(b) SunderlalBahuguna
(c) Maneka Gandhi
(d) Dr. VergheseKurien

Q134

What is the difference between binary fission and multiple fission?

(a) In binary fission, the nucleus of the parents body divides repeatedly. In multiple fission, this occurs only once
(b) In binary fission, the nucleus of the parents body divides once. In multiple fission, this happens many times over
(c) There is no difference between these two processes
(d) In multiple fission, immortality is guaranteed. This is not the case in binary fission

Q135

According to the Red Data Book, a critically endangered species is the one that:

(a) Has been totally eliminated
(b) Is likely to become extinct if it is not allowed to realize its full biotic potential
(c) Faces a high risk of extinction
(d) None of these

PART D: CLASS XII
ZOOLOGY

Q136

If the bleeding from a wound is not stopping, the patient lacks:

(a) Vitamin A
(b) Vitamin C
(c) Vitamin E
(d) None of these

Q137

The Change in the sequence of nucleotide in DNA is called:

(a) Mutagen
(b) Mutation
(c) Recombination
(d) Translation

Q138

Which one of the following is a correct match?

(a) Down syndrome: 21^{st} chromosome
(b) Sickel cell anaemia: X-chromosome
(c) Haemophilia: Y-chromosome
(d) Parkinson's disease X- and Y-chromosomes

Q139

Genetic drift operates a:

(a) Small isolated population
(b) Large isolated population
(c) Fast reproductive population
(d) Slow reproductive population

Q140

Which hormones control the menstrual cycle in human beings?

(a) FSH
(b) LH
(c) FSH, LH, estrogen
(d) Progesterone

Q141

When both ovaries are removed from the rat, which hormone is decreased in blood?

(a) Oxytocin
(b) Prolactin
(c) Estrogen
(d) Gonadotrophic Releasing Factor

Q142

The middle part of the epididymis is called:

(a) Corpus Epididymis
(b) Cauda Epididymis
(c) Caput Epididymis
(d) Central Epididymis

Q143

Choose the correct sequence of stages of growth curve for bacteria:

(a) Lag, log, stationary, decline phase
(b) Lag, log, stationary phase
(c) Stationary, lag, log, decline phase
(d) Decline, lag, log phase

Q144

In the parlance of human reproduction, what is orgasm?

(a) Ejaculation of semen at the end of copulation
(b) Emission of alkaline liquid from penis
(c) Pleasure sensation in male and female at the peak of sexual stimulation during copulation
(d) The period before the erection of penis

Q145

The initiation factors in procaryotes are:

(a) IF3
(b) IF2
(c) IF1
(d) All of these

Q146

Ribosomes are produced in:

(a) Nucleolus
(b) Cytoplasm
(c) Mitochondria
(d) Golgi body

Q147

DNA replication occurs during the:

(a) T-phase of cell cycle
(b) R-phase of cell cycle
(c) Beginning of the cell cycle
(d) S-phase of cell cycle

Q148

Organisms that get obtain energy by the oxidation of reduced inorganic compound are called:

(a) Photoautotrophs
(b) Chemoautotrophs
(c) Saprozoic
(d) Coproheterotrophs

Q149

In which animal is dimorphic nucleus found?

(a) Amoeba
(b) Trypanosomagambiens
(c) Plasmodium vivax
(d) Paramecium caudatum

Q150

Which one of the following is not a major feature of a species?

(a) Anatomical similarity
(b) Molecular similarity
(c) Same karyotype
(d) Different ancestors

Q151

Two different species cannot live for a long period in the same niche or habitat. This law id called:

(a) Allen's Law
(b) Mendel's Law
(c) Cause's Competitive Exclusion Principle
(d) Weismann's Theory

Q152

A gene is said to be dominant if:

(a) It expresses it's effect only in homozygous stage
(b) It expresses only in heterozygous condition
(c) It expresses in both homozygous and heterozygous conditions
(d) It is never expressed in any condition

Q153

The pleiotropic gene is the following:

(a) Haemophilia
(b) Thalassemia
(c) Sickle cell anaemia
(d) Colour blindness

Q154

Jacob and Monod studied lactose metabolism in E. coil and proposed operon concept. The Operon concept is applicable to all:

(a) Prokaryotes
(b) Prokaryotes and some eukaryotes
(c) Prokaryotes and all eukaryotes
(d) Prokaryotes and some protozoans

Q155

Out of 64 codons, 61 codons code for 20 types of amino acids. It is called:

(a) Degeneracy of genetic code
(b) Overlapping of gene
(c) Wobbling of codon
(d) University of codon

Q156

In a DNA percentage of thymine is 20. What is the percentage of guanine?

(a) 20%
(b) 40%
(c) 30%
(d) 60%

Q157

Which one of the following statements is incorrect?

(a) Transcription is the synthesis of RNA from DNA
(b) In replication, RNA primer is essential for initiation
(c) In Prokyarotic transcription, the processing of released RNA cannot occur in cyptoplasm
(d) In Eukarytic transcription, mRNA is generally monocistronic

Q158

Which steroid is used for transformation?

(a) Cortisol
(b) Cholesterol
(c) Testosterone
(d) Progesterone

Q159

Choose the correct statement for bacterial transduction?

(a) Transfer of some genes from one bacteria to another bacteria through virus
(b) Transfer of genes from one bacteria to another bacteria through conjugation
(c) Bacteria obtained its DNA directly
(d) Bacteria obtained DNA from other external

Q160

If a diploid cell is treated with colchicine, it becomes a:

(a) Triploid
(b) Tetraploid
(c) Diploid
(d) Monoploid

Q161

The nucleus of a donor embryonal cell/somatic cell is transferred to an enucleated egg cell. After, the formation of organism, what shall be true?

(a) Organism will have extra-nuclear genes of the donor cell
(b) Organism will have extra-nuclear genes of recipient cell
(c) Organism will have extra-nuclear genes of both donor and recipient cell
(d) Organism will have extra-nuclear genes of recipient cell

Q162

Which one of the following enzymes are used for joining the bits of DNA?

(a) Ligase
(b) Primase
(c) DNA polymerase
(d) Endonuclease

Q163

The codon is found in____and____but anticodon is found in____?

(a) DNA; mRNA; tRNA
(b) mRNA; tRNA; cell
(c) DNA; RNA; mRNA
(d) None of these

Q164

The exon part of m-RNAs has the codons for:

(a) Protein synthesis
(b) Lipid synthesis
(c) Carbohydrate synthesis
(d) Phospholipid synthesis

Q165

There are three genes a, b, c. The percentage of crossing over between a and b is 20%, between b and c is 28% and between a and c is 80%. What is the sequence of genes on the chromosome?

(a) B, a, c
(b) A, b, c
(c) A, c, b
(d) None of these

Q166

The manipulation of DNA in genetic engineering became possible due to the discovery of:

(a) Restriction endonuclease
(b) DNA ligase
(c) Transcriptase
(d) Primase

Q167

Sympatric species are the ones that have been developed:

(a) Due to crossbreeding
(b) Reproductive isolation
(c) In adjoining geographical areas
(d) None of these

Q168

The IFN-g interferons are produced by:

(a) T-lymphocytes
(b) Epithelial cells
(c) Leucocytes
(d) Macrophytes

Q169

The ratio of complementary genes is:

(a) 9 : 3 : 4
(b) 12 : 3 : 1
(c) 9 : 3 : 3 : 4
(d) 9 : 7

Q170

A and B genes are linked. What shall be the genotype of progeny in the cross between AB/ab and ab/ab?

(a) AAbb and aabb
(b) AaBb and aabb
(c) AABB and aabb
(d) None of these

Q171

The probability for a couple of having four sons is:

(a) $\frac{1}{4}$
(b) $\frac{1}{8}$
(c) $\frac{1}{16}$
(d) $\frac{1}{32}$

Q172

Which one of the following is a pair of biofertilizers?

(a) Azolla and BGA
(b) Nostoc and legume
(c) Rhizobium and grasses
(d) Salmonella and E. coil

Q173

Two non-allelic genes produce the new phenotype when present together but fail to do so independentaly, it is called:

(a) Epistasis
(b) Polygene
(c) Non-complementary gene
(d) Complementary gene

Q174

Salmonella is related to:

(a) Typhoid
(b) Polio
(c) TB
(d) Tetanus

Q175

Molasses can be processed with help of the following:

(a) Methanobacterium
(b) Coli
(c) Saccharomyces cerevisiae
(d) Candida lipolytica

Q176

The following is a sex chromosomal abnormality:

(a) Down's Syndrome
(b) 18-Trisomy
(c) Myelogenous Leukemia
(d) Turner's Syndrome

Q177

Forthcoming generations are less adaptive than their parental generations due to:

(a) Natural selection
(b) Mutation
(c) Genetic drift
(d) Adaptation

Q178

During regeneration, modification of an organ into another is called:

(a) Morphalogenesis
(b) Epimorphosis
(c) Morphallaxis
(d) Acretionary growth

Q179

In the parlance of molecular Basis of Inheritance, an inducer:

(a) Is a chemical that acts as a regulator protein
(b) Is a substrate, hormone or metabolite that , after coming in contact with a repressor, changes the repressor into a non-DNA binding state
(c) Is a catabolic activator protein
(d) None of these

Q180

In the model of B-DNA, the base pairs lie:

(a) At nearly 180 degrees to the axis of helix
(b) At nearly 90 degrees to the axis of helix
(c) Nearly parallel to the axis of helix
(d) None of these

ANSWERS AND EXPLANANTIONS

PART A: PHYSICS

Sol. 1 (b)

An electromagnetic wave is the wave that has the oscillations of electric and magnetic fields in mutually perpendicular planes. Also, the oscillations are perpendicular to the direction of propagation of wave.

The direction of propagation of electromagnetic wave is given by the poynting vector:

$$\vec{S} = \vec{E} \times \vec{H} = \frac{\vec{E} \times \vec{B}}{\mu_0}$$

This parallel to $\vec{E} \times \vec{B}$.

The right choice is (b).

Sol.2 (c)

Angular limit of resolution of eye is the ratio of wavelength of light to diameter of eye lens.

$== \frac{Wavelengt\ h\ of\ light}{Diameter\ \ of\ eye\ lens}$

i.e., θ=$\frac{\lambda}{d}$…….. (i)

if y is the minimum resolution between two objects at distance D from eye, we have:

θ=$\frac{y}{D}$…… (ii)

From eqns. (i) and (ii), we get:

$$\frac{y}{D} = \frac{\lambda}{d}$$

OR y=$\frac{\lambda D}{d}$

Given, λ=5000 $\dot{A}$= 5×10^{-7}m , D=50, d=2mm=2×10^{-3}m

Substituing in Eqn. (iii), we get:

$$y = \frac{5 \times 10^{-7} \times 50}{2 \times 10^{-3}}$$

=12.5×10^{-3} m

=1.25cm **The right choice is (c).**

Sol. 3 (c)

For total internal reflection, the angle of incidence, the angle of incidence should be greater than the critical angle.

i.e., I > C

or, θ > C

or, sin θ > sin C

and$\sin C = \frac{1}{\mu}$

and $\theta = 90^0 - r$

so, $\sin(90^0 - r) > \frac{1}{\mu}$

i.e., $\mu > \frac{1}{\cos r}$

according to shell's law, we have:

$$\frac{\sin 45^0}{\sin r} = \mu$$

$$\Rightarrow \sin r = \frac{1}{\sqrt{2\mu}}$$

$$\Rightarrow \cos r = \sqrt{1 - \sin^2 r} = \sqrt{1 - \frac{1}{2\mu^2}}$$

Thus, eqn. (i) becomes

$$\mu > \frac{1}{\sqrt{1 - \frac{1}{2\mu^2}}}$$

$$\Rightarrow \mu^2 - \frac{1}{2} = 1 \text{ or, } \mu = \frac{\sqrt{3}}{2}$$

The right choice is (c).

Sol.4 (b)

Cathode rays are negatively charged particles, called **Electron.** Cathode rays possess very high kinetic energy due to their high velocity. When these highly energetic rays fall on platinum (a metal), their kinetic energy is converted into heat energy. Outside the discharge tube, if an electric field is applied, the cathode rays bend towards the positive place. Cathode rays travel in straight lines. They cast shadow of the object placed in their straight line path. In certain substances like barium platinocyanides, zinc sulphate , diamond etc, they produce fluorescence. **The right choice is (b).**

Sol. 5 (c)

Give $\frac{I_c}{I_E}$= Current gain =α = 0.96

So, current gain in common emitter configuration is $\beta = \frac{\alpha}{1-\alpha}$

$=\frac{0.96}{1-0.96} - \frac{0.96}{0.04} = 24$

Sol. 6 (b)

For conduction in a p-n junction, it should be forwarded biased. For the p- side must be connected to positive terminal (higher potential) and n- side must be connected to negative terminal (lower – potential). **Fig 4.6** below shows the p-n junction in a conducing state (forward biased conducing).

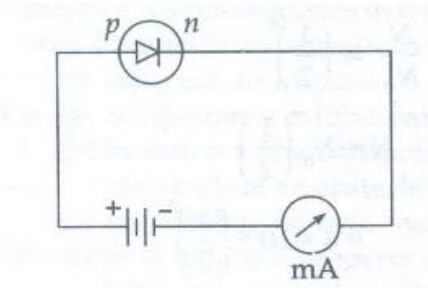


Fig. 4.6

The right choice is (b).

Sol. 7 (a)

In forward biasing, ideal junction diode has zero resistance and infinite resistance in reverse biasing. In forward biasing, the diode conducts. For ideal junction diode, the forward resistance is zero. Therefore, entire applied voltage occurs across resistance R i.e., there is no voltage drop.

In reversing biasing, the diode does not conduct, so it has infinite resistance. Thus, voltage across R is zero in reverse biasing.

The right choice is (a).

Sol.8 (a)

Refer Fig. 4.7.

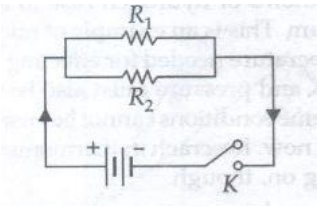


Fig. 4.7

We have:

$P = VI$….. (i)

But $V = IR$

$\Rightarrow I = \frac{V}{R}$

Put Eqn. (ii) in eqn. (i)

$P = V.I$

$=V.\frac{V}{R} = \frac{V^2}{R}$

Voltage V is same a cross each resistor.

$\Rightarrow P\ \alpha \frac{1}{R}$

Also $V = IR$

$\Rightarrow I = \frac{V}{R}$

Voltage V is same across each resistor.

$\Rightarrow I\alpha \frac{1}{R}$…… (iv)

From Eqn. (iii) and Eqn. (iv), we conclude that in a parallel set of resistors, the current, power consumed and heat generated would be more in the resistance with small resistance values.

The right choice is (a).

Sol. 9 (c)

The surface and interior of a charged conductor are equipotential. Therefore, the potential is same throughout the charged conductor.

The right choice is (c).

Sol. 10 (a)

A galvanometer has its low own resistance but a voltmeter must have high resistance. A Voltmeter is a modified form of a pivoted-coil galvanometer. Since the resistance of the coil of a galvanometer is low, its resistance is to be increased. It is a necessary condition for making a voltmeter. So, a high resistance should be connected in series with the galvanometer. **Refer Fig. 4.8.**

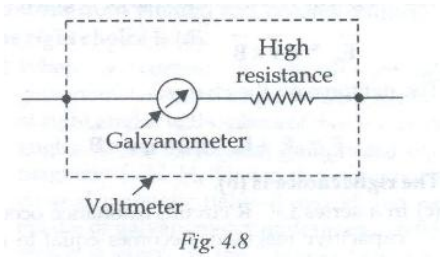


Fig. 4.8

It is obvious that the resistance of an ideal voltmeter has to be infinite.

The right choice is (a).

Sol. 11 (b)

The common potential difference across two capacitors connected in parallel:

$$V' = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$$

Here, $V_1 = V, V_1 = 0$

$$\Rightarrow V' = \frac{C_1V}{C_1+C_2}$$

The right choice is (b).

Sol. 12(a)

In an open circuit, the emf of the cell:

E=2.2 V

In a closed circuit, terminal potential difference:

$V = 1.8\,V$

External resistance, R=5Ω

Thus, internal resistance of cell is

$$r = \left(\frac{E}{V} - 1\right) R = \left(\frac{2.2}{1.8} - 1\right) 5$$

$$= \left(\frac{11}{9} - 1\right) 5 = \frac{2}{9} \times 5 = \frac{10}{9}\Omega$$

The right choice is (a).

Sol. 13 (c)

Electrostatic potential energy of charge +q placed at the centre of cube is:

$$u = 8 \times \frac{1}{4\pi\varepsilon_0} \times \frac{q(-q)}{half - diagonal\ distance}$$

$$= 8 \times \frac{1}{4\pi\varepsilon_0} \times -\frac{q^2}{b\frac{\sqrt{3}}{2}}$$

$$= -\frac{4q^2}{\sqrt{3}\pi\varepsilon_0 b}$$

The right choice is (c).

Sol. 14 (b)

If $\vec{E}$ is the electric field strength and $\vec{B}$ is the magnetic field strength and q is the charge on the particle, the electric force on the charge is given by:

$$\overrightarrow{F_e} = q\vec{E}$$

The magnetic force on the charge is given by:

$$\overrightarrow{F_e} = q\vec{v} \times \vec{B}$$

The net force on the charge:

$\vec{F} = \overrightarrow{F_e} + \overrightarrow{F_m} = q\vec{E} + q\vec{v} \times \vec{B}$ **The right answer choice is (b).**

Sol. 15 (c)

In a series L-C-R circuit, resonance occurs when capacitive reaction becomes equal to inductive reactance.

In a series L-C-R circuit at resonance, capacitive reactance is equal to inductive reactance.

$\Rightarrow X_c = X_L$

$\Rightarrow \frac{1}{\omega C} = \omega L$

Total impedance of the circuit

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

$\Rightarrow Z = R$

So, power factor

$\cos \Phi = \frac{R}{Z} = \frac{R}{R} = 1$

Thus, power LOSS AT RESONANCE IS GIVEN BY:

$P = E_{rms}\, I_{rms} \cos \Phi$

$= E_{rms}\, I_{rms} \times 1$

$= (I_{rms}\, R) I_{rms}$

$= (I_{rms})^2 R$

$= I^2 R$

The right choice is (c).

Sol.16 (c)

Number of half-lives

$$n = \frac{t}{T} = \frac{30days}{10days} = 3$$

So, numbr of undecayed radioactive nuclei is given by:

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^n$$

$$\Rightarrow N = N_0 \left(\frac{1}{2}\right)^n$$

$$= 4 \times 10^{10} \left(\frac{1}{2}\right)^3$$

$$= 4 \times 10^{10} \times \frac{1}{8} = 0.5 \times 10^{10}$$

The number of nuclei decayed after 30days

$$= N_0 - N = 4 \times 10^{10} - 0.5 \times = 3.5 \times 10^{10}$$

The right choice is (c).

Sol. 17 (a)

The binding energy for light nuclei (A< 20) is much less than the binding energy heavier ones. This suggests a process that is the reverse of nuclear fission. When two light nuclei combine to form a heavier nucleus, the process is called **Nuclear Fusion.** The union of two light nuclei for creating a heavy nucleus also leads to the transfer of mass and a consequent liberation of energy. In the sun, two atoms of hydrogen fuse to form an atom of helium. This is an example of nuclear fusion. The temperature needed for effecting nuclear fusio is10^6 K and pressure must also be very high. Such extreme conditions cannot be created on the earth, as of now. Research in thermonuclear reactions is going on, though.

Sol.18 (d)

In a nuclear reaction, mass number and atomic number remain conserved.

Let an unknown product nucleus be zX^A

The reaction can be written as

$$\underset{(\text{Oxygen})}{{}_8O^{16}} + \underset{(\text{Deuterium})}{{}_1H^2} \rightarrow \underset{(\text{UnknownNucleus})}{{}_zX^A} + \underset{(\alpha-\text{particle})}{{}_2He^4}$$

As per the law of conservation of mass number:

16 + 2 = A + 4⇒ A = 14

As per the law of conservation of atomic number:

$8 + 1 = Z + 2 \Rightarrow Z=7$

Thus, the unknown product nucleus is Nitrogen ($_7N^{14}$)

The right choice is (d).

Sol.19 (b)

For photoemission to take place from a metal, the wavelength of incident ray must be less than threshold value. For effecting the photoelectric emission from a given metal plate, the incident wavelength must be less than that of ultraviolet rays, assuming the wavelength of ultraviolet rays, as the threshold value. Out of the given radiations, X-rays have a wavelength less than that of ultraviolet rays. Thus, X-rays can cause photoelectric emission.

The right choice is (b).

Sol.20 (a)

Interference is a phenomenon in which two waves of same frequency superpose to give resultant intensity different from sum of their separate intensity. So, it cannot exhibit particle nature of light. Diffraction is a phenomenon is which light bends at sharp ends of an obstacle or a hole. So, it also cannot exhibit particle nature of light. Polarization of light is a property due to which a light ray (after emerging through a crystal like tourmaline) will have vibrations in a plane that is perpendicular to its direction of propagation. So, it also cannot explain the particle nature of light. Photoelectric effect states that light travels in the form of bundles or packets of energy, called **Photons.** This effect can be explained on the basis of quantum nature of light.so, it explains the particle nature of light.

The right choice is (d).

Sol. 21(a)

The light from the source will not emerge out of water if angle of incidence is greater than critical angle.

Refer Fig. 4.9. We can observe that I >$\boldsymbol{\theta}_C$

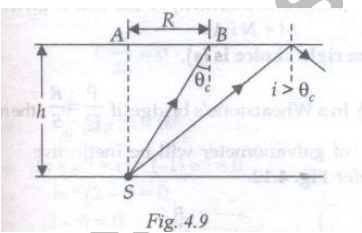


Fig. 4.9

The, minimum radius R corresponds to i= $\boldsymbol{\theta}_C$.

In ΔSAB, we have:

$\frac{R}{h} = \tan \theta_C$

$\Rightarrow R = h \tan\boldsymbol{\theta}_C$

Refer Fig.4.10

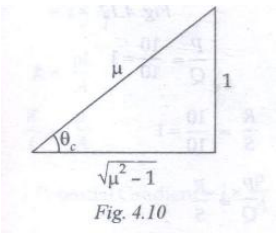


Fig. 4.10

$$\Rightarrow R = \frac{h}{\sqrt{\mu^2-1}} = \frac{4}{\sqrt{\left(\frac{5}{3}\right)^2-1}}$$

$$= \frac{4\times 3}{\sqrt{25-9}} = \frac{4\times 3}{4} = 3m$$

The right option is (a).

Sol.22 (d)

The intensity of light source is given by:

$$I\alpha \frac{1}{d^2}$$

Where d is the distance of light source from the cell.

Or, $$\frac{I_1}{I_2} = \left(\frac{d_2}{d_1}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

Or, $I_2 = 4I_1$

As the number of photoelectrons emitted is directly proportional to intensity, the number of photoelectrons emitted will become 4 times, i.e., 4 n.

The right choice is (d).

Sol. 23 (b)

When a current is passed through the galvanometer coil, a magnetic field B is produced at right angles to the plane of the coil, i.e, at right angles to the horizontal component of earth's magnetic field H. under the influence of two crossed magnetic fields B and H, the magnetic needle of galvanometer undergoes a deflection θ which is given by the Tangent Law. Using the Tangent Law, we can find a relationship:

Iα tan θ

It indicates that the tangent galvanometer is an instrument used for deleting electric current in circuits.

The right choice is (b).

Sol. 24 (d)

If a capacitor of capacitance C is connected with an AC signal, the reactance of that circuits is purely capacitive.

The capacitive reactance is

$X = \frac{1}{\omega C} = \frac{1}{2\pi f C}$ $(\omega = 2\pi f)$

$\Rightarrow X\ \alpha \frac{1}{fC}$

$\therefore \frac{X'}{X} = \frac{fC}{f'C'} = \frac{f \times C}{2f \times 2C}$

$\Rightarrow \frac{X'}{X} = \frac{1}{4}$

$\Rightarrow X' = \frac{X}{4}$

The right choice is (d).

Sol. 25 (b)

The energy stored between the palates of a capacitor

$= \frac{1}{2}\frac{Q^2}{C}$ Hence, $U = \frac{1}{2}\frac{Q^2}{C}$

Now, $\sigma = \frac{Q}{A}\ and\ C = \frac{\varepsilon_0 A}{d}$

$\therefore U = \frac{1}{2}\frac{(\sigma A)^2}{(\varepsilon_0 A/d)}$

Or, $U = \frac{A\sigma^2 d}{2\varepsilon_0}$

Or, $U = \frac{1}{2}\left(\frac{\sigma}{\varepsilon_0}\right)^2 \times \varepsilon_0 A d$

Or, $U = \frac{1}{2}E^2\varepsilon_0 A d$ Energy density or energy stored per unit volume given by:

$u = \frac{U}{V} = \frac{U}{Ad} = \frac{1}{2}\varepsilon_0 E^2$

$= \frac{1}{2}\varepsilon_0\left(\frac{V}{d}\right)^2 = \frac{1}{2}\frac{\varepsilon_0 V^2}{d^2}$

The force on a conductor per unit area which is everywhere along the normal to the surface is $\frac{1}{2}\varepsilon_0 E^2$

The right choice is (b).

Sol.26 (c)

According to Gauss' law, the total electric flux through a closed surface is equal to $\frac{1}{\varepsilon_0}$ times the total charge enclosed by that surface.

The electronic flux coming out of the cube is given by:

$\Phi = \frac{1}{\varepsilon_0} \times$charge enclosed

$= \frac{1}{\varepsilon_0} \times q \times 10^{-6}$

A cube has six faces. Hence, the electric flux through each face is:

$\Phi = \frac{\Phi}{6} = \frac{1}{6\varepsilon_0} \times q \times 10^{-6} = \frac{q \times 10^{-6}}{6\varepsilon_0}$

The right choice is (c).

Sol.27 (a)

The magnetic susceptibility of a material a measure of the 'case' with which a specimen of that material can be magnetized in a magnetising filed. For a diamagnetic substance, magnetic susceptibility (x_m) is independent of temperature.

As per Curie's law, (x_m) for paramagnetic and ferromagnetic materials varies as $x_m \alpha \frac{1}{T}$. T is the Kelvin temperature.

The right choice is (a).

Sol.28 (a)

Refer Fig. 4.11. If an electric dipole is placed perpendicular to an electric field, the net force on this dipole will be zero but torque on it will not be zero.

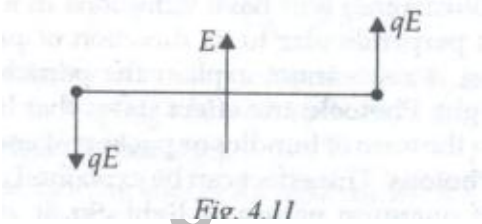


Fig. 4.11

Torque τ=pEsinθ

$\Rightarrow \vec{\tau} = \vec{P} \times \vec{E}$

The right choice is (a).

Sol. 29 (a)

If there are N turns in a coil, I is the current and A is the area of the coil, the magnetic dipole moment (magnetic moment) of the coil is given by:

M = N i A

Sol.30 (b)

In a Wheatstone's bridge, if $\frac{P}{Q} = \frac{R}{S}$, the resistance of galvanometer will be ineffective.

Refer **Fig. 4.12.**

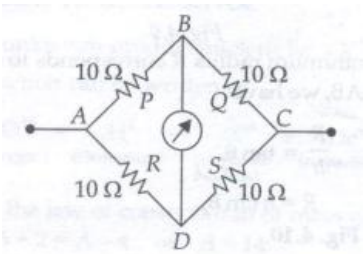


Fig. 4.12

$$\frac{P}{Q} = \frac{10}{10} = 1$$

$$\frac{R}{S} = \frac{10}{10} = 1$$

$$\Rightarrow \frac{P}{Q} = \frac{R}{S}$$

So, the galvanometer will be ineffective.

This Wheatstone bridge can be re-drawn. Refer **Fig. 4.13.**

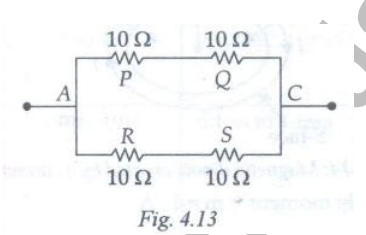


Fig. 4.13

ResistanceP and Q in series:

R' = 10 + 10 =20Ω

Resistance R and S are in series:

R'' = 10 + 10 =20Ω

Now, R' and R" are in parallel. Thus, the net resistance of the circuit is:

$= \frac{R' \times R''}{R' + R''} = \frac{20 \times 20}{20 + 20} = 10\Omega$

The right choice is (b).

Sol.31 (d)

The emf is given by the equation:

$e = -L\frac{di}{dt}$

It is given that emf is zero. Thus,we have:

$e = -l\frac{di}{dt} = 0$

$\Rightarrow \quad L\frac{di}{dt} = 0$

$\Rightarrow \quad \frac{d}{dt}(t^2 e^{-1}) = 0$

$\Rightarrow 2t \times e^{-t} + t^2 \times (-1)e^{-t} = 0$

$\Rightarrow \quad te^{-t}(2 - t) = 0$

$\Rightarrow \quad (2 - t) = 0 \qquad (\because te^{-t} \neq 0)$

$\Rightarrow$ t =2s

The right choice is (d).

Sol. 32 (c)

The potential is gradient of a wire is equal to the fall in potential per unit length.

Potential Gradient = Potential fall per unit length = Current × Resistance per unit length

$i \times \frac{R}{l}$

Now, $R = \frac{\rho l}{A}$

$\Rightarrow \quad \frac{R}{l} = \frac{\rho}{A}$

$\therefore$ potential Gradient $= i \times \frac{\rho}{A}$

$\rho = 10^{-7}\Omega - m, i = 0.1A, A = 10^{-6}m^2$

$\Rightarrow$ potential Gradient = $0.1 \times \frac{10^{-7}}{10^{-6}} = \frac{0.1}{10} = 0.01 = 10^{-2}V - m^{-1}$ **The right choice is (c).**

Sol.33 (d)

$\frac{\Delta i_c}{\Delta i_E}$is the current gain (α) in the Common Base or CB configuration.

$\alpha = \frac{\Delta i_c}{\Delta i_E}$=0.98

The current gain in the Common Emitter or CE configuration:

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.98}{1-0.98}$$

$= \frac{0.98}{0.02}$=49

The right choice is (d).

Sol.34 (b)

In the circuit, diode $D_1$is forward- biased and diode D_2 is reverse-biased. Therefore, no current flows in the arm containing D_2. Tghus, the entire current flows through the circuit is given by:

$$= \frac{5}{20+30} = \frac{5}{50} = 0.1\ A$$

The right choice is (b).

Sol.35 (d)

The given truth table follows a NAND gate whose output is 1 only if at least one of its inputs is zero. Its Boolean expression is as follows:

$Y = \overline{A.B}$

$\Rightarrow \overline{1.1} = \bar{1} = 0$

$\overline{0.1} = \bar{0} = 1$

$\overline{1.0} = \bar{0} = 1$

$\overline{0.0} = \bar{0} = 1$

The NAND gate is the universal or digital building block. That is because due to the repeated use of the NAND gate, we can perform all logic function, viz. OR, AND,etc.

The right choice is (d).

Sol. 36 (d)

The activity of a radioactive substance is given by:

$R = R_0 \left(\frac{1}{2}\right)^n$

Here, n = number of half-lives

$= \frac{t}{T_{\frac{1}{2}}} = \frac{24}{6} = 4$

$R = 0.01\mu C$

Hence, $0.01 = R_0\left(\frac{1}{2}\right)^4$

Or $R_0 = 0.01 \times (2)^4$

$=0.01\times16=0.16\mu C$

The right choice is (d).

Sol.37 (d)

Follow the magic formula which was extracted from the phrase – BB Roy Great Britain Very Good Wife.

B	B	R	O	Y	G	B	V	G	W
0	1	2	3	4	5	6	7	8	9

First band is yellow ↔ 4

Second band is Gray ↔ 8

Third band is Red ↔ 2

Fourth band is Black ↔ 5

So, the resistance value is

$= 48 \times 10^2 \Omega \pm 5\%$

The right answer choice is (d).

Sol. 38 (c)

The magnetic dipole moment of a revolving electron is given by:

$$h_e = \frac{evr}{2}$$

$$=\frac{el}{2m_e}$$

$$= n\left[\frac{eh}{4\pi m_e}\right]$$

Where, I = magnitude of angular momentum of the electron

n = number of revolution orbit of the election,

e = charge on the electron

m_e = mass of the electron

r = radius of the orbit

V= speed of the electron and

h = Planck's constant

Sol. 39 (a)

A current loop can get as a magnetic dipole. A current loop of area A has been shown in **Fig. 4.14**. The current I flows through it. It behaves as a magnetic dipole.

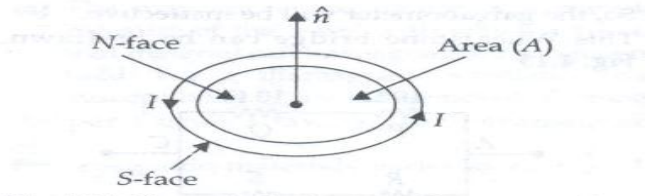


Fig. 4.14: Magnetic dipole created by a current loop

Dipole moment =m =-I. A

Also, $\vec{m} = I.\vec{A}$(Vector form)

The direction of $\vec{m}$ is given by the Right Hand Thumb Rule. If we are the fingers of our right hand along the directions of current in the loop, we find that the extended thumb gives us the direction of the the magnetic moment associated with the loop.

The right choice is (a).

Sol. 40 (b)

The wavelength range of microwaves varies from 0.3 m to 10^{-3} m. their frequency band is 10^{9} - 10^{12} Hz. They are generated in klystrons, magnetrons and gun diodes. They are also used in microwave ovens for cooking and baking purposes. They impart very high energy to food particles in a microwave oven the food particles start vibrating at very high frequencies. These movements generate heat in food. Thus, it gets heated up in a jiffy. Due to their short wavelength, microwaves can also travel as beams in a signal.

The right choice is (b).

Sol. 41 (c)

The visible light has the wavelength band ranging from,700nm to 400nm. **Table 4-1**shows the entire electro-magnetic spectrum in nut shell.

The right choice is (c).

Sol.42 (b)

Refer Fig. 4.15.

α =0.8 m

r = 0.6 m

N= 30

I = 2.5 A

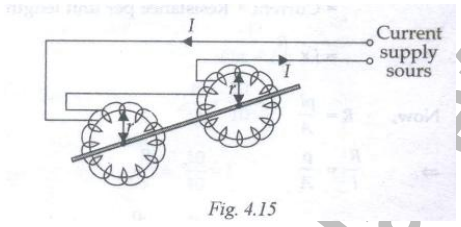


Fig. 4.15

Table:

Table 4-1: Electromagnetic Spectrum

Name	Frequency range (Hz)	Wavelength range	Production	Detection	Main properties and uses
Radiation	10^{9} to 10^{9}	> 0.1 m	Rapid accelerations and decelerations of electrons in aerials.	Receivers aerials.	Different wavelengths find specialised uses in radio communication.
Microwaves	10^{9} to 10^{12}	0.1 m to 1 mm	Klystron valve or magnetron valve.	Point contact diodes.	(a) Radar communication. (b) Analysis of fine details of molecular and atomic structure. (c) Since $1 - 3 \times 10^{-2}$ m, useful for demonstration of all wave properties on a macroscopic scale.
Infrared	10^{11} to 5×10^{14}	1 mm to 700 nm. Vibration of	atoms and molecules. Thermopiles Bolometer	Infrared photographic film.	(a) Useful for elucidating molecular structure. (b) Less scattered than visible light by atmospheric particles-useful for haze photography.
Visible light	4×10^{14} to 7×10^{14}	700 nm to 400 nm	electrons in atoms emit light when they move from one energy level to a lower energy level.	Human eye Photocells Photographic film.	(a) Detected by stimulating nerve endings of human retina. (b) Can cause chemical reaction.
Ultraviolet	10^{15} to 10^{17}	400 nm to 1 nm	Inner shell electrons in atoms moving from one energy level to a lower level.	Photocells Photographic film.	(a) Absorbed by glass. (b) Can cause many chemical reactions, e.g., the tanning of the human skin. (c) Ionize atoms in atmosphere, resulting in the ionosphere.
X-rays	10^{16} to 10^{19}	1 nm to 10^{-3} nm.	X-ray tubes or inner shell electrons.	Photographic film, Geiger tubes, Ionization chamber.	(a) Penetrate matter (e.g., radiography) (b) Ionize gases (c) Cause fluorescence (d) Cause photoelectric emission from metals. (e) Reflected and diffracted by crystals enabling ions lattice spacing and N_A (or wave-length to be measured.
Gamma rays	10^{18} to 10^{22}	$< 10^{-3}$ nm	Radioactive decay of the nucleus.	Photographic film, Geiger tubes, Ionization chamber.	Similar to X-rays.

Magnetic field at the centre of each coil $=B_1$

$$= \frac{\mu_0 NI}{\alpha}$$

$$= \frac{4\pi \times 10^{-7} \times 30 \times 2.5}{2 \times 0.8}$$

$$= \frac{4\pi \times 10^{-7} \times 30}{2 \times 8} \times \frac{25}{10} \times 10$$

$$= \frac{4 \times 22 \times 30 \times 25 \times 10^{-7}}{7 \times 8}$$

$$= 4125 \times 10^{-7}$$

$$= 4.125 \times 10^{-4}$$

$$4.13 \times 10^{-4}$$

Magnetic field at the centre of one coil due to the current in the other coil = B_2

$$= \frac{\mu_0 N I r^2}{2(\alpha^2 + r^2)^{1.5}}$$

$$= \frac{4\pi \times 10^{-7} \times 30 \times 2.5 \times (0.6)^2}{2[(0.8)^2 + (0.6)^2]^{1.5}}$$

$= 4 \times \frac{22}{7} \times \frac{10^{-7} \times 30 \times 2.5 \times 0.36}{2[0.64+0.36]^{1.5}}$

$$= 4 \times \frac{22}{7} \times \frac{10^{-7} \times 30 \times 2.5 \times 0.36}{2[1.0]^{3/2}}$$

$$= 4 \times \frac{22}{7} \times \frac{30 \times 2.5 \times 0.36}{2[1^2]^{3/2}} 10^{-7}$$

$$= 4 \times \frac{22}{7} \times \frac{30 \times 2.5 \times 0.36}{2[1]^3} 10^{-7}$$

$$= 4 \times \frac{22}{7} \times \frac{30 \times 2.5 \times 0.36 \times 10^{-7}}{2 \times 1}$$

$$= 169.71 \times 10^{-7}$$

$= 0.16971 \times 10^{-4}$tesla

$$= 0.17 \times 10^{-4}\ tesla$$

(a) when currents are in the same directions, the magnetic fields are added. The restaurant field at the center of each coil is:

$B = B_1 + B_2 = 4.13 \times 10^{-4} + 0.17 \times 10^{-4}$

$(4.13 + 0.17) \times 10^{-4}$

$=4.30 \times 10^{-4}$ tesla

(b) when the currents are in the opposite directions, the magnetic fields are subtracted. The resultant field at the centre of each coil is:

$B^1 = B_1 - B_2$

$= 4.13\times10^{-4} - 0.17 \times10^{-4}$

$= (4.13 - 0.17) \times 10^{-4}$

$=3.96\times10^{-4}$ tesla

The right choice is (b).

Sol. 43 (a)

Drift velocity = $\frac{eE\tau}{m}$

$= \frac{eV\tau}{ml}$

If V becomes 3 times, the drift velocity would also be trebled (because it is directly proportional to V).

The right choice is (c).

Sol. 44 (d)

If current is allowedto pass through the wire of a potentiometer for a long period, it would get heated up. High heat would increase its resistance. So, the potentiometer would not give correct readings in the circuit it is in.

The right choice is (d).

Sol. 45 (a)

If Φ is the phase difference between current and voltage, we have:

$\tan \Phi = \frac{X_L - X_c}{R}$

$\Rightarrow \frac{X_L - X_c}{R} = \tan 45^0 = 1$

$\Rightarrow X_L - X_c = 1.R = R$

$\Rightarrow -X_c = R - X_L$

$\Rightarrow X_c = -R + X_L$

$= X_L - R$

$\Rightarrow \frac{1}{2\pi fC} = 2\pi fL - R$

$\Rightarrow 2\pi fC = \frac{1}{(2\pi fL - R)}$

$\Rightarrow C = \frac{1}{2\pi f(2\pi fL - R)}$

The right choice is (a).

PART B: CHEMISTRY

Sol. 46 (c)

Moles of 2.5 L of 1 M NaOH = 2.5 ×1=2.5, Moles of 3.0 L of 5.0 M NaOH = 3.0 ×0.5 =1.5 Total moles of NaOH in solution = 2.5 + 1.5 =4.0 Total volume of the solution = 2.5 + 3.0 = 4.0 L

Hence, $M_1 \times V_1 = M_2 \times V_2$

$4.0 = M_2 \times 5.5$

∴ Molarity of resultant solution = $M_2 = \frac{4.0}{5.5}$M

= 0.73 M

The right choice is (c).

Sol. 47 (b)

pH = $log\frac{1}{[H^+]}$

pH is inversely proportional to hydrogen ion concentration. As concentration of H^+ decreases, the value of pH increases and vice-versa.

Ammonium chloride (NH_4Cl) is a salt of weak base and strong acid so, its aqueous solution will be acidic:

$$NH_4Cl + H_2O \rightarrow \underset{Waekbase}{NH_4OH} + \underset{Strongacid}{HCl}$$

So, the pH value of NH_4Cl is less than 7.

$NaNO_3$(Sodium nitrate) is the salt of strong acid and strong base. So, its aqueous solution is neutral:

$$NaNO_3 + H_2O \rightarrow \underset{Strongbase}{NaOH} + \underset{Strongacid}{HnO_3}$$

So, the pH value of $NaNO_3$ is 7.

CH3COOK (Potassium acetate) is a salt of strong base and weak acid. Its aqueous solution will be basic and its pH value will be > 7 (pH ≈8.8)

$$CH_3COOK + H_2O \rightarrow \underset{Weakacid}{CH3COOH} + \underset{strongbase}{KOH}$$

Na_2CO_3 (Sodium carbonate) is a salt of strong base and weak acid. Its aqueous solution is also basic and its pH value will be more than 10.

The right choice is (b).

Sol.48 (b)

The solution of NH_4Cl acts as a basic buffer solution. For a basic buffer solution:

$$pOH = pK_b + \log\frac{[salt]}{[Base]}$$

pOH = 14 – pH = 14 – 9.25 = 4.75

$4.75 = pK_b + \log\frac{0.1}{0.1}$

$pK_b = 4.75$

The right choice is (b).

Sol. 49 (b)

For the reaction $3A \rightarrow B + C$

If it is zero-order reaction, so the rate remains the same at any concentration of A or $\frac{dx}{dt}$=K $[A^0]$. It means that rate is independent of the concentration of reactants.

The right choice is (b).

Sol. 50 (b)

In 7 grams of nitrogen, the number of molecules is given by:

$= \frac{7.0}{28}$mol = 2.5 × N molecules

N = Avogadro number = 6.023×10^{23}

In 2 g $H_2 = \frac{2.0}{2}$mol = 1 × N molecules

In 16 mg $NO_2 = \frac{16.0}{46}$mol = 0.348 × N molecules

In 16 g $O_2 = \frac{16}{32}$mol = 0.5 × N molecules

Hence, maximum number of molecules is present in 2 grams of hydrogen gas.

The right choice is (b).

Sol. 51 (b)

For a dilute solution, we have:

PV = nRT

Or πV = nRT

Or $\pi = \frac{n}{V}RT$

$\Rightarrow \pi V = \frac{m_2}{M}RT$

$\Rightarrow M = \frac{m_2 RT}{\pi V} = \left[\frac{m_2}{V}\right]\frac{RT}{\pi}$

Where, π = osmotic pressure

V = volume of solution

N = number of moles of solute

m_2 = mass of solute

M = molecular mass of solute

The right choice is (b).

Sol. 52 (c)

Raoult'slaw is valid for ideal solutions only. These two components A and B follow the condition of Raoult's law if the force of attraction between A and B is equal to the force of attraction between A – A and B – B.

The right choice is (c).

Sol. 53 (b)

Sodium chloride dissociates in water.

$NaCl \rightleftharpoons Na^+ + Cl^-$

$H_2O \rightleftharpoons H^+ + OH^-$

When electric current is passed through this solution using platinum electrode, Na^+ and H^+ move towards anode.

At cathode:

$H^+ + e^- \rightarrow H$

$H + H \rightarrow H_2$

At anode:

$Cl^- - e^- \rightarrow Cl$

$Cl + Cl \rightarrow Cl_2$

If mercury is used as a cathode, H^+ ions are not discharged at mercury cathode because mercury has a hogh hydrogen over – voltage. Na^+ ions are discharged at cathode in performance of H^+ ions, yielding sodium which dissolves in mercury to form the sodium amalgam.

The right choice is (b).

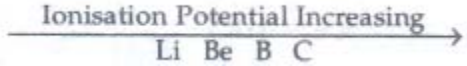
Sol. 54 (b)

Bond energy ofF_2 is less than for Cl_2 because in F_2 molecules, electron-electron repulsionof 2p- orbital of two fluorine atoms is maximum in comparison atoms. So, less amount of energy is needed for breaking the bond of F_2 in comparison to that of Cl_2.

The right choice of (b).

Sol. 55 (b)

Li, Be, B and C are present in IInd period of the Periodic Table. In a period, if we move from left to right, ionization potential increases.



But in case of Be and B, Be has a higher ionisationpotential than B due to its stable configuration.

Refer **Fig. 4.16.**

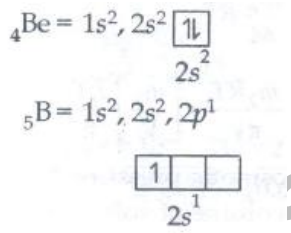


Fig. 4.16

So, the correct order of ionization potentials of the given elements is as follows:

Li < B < Be < C In choice (b),the order is incorrect.

The right choice is (b).

Sol. 56 (a)

In lanthanides (Atomic numbers 58 to 71) the electronic configuration of three outermost shell is (n−2) f^{1-14}, (n−1) s^2 p^6d^{0to1}, ns^2

The right option is (a).

Sol. 57 (a)

An atom has the electronic configuration:

$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $3d^3$ $4s^2$

It is a member of d−block elements because the last electron iis filed in d− subshell as $3d^3$ and following electronic configuration is possible for the d- subshell as (n−1) d-subshell as $(n-1)d^{1\text{ to }10}$

Group III	B	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
$ns^2(n-1)\ s^2p^6$	d^1	d^2	d^3	d^4	d^5	d^6	d^7	d^8	d^9	d^{10}

Hence, it is a member of the firth Group.

The right option is (a).

Sol. 58 (c)

CN^- and CO are iso- electronic because they have equal number of electrons.

In CN^-, the number of electrons =6 +7 + 1 =14

In CO, the number of electrons = 6 + 8 = 14

The right choice is (c).

Sol. 59 (d)

Refer Fig. 4.17. in NO_3^- ion, we have

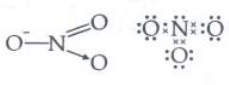


Fig. 4.17

Nitrogen has four bond pairs and zero lone pair of electrons.

The right choice is (d).

Sol. 60 (d)

In the silver plating of copper, $K[Ag(CN)_2]$ is used instead of $AgNO_3$. The reason is less availability of Ag^+ ions. Note that Cu cannot displace Ag form $K[Ag(CN)_2]$ ion.

The right option is (d).

Sol. 61 (d)

Zn is present above H_2 in the electrochemical series. So, it liberates hydrogen gas from dilute HCl/H_2SO_4. But HNO_3 is an oxidisingagaent. The hydrogen obtained in this reaction is converted into H_2O. In HNO_3, NO^-_3 ion is reduced and gives NH_4NO_3, N_2O,NO and NO_2(depending upon the concentration of HNO_3).

$[Zn + 2HNO_3 \rightarrow Zn(NO_3)_2 + 2H] \times 4$

(nearly 6%)

$HNO_3 + 8H \rightarrow NH_3 + 3H_2O$

$4Zn + 10HNO_3 \rightarrow 4Zn(NO_3)_2 + NH_4NO_3 + 3\,H_2O$

The right choice is (d).

Sol. 62 (c)

Refer Fig. 4.18. n-propyl alcohol and isopropyl alcohol give different product on oxidation with $K_2Cr_2O_7$

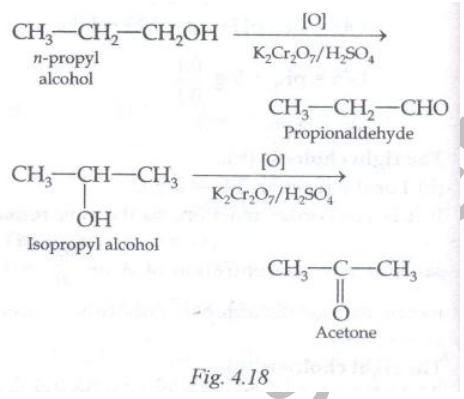


Fig. 4.18

The right choice is (c).

Sol. 63 (b)

Reamer – Tiemann reaction: when phenol is treated with chloroform and NaOH, Salicylaidehyde is obtained. Refer **Fig. 4.19.**

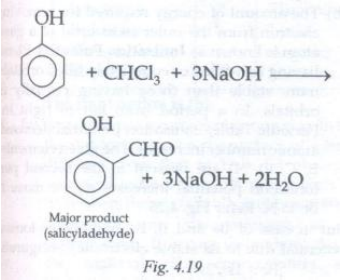


Fig. 4.19

The right choice is (b).

Sol. 64 (c)

Rosenmund's Reaction. Refer **Fig. 4.20**

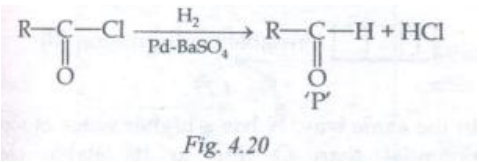


Fig. 4.20

The right choice is (c).

Sol. 65 (c)

Refer Table 4-III.

Table 4-III.

Element	%	Atomic Weight	Relative Number	Ratio Of Elements
C	40.0	12	40/12=3.33	3.33/3.33=1
H	13.3	1	13.3/1=13.3	13.3/3.33=4
N	46.7	14	46.7/14=3.33	3.33/3.33=1

Hence, the empirical formula of compound is CH_4N.

The right choice is (c).

Sol. 66 (b)

Enzymes are made up of proteins with specific structures. They act as catalysts in a host of biochemical reactions.

The right option is (b).

Sol. 67 (c)

Refer Fig. 4.21. The isomers having the same molecular formula but differ in terms of the position of atoms or groups in space due to hindered rotation about a double bond are known as **Geometrical Isomers.**

The right option is (c).

Sol. 68 (b)

$CH_3{-}CH_2{-}CHCl \xrightarrow[\Delta]{NaNH_2}$

$CH_3{-}\ CH \equiv CHCl \xrightarrow[\Delta]{NaNH_2} CH_2{-}C{\equiv}\ CH.$

Final product

Fig.4.21

The right option is (b).

Sol. 69 (b)

All proteins are not in L-form but they may be present in form of D or L.

The right choice is (b).

Sol. 70 (b)

Refer Fig.4.22 Temperature is the effective factor for the dehydration of alcohol by Al_2O_3.

$R{-}CH_2{-}CH_2OH \xrightarrow[\Delta 350^0-380^0\,C]{Al_2O_3}$

$R - CH = CH_2 + H_2O$

Fig.4.22

At 220^0 C to 250^0C, it forms other.

Sol.71 (a)

The structure of DNA molecules is double helical. In this structure, the double helixes are made up of polynucleotide chains which are held together with the help of H-bonds.in these helixes, the Adenine (A) base is linked with Thymine (T)through two H-bonds and Guanine (G) is linked with Cytocine (C) through three H-bonds. Thus, the bonds are $A = T$, and G≡C. in the question statements, we have shown only none line for bonds of all types. infact, they can be more than one bond in many cases.

The right choice is (a).

Sol.72 (a)

Starch is also known as **Amylum** which occurs in all green plants. A molecule of starch $(C_6H_{10}O_5)_n$ is made up of a large number of α- glucose rings that are joined through through an oxygen atom.

The right choice is (a).

Sol. 73 (c)

A peptide bond is formed by the reaction of the COOH group of one amino acid with the NH_2 group of another amino acid. It is represented as follows. Refer **Fig. 4.23**

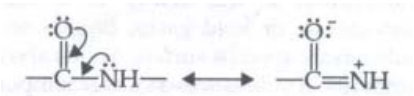


Fig. 4.23

As partial double bond is character found between C−N bond, the bond length of C−N in protein should be smaller than usual C−N bond length.

The right choice is (c).

Sol. 74 (a)

Fig. 4.24

Shows the structure of 2, 3-dimethyl pentane.

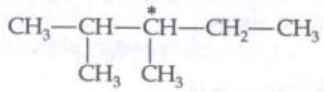


Fig. 4.24

This molecule shows the property of optical isomerism due to the the presence of an asymmetric $\overset{*}{C}$ atom.

The right choice is (a).

Sol. 75 (c)

When a biochemical reaction is carried out in laboratory from outside a human body in the absence of enzyme, the rate of reaction obtained is 10^{-6} times than the activation energy of reaction in the presence of the enzyme. It is different from the value of E_a obtained in laboratory.

That is because for a given chemical reaction:

$K = Ae^{E\alpha/RT}$ (Arrhenius equation)

The right choice is (c).

Sol.76 (c)

Density = 1.17 g-cc^{-1}

= 1170 g-L^{-1}

Molarity of solution = $\frac{strengt\ h\ in\ g-L^{-1}}{Molecular\ \ Weig\ ht}$

=$\frac{1170}{36.5}M$

= 32.05 M

The right choice is (c).

Sol. 77 (c)

Reverse Osmosis: The minimum external pressure applied to a solution separated from a solvent with the help of a semipermeable membrane for preventing osmosis is called **Osmotic Pressure.**When the pressure applied to the solution is more than osmotic pressure, the solute will pass from solution into solvent through the semi permeable membrane. This phenomenon is known as **Reverse Osmosis.**

The osmotic pressure of sea water is 25 atm at 15^0 C when pressure greater than 26 atm is applied on sea water that I separated by a rigid semipermeable membrane, pure water is obtained. This is also called **Desalination of Sea Water.**

The right choice is (c).

Sol.78 (a)

Adsorption is the ability of a substance to concentrate or hold gases, liquids or dissolved substances upon its surface. Solids absorb greater amounts of substances at lower temperatures. In general, adsorption decreases with increasing temperature.

The right choice is (a).

Sol. 79 (a)

The compounds having the same structure and same hybridization are known as **Iso Structural Species.**

Examples: XeF_2 and IF_2^- are sp^3d hybridised and both have a linear shape.

F – I$^-$ – F F–Xe–F

The right choice is (a).

Sol.80 (a)

$La(OH)_3$ is more basic than $Li(OH)_3$. In lanthanides, the basic character of hydroxides decreases as ionic radius decreases.

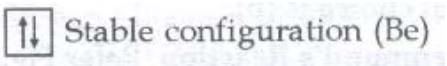
The right choice is (a).

Sol. 81 (b)

The amount of energy required for removing an electron from the outer-most orbit of a gaseous atom is known as **Ionisation Potential.**Elementshaving half-filled or completelyfilled orbitalsare more stable than those having partially filled orbitals.in a period from left to right in the Periodic Table, ionisation potential decreases as atomic number increases. The given elements (Be, B, C, O, N) are present in the second period. Ionisation potential increases as we move from Be to N. Refer **Fig.4.25.**

But in case of Be and b, Be has higher ionisationpotential due to its stable electronic configuration.

$_4Be = 1s^2, 2s^2$



$_5Be = 1s^2, 2s^2, 2p^1$

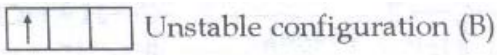
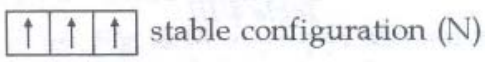


Fig. 4.25

In the same way, N has a higher value of ionization potential than O due to this stable electronic configuration. Refer **Fig.4.26**

$_7N = 1s^2, 2s^2, 2p^3$



$_8O = 1s^2, 2s^2, 2p^4$

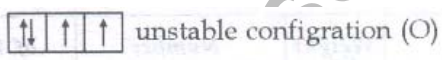


Fig. 4.26

So, the correct order of increasing (first) ionization potential is:

The right choice is (b).

Sol. 82 (b)

The proteins that provide all essential amino acids in the right proportion for human nutation are known as Complete Proteins. Examples include meat, fish, milk, eggs, etc. Incomplete proteins are deficient in one or more essential amino acids. Examples include rich, wheat and corn. Rice lacks threomine and lysine. Corn lacks tryptophan. Lysine is absent in rice, corn and wheat. Beans, peas and legumes lack methiomine. So, almost all plant proteins are incomplete. In order to make up for this protein deficit, we must consume pulses along with vegetables. Also note that ten essential amino acids have been listed in **Table 4-IV**

Table 4- IV Top Ten Amino Acids

SN.	***Amino Acid***	***SN***	***AminoAcid***
1.	Valine	6.	Tryptophan
2.	Lencine	7.	Threonione
3.	Isolencine	8.	Lysine
4.	Phenylalanine	9.	Arginine
5.	Methionion	10.	Histidine

The right option is (b).

Sol.83 (d)

Adsorption is a surface phenomenon. In this case, the concentration on the surface of adsorbent is different from that in bulk (in absorption). It occurs on surface only. Its rate is high to begin with. Then, the rate falls till equilibrium is obtained. Absorption, on the contrary, is a bulk phenomenon. IT occurs throughout the body of material. The concentration is same throughout the material. The rate remains the same throughout the process.

Fig. 4.27 shows the process or adsorption

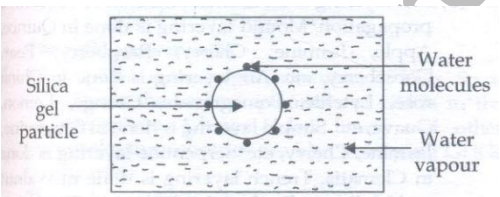


Fig. 4.27: Adsorption

Fig. 4.28

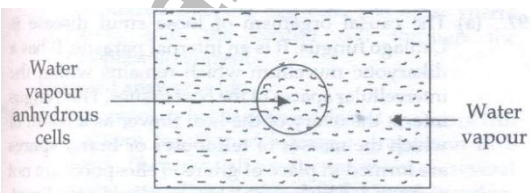


Fig. 4.28 Absorption

The right choice is (d).

Sol. 84 (c)

In Ni $(CO)_4$,Ni has zero oxidation number.

$_{28}Ni = 1s2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^6, 3d^8, 4s^2$

In the excited state and during the formation of Ni $(CO)_4 \rightarrow$ Ni shows sp^3hybridisation Refer **Fig. 4.29.**

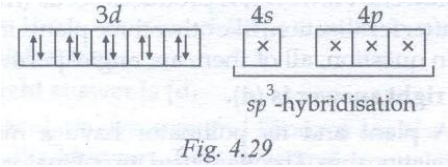


Fig. 4.29

Hence, no unpaired electron is present in Ni. So, $Ni(CO)_4$ shows the property of diamagnetism and tetrahedral structure.

Sol. 85 (a)

X−H−Y, X and Y are Electronegative elements. Thus, the electron density on X will increase. The electron density on H will decrease.

The right choice is (a).

Sol.86 (a)

Refer Fig. 4.30. For a π-overlap, the lobes of the atomic orbitals are perpendicular to the line joining the nuclei.

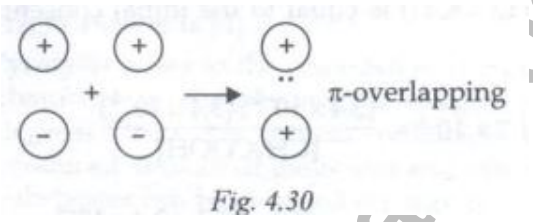


Fig. 4.30

The right choice is (a).

Sol.87(c)

The basic strength of proportional to the rate of acceptance of proton. In $R{-}NH_2$, N−has a lone pair of electrons which intensifies due to the electron-releasing R−group and increases the tendency to donate a lone pair of electrons to H^+ secondly, as the size of ion increases, there is less attraction for H^+. Thus, it forms a weaker bond with H−atom and is less basic in nature. The order of the given series is

$RNH_2 > NH_3 > HS^- > I^-$

The right choice is (c).

Sol.88 (b)

Ferrocene is a π−bonded organometallic compound. **Fig. 4.31** shows its structure.

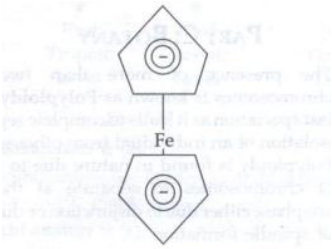


Fig. 4.31: Ferrocene (Fe (η^5—C_5H_5))

The examples of π-bonded organometallic compounds are Ferrocene, Dibenzene chronium $[Cr.(\eta^6{-}C_6H_6)]$ and Zeisse's salt $[K(PtCl_3(\eta^2{-}C_2H_4))]$.

The examples of σ-bonded organometallic compounds are−Grignard reagent (R−Mg−X), Diethyl zinc $[(CH_3(H_2)_2Zn]$ and Tetramethyl tin $[(CH_3)_4Sn]$

The right choice is (b).

Sol.89(d)

$CH_3COO \rightleftharpoons CH_3COO^- + H^+$

$K_4 = \frac{CH_3COO^-[H^+]}{[CH_3COOH\ ]}$

Given that $[CH_3COO^-] = [H^+] = 3.4 \times 10^{-4}$ M

K_a for $CH_3COOH = 1.7 \times 10^{-5}$

CH_3COOH is a weak acid. So, the concentration of (CH_3COOH) is equal to the initial concentration in it.

$1.7 \times 10^{-5} = \frac{(3.4 \times 10^{-4})(3.4 \times 10^{-4})}{[CH_3COOH\ ]}$

$[CH_3COOH] = \frac{3.4 \times 10^{-4} \times 3.4 \times 10^{-4}}{1.7 \times 10^{-5}}$

$= 6.8 \times 10^{-3}$ M

The right choice is (d).

Sol.90 (b)

Solubility of M_2S salt is 3.5×10^{-6} M

$M_2S \rightleftharpoons 2M^+ + S^{2-}$

$3.5 \times 10^{-6}\ M$ $\quad 2 \times 3.5 \times 10^{-6}$ M $\quad 3.5 \times 10^{-6}$ M

On 100% ionisation

Solubility product of $M_2S = K_{sp}$

$= [M^+]^2[S]$

$= (7.6 \times 10^{-6})^2 (3.5 \times 10^{-6})$

$= 171.5 \times 10^{-18}$

$= 1.71 \times 10^{-16}$

The right choice is (b).

PART C: BOTANY

Sol.91(c)

The presence of more than two sets of chromosomes is known as Polyploidy. It causes fast speciation as it leads to complete reproductive isolation of an individual from other gene pools. Polyploidy is found in nature due to the failure of chromosomes to separate at the time of anaphase either due to disjunction or due to failure of spindle formation.

The right answer is (c).

Sol.92 (d)

When parthenogenesis occurs in larva, it is called Paedogenetic Parthenogenesis. Obligatory breed exclusively through parthenogenesis. Complete parthenogenesis and obligatory parthenogenesis are one and the same concept. Incomplete parthenogenesis, also called Cyclic Parthenogenesis, is found in those animals in which both sexual production and parthenogenesis take place.

The right answer is (d).

Sol.93(c)

Stone flies are exoptery gote insects with aquatic nymphs, long antennae, biting mouth parts and weak flight. Adults have the tendency to feed on lichens and unicellular algae. These are good pollution indicators.

The right answer is (c).

Sol.94 (a)

Strains of saccharmoyces cerevisiae are extensively used for leavening of bread. During fermentation, the yeast produces alcohol and CO_2 which leaves the leavened bread, making it slightly porous.

$Bacteria -$ Unicellular prokaryotic micro-organism

$Virus -$ Particulate obligate parasite.

$Protozoa -$ Unicellular eukaryotic micro-organisms.

The right answer is (a).

Sol.95 (a)

Methane is generated bny methanogenic bacteria in a biogas plant. So, organic acids are converted into CH_4 and CO_2 by these bacteria.

The right answer is (a).

Sol.96 (b)

Soil layering is an artificial method of vegetative propagation. Mound layering is done in Quince, Apple, Jasmine, Cherry, Raspberry, Pear, Gooseberry, etc. Air layering is done in China rose, Lytchie, Pomegranate, Orange, Lemon, Guava, etc. Simple layering is done in Grapevine, Jasmine, Cherry, etc. Serpentine layering is done in Clematis. Trench layering is done in Walnut and Mulberry. Tip layering is done in Raspberry, Blackberry and Dewberry.

The right answer is (b).

Sol.97 (a)

The casual organism of loose smut disease is Ustilago fungus. It is an internal parasite. It has a dikaryotic mycelium which remains within the intercellular spaces of the host tissues. This fungus infects the ovary of the host flower as a result of which the masses of teliopores or brand spores are formed in place of grains. Teliospores ate not surrounded by any wall hence called Loose Smut. These spores are dispersed by wind to healthy plants. Wheat is the target of loose smut.

The right answer is (a).

Sol.98 (d)

Pinus is a gymnospermic plant. The ovules of Pinus are uncovered which lie on the megasporophyll. Hence these plants do not have flowers. However, it produces seeds (from ovule after fertilization) like other three plants mentioned in questions; all of them are angiosperms.

The right answer is (d).

Sol.99 (a)

A plant an its pollinator have a mutualistic relationship. The plant uses its pollinator to ensure cross-pollination while pollinator uses the plant as food

Commensalism: One organism is benefited while the other living vicinity, the first one neither getting any benefit nor being harmed.

The right answer is (a).

Sol.100 (b)

In anatropous ovules, the micropyle comes to lie close to the funiculus due to unilateral growth of the ovule Refer **Fig. 4.32**

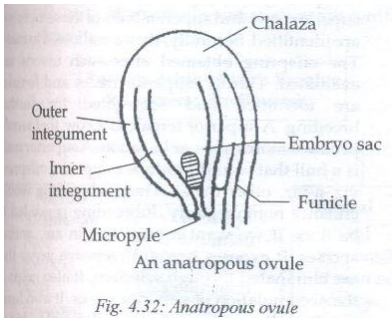


Fig. 4.32: Anatropous ovule

Sol.101 (c)

The USA is the largest consumer of fuels. So, it releases the highest quantities of GHGs in the atmosphere. China, India, Brazil and other developing countries are also producing GHGs in excess

The right answer is (c).

Sol.102 (d)

The contents of the pollen tube are discharged in the synergid from where the first sperm is transferred into the egg cell. The other sperm moves into the central cell through the cytoplasmic current.

The right answer is (d).

Sol.103 (b)

In composite fish farming, selected species of fish are kept together in a proper proportion in a pond. Then, the fish production increases several times over. This is also called mixed farming. Compatibale species do not harm each other in this type of fish farming. The pond is also property utilized that way.

The right answer is (b).

Sol.104 (d)

The first three options are correct. Catla catla is a surface feeder. Lobeo-rohita is a column feeder. Finally, Cirrhina mrigala is a bottom feeder. All the three varieties of fish are used in composite fish farming.

The right answer is (d).

Sol.105 (c)

Utricularia, Drosera and Dionaea are also known as Bladderwort, Sun dew and venus fly trap, respectively. They all are insectivorous plants.

The right answer is (c).

Sol.106 (d)

The development of disease in a plant depends upon the host's genotype, pathogen's genotype and the environment in which host and pathogen survive.

The right answer is (d).

Sol.107 (d)

Option (d) has the wrong statement Microorganisms play a little roles in the process of energy flow. Other statements are correct.

The right answer is (d).

Sol.108(c)

Pyrolysis refers to the combustion of material in chambers in the absence of oxygen at 1650 degrees C. In this process, pollutions are not produced. Industrial gases and other useful substances can be obtained through it.

The right answer is (c).

Sol.109 (a)

Refer Fig. 4.33.plants, being photosynthesis, occupy first trophic level (T_1) in the food chain. A trophic level is a step in the flow of energy through an ecosystem, such as the step at which plants manufacture food or the step at which carnivores feed on other animals.

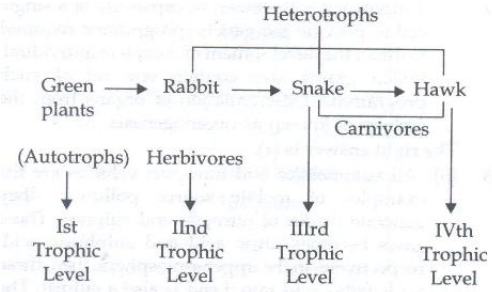


Fig. 4.33

The right answer is (a).

Sol.110 (a)

Cucuta, commonly known as dodder or amarbel, is a parasite plant.

The right answer is (a).

Sol.111 (d)

The first three options are correct Nuclear plants and research reactors can generate low-intermediate- and high-level radiations. High-level radiations can also cause loss of hair and tumours of various types. The spent fuel of atomic reactors is equally dangerous for the staff handling it.

The right answer is (d).

Sol.112(c)

A mining quarry and an industrial estate (spread over a large area) are the examples of area source pollution. Note that pollution is of many types, it depends upon the origin of pollutant. Thus, point source, line source, area source, diffuse source, fixed source and pollution are the major categories of pollution genres.

The right answer is (c).

Sol.113 (a)

Since AABbCC contains only one heterozygous allelic pair 'Bb' the cross would behave as monohybrid cross leading to 3:1 phenotypic ratio in F_2. Refer **Fig. 4.34**

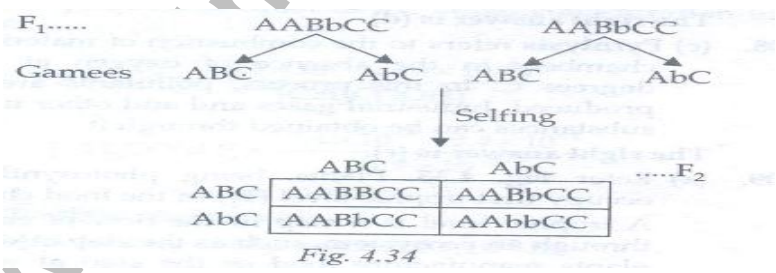


Fig. 4.34

The phenotypic ratio is 3:1 **The right answer is (a).**

Sol.114 (a)

Totipotency is the inherent capability of a single cell to provide the genetic programme required to direct the development of complete individual. Pollen grains also contain one set of such programme. Differentiation of organs from the embryo is known as organogenesis.

The right answer is (a).

Sol.115 (b)

All automobiles and transport vehicles are the examples of mobile source pollution. They generate oxides of nitrogen and sulphur. These gases becomes nitric acid and sulphuric acid, respectively, in the upper atmosphere then, these acids fallas acid rain. Lead is also a culprit. The government has banned the sale of petrol having lead. Despite all these measures, automobile pollution remains a chief area od concern for environmentalists. Also read the answer of Question number 112.

The right answer is (b).

Sol.116 (a)

Refer Fig. 4.35. Cashew nut, potato and rubber are new world crops. Mango, tea and coffee are old world crops.

The right answer is (a).

Sol.117 (a)

It is difficult for the developing countries to maintain such crops.

The right answer is (a).

Sol.118 (b)

Embryogenesis leads to the formation of organs. This is also called Organogenesis. Gametogenesis leads to fertilisation. Parthenogenesis refers to the development of an egg into a complete individual without fertilisation.

The right answer is (b).

Sol.119 (c)

Castor, cereals and Coconut are endospermic or albumnious. On the other hand, Pea, bean and Sunflower are Non-endospermic or exalbuminous.

The right answer is (c).

Sol.120 (c).

Inbreeding is done between the animals of the same breed for 4-6 generations. Cows, buffaloes and poultry chickens are bred that way. Firstly, superior cows and superior bulls of the same breed are identified. Secondly, they are allowed to mate.The offspring obtained after such unions are evaluated. Thirdly**,** superior males and females are identified and segregated for further breeding. A superior is a cow that would produce more milk per lactation. A superior male is a bull that would produce a superior offspring viz.-a-viz. other males. Thus, inbreeding would enhance homozygosity. Inbreeding is needed to be done if we want a pure line in any animal species. It exposes harmful recessive genes that are eliminated through selection. It also in the accumulation of superior genes. It also leads to the elimination of less desirable genes. However, continuous inbreeding leads to reduced fertility and productivity may take a beating if it is continued over a many a generation. This phenomenon is called Inbreeding Depression. So, only selected animals of the breeding population ought to be mated with the superior animals of the same breed but they should not be related to the breeding population. Outbreeding, on the contrary, is the breeding of two unrelated animals. It can be done between the animals of the same breed but the animals do not have the common ancestors; in this case, it is called outcrossing. It can also be done by cross-breeding superior males of one breed with the superior females of another breed, in that case, it is called cross-breeding. Finally it can be done by letting the male and female animals of two different species and obtaining the species that is different from both parents; in that case, it is called Interspecific Hybridization. Example: A mule is produced through the Outbreeding process in which a female horse and a male donkey are allowed to mate. The offspring (males) are much tougher than both of their parents. They do pretty well in high-altitude areas. Note that Outbreeding has three subtypes (outcrossing, cross-breeding and interspecific hybridization).

The right answer is (c).

Sol.121 (d)

Bioprospecting refers to the exploration of molecularly genetic and species level products of economic significance. Scientists are trying to use rich biodiverse regions of the world for generating such products on a commercial scale. These products enhance the living standards of man and add to the wealth of corporate firms. Example: Biocon is a firm that is focusing on biodiversity related products its CEO is Ms. Kiran Majumdar Shaw.

Basically, there are three reasons behind man's resolve to conserve biodiversity. Fig. 4.35 shows them in nutshell. You can also read books on botany regarding this topic. Alternatively.

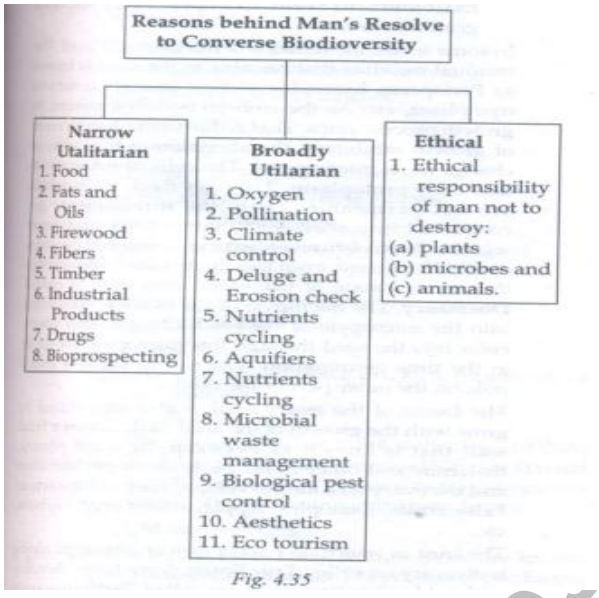


Fig. 4.35

The right answer is (d).

Sol.122 (b)

The plants of dry areas are called Xerophytes. They modify their own structure to enhance water absorption. They also adapt themselves to the dry environment by reducing transpiration and storing absorbed water. Some animals like Kangaroo Rat do not drink water at all. They use the water of the food they eat. They use their metabolism to survive. The animals of dry areas released solid faeces and urine and thus retain water in their bodies for long durations. The options (a), (c) and (d) are suitable for hydrophytes (aquatic plants) or other plants and animals depending upon vegetation (option (d)suits them).

Here, the right answer is (b).

Sol.123 (d)

A food chain can be defined as a sequence of population or organisms of an ecosystem through which the food and the energy is possesses pass through each one o the members thus becoming the food of later member of the sequence. Fig. 4.36 shows a food chain. Note that there is a progressive decline in the amount of energy available in the food chain even as we move from the sun and reach the head of the food chain (predator, snake in this case).

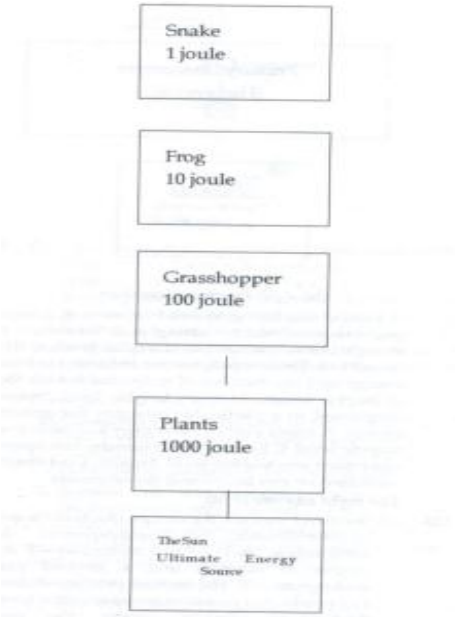


Fig. 4.37 shows the pyramid on numbers in a grassland ecosystem.

Fig. 4.37 shows the pyramid on numbers in a grassland ecosystem

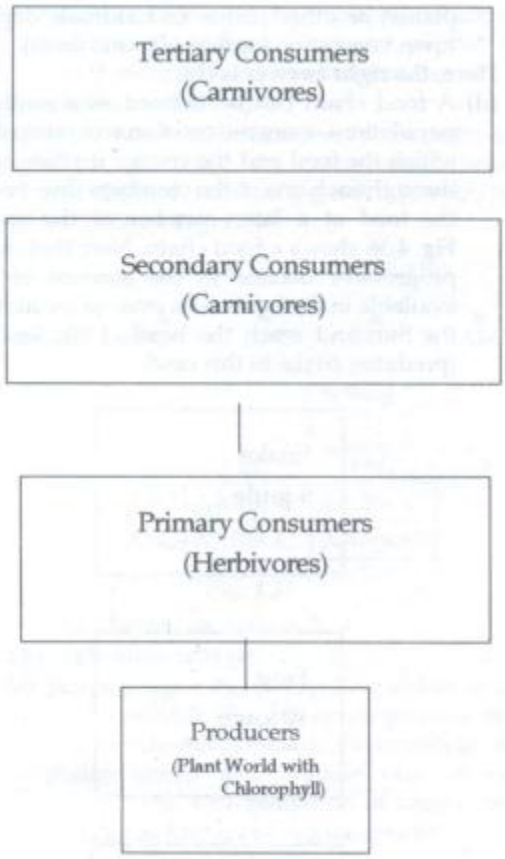


Fig. 4.37: Pyramid of numbers

A food chain has grassland ecosystem a series of population related by 'eating' and ''be eaten.'' It is a straight chain. The number of trophic levels in it varies from 3 to 6. There is progressive reduction in biomass, energy and the number of individuals with the rise in trophic levels. At every trophic level, biomass is consumed in a particular quantity for generating energy. A major part of the energy available at every trophic level is lost as heat . Humans can operate at more than one trophic level. Finally, food chains are sustained by producers and decomposers.

The right answer is (d).

Sol.124 (d)

Seed and fruit are the end products of the process of fertilization. In angiosperms, double fertilization leads to two structures−a diploid zygote or oospore and a triploid primary endosperm cell. The triploid primary endosperm cell produces a nutritive tissue which is known as Endosperm. Zygote creates the embryo. Endosperm gives nutrition to embryo. Even as the embryo grows, the central section of the endosperm is consumed. The endosperm corrodes the nucleus. In some seeds, the endosperm remains in the seed as a food storage tissue. Such seeds are known as Endospermic Seeds or Albuminuous Seeds. Examples: Castor maize, wheat, barley, rubber, coconut, etc. In other seeds, endosperm is totally consumed by the embryo; the embryo grows even as it does so. The food for the development in the future is stored in cotyledons. The cotyledons become very big because of the food stored inside them. Such seeds are called Nonendospermic Seeds or Exalbuminous Seeds. Examples: Pea, gram, bean, groundnut etc.

In some seeds, the remains of nucellus still exist. The residual nucellus that remains in the seed is known as Perisperm. Examples: Coffee, castor, cardamom nymphaea, etc. As the embryo becomes mature its, growth process stops. That is due to the development of growth inhibitors, the abscission of funiculus or change in its integuments. The cells of integuments lose their protoplasm. They get thick walls which are not permeable. Then the integuments get converted into seeds coats, outer testa and inner tegmen. The moisture content inside the seed becomes nearly 15 percent, even less in this seed, the embryo thrives in a state of inactivity; this state is called Doemancy. The micropyle of the seed. Oxygen and water enter into the seed through this micropyle (of seed) at the time germination. The micropyle is a small pole on the outer part of the seed.

The tissue of the ovary wall is also stimulated to grow with the growth of the seed. It develops a fruit wall that is known as Pericarp. In some plants, thalamus and other floral parts show proliferation and the ovary wall also develops. They are known as False fruits. Examples: Apple, strawberry, cashew , etc. The fruit in which no part of flower develops along with ovary are called True Fruits. Some fruit develop without fertilization. They are called Parthenocarpic Fruits. Examples: Banana. Parthenocarpy, the process of production of seedless fruits, can be done through hormonal treatment. In options (a), (b) and (c), the residual nucellus persists. So, they are all perisperms. In the case of groundnut (option(d)), the endosperm is totally consumed by the growing embryo. The food for the later development of embryo is stored in cotyledons. Such seeds are called Nonedospermic Seeds.

The right answer is (d).

Sol.125 (b)

The polymers Chain Reaction (PCR) technology was developed by Kary Mullis (1985).Kary Mullis and Michael Smith had won the Nobel Prize in Chemistry (1993). We can define PCR as the DNA replication in vitro. It leads us to the selective amplification of a particular part of a DNA molecule. It can be used for creating a DNA fragment for the purpose of cloning. When a double-standed DNA strands become separate from each other. So, they become single-standard molecules. It these molecules are copied by a DNA dublicated. If this process is repeated several times over, the multiples copies of the original DNA sequence can be generated. In order to effect a PCR, we need the following :

1. DNA template.

2. Two nucleotide primers.

3. DNA polymers (a kind of enzyme).

The process of PCR is as follows:

1. Denaturation

2. Annealing

3. Extension or polymerisation

The application of PCR are as follows:

1. Detection of pathogens.

2. Diagnosis of mutations of a particular kind.

3. DNA finger printing.

4. Detection of microorganisms.

5. Diagnosis of plant pathogens.

6. Prenatal diagnosis.

7. Palaeontology (cloning of DNA fragments of extinct animals)

8. Gene therapy.

Note that the recombinant DNA technology (rDNA) is used for cutting DNA at particular locations. It is not part of PCR. Note that PCR likely to take over most applications of gene cloning in the near future.

The right answer is (b).

Sol.124(d)

The animals that carry foreign genes are known as Transgenic Animals. The process of producing a transgenic animal involves the following steps.

1. Location, identification and separation of the desired gene.

2. Selection of an apt vector (a virus in most cases) or direct transmission.

3. Combination of the desired gene with the vector.

4. Introduction of the transferred vector in cells, tissues, embryo or mature individual.

5. the demonstration of the final integration of the foreign gene in the transgenic tissue a animal.

The salmon fish was the first ever transgenic animal produced for food production. Fig. 4.38 shows the process of genetic modification which the Atlantic Salmon had gone through. All other options are correct but the Salmon was the pioneer, especially in the realm of food production through the transgenic production process (in animals).

The right answer is (d).

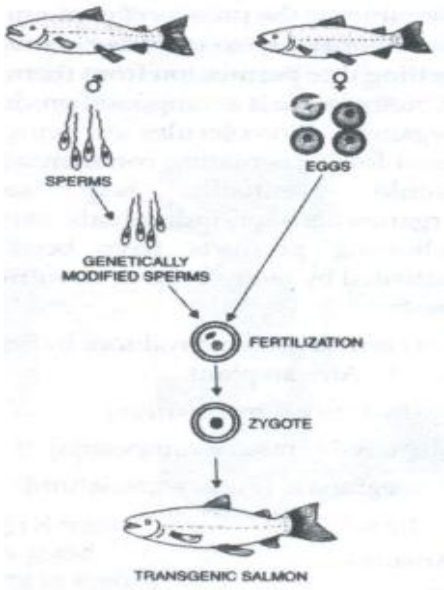


Fig. 4.38

Sol.127 (b).

Gene therapy is a process of genetic engineering. We used this therapy to replace faulty genes in an organisms with a healthy functional gene. It has many applications. For example, the faulty genes of a diabetic can be replaced by healthy ones for making him free from diabetes. The Possibilities of gene therapy are gargantuan and scientists have just started their marathon run in this vast field

There are two types of gene therapy, as follows:

1. Greenline Gene Therapy: In this therapy, green cells (sperms, eggs or zygotes) are modified by introducing healthy functional genes which are individually integrated into their genomes.

2. Somatic Cell Gene Therapy: In this therapy, genes are introduced only in somatic cells.

Currently, the law allows the entry of new genes into somatic cells. Further, the genetic modification of the germ cells of offspring is not allowed.

The right answer is (b).

Sol.128 (c).

Human insulin was made by Tsan for the first time. The process of its manufacture is as follows:

1. Isolation of donor or DNA segment.

2. Formation of recombinant DNA.

3. production of multiple copies of and rDNA

4. Introduction of rDNA in the recipient organisms.

5. Screening of transformed cells

The right answer is (c).

Sol.129(b)

Biopiracy is the process of exploiting or patenting the bioresources of other countries without getting due permission from them in legal terms. A biomolecule is a compound produced by a living organism. Biomolecules are being patented and used for perpetuating commercial activities that would eventually help some nations, organizations or individuals earn money. The following products have been illegally got patented by many firms or countries in the recent past:

1. Brazzern (a protein produced by Penta displandra) a west African Plant

2. Basmati rice (Oryza sativa)

3. Mustered (Brassica campestris)

4. Pomegranate (Punica granatum)

5. Ginger

6. Amaltas

7. Castor

8. Goosebeary

9. Turmeric

10. Margosa (Neem)

11. Bahera (an Indian Ayurvedic herb)

12. Marine (fungi of Thailand (200 strains)

The companies a Japan, Germany and the USA are the chief bio-pirates against which strict actions were contemplated but never taken.

The right answer is (b).

Sol.130 (c)

According to the Indian Patent Act (1970), the patents are value for a period of 7 or 14 years. The patent of bioresources also fall under this genre of patent law.

The right answer is (c).

Sol.131 (a)

The ozone layer is being formed and photodissociated in the stratosphere. It dissipates the energy a ultra-violet secretion. It is the only gas in the atmosphere that can check the harmful ultraviolet radiation emanating from the sun. the UV radiation of the sun converts O_3 into O_2. Study the following reaction carefully.

IMAGE PAGE NO 142

The ozonesphere, a sublayer of the stratosphere, is the layer in which O_3 exists in an independent state. it blocks UV radiation. The thicker the O_3 layer in the atmosphere, the safer we are on the earth from the lethal UV radiation. At the poles of the earth, the O_3 content is less. So, people living there are more vulnerable to the harmful effects of UV radiations. This radiation can cause skin cancer among humans. The industrialised nations of Europe released lots of CFCs during the past 30 years. These CFCs have deplated the ozone layer over the poles.

The right answer is (a).

Sol.132 (d)

GHCs are needed for keeping the mother earth cosy enough for our survival. They are radiatively active gases. They absorb long-wave radiations emitted by the earth and do not allow them to go into the outer space. Further, they reflect a part of these radiations back to the earth. This is called Green House Flux(GHF). Due to GHF, the means yearly temperature of the earth is 15°C. if they are absent, the mean yearly temperature would be - 18°C. Refer Table 4-V. Recently, the introgovernmental Panel on Climate chan

CO_2	CHG	CFCs	N_2O
(60%)	(20%)	(14%)	(6%)

ge (IPCC) has declared that GHGs are given more that to the earth than it plausibly needs. Thus, the concept of global warming has become a major issue for marine biologists and countries all over the world.

The right answer is (d).

Sol.133 (b)

Sunderbal Bahnguna led the Chipko movement. He ordered his volunteers to stick to the trees (chipko) that were being felled in the mountainous regions of Uttarakhand. He became a crusader against tree felling and worked for the cause of environmental protection. Medha Patkar was associated with the Narmada Bachao Aandolan. Maneka Gandhi handles issues related to the cruelty done to animals. Dr. Verghese Kurien was the pioneer of the white revolution in India which had led to the production of record quantities of milk and the creation of India's best milk brand−Amul.

The right answer is (b).

Sol.134 (b)

This is the only correct statement. All differences have been listed in Table 4-VI

Multiple Fission

1. A number of daughters produced
2. No immortality is present in this fission
3. Residue is left behind
4. The nucleus of parent body divides repeatedly
5. It can occur under favourable conditions as well as unfavorcable

Binary Fission

1. Only two daughters produced
2. Organism becomes immortal
3. No residue is left behind.
4. The nucleus of parent body divides only once
5. It occurs during favourable conditions only

The right answer is (b).

Sol.135 (d)

All three options are incorrect A critically endangered specres, as per the Red Data Book of the World Conservation Umon (WCU), is the one that is facing a very high risk of extinction in the wild and may be extinct at any point of time in the immediate future. The number of critically endangered animals in India is 18. The number of critically endangered plants in India is 44.

The right answer is (d).

PART D: ZOOLOGY

Sol.136 (d)

The patient lacks vitamin K, a natural agent for clotting blood.

The right answer is (d).

Sol.137 (b)

The alternation in the arrangements or amount of genetic material (DNA/genetic RNA)in a cell or virus is called Mutation.Point mutations involve minor changes in the genetic material while macro mutations involve large segments of chromosomes. Frameshift mutations are the addition or deletion of nucleotide (not involving 3 base pairs)so that the reading frame of the RNA is shifted to left or right during translation.

The right answer id (b).

Sol.138 (a)

Down's syndrome also known as Mangolian Idiocy, is a trisomic condition resulting from non-disjunction of chromosome 21. The child is mentally retarded, has flat face and eyes like those found in Mangolian race (and hence the name). The chances of down syndrome in child increase with mother's age and become alarmingly high after the mother reaches the age of 40.

The right answer is (a).

Sol.139 (a)

(a) Genetic drift refers to changes in allele frequencies of a gene pool due to chance. Though it operates both in large and small populations, it is expected to be Significant only in small populations where alleles may become extinct or get fixed on chance only.

The right answer is (a).

Sol.140 (c)

The Follicle Stimulating Hormone (FSH), Leutenising Hormone (LH) and Estrogen all play important roles in controlling the menstrual cycle in human females. Refer Fig. 4.39

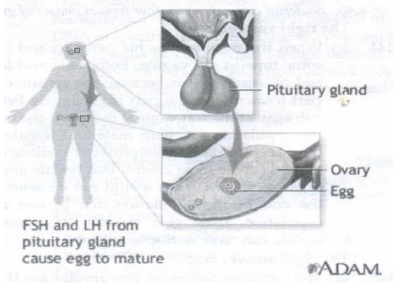


Fig. 4.39 : FSH and LH (horomones) **The right answer is (c).**

Sol.141 (c)

If both the ovaries are removed, the blood plasma level of estrogen will be affected as it is produced by theca internal cells of Graafian follicles. Estrogen regulates the growth and development of female accessary reproductive organs, secondary sexual characters and sexual behaviour.

The right answer is (c).

Sol.142 (a)

The middle part of the epididymis is called Corpus Epididymis. Epididymis is a mass of long, narrow and closely coiled tubule that lies along the inner side of male testis. Its three parts are- Caput Epididymis, Corpus Epididymis and Cauda Epididymis.

The right answer is (a).

Sol.143 (a)

When microbes are grown in a closed system or batch culture, the resulting growth curve has usually four phases: (a) lag phase (b) exponential (log) phase (c) stationary phase (d) death phase.
Fig. 4.40 shows abacterial curve that depicts four typical phases of growth.

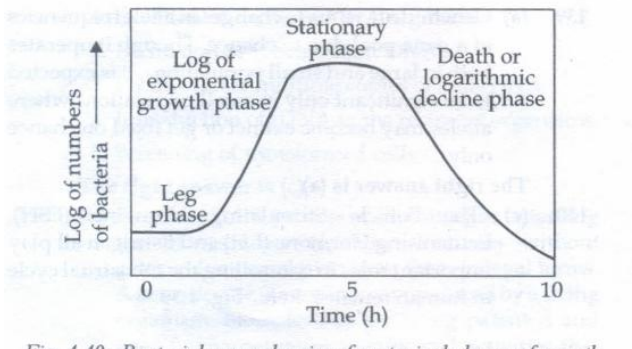


Fig. 4.40: Bacterial curve showing four typical phases of growth

The right answer is (a).

Sol.144(c)

When the male moves his penis to and fro for some time in the vagina, both male and female feel pleasure. That is because the sensitive front part (crown) and the part immediately below it rub against the soft vaginal tissue. At the peak of the copulation act, both male and female have the pleasure peak. This pleasure peak is called Orgasm. Male must ensure that female also gets orgasm otherwise she would not be satisfied at the' end of the copulation act. In one act of copulation, male gets orgasm only once but female can have multiple orgasms.

The right answer is (c).

Sol.145 (d)

The initiation factors in procaryotes are IF3, IF2 and IF1.

The right answer is (d).

Sol.146 (a)

The proteins required for the formation of ribosome are synthesized within the cytoplasm through the process of translation. These proteins are later shifted to nucleus and then, to nucleolus where the RNA and proteins are assembled into ribosomal subunits.

The right answer is (a).

Sol.147 (d)

Replication is the process of making the copies of human D A. The human D A acts as its own template in this process. DNA replication is an autocatalytic function of DNA. It normally occurs during the S-phase of cell cycle. When chromosomes are in a highly extended form.

The right answer is (d).

Sol.148 (b)

The organisms obtaining energy by chemical reactions independent of light are called Chemoautotrophs. The reactants obtained from the environment may be inorganic (in case of Chemoautotroph) or organic (in case of chemoheterotrophs) . Photoautotrophs organisms are the ones that make their own food by photosynthesis, using the energy of sun. Saprozoic organisms are the ones that obtain food from dead and decaying mater.

The right answer is (d).

Sol.149 (d)

Paramecium is heterokaryotic-it possesses a dimorphic nuclear apparatus (a single large macronucleus which controls metabolism; and one or more small micronuclei concerned with Reproduction). Refer Fig. 4.41.

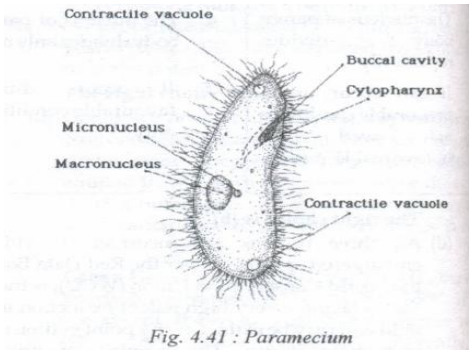


Fig. 4.41 : Paramecium

The right answer is (d).

Sol.150 (d)

Common ancestor is the typical feature of any species. AlI members of a species living anywhere in the world have been derived from a common ancestor.

The right answer is (d).

Sol.151(c)

The Competitive Exclusion Principle was postulated by Sovietecologist,G.F.Gause.It states that if two species are competiting with each other for the same limited resource, then one of the species will be also to use that resource more efficiently than the other and the former will therefore eventually eliminate the latter locally.

The right answer is (c).

Sol.152 (c)

A dominant gene would lead to the expression of its phenotype irrespective of the fact whether its allelic gene is dominant or recessive. E.g. :R gene, which is responsible for red colour, is dominant over r gene which is responsible for white colour.Then R will express itself in homozygous i.e., RR as well as in heterozygous *i.e.*, Rr conditions.

The right answer is (c)

Sol.153 (c)

The ability of a gene to affect an organism in many ways is called Pleiotropy (Greek: *Pleion* – more) and that gene is called Pleiotropic Gene. For example, the individuals heterozygous for the sickle cell anaemia (Hb^A Hb^S) are resistant to malaria.

The right answer is (c).

Sol.154 (a)

Jacob and Monod's operon concept is basically the theory of gene expression in prokaryotes.

The right answer is (a).

Sol.155 (a)

For a particular amino acid, more than one codon can be used.

The right answer is (a).

Sol.156 (c)

Total DNA (100) = A + T + C + G
A = 20% (Given)
A = T (Base pairing rule)
100 = 20 + 200 + C + G
C + G = 100 - 40 = 60
C/G = 30 (because C = G)
Thus, the percentage of Guanine is 30%.

The right answer is (c).

Sol.157(c)

In option (c), the opposite of the fact has been mentioned. In Prokyarotic transcription, the processing of released RNA does occur in cytoplasm. All statements are correct, except the one mentioned in option (c).

The right answer is (c).

Sol.158 (b)

Cholesterol forms a major component of animal cell membranes. Liposomes (artificially created spheres surrounded by a phospholipid bilayer like a membrane) are used for transformation (transgenics).

The right answer is (b).

Sol.159 (a)

Transduction involves the picking up of DNA by bacteriophage from one bacterial cells and transfer of the same to another where the DNA fragment may get incorporated into the bacterial host's genome.

The right answer is (a).

Sol.160 (b)

Cholchicum autumnal provides an alkaloid called Colchicine which is used in plant breeding for doubling the chromosome number. Treatment with 0.1 percent colchicine inhibits spindle formation so that chromatids fail to separate during anaphase.
The right answer is (b).

Sol.161 (b)

The organism will have extranuclear genes of the recipient cell. Since the recipient-cell has already been enucleated (its nucleus has been removed), the organism developing from it would have the nuclear genes of the donor cell.

The right answer is (b).

Sol.162 (a)

Ligase enzymes catalyse condensation of two molecules involving hydrolysis of ATP or any other such triphosphate. DNA ligase is used for joining bits of DNA.

The right answer is (a).

Sol.163 (a)

The codon is found in DNA and mRNA but anticodon is found in tRNA.

The right answer is (a).

Sol.164 (a)

m-RNA consists of codons for protein synthesis. Exon is the stretch of bases which codes for amino acids while the non-coding stretches of bases is called Intron.
The right answer is (a).
Sol.165(a)

Refer Fig. 4.42.

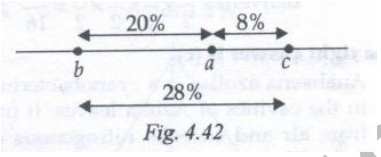


Fig. 4.42

The right answer is (a).

Sol.166 (a)

The isolation of restriction endonucleases by Nathans and Smith (1970) made it possible to cut DNA at specific sites. Restriction enzyme can cut both strands of DNA when foreign nucleotides are introduced in the cell. They cleave DNA to generate a nick with a 5' phosphoryl and 3' hydroxyl terminus.

The right answer is (a).

Sol.167 (b)

Sympatric species is the one that has been developed due to reproductive isolation. Thus, it occurs in an overlapping or the same area of geographical distribution as its sister species.

The right answer is (b)

Sol.168 (a)

The interferons IFN-g are produced by Tlymphocytes induced by antigenic stimulation. The interferons IFN-a are produced when lymphocytes and leucocytes are exposed to viruses. The interferons IFN-b are produced by fibroblasts, epithelial cells, macrophytes and leucocytes in response to viral infection.

The right answer is (a).

Sol.169 (d)

In case of complementary genes, the ratio of 9: 7 is obtained in F2 generation. This was first discovered by Batesian and Punnet. Complementary genes are those genes which express themselves when present together. None of these. Two genes expresses itself when present
alone.

The right answer is (d).

Sol.170 (b)

Linked genes occur on the same chromosome and do not separate during inheritance (complete linkage). Refer Fig. 4.43.

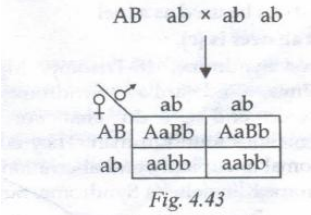


Fig. 4.43

Genotype is AaBb and aabb.

The right answer is (b).

Sol.171(c)

Probability of having a son in one delivery = $\frac{1}{2}$

$\therefore$ probability of having four sons in four

Deliveries $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$

The right answer is (c).

Sol.172 (a)

Anabaena azollae is a cyanobacterium that lives in the cavities of Azolla leaves. It fixes nitrogen from air and excretes nitrogenous compounds. BGA(Blue-Green Algae-Cyanobacterial) are also nitrogen fixers. Refer Fig. 4.44.

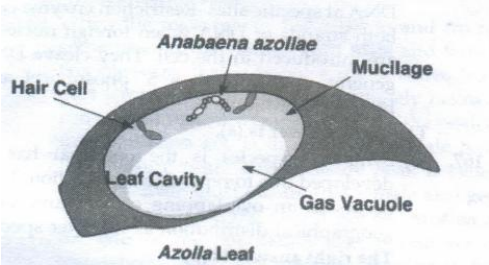


Fig. 4.44: Anabaena azollae

The right answer is (a).

Sol.173 (d)

In complementary genes, two separate pairs of genes interact to produce the phenotype in such a way that neither of the dominant genes is expressive unless the other one is present.

The right answer is (d).

Sol.174 (a)

Salmonella typhi causes typhoid fever. The incubation period is about two weeks. The patient first suffers from high fever of 40° Celsius and incessant headache. Polio, TB and Tetanus are caused by the polio virus, Mycobacterium tuberculosis and Clostridium tetani, respectively.
The right answer is (a).

Sol.175 (c)

Molasses can be processed with help of Saccharomyces cerevisiae, a kind of yeast. It can be used as material for fermentation. Ethanol can be distilled after fermentation. the solid mass left behind can be used as a fuel.
The right answer is (c)

Sol.176 (d)

Down's Syndrome, 18-Trisomy, Myelogenous Leukemia, Edward's Syndrome, Patau's syndrome and Cri du chat are autosomal abnormalities found in man. They occur due to autosomal aneuploidy and aberrations. Turner's Syndrome, Klinefelter's Syndrome, Superfemales and Supermales occur due tposex chromosomal abnormalities.
The right answer is (d).

Sol.177 (b)

The word mutation is derived from Latin word mutatus means a change and ion means result of a process. Mutation is a heritable change in the kind structure, sequence of number of the component part of a DNA molecule. Mutation is the original source of genetic variation. It may be harmful. For mutation, the forthcoming generations are less adaptive than their parental generations. As a result of natural selection, the frequency of genes 'of non-adaptive value is greatly reduced thus leading to diminished diversity and diminished adoptively to further changes.
The right answer is (b).

Sol.178 (b)

Epimorphosis is the replacement of a lost organ of the body by proliferating new cells from the surface of the wound or injured part Morphogenesis (Greek term 'Morphe' = form and 'genesis' = origin) is the growth shaping and arrangement of body parts according to genetically predefined patterns. The extent direction and rate of morphogenesis depend genetic controls and environmental factors, refer Fig. 4.45.

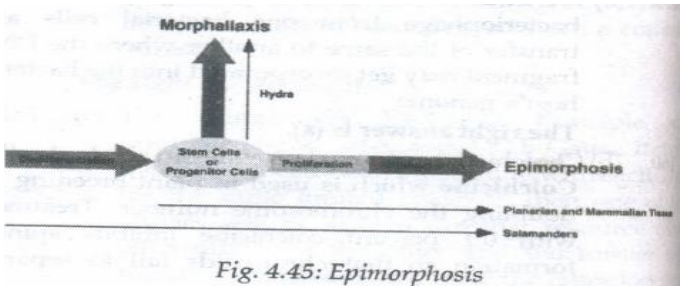


Fig. 4.45: Epimorphosis

The right answer is (b).

Sol.179 (b)

In the parlance of"Molecular basis of Inheritance,"an inducer is a substrate, hormone or metabolite that, after coming in contact with a repressor changes the repressor into a non-DNA binding state. It does this to make the operator gene free For example the inducer for lac-operon of Escherichia coli is Lactose.

The right answer is (c).

Sol.180 (b)

In the model of B-DNA, the base pairs lie at nearly 90degrees to the axis of helix. BDNA is also called Balanced DNA. The DNA Duplex Model was proposed by Watson and Crick. This model is a right-handed spiral.

The right answer is (b).

PART A: CLASS XII PHYSICS

Q1

Two ideal diodes have been connected to a battery; the circuit depicts the connection lucidly. Refer Fig. 5.1. the current supplied by the battery is:

(a) 1.75 A

(b) 0.8 A

(c) 2.25 A

(d) 0.5 A

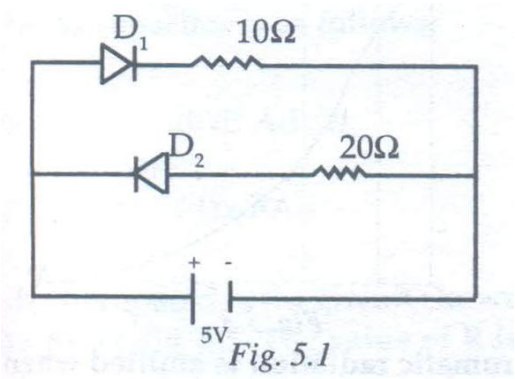


Fig. 5.1

Q2

An electric dipole of moment p has been placed in an electric field that has an intensity E. the dipole acquires a position so that the axis of the dipole makes an angle $\hat{a}$ with the direction of the field. Assuming that the potential energy of the zero when $\theta=90^0$, the torque and potential energy of the dipole will be (respectively):

(a) pESinθ, − pEcos θ

(b) pEsin θ, − 2pEcosθ

(c)pEsin θ, 2 pEcosθ

(d) pEsin θ, −pEsinθ

Q3

When drift velocities are comparable with the speed of light, the magnetic forces and electric forces:

(a)are equal to each other

(b) are very different from each other

(c) are comparable with each other

(d) cannot be calculated

Q4

At the magnetic pole of the earth, the angle of dip is ___ while at the magnetic equator of the earth, its value is ____.

(a) 70^0,75^0

(b) 0^0,90^0

(c) 75^0,70^0

(d) 90^0, 0^0

Q5

A pure- sin-wave inverter is preferred over a square-wave inverter because of the consideration of:

(a) price

(b) Noise

(c) efficiency

(d) None of these

Q6

As has been shown in fig. 5.2, five resistances, each of value 10Ω, have been completed in a logical arrangement. What is the current flowing through the section SPR?

(a) 2.1 A

(b) 3.1 A

(c) 4.1 A

(d) 1.2 A

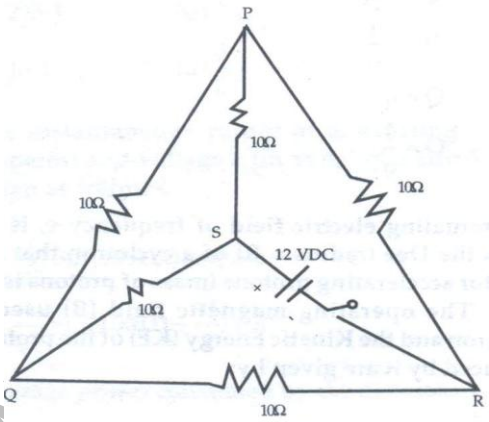


Fig. 5.2

Q7

Which one of the following statements is true?

(a) The output of an OR gate is 1 if either or both inputs are 1 each.

(b) The output of OR gate is never 1

(c) The OR gate would always deliver on output of 1.

(d) None of these.

Q8.

A duo of red and green rays has been made to fall on the face of a glass slab. After coming out of the opposite parallel face, these two would:

(a) move in non-parallel directions after coming out of the same point.

(b) move in two different parallel directions after coming out of two different points.

(c) move in the same direction after coming out of the same point.

(d) None of these.

Q9

A milli-voltmeter of range 25 m V to be converted into an ammeter of range 25 A. The value of the necessary shunt will be:

(a) 0.003Ω

(b) 0.01Ω

(c) 1.001 Ω

(d) 0.001Ω

Q10

A mixture comprises two radioactive materials – Cosmo 1 and Cosmo-2. The half-life of Cosmo-1 is 20 s. the half-life of Cosmo-2 is 10s. the mixture has 40 g of Cosmo-1 and 160 g of Cosmo -2. These amounts in the mixture will become equal after a period of:

(a) 60s

(b) 80s

(c) 20s

(d) 40s

Q11.

Four point charges – Q,- q, 2q and 2Q have been placed in the concerns of a square. These is only one charge in one corner. The relationship between Q and q for which the potential at the centre of the square is zero is as follows.

(a) Q=θ q

(b) Q=$-\frac{1}{q}$

(c) Q =q

(d) Q =$\frac{1}{q}$

Q12

An alternating electric field of frequency v, is applied across the Dee (radius = R)of a cyclotron that is being used for accelerating protons (Mass of protons is m units each). The operating magnetic field (B) used in the cyclotron and the Kinetic Energy (KE) of the problem beam produced by it are given by:

(a) $B = \frac{mv}{e} and\ K = 2m\pi^2v^2R^2$

(b) $B = \frac{2\pi mv}{e} and\ K = m^2\pi vR^2$

(c) $B = \frac{2\pi mv}{e} and\ K = 2m\pi^2v^2R^2$

(d) $B = \frac{mv}{e} and\ K = 2m^2\pi R^2$

Q13.

A ray of light is incident at an angle of incidence I on one face of a prism of angle A (it has been assumed to be small). The light ray emerges normally from the opposite face of the prism in question. If the Refractive Index (RI) of the prism is I, the angle of incidence (i) is approximately equal to:

(a) µA

(b) $\frac{\mu A}{2}$

(c) A/µ

(d) A/2µ

Q.14

A concave mirror has focal length F_1. It has been placed at a distance D from a convex lens of focal length F_2. A beam of light coming from infinity and falling on this convex-lens-concave- mirror combination goes back to infinity. The distance D must be equal to:

(a) $f_1 + f_2$

(b) $(a) - f_1 + f_2$

(c) $2f_1 + f_2$

(d) $-2f_1 + f_2$

Q15

The transfer characteristic (a plot of output voltage of V_0 versus input voltage V_i) for a base- biased transistor in the CE configuration. Refer Fig.5.3. if we want to use this transistor as a switch, we must use it:

(a) in region III

(b) in region (I) and (III) both

(c) in region II

(d) in region I

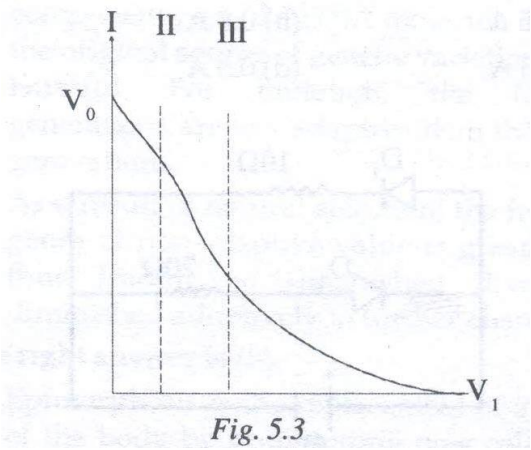


Fig. 5.3

Q16.

A monochromatic radiation is emitted when election on hydrogen atom jumps from the first excited state to the ground state and irradiates a photosensitive material. The stopping potential is 3.57 V. the threshold frequency of the material is:

(a) 4×10^{15} Hz

(b) 5×10^{15} Hz

(c) 1.6×10^{15} Hz

(d) 2.5×10^{15} Hz

Q17.

What is the equation of the flux flowing through a cube of side a if a point charge q is at one of its corners?

(a) $\frac{2q}{\varepsilon_0}$ (b) $\frac{q}{8\varepsilon_0}$

(c) $\frac{q}{\varepsilon_0}$ (d) $\frac{q}{2\varepsilon_0}\ 6a^2$

Q18.

The magnifying power of a telescope is 9. When it is adjusted for parallel rays, the distance between the objective and eyepiece is 20 cm. what is the focal length of lineses?

(a) 10cm, 10cm

(b)15cm, 5 cm

(c) 16 cm, 3.5 cm

(d) 18 cm, 2 cm

Q19

A ring is made up of a wire having a resistance R_0 =120Ω. Find the points A and B (as shown in Fig 5.4) at which a current –carrying conductor should be attached so that the rsistance R of the circuit between the points A and B is equal to 8/3 Ω.

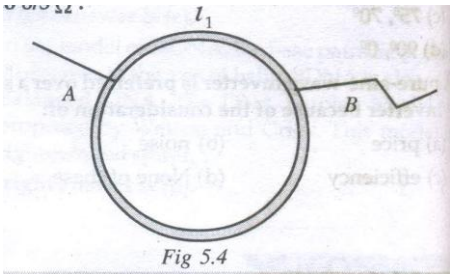


Fig 5.4

(a) $\frac{l_1}{l_2} = \frac{5}{8}$

(b) $\frac{l_1}{l_2} = \frac{1}{3}$

(c) $\frac{l_1}{l_2} = \frac{3}{8}$

(d) $\frac{l_1}{l_2} = \frac{1}{2}$

Q20

A parallel-plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and the area of each plate is A. the energy stored in the capacitor is as follows:

(a) $\frac{1}{2}\varepsilon_0 E^2$

(b) $\frac{E^2 Ad}{\varepsilon_0}$

(c) $1\frac{1}{2}\varepsilon_0 E^2 Ad$

(d)$\varepsilon_0 EAd$

Q21

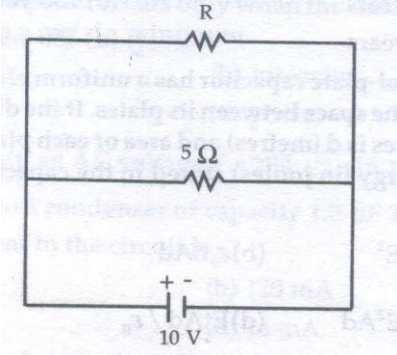
The power din the circuit shown in the figure is 30 watts. Refer Fig. 5.5. the value of R is:

(a) 18 Ω

(b) 10Ω

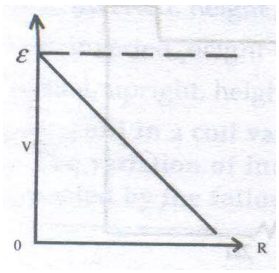
(c) 11Ω

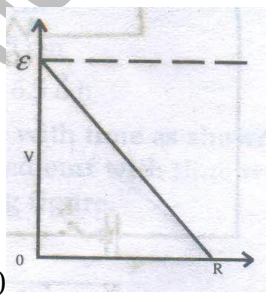
(d) Cannot be determined

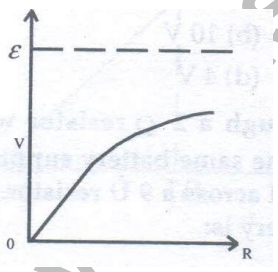


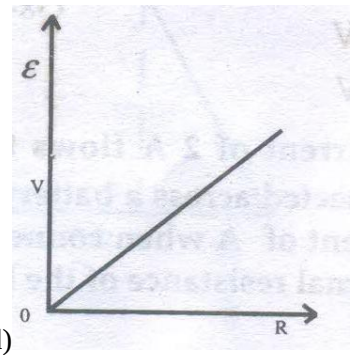
Q22.

A cell having an emf E and internal resistance r has been connected across a variable external resistance R. As the value of R is increased,the plot of potential difference V across R is drawn. That curve is:

(a)


(b)


(c)


(d)


Q23.

A magnetic needle has been suspended parallel to a magnetic field. It needs √3 J of work to turn it through an angle of 60^0. The value of torque needed for maintaining the needle in this position is:

(a) 2√3 J

(b) 3J

(c) √3J

(d) $\frac{3}{2}$ J

Q24.

The instantaneous values of alternating current i (in amperes) and voltage e (in volts) of a circuit have been given as follows.

$$t = \frac{1}{\sqrt{2}}\sin(100\pi t) ampere$$

$$e = \frac{1}{\sqrt{2}}\sin\left(100\pi t + \frac{\pi}{3}\right) volt$$

The average power consumed by the circuit is:

(a) $\frac{1}{4}$watts

(b) $\frac{\sqrt{3}}{4}$watts

(c) $\frac{1}{2}$watts

(d) $\frac{1}{8}$watts

Q25.

In a coil of resistance 10Ω the induced current developed by the changing magnetic flux through it has been shown as a function of time. Refer Fig. 5.6.the magnitude of change in flux through the coil is:

(a) 8webers

(b) 7webers

(c) 2webers

(d) 4webers

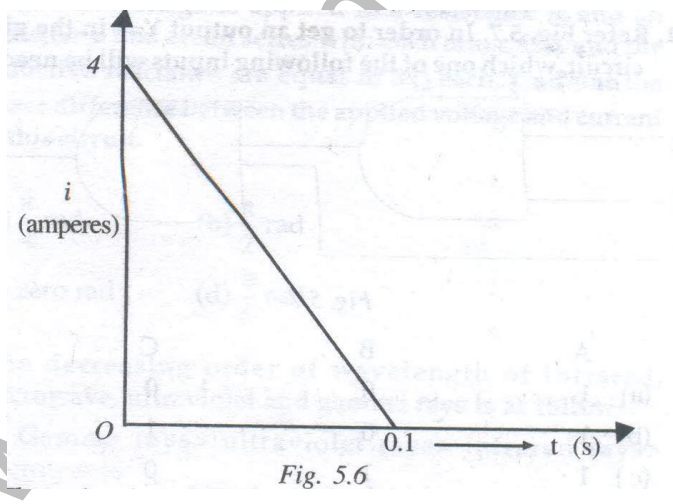


Fig. 5.6

Q26.

The ratio of amplitude of a magnetic field to the amplitude of an electric field for an electromagnetic wave propagating in vacuum is equal to:

(a) the speed of light in any medium

(b) reciprocal of speed of light in vacuum

(c)the ratio of magnetic permeability to the electric susceptibility of vacuum

(d) unity

Q27

For the angle of minimum deviation of a prism to be equal to its reflecting angle, the prism must be made of a material whose refractive index:

(a) lies between $\sqrt{2}$ and 1

(b) lies between $\mu_{min} = \sqrt{2}$ and $\mu^{max} = 2$

(c) is less than1

(d) is greater than 2

Q28.

Two radiations of photons energies 1 eV and 2.5 eV successively illuminate a photosensitive metallic surface having a work function 0.5 eV. The ratio of the maximum speed of the emitted electrons is:

(a)1 : 2

(b) 2: 1

(c) 1 : 4

(d) 4 : 1

Q29

The half-life of a radioactive nucles is 50 days.the time interval $(t_2–t_1)$ between the time t_2 when two third of it had decayed and the time t_1 when one third of it had decayed is:

(a) 30 days

(b) 60 days

(c) 50 days

(d) 15 days

Q30

The input resistance of a silicon transistor is 100 Ω. The base current is changed by 40μ A. this leads to the change in collector current by 2 mA. This transistor is used as a common Emitter (CE) amplifier with a load resistance of 4 k Ω. The voltage gain of the amplifier is:

(a) 2000

(b) 3000

(c) 4000

(d) 1000

Q31

Refer Fig. 5.7. In order to get an output Y=1 in the given circuit, which one of the following inputs will be needed?

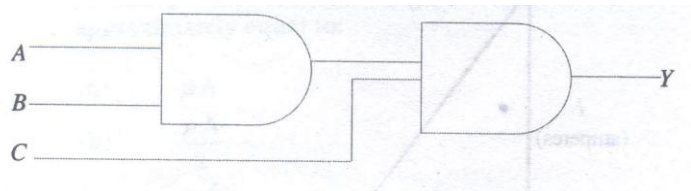


Fig. 5.7

	A	B	C
(a)	1	0	0
(b)	1	0	1
(c)	1	1	0
(d)	0	1	0

Q32.

The symbolic representation of four logic gates can be shown as follows (refer fig 5.8):The correct order for the gate type is as follows:

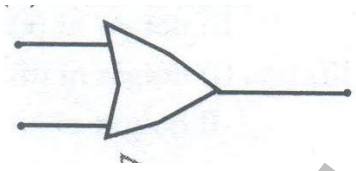
(a) (i) NAND (ii) NOT (iii) OR (iv) NOR

(b) (i) NAND (ii) OR (iii) NOR (iv) AND

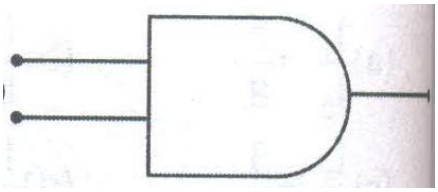
(c) (i) OR (ii) AND (iii) NOT (iv) NAND

(d) None of these

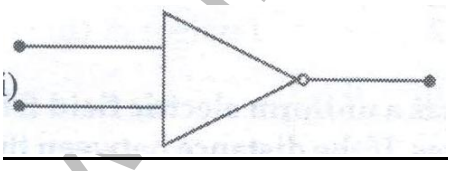
(i)



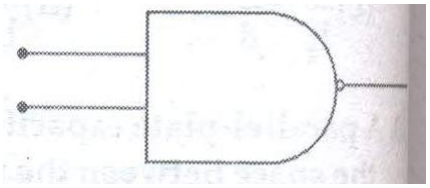
(ii)



(iii)



(iv)



Q33.

A radioactive nucleus of mass M emits a photon of frequency v and the nucleus recoils. The recoil energy will be equal to the following:

(a) $h^2v^2/2Mc\text{^}2$

(b) zero

(c) hv

(d) $Mc^2 - hv$

Q34.

The half-life of a radioactive isotope Cosmo-1 is 50 years. It decays to another element, Cosmo-2, which is stable. The two elements Cosmo-1 and Cosmo-2 were in the ratio of 1 : 15 in a sample of a given rock. The age of the rock is likely to be:

(a) 200 Years

(b) 250 Years

(c) 100 Years

(d) 150 Years

Q.35

A parallel- plate capacitor has a uniform electric E(V-m^{-1}) in the space between its plates. If the distance between the plates is d (metres) and area of each plate is A (metre^2),the energy (in joules) stored in the capacitor is:

Q36.

The power dissipated in a resistor of 9Ω is 36 W. Refer Fig. 5.9. The potential difference across a resistor of resistance 2 Ω is

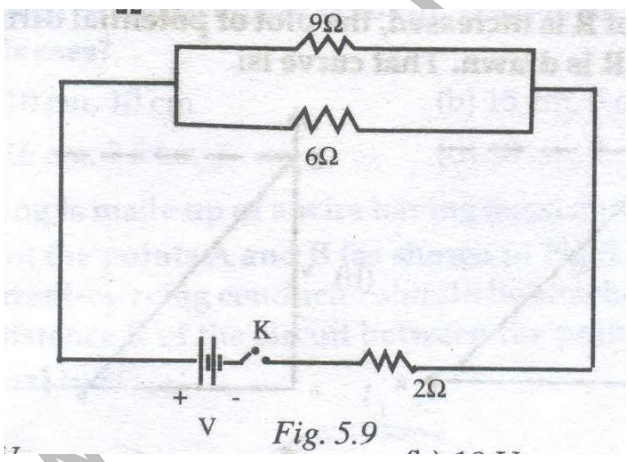


Fig. 5.9

(a) 8 V

(b)10V

(c) 2V

(d) 4 V

Q.37

A current of 2A flows through a 2 Ω resistor when connected across a battery. The same battery supplies a current of A when connected across a 9 U resistor. The internal resistance of the battery is:

(a) $\frac{1}{3}\Omega$

(b) $\frac{1}{4}\Omega$

(c) 1Ω

(d) 0.5 Ω

Q38.

According to Lenze's slow, the direction of induced emf is such that it:

(a) supports the cause that produces it

(b) opposes the cause that produces it

(c) remains neutral to the cause that produces it

(d) None of these

Q39.

The fusion reaction takes place at high temperature because:

(a) atoms get ionized at high temperature

(b) kinetic energy is high enough to overcome the Coulomb repulsion between nuclei

(c) molecules break up at high temperature

(d) nuclei break up at high temperature

Q40.

Photoelectric emission occurs only when the incident light has more than a certain minimum

(a) wavelength

(b) intensity

(c) frequency

(d) power

Q41.

In an AC circuit, an AC voltage e=200 √2 sin 100t (volt) is connected to a condenser of capacity 1.0 μF the RMS value of current in the circuit is

(a) 10 mA

(b) 120 mA

(c) 20 mA

(d) 14 mA

Q42.

A biconvex lens has a radius of curvature of magnitude 20 cm. which one of the following options aptly describes the image formed of an object of height 2 cm placed at a distance of 30 cm from the lens?

(a) Virtual, upright, height =0.5 cm

(b) Real, inverted, height =4 cm

(c)Real, inverted, height = 5.5 cm

(d) Virtual, upright, height= 6.5 cm

Q43.

The current I in a coil varies with time as shown in Fig. 5.10. The variation of induced emf with time would be represented by the following figure.

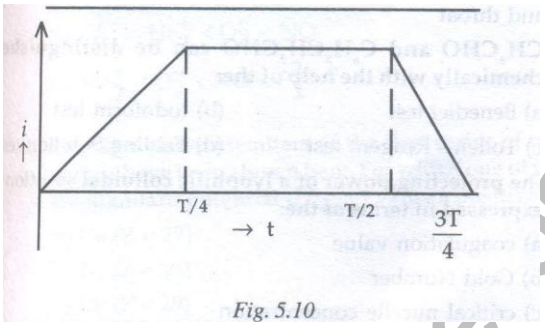
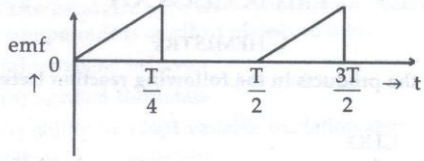
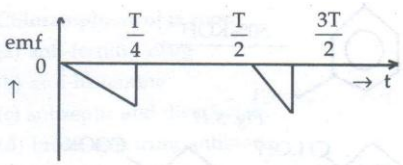


Fig. 5.10

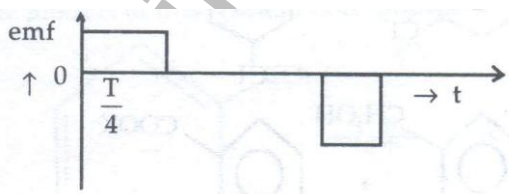
(a)



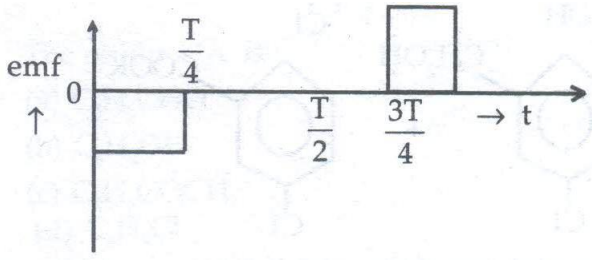
(b)



(c)



(d)



Q.44

An AC voltage is applied to a resistance R and an inductor L that are in series with each other. If R and the inductive reactance are equal to 3Ω each, find out the phase difference between the applied voltage and current in this circuit.

(a) $\frac{\pi}{4}$rad

(b) $\frac{\pi}{2}\ rad$

(c) zero rad

(d) $\frac{\pi}{6}$rad

Q45.

The decreasing order wavelength of infrared, microwave, ultraviolet and gamma rays is a s follows.

(a) Gamma rays > ultraviolet rays> infrared rays> microwaves

(b) Microwaves > gamma rays> infrared rays > ultraviolet rays

(c) Infrared rays> microwaves> ultraviolet rays > gamma rays

(d) Microwaves> infrared rays > ultraviolet rays> gamma rays

Part B: CLASS XII

CHEMITSRY

Q46.

Predict the products in the following reaction (refer Fig. 5.11):

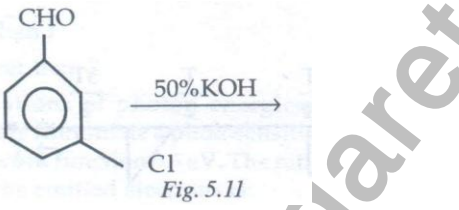
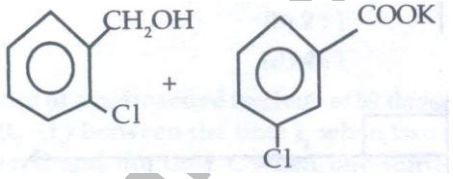
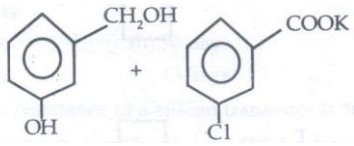


Fig. 5.11

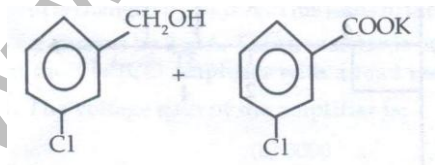
(a)



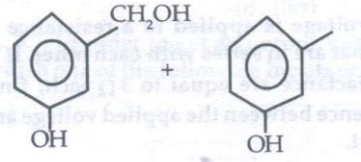
(b)



(c)

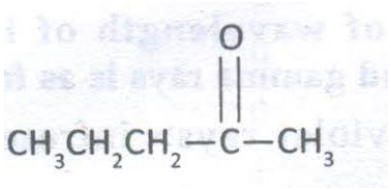


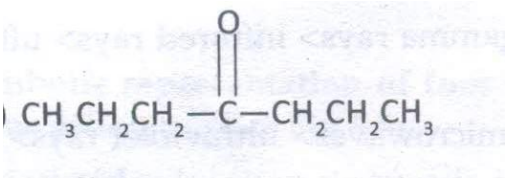
(d)

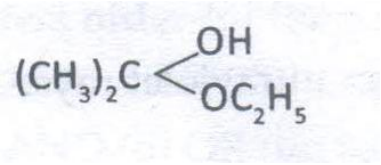


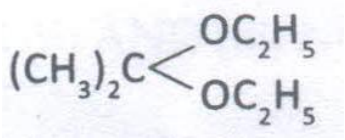
Q47.

Acetone is treated with excess of ethanol on the presence of hydrochloric acid. The product so obtained is:

(a) 

(b) 

(c) 

(d) 

Q48.

A metal crystallises what a Face Centered Cubic (FCC) lattice .The edge of the unit cell is 408 pm. The diameter of the metal atom is:

(a) 288 pm

(b) 408 pm

(c) 144 pm

(d) 204 pm

Q49.

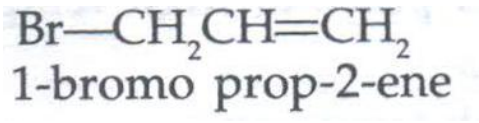
Which one of the following is not a condensation polymer?

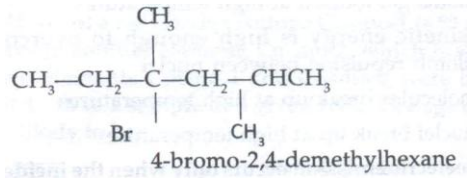
(a) Melamine (b) Glyptal

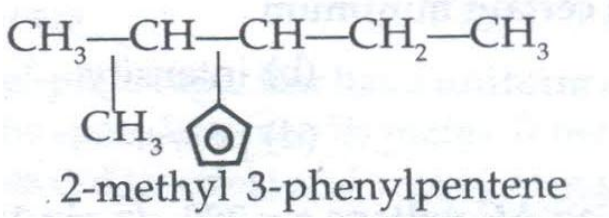
(c) Dacron (d) Neoprene

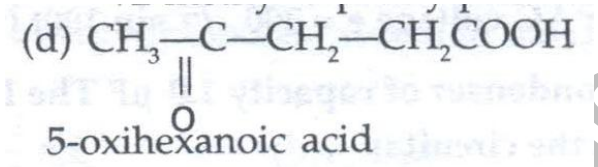
Q.50

Which nomenclature is not according to the IUPACsystem?

(a) 

(b) 

(c) 

(d) 

Q51.

The number of octahedral void (s) per atom present in a cubic close-packed structure is:

(a) 1

(b) 3

(c) 2

(d) 4

Q52.

Which one of the following statements regarding photochemical smog is not correct?

(a) Carbon monoxide does not p[lay any role in photochemical smog formation.

(b) photochemical smog is an oxidising agent in the atmosphere

(c)photochemical smog is formed through the photochemical reaction involving solar energy

(d) photochemical smog does not cause irritation in eyes and throat

Q53.

CH_3CHO and $C_6H_5CH_2CHO$ can be distinguished chemically with the help of the:

(a) Benedict test

(b) Iodoform test

(c) Tollen's Reagent test

(d) Fehling Solution test

Q54.

The protecting power of a lyophilic colloidal solution is expressed in terms of the:

(a) coagulation value

(b) Gold Number

(c) critical micelle concentration

(d)oxidation number

Q55.

Which one of the following acids does not exhibit optical isomerism?

(a) Maleic acid (b) α- amino acids

(c) Lactic acid (d) Tartaric acid

Q56.

Which one of the following statements is false?

(a) Artificial silk is delivered from cellulose.

(b) Nylon -66 is an example of elastomers.

(c) the repeat unit in natural rubber is isoprene.

(d) Both starch and cellulose are the polymers of glucose

Q57.

The killer hooch takes lives of several hundred people in india every year? Who is the major culprit behind it?

(a) Phenol derivation (b) Ethyl alcohol

(c) Ketone derivative (d) Acetaldehyde

Q58.

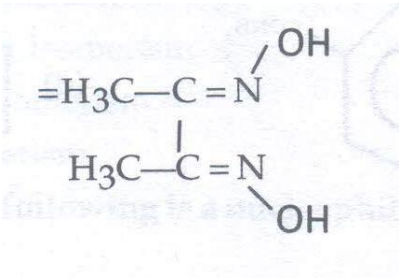
Refer Fig.5.12 Red precipitate is obtained when an ethanol solution of dimethylglyoxime is added to ammonical Ni (II). Which one of the following statements is not true?

(a) Red complex has a square planar geometry.

(b) The complex has symmetrical hydrogen bonding.

(c) Red complex has a tetrahedral geometry.

(d) Dimethylglyoxime functions as a bidentate ligand



Q59.

Four diatomic species have been listed here. Identifying the correct order in which the bond order is increasing in them.

(a) $NO < O_2^- < C_2^{2-} < He_2^+$

(b) $O_2^- < NO < C_2^{2-} < He_2^+$

(c) $C_2^{2-} < He_2^+ < O_2^- < NO$

(d) $He_2^+ < O_2^- < NO < C_2^{2-}$

Q60.

Four successive members of the first series of transition metals have been shown here. For which one of them, has the standard potential ($E^0_{M2+/M}$) value a positive sign?

(a) Co (Z = 27)

(b) Ni (Z = 28)

(c) Cu (Z = 29)

(d) Fe (Z = 26)

Q61.

The catalytic activity of transition metals and their compounds is ascribed mainly to their:

(a) magnetic behavior

(b) unfilled d- orbitals

(c) ability to adopt variable oxidation states

(d) chemical reactivity

Q62.

Chloramphenicol is a/an:

(a) anti- fertility drug

(b) anti- histamine

(c) antiseptic and disinfectant

(d) broad-spectrum antibiotic

Q63.

Consider the following reaction. Refer Fig. 5.13. the product of this reaction is as follows:

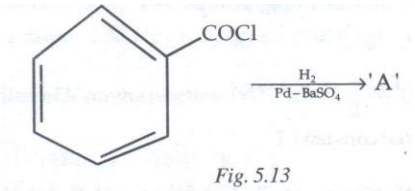


Fig. 5.13

The product 'A' is

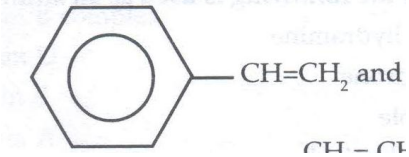
(a) C_6H_5CHO
(b) C_6H_5OH
(c) $C_6H_5COCH_3$
(d) C_6H_5Cl

Q64.

Which one of the following sets forms biodegradable polymers?

(a) $CH_2 = CH –CN$ and $CH_2 = CH – CH = CH_2$
(b) $H_2N – CH_2 – COOH$ and $H_2N –(CH_2)_5 – COOH$
(c) $HO – CH_2 – CH_2 – OH$ and

(d)



$CH_2 = CH –CH = CH_2$

Q65.

The values of the standard electrode potential of three metals X,Y and Z are – 1.2 V, +0.5V and -3.0 V, respectively. The decreasing order of reducing power of these metals is:

(a) Y > X > Z
(b) Z >X > Y
(c) X > Y > Z

Y > Z > X

Q66.

What is the basic reaction of Aliminum hydroxide in our stomach?

(a) It produces OH^- ions
(b) It nutrilises HNO_3
(c) It nutrilisesHCl
(d) It reacts with the stomach wall

Q67.

If x is amount of adsorbate and m is the amount of adsorbent, which one of the following relations is not related to the adsorption process?

(a) $\frac{x}{m}$=f(T) at cons tan t p
(b) p = f(T) at cons tan t $\left(\frac{x}{m}\right)$
(c) $\frac{x}{m} = p \times T$
(d) $\frac{x}{m}$ =f(p)at cons tan t T

Q68.

The van't Hoff factor I for a compound, which undergoes dissociation in one solvent and association in other solvent, is (respectively)

(a) Less than one and less than one
(b) Greater than one and less than one
(c) Greater than one and greater than one
(d) Less than one and greater than one

Q69.

The d-electron configuration of Cr^{2+}, Mn^{2+}, Fe^{2+} and Co2+ are d^4, d^5 and d^7, respectively. Which one of the following will exhibit the minimum paramagnetic behavior?

(a) $[Fe(H_2O)_6]^{2+}$ (b) $[Co(H_2O)_6]^{2+}$

(c) $[Cr(H_2O)_6]^{2+}$ (d) $[Mn(H_2O)_6]^{2+}$

Q70.

Which one of the following is used as an anthistamine?

(a) Diphenylhydramine

(b) Noretheindrone

(c) Omeprazole

(d) Chloramphenicol

Q71.

The correct order of increasing bond length of C−H, C−O, C−C and C=C is

(a) C−C < C = C < C−O <C−H

(b) C−O < C – H< C – C < C = C

(c) C− H < C –HO < C – C < C = C

(d) C – H < C = C < C – O < C – C

Q72.

Which one of the following has been classified as a polyester polymer?

(a) Bakelite

(b)Melamine

(c) Nylon-66

(d) Terylene

Q73.

Refer Fig. 5.14. In a set of reactions, m – bromo –benzoic acid yielded a product. identify that product.

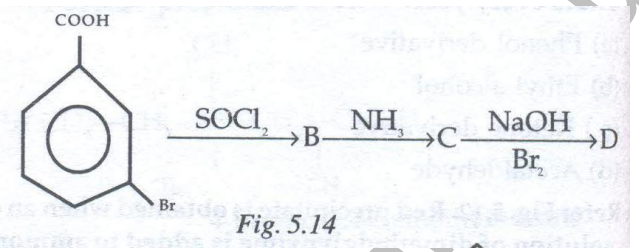
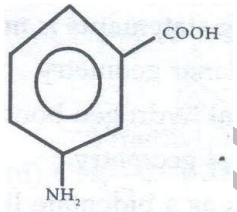
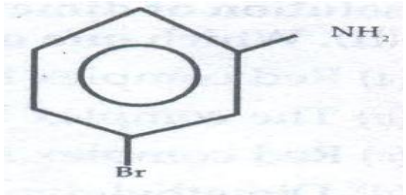


Fig. 5.14

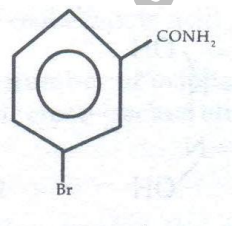
(a)



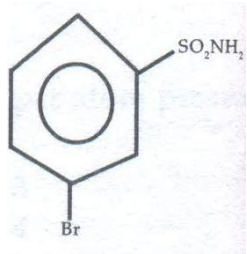
(b)



(c)



(d)



Q74.

The correct IUPAC name of the compound shown in Fig. 5.15 is as follows.

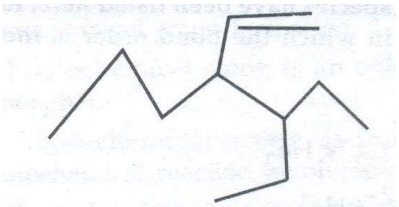


Fig. 5.15

(a) 3- ethyl- 4-ethenylheptane

(b) 3- ethyl-4- propylhex- 5- ene

(c) 3-(1-ethyl propyl) hex-1-ene

(d) 4- ethyl -3-propylhex -1- ene

Q75.

Refer fig. 5.16. What is the product obtained in the following reaction?

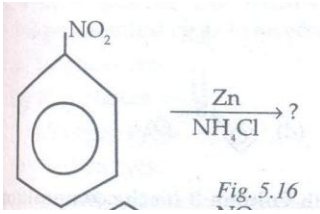
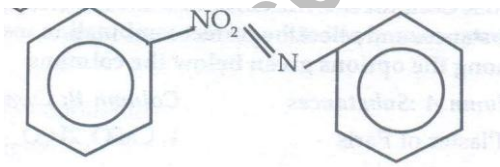
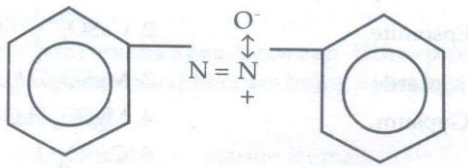


Fig. 5.16

(a)



(b)



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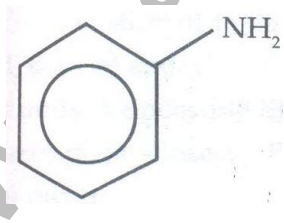

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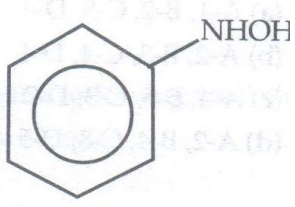


Q76.

The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which tape of isomerism?

(a) Ionisation isomerism

(b) Co- ordination isomerism

(c) Geometrical isomerism

(d) Linkage isomerism

Q77.

Which one of the following is a nucleophilic substitution reaction?

(a) $RCHO + R'MgX \rightarrow R-\underset{\underset{OH}{\downarrow}}{CH}-R'$

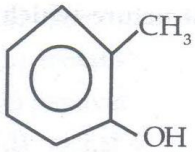
(b) $CH_3-CH_2-\underset{\underset{CH_3}{\uparrow}}{CH}-CH_2Br + NH_3 \rightarrow CH_3-CH_2-\underset{\underset{CH_3}{\uparrow}}{CH}-CH_2NH_2$

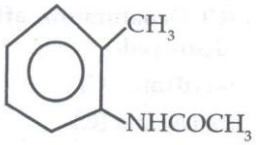
(c) $CH_3CHO + HCN \rightarrow CH_3$

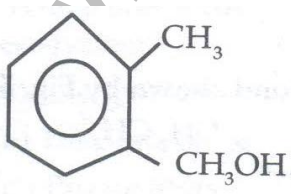
(d) $CH_3-CH=CH_2 + H_2O \xrightarrow{H+} CH_3-\underset{\underset{OH}{\downarrow}}{CH}-CH_3$

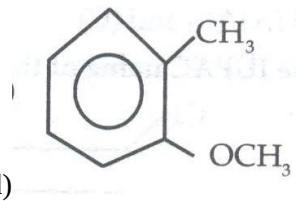
Q78.

Which one of the following is most reactive towards an electrophilic reagent?

(a) 

(b) 

(c) 

(d) 

Q79.

The mole faction of the solute in a 1.00 molal aqueous solution is:

(a) 0.0177

(b) 0.344

(c) 1.7700

(d) 0.1770

Q80.

For the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the equilibrium constant is K_1. The equilibrium constant is K_2 for the reaction: $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$. what is the value of K for the reaction $NO_2(g) \rightleftharpoons \frac{1}{2}N_2(g) + O_2(g)$?

(a) $1/(4 K_1K_2)$

(b) $[1/ K_1K_2]^{1/2}$

(c) $1/(K_1K_2)$

(d) $1/(2 K_1K_2)$

Q81.

Which one of the following has the minimum bond order?

(a) O_2^-

(b) O_2^{2-}

(c) O_2

(d) O_2^+

Q82.

Acidified $K_2Cr_2O_7$ solution turns green when $Na_2 So_3$ is added to it. This is due to the formation of:

(a) CrO_4^{2-}

(b) $Cr_2(SO_3)_3$

(c) $CrSO_4$

(d) $Cr_2(SO_4)_3$

Q83.

The active ingredient in bleaching powder is as follows (it performs the bleaching reaction):

(a) $Ca(OCl)_2$

(b) CaO_2Cl

(c) $CaCl_2$

(d) $CaOCl_2$

Q84.

Which one of the following is not a fat- solute vitamin?

(a) Vitamin B complex

(b) Vitamin D

(c) Vitamin E

(d) Vitamin A

Q85.

Which ones of the following facts about denaturation are true?

Facts for Consideration

(A) Denaturationof proteins causes loss of secondary and tertiary structures of the protein.

(B) Denaturation leads to the conversion of double – strand of DNA into single strand.

(C) Denaturation affects primary structure which gets distrooyed.

(a) (B) and (C)

(b) (A) and (C)

(c) (A) and (B)

(d) (A), (B) And (C)

Q86.

The IUPAC name of the compound shown by Fig. 5.17.is

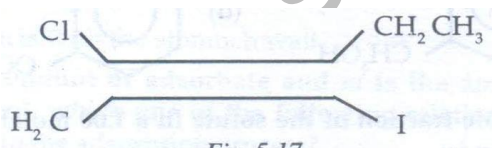


Fig. 5.17

(a) trans-2-chlorio – 3-iodo-2 –pentene

(b) cis -3 – iodo- 4- chloro -3 – pentene

(c) trans – 3 –iodo-4- chlro -3 –pentene

(d) cis -2 – chloro -3 –iodo -2- pentene

Q87.

Match the compounds given in Column A with those in Column B and select the appropriate option by using the code given below the columns:

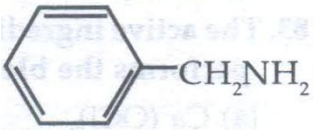
	Column A	**Column A**
A.	Benzaldehyde	1. Phenolphthalein
B.	Phthalic anhydride	2.Benzoin condensation
C.	Phenyl benzoate	3. Oil of wintergreen
D.	Methyl Salicylate	4. Fries rearrangement

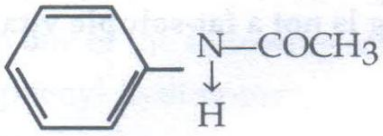
	A	B	C	D
(a)	4	1	3	2
(b)	4	2	3	1
(c)	2	3	4	1
(d)	2	1	3	4

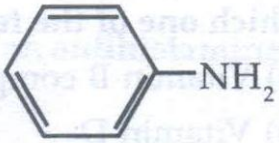
Q88.

Which one of the following compounds is most basic?

(a) 

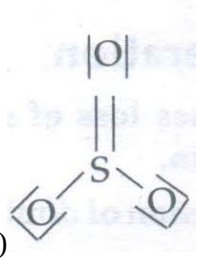
(b) 

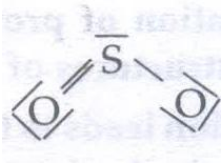
(c) 

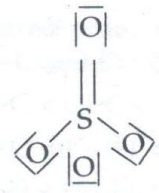
(d) 

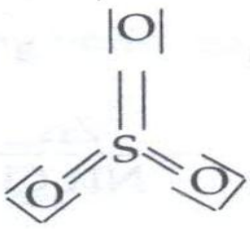
Q89.

Which one of the following structures is the most preferred one and hence carries the lowest amount of energy for SO_3?

(a) 

(b) 

(c) 

(d) 

Q90.

Match Column A with Column B for the composition substances and select the correct combination answer from among the option given below the columns:

Column A: Substances	**Column B: Composition**
A. Plaster of paris	1. $CaSo_4 2H_2O$
B.Epsomite	2. $CaSo_4\frac{1}{4}H_2O$
C. Kieserite	3.$MgSo_4 7\ H_2O$
D. Gypsum	4.$MgSO_4H_2O$
	5.$CaSO_4$

(a) A-1, B-2, C-5, D-4 (b) A-2, B-3, C-4, D-1

(c) A-4, B-5, C-3, D-2 (d) A-2, B-4, C-3, D-5

Part C: CLASS XII

BOTANY

Q91.

Which part would be most suitable for raising virus free plants for micro- propagation?

(a) Bark

(b) vascular tissue

(c) Meristem

(d) Node

Q92.

Edible pollens are produced by:

(a) Magnolia

(b) Rosa

(c) Clematis

(d) All of these

Q93.

Siphonogany is a genre of:

(a) fertilization of male and female gametes

(b) respiration of leaves

(c)sugar formation during photosynthesis

(d) release of pollen unto the air

Q94.

Both autogamy and geitonogamy are prevented in:

(a) papaya

(b) cucumber

(c) castor

(d) maize

Q95.

Which one of the following is not a gaseous biogeochemical cycle in an ecosysytem?

(a) Sulphur cycle

(b) Phosphours cycle

(c) Nitrogen cycle

(d) Carbon cycle

Q96.

An organic substance that can withstand environmental extremes and cannot be degraded by any enzyme is:

(a) Cuticle

(b) Sporopollenin

(c) Lignin

(d) Cellulose

Q97.

The natural exchanges between lithosphere and hydrosphere or atmosphere are being upset by:

(a) deforestation

(b) the rising number of marine animals

(c) combustion of fossil fuels

(d) Both (a) and (c)

Q98.

Identify the possible line A in the following food chain

Green plant – Insect – Frog -A-Eagle

(a) rabbit

(b) wolf

(c) cobra

(d) parrot

Q99.

Identify the incorrect statement from among the following.

(a) the reservoir pool is sedimentary nutrient cycling is hydrosphere

(b) the biogenetic material in gaseous nutrient cycling is basically gaseous.

(c) Sedimentary nutrient cycling is a slow process

(d) Gaseous nutrient cycling is nearly perfect

Q100.

Monascus puepureus is a yeast used on a commercial basis in the production of:

(a) ethanol

(b) streptokinase for removing clots from the blood vessels

(c) citric acid

(d) blood cholesterol-lowering statins

Q101.

What is a Parasitic Food Chain in the parlance of ecosystems?

(a) It is a food chain starting with a parasite

(b) It is a food chain ending with a parasite

(c) It is a food chain starting with a herbivore

(d) It is a food chain sans parasites of any kind

Q102.

The gynoecoum consists of many free pistils in flowers of:

(a) Aloe (b) tomato

(c) papaver (d) michelia

Q103.

Which one of the following is not a functional unit of an ecosystem?

(a) Energy flow (b)Decomposition

(c) Productivity (d) Stratification

Q104.

Which one of the following has been correctly matched?

(a) Onion	-Bulb
(b)Ginger	-Sucker
(c)Chlamydomonas	-Conidia
(d)Yeast	-Zoospores

Q105.

Which statement is correct from among the following?

(a) Litter is mostly dried plant matter

(b) Detritus is mostly dried plant matter

(c) Detritus is of three types

(d) Litter is below the ground

Q106.

Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition?

(a) Azotobacter

(b) Aspergillus

(c) Glomus

(d) Trichoderma

Q107.

Producers are basically at the _____ trophic level and see the _____ radiation to produce food (carbohydrates).

(a) Fourth; Night

(b)Third; Ultraviolet

(c) First; solar

(d) Second; daylight

Q108.

Even ion absence of pollinating agents,seed setting is assured in:

(a)Commellina

(b) Zostera

(c) Salvia

(d) fig

Q109.

Yeast is used in the production of:

(a) Critic acid and lactic acid

(b) Lipase and pectinase

(c) Bread and beer

(d) Cheese and butter

Q110.

A nitrogen-fixing microbe associated with Azolla in rice fields is:

(a) Spirulina

(b) Anabaena

(c) Frankia

(d) Tolypoyhrix

Q111.

Water containing cavities in vascular bundles are found in:

(a) sunflower

(b) Maize

(c) cycas

(d) pinus

Q112.

Coconut water and the edible part of coconut are equivalent to:

(a) endosperm (b) endocarp

(c) mesocarp (d) embryo

Q113.

Which one of the following pairs has been wrongly matched?

(a) Ginkgo – Archegonia (b) Salvinia – Prothallus

(c) Viroids – RNA (d) Mustard – Synergids

Q114.

In a suspension culture, the cells are suspended in:

(a) a gaseous medium

(b) a powdery medium

(c) a liquid medium

(d) any medium as per the convenience of the tissue culture connoisseur

Q115.

Which one of the following is not a hormone used in plant tissue culture?

(a) Indole -3 –Acetic acid

(b) ABA

(c) Spermidine

(d) Sucrase

Q116.

Which one of the following is a cytokinin?

(a) ABA

(b) Putrescine

(c) 6- Benzylaminopurine

(d) Indole -3- Butyric acid

Q117.

An example of a physical mutagen is the following.

(a) EMS (b) Sodium azide

(c)Gamma rays (d) all of the above are physical mutagens

Q118.

Somaclonal variation is observed in plants during the course of:

(a) pollination (b) tissue culture

(c) maturation (d) decay

Q119.

Which one of the following statements is wrong?

(a) When pollen is shed at the two-cell stage, double fertilization does not take place

(b) Vegetative cell is larger than generative cell

(c) In some plants, pollen grains remain viable for months

(d) Intine is made up of cellulose and pectin

Q120.

Plants with ovaries having only one or a few ovules are generally pollinated by:

(a) bees (b) butterflies

(c) birds (d) wind

Q121.

Sacred grooves are especially useful in:

(a) Generating environmental awareness (b) Preventing soil erosion

(c) year- round flow of water down the rivers (d) Conserving rare and threatened species

Q122.

Tobacco plants resistant to a Nematode have been developed by the introduction of DNA that produces (In host cells):

(a) both sense and antisense RNA (b) a particular hormone

(c) anantifeedant (d) a toxic protein

Q123.

Which statements out of the following ones are true? I. Single cell spirulina can produce large quantities of food rich in protein, minerals, vitamins etc.

II. Body weight-wise the microorganism Methylophilusmethylotrophus may be able to product several times more proteins than the cows per day.

III. Common button mushrooms are a very rich source of vitamin-C.

IV. A rice variety has been developed which is very rich in calcium.

(a) Statements (III), (IV) (b) Statements (I), (III), and (IV)

(c) Statements (II), (III), and (IV) (d) Statements (I) and (III)

Q124.

Which one of the following combination is incorrect?

(a) Zinc− Vomitting, cramps, renal damage.

(b) Copper – uremia, coma, hypertension

(c) Lead – anaemia, convulsions, liver damage

(d) Cobalt – Minamata ,Itai – itai.

Q125.

Agarose is extracted from seaweeds. It is useful in:

(a) tissue culture

(b) PCR

(c) gel electrophoresis

(d) spectrophotometry

Q126.

He eyes of the potato tuber are

(a) flower buds

(b) shoot buds

(c) axillary buds

(d) root buds

Q127.

Large woody vines are more commonly found in:

(a) Mangrover (b) tropical rainforests

(c) alpine forests (d) temperate forests

Q128.

The CAM helps plants in their

(a) secondary growth (b) disease resistance

(c) reproduction (d) conserving water

Q129.

The function of leghaemoglobin ion the root nodules of legumes is:

(a) oxygen removal

(b) nodule differentiation

(c) expression of nif gene

(d) inhibition of nitrogenase activity

Q130.

The mass of living matter at a trophic level in an area at any point of the time is known as:

(a) Detritus

(b) Humus

(c) Standing

(d) Standing crop

Q131.

A collection of plants and seeds having diverse alleles of all the genes of a crop is called:

(a) germplasm

(b) gene library

(c) genome

(d) herbarium

Q132.

Which one of the following is not a source of water pollution?

(a) Industrial waste (b) Oil spill

(c) Slaughter house (d) Rainwater

Q133.

Fly ash is being processed for making:

(a) industrial chemicals (b) bricks

(c) pavements (d) natural manure

Q134.

In land plants, the guard cells differ from other epidermal cells in having:

(a) mitochondria

(b) endoplasmic recticulum

(c) chloroplasts

(d) cytoskeleton

Q135.

The pollen tube enters the ovule through the micropyle. This mode of entry is called:

(a) Mesogamy

(b) Porogamy

(c) Chalazagamy

(d) Syngamy

PART D: CLASS XII

ZOOLOGY

Q136.

The most abundant prokaryotes helpful to man for making curd from milk and in the production of antibiotics are:

(a) Cyan bacteria

(b) Archaebacteria

(c) Chemosynthetic autotrophs

(d) Hetertrophic bacteria

Q137.

What is Fig. 5.18 showing?

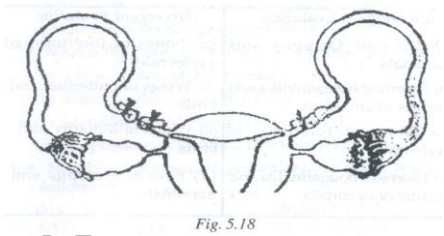


Fig. 5.18

(a) Tubectomy

(b) Renal surgery

(c) Ovaries

(d) Sperm

Q138.

Fig.5.19 shows the E.coli vector,PBR identify the recognition sites of restriction endonucleases.

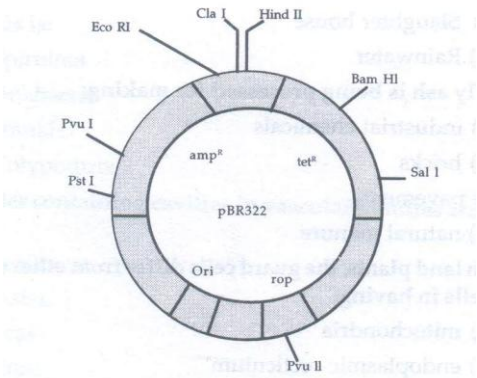


Fig. 5.19

(a) ori-original restriction enzyme

(b) rop- reduced osmotic pressure

(c) Hind III, Eco RI-selectable markers

(d) amp^R ,tet^R- antibiotic resistance genes

Q139

Which one of the following is not part of a transcription unit in DNA?

(a) The inducer

(b) A terminator

(c) A promoter

(d) A structural

Q140

A single stand of nucleic acid tagged with a radioactive molecule is called:

(a) vector

(b) Selection marker

(c) Plasmid

(d) Probe

Q141.

Refer table 5.1.Which one of the following options gives one correct example each of convergent evolution and divergent evolution?

Table 5-1

Convergent Evolution	Divergent Evolution
(a) Eyes of Octopus and mammals	(a) Bones of forelimbs of vertebrates
(b) Thorns of Bougainvillia and tendrils of cucurbita	(b) Wings of butterflies and birds
(c) Bones of forelimbs of vertebrates	(c) Wings of butterfly and birds
(d) thorns of Bougainvillia and tendrils of cucurbita	(d) Eyes of Octopus and mammals

Q142.

The Ribosomal RNA is activity synthesized in:

(a) lysosomes

(b) nucleolus

(c) nucleoplasm

(d) ribosomes

Q143.

During the process of gamete formation, The enzyme recombinase participates during the:

(a) Metaphase – I

(b) Anaphase –II

(c) Prophase –I

(d) Prophase –II

Q144.

Which one of the following is not a property of cancerous cells (the remaining three certainly are?)

(a) They complete with normal cells for vital nutrients

(b) They do not remain confined in the area of formation.

(c) They divide in an uncontrolled manner

(d) They show contact inhibition

Q145.

In a normal pregnant woman, the amount of total gonadotropin activity was assessed. The result expected was high:

(a)level of circulating FSH and LH in the uterus for stimulating implanting of the embryo

(b) level of circulating HCG for simulating endometrial thickening.

(c) levels of FSH and LH in uterus for simulating endometrial thickening

(d)level of circulating HCG for simulating oestrogen and progesterone synthesis

Q146.

Identify the correct statement:

(a) In linked genes, the dihybrid ratio is 3:1

(b) In unlinked genes, the dihybrid ratio is 9:3:3:1

(c) Unlinked genes undergo segregation

(d) In dihybirds, linked genes show a test cross ratio1 :3

Q147.

Refer Table 5-II. In which one of the following options, are the two examples correctly matched with with their particular type of immunity?

Table 5-II

Examples	Type of Immunity
(a) Polymorphounclear leukocytes and monocytes	(i) Cellular barriers
(b) Anti- tetanus and anti-snake bite injections	(ii) Active immunity
(c) Saliva in mouth and tears in eyes	(iii)Physical barriers
(d) Mucus coating of epithelium lining the urinogenital tract and HCl in stomach	(iv) Physiological barriers

Q148.

The Leydig cells found in the human body are the secretery source of:

(a) progesterone

(b) intestinal mucus

(c) glucagon

(d) androgens

Q149.

Which one is a true statement regarding DNA polymerase used in PCR?

(a) It is used to ligate introduced DNA in recent cells

(b) It serves as a selectable marker

(c) It is isolated from a virus

(d) It remains active at high temperature

Q150.

In Fig.5.20, we can observe the categories of small molecular weight organic compounds in living tissues. Identify the category shown and the one blank component X in it.

(a) Cholesterol — Guanin

(b) Amino acid — NH_2

(c) Nucleotide — Adenine

(d) Nucleoside — Uracil

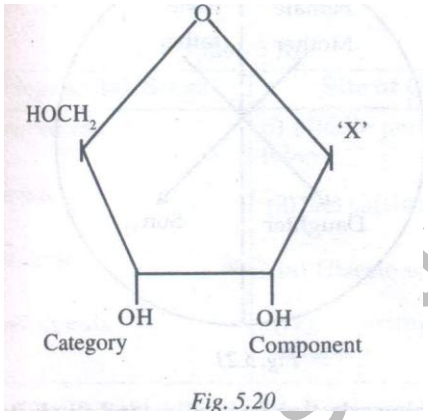


Fig. 5.20

Q151.

If one stand of DNA has the nitrogenous base sequence as ATCTG, what would be the complementary RNA strand sequence?

(a) TTAGU

(b) UAGAC

(c) AACTG

(d) ATCGU

Q152.

The following are the features of sex-linked inheritance:

(a) A majority of sex-linked traits is recessive

(b) Females act as carreiers of sex- linked disorders

(c) Mother passes the alleles of a sex- linked trait to her sons and daughters

(d) All of these

Q153.

Which one of the following is not a stage of crossing over mechanism?

(a) Synapsis

(b) Crossing Over

(c) Tetrad stage

(d) Double Crossing Over

Q154.

Gene regulation has the following advantages:

(a) It enables the cell to adjust metabolism as per the needs of environmental alterations

(b) It ensures smooth completeion of chain reactions

(c) It synthesizes enzymes only when it is needed

(d) All of these

Q155.

F_2 generation in a Mendelian cross showed that both genotypic and phenotypic ratios are same as 1:2:1. It represents a case of

(a) co- dominance

(b) di-hybrid cross

(c) monohybrid cross

(d)monohybrid cross with incomplete dominance

Q156.

The goals of the Human Genome Project are as follows:

(a) To determine the sequence and number of all base pairs in the human genome

(b) To identify all genomes ion the human genome

(c) To identify the genes that cause genetic disorders

(d) All of these.

Q157.

The number of gens that are causing health hazards among humans are nearly:

(a) 30,000

(b) 3,000

(c) 1,200

(d) 300

Q158.

Which one of the following is an example of carrying out biological control of pests/diseases using microbes?

(a) Trichoderma sp. Against certain white plant pathogens

(b) Nucleopolyhedrovirus against white rust in brassica

(c) BT – cotton to increases cotton yield

(d) Lady bird beetle against aphids in mustard

Q159.

What is the basic operation of DNA fingerprinting?

(a) Identifying of killer genes

(b) Identification of healthy genes

(c) Identification of nucleotide sequences

(d) Suppression of genomic DNA sequence

Q160.

Nearly 90 percent of protoplasm is made from the following:

(a) C, H, O, N

(b) H,O, Ca, Fe

(c) O, Fe, Mn, Zn

(d) Fe, O, H, Ca

Q161.

Read the following four statements carefully.

I. In transcription, adenosine pairs with urecil

II. Regulation of lac operon by repressor is referred to as positive Regulations

III. The human genome has approximately 50,000 genes

IV. Haemophilia is a sex-linked recessive disease

How many of the aforementioned statements are true?

(a) Two

(b) Three

(c) Four

(d) One

Q162.

Human hormones are produced by:

(a) hypothalamus

(b) ductless glands

(c) thyroid only

(d) pancreas only

Q163.

The rate of formation of new organic matter by rabbit in a grassland, is called:

(a) Net productivity

(b) Secondary Productivity

(c) Net Primary Productivity

(d) Gross Primary productivity

Q164.

Biolistics (popularly known as Gene Gun) is apt for:

(a) disarming pathogen vectors

(b) transformation of plant cells

(c) Constructing recombinant DNA by joining with vectors

(d) DNA fingerprinting

Q165.

In genetic engineering antibiotics are used:

(a) as selectable markers

(b) to select healthy vectors

(c) as sequences form where replication starts

(d) for keeping cultures free of infection

Q166.

What is concept of Neo Lamarckism?

(a) Environment can change the heredity of an organism

(b) At least some of the variations acquired by an individual can be passed on to offspring

(c) Internal vital force does not play any role in evolution

(d) All of these

Q167.

Which one of the following is not a tenet of the Mutation Theory?

(a) the accumulation of variations produces a new species. Sometimes, a single species is produced from a single mutation

(b) Mutations become operational all of a sudden

(c) No mutation is inheritable

(d) Evolution is a jerky and discontinues procedure

Q168.

What is hybrid sterility?

(a) Hybrids may be sterile

(b) Hybrids may be virile under some conditions

(c) The offspring of hybrids may not produce offspring further

(d) None of these

Q169.

What forms the basis of DNA finger printing?

(a) The relative proportiona of purines and pyrimidines in

(b) The relative difference in the DNA occurrence in blood, skin and saliva

(c) The relative amount of DNA in the ridges and grooves of the fingerprints

(d) Satellite DNA occurring as highly repeated short DNA segments

Q170.

Fig.5.21 is the inheritance pattern a certain type of trains in human beings. Which one of the following conditions is an example of this pattern?

(a) Phenylketonuria

(b) Sickle cell anaemia

(c) Haemophilia

(d) Thalassemia

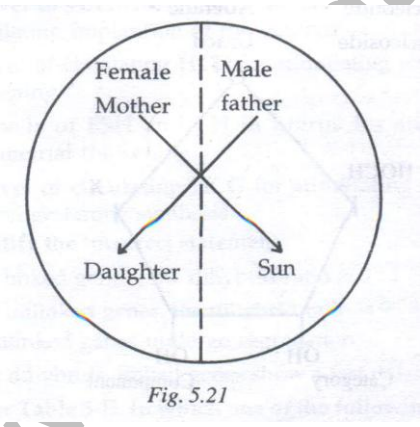


Fig. 5.21

Q171.

Stabilising selection favours_____ and eliminates_____.

(a) Averge-sized individuals; small-sized individuals

(b) Small-sized individuals; Average-sized individuals

(c) Small-sized individuals; some individuals

(d) None of these

Q172.

Transient polymorphism occurs when there are:

(a) difference morphs in a population

(b) same morphs in a population

(c) different morphs in a population undergoing a strong selection pressure

(d) None of these

Q173.

Identify the human developmental stage shown in Fig8.24 and the related right place of its occurrence in a normal pregnant woman in Table 5-III given below Fig. 5.2. Select the right option for the picture and its correct tabular description.

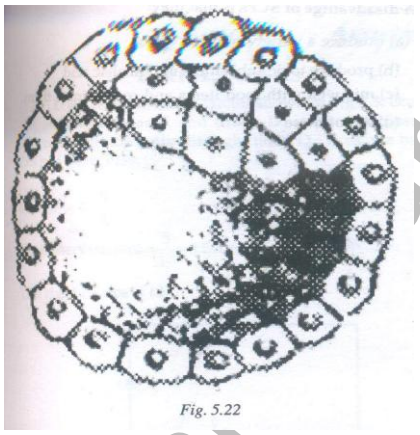


Fig. 5.22

TABLE 5-III

Developmental Stage	Site of Occurrence
(a) Late morula	(i) Middle part of fallopian tube
(b) Blastula	(ii) End part of fallopian tube
(c) Blastocyst	(iii) Uterine well
(d) 8-cell morula	(iv) Starting point of fallopian

Q174.

In table 5-V, identify the likely organisms (I), (II) (III) and (IV) in the food web shown in Fig.5.23. Table 5-IV has only right option corresponding to Fig.5.23.

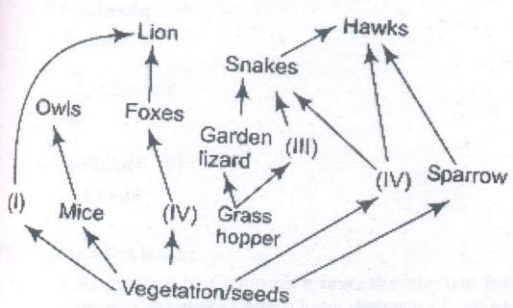


Fig. 5.23

Table 5-V

	(I)	(II)	(III)	(IV)
(a)	Deer	Rabbit	Frog	Rat
(b)	Dog	Squirrel	Bat	Deer
(c)	Rat	Dog	Tortoise	Crow
(d)	squirrel	Cat	rat	Pigeon

Q175.

Which of the following is a correct match?

(a) Cortisone: Rhumatoid arthritis

(b) Prednisolone: Anti-inflammatory drug

(c) Oestrogen: Antihistamine

(d) Salmeterol and Fluticasone propionate: Asthma attack

Q176.

Restriction enzymes are of three types. They are:

(a) Nucleases, endonucleases, restriction nucleases

(b)exonucleases, nucleases, beta nucleases

(c) alpha nucleases, endonucleases, restriction nucleases

(d) exonucleases, endonucleases, restriction nucleases

Q177.

The main source of Vitamin B_{12} is the:

(a) prostrate gland

(b) kidney

(c) stomach wall

(d) liver

Q178.

Which one of the following is not a bio-weapon?

(a) B. anthracis

(b) Shigella spp.

(c) V.cholera

(d) Rhizobium

Q179.

Fig.5.24 is a sectional view of the female reproductive system of humans. Which one set made from the six parts (designated from A to Fin Fig. 5.24) has been correctly identified?

(a) C- Infundibulum, D- Fimbriae, E-Cervix

(b) D-Oviducal funnel, E-Uterus, F-Cervix

(c) A-Perimetrium, B-Myometrium, C-Fallopain tube

(d) B-Endometrium, C-Infundibulum, D-Fimbriae

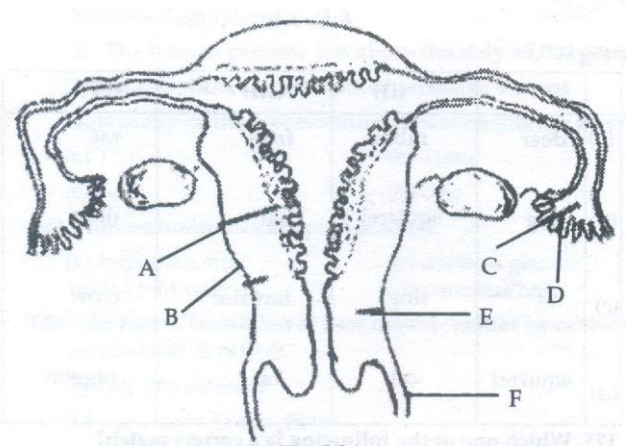


Fig. 5.24

Q180.

A disadvantage of SCPs is that they:

(a) produce a variety of bakery food

(b) produce toxic substances and nucleic acid

(c) mix well with food items and contaminate them

(d) All of these

ANSWERS WITH EXPLANATIONS

PART A: PHYSICS

Sol.1 (d)

Look at the modified circuit shown in Fig.5.5. Diode D_1 is forward biased and diode D_2 is reverse biased. Current will flow only through diode D_1. Thus, we have (as per Ohm's law):

Current = I= $\frac{V}{R}$ So, Battery current = $\frac{5}{10}$=0.5 A

The right choice is (d).

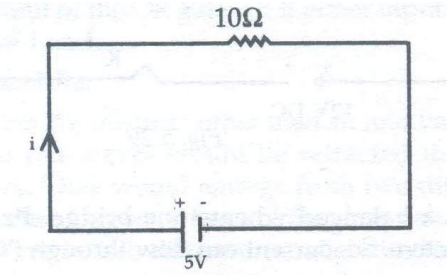


Fig. 5.25

Sol. 2 (a)

Torque = τ = pEsin**θ**.look at Fig. 5.26.

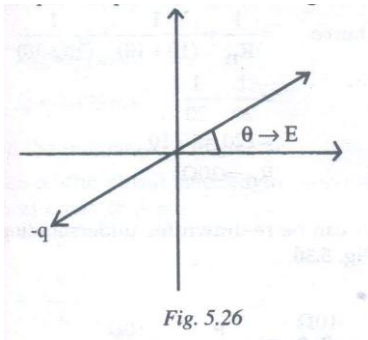


Fig. 5.26

P.E of dipole

$V = -\int \tau \, d\theta$

$=\int_{\frac{\pi}{2}}^{0} pEsin\theta d\theta = -pE[cos\theta - 0]$

$-pEcos\theta$

The right choice is (a).

Sol.3 (c)

According to Coulomb's law,the electric force between two charges q1 and q2 at a distance r from each other is given by the following relationship:

$Fe = \frac{q1}{4\pi\varepsilon_0 r^2}$ ..... (i)

Let two parallel current elements dI_1 and dI_2 carry parallel currents I_1 and I_2, respectively. They are at a distance of r from each other. Magnitude of magnetic forces between dI_1 and $dI_{2=}$ $F_m \Rightarrow Fm\frac{\mu_0}{4\pi} \times I_1 I_2 \times \frac{dI_1 dI_2}{r^2}$ Let q_1 be the total charge on element dI_1 and let v_1 be the drift velocity of free electrons. Similarly, let q_2 be the total charge on element $dI_2$and let v_2 be the drift velocity of free electrons. Thus, we have:

$\Rightarrow I_1 dI_1 = q1v1$ And $I_2 dI_2 = q2v2 \Rightarrow Fm = \frac{\mu_0}{4\pi} \times I_1 I_2 \times \frac{dI_1 dI_2}{r^2} = \frac{\mu_0 \times (q1q2) \times (v1v2)}{4\pi r^2}$ .....(ii)

Dividing eq. (ii) by Eqn.(i), we get: $\frac{Fm}{Fe} = v1v2(\mu_0\varepsilon_0)$ .....(iii)

$\mu_0\varepsilon_0$ must be the dimensions of $(\text{Velocity})^{-2}$

$\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ =C, Where, c = velocity of light = $3 \times 10^{+8}$ m $-s^{-1}$

So, $\Rightarrow \mu_0\varepsilon_0 = c^{-2}$

$\frac{1}{c^2} = \frac{1}{(3\times10^8)^2}$

$\frac{1}{9} \times 10^{-16}$m - sec^{-2}

The electron drift velocities, i.e., v1 and v2 are nearly 10^{-5} m-sec^{-1} each.

Hence, Fm<<Fe This means that magnetic forces are very small in comparison with electrostatic forces.

Rewrite Eqn (iii):

$\frac{Fm}{Fe}$= $(v_1V_2)\times(\mu_0\varepsilon_0)$ ..... (iii)

When drift velocities are comparable with the speed of light, the magnetic and electric forces are comparable. That is because the product (V_1 V_2) is nearly equal to $10^{-5}\times10^{-5} = 10^{-10}$ m-s^{-1}. The value of

$\mu_0\varepsilon_0 = c^{-2} = \frac{1}{9} = 10^{-16}$

Both value are comparable.

Hence, F_m and F_e are comparable when drift velocities approach the speed of light.

The right choice is (c).

Sol.4 (d)

The angle of dip is the angle which the axis of a magnetic needle makes with the horizontal at a place.

At the magnetic pole, its value is 90^0 at the magnetic equator, its value is 0^0.

The right choice is (d)

Sol. 5 (b)

a pure sine-wave inverter produces AC sinusoidal output by taking DC input. Look at Fig.5.27.

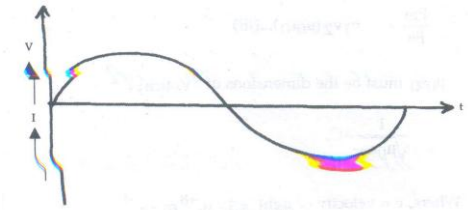


Fig. 5.27

A square-wave inverter produces a square wave output by taking input. Look at Fig.5.28.

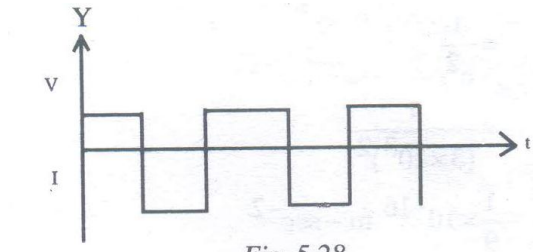


Fig. 5.28

It is true that DC energy converted into AC in case of square-wave inverter is also less as compared to the DC energy converted into AC in the case of a sinusoidal inverter. However, the more peculiar nuisance was the noise factor in square-wave generation.

Households were bothered more by the noise of square- wave output than by the poor conversion efficiency.

So, the pure sine-wave inverter replaced the square –wave inverter.

We may be tempted to pick choice (c) but here choice (b) is more accurate.

The right choice is (b)

Sol.6 (d)

Let us redraw the circuit. Look at Fig. 5.29.

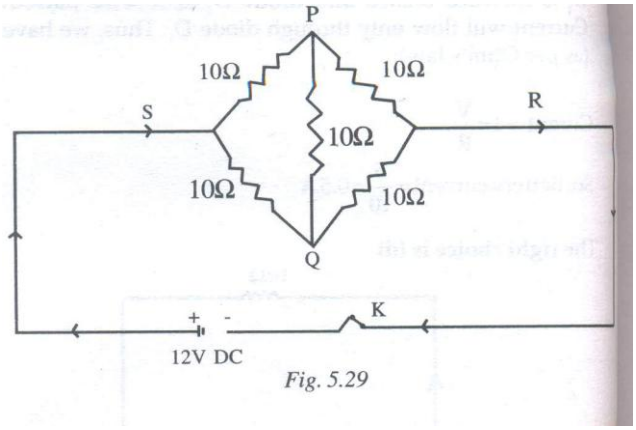


Fig. 5.29

It is a balanced wheat stone bridge. Its arm PQ is not effective. So, current can flow through PQ.

So, SP/PR=SQ/QR=1

Net resis tan ce$= \frac{1}{R_n} = \frac{1}{(10+10)} + \frac{1}{(10+10)}$

$= \frac{1}{20} + \frac{1}{20}$

$= 220 = 1/10$

$\Rightarrow R_n = 10\Omega$

The circuit can be re-drawn for understanding purpose. Look at Fig. 5.30.

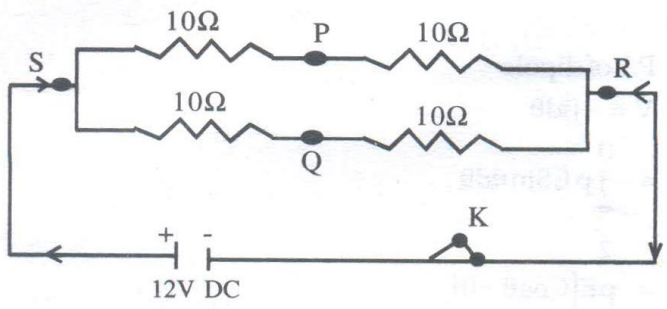


Fig 5.30

According to Ohm's law, we have V =IR So, I = current = V/R

$=\frac{12}{10}$ =1.2 A

The right choice is (d).

Sol.7 (a)

The truth table of OR Gate has been shown in Table. Its Boolean expression is as follows:

A + B =Y

Table 5- V: Truth Table of OR Gate

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

Hence, the output of the OR gate is 1 if either input is 1 or both inputs are 1 each.

The right choice is (a)

Sol.8 (b)

A glass slab is a medium other than air and vacuum. So, green and red waves would be refracted through different angles. They would emerge from two different points on the other (opposite) force of the glass slab. Then, they would move in two different parallel directions.

The right choice is (b).

Sol.9 (d)

Full-scale deflection current

$= ig = \frac{25}{G} mV$

$\Rightarrow ig \times G = 25mV$

Here, G is the resistance of the meter.

The value of the shunt needed to convert it into an ammeter of range 25 A is:

S $= \frac{i_g G}{i - i_g}$

$\Rightarrow$ S $\frac{25mV}{25A}$

$= \frac{25^{-}10^{-3}V}{25A}$

$=10^{-3}$

$= \frac{1}{1000} = 0.001\ \Omega$ **Thus, the right option is (d).**

Sol.10 (d)

(i)for mixture Cosmo-1

$40g \xrightarrow{20S\quad T_{1/2}} 20g \xrightarrow{20S\quad T_{1/2}} 10g$

(ii)For mixture Cosmo -2

$160g \xrightarrow{10S\quad T_{1/2}} 80g \xrightarrow{10S\quad T_{1/2}} 40g$

$\xrightarrow{10S\quad T_{1/2}} 20g \xrightarrow{10S\quad T_{1/2}} 10g$

Thus, after 40 seconds, the quantities of Cosmo-1 and Cosmo-2 would remain the same. That is because the quantity of Cosmo -2 Cosmo-1 in the beginning of the decay reaction.

The right choice is (d).

Sol.11 (a)

Look at Fig. 5.31. The potential at the centre of the square is zero. Thus, we have:

$V_1 + V_2 + V_3 + V_4 = 0$

$-\frac{kQ}{r} - \frac{kq}{r} + \frac{k2Q}{r} + \frac{k2q}{r} = 0\backslash$

$-Q - q + 2q + 2Q = 0$

$Q = -q$

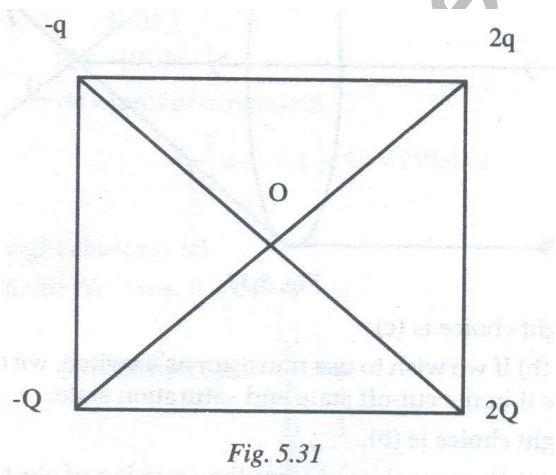


Fig. 5.31

The right choice is (a).

Sol.12 (c)

Frequency $v = \frac{eB}{2\pi m}$

$KE = \frac{1}{2}mv^2$ and radius $= R = \frac{mv}{eB}$

Here, velocity = $v = \frac{\pi R}{T/2} = \frac{2\pi R}{T} = 2\pi v$

∴ Radius =R= $\frac{m(2\pi Rv)}{e}$

Kinetic Energy = $\frac{1}{2}m(2\pi Rv)^2 = 2m\pi^2 v^2 R^2$

The right choice is (c).

Sol. 13 (a)

Look at Fig. 5.32.

If the angle is too small, we have

$\mu = \frac{\sin i}{\sin r}$

$\mu = \frac{\sin i}{\sin A}$

$\mu = \frac{i}{A}$

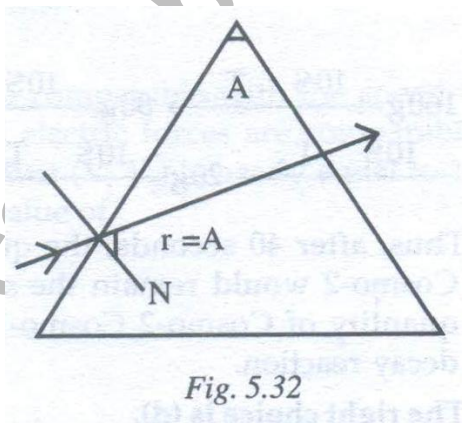


Fig. 5.32

The right choice is (a)

Sol. 14 (c)

Refer Fig 5.33.

d = $2f_1 + f_2$

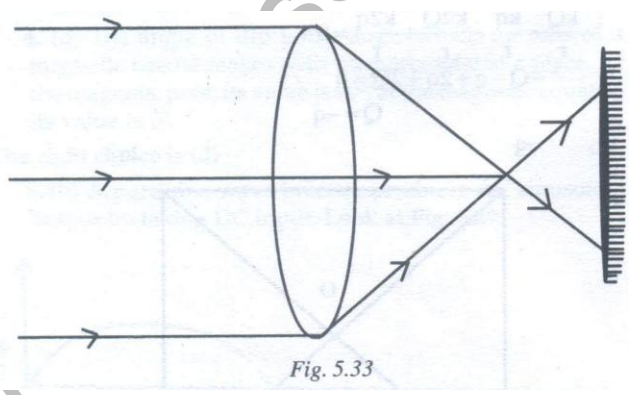


Fig. 5.33

The right choice is (c).

Sol. 15 (b)

If we wish to use transistor as a switch,we ought to use it in the cut- off state and saturation state.

The right choice is (b).

Sol. 16 (c)

Energy released from the emission of electron = E

E= (-3.4)-(-13.6) = 10.2 eV = 10.2 eV

From photo electric equation. Work function $\Phi = E - eV = hv$

$v = \frac{E-eV}{h} = \frac{(10.2-3.57)_e}{6.67\times10^{-34}}$

$v = \frac{6.63\times1.6\times10^{-19}}{6.67\times10^{-34}} = 1.6 \times 10^{15}$

The right choice is (c).

Sol.17 (b)

Charge enclosed = q/8

Therefore, flux $\Phi = \frac{qenclosed}{\varepsilon_0}$

$\Phi = \frac{q}{8\varepsilon_0}$

The right choice is (b).

Sol.18 (d)

Let the focal length of the objective be = f_1 Let the focal length of the eye piece be =f_2

We have been given that:

Also, $f_1 + f_2 = 20$

So, $f_1 = 9f_2$

So, $9f_2 + f_2 = 20$

So, $f_2 = 2$ cm

$f_1 = 9f_2$

so, $f_1 = 9\times2=18$ cm.

The right option is (d).

Sol.19 (d)

Here, $R_1 + R_2 = 12\Omega$

And $\frac{R_1 \times R_2}{R_1 + R_2} = \frac{8}{3}\Omega$

$\Rightarrow R_1 R_2 = 32\Omega$

We get R_1 =8 and R_2 =4

Again, $R_1 = \frac{121_1}{1_1 + 1_2}$

And $R_2 = \frac{121_2}{1_1 + 1_2}$

The right choice is (d).

Sol. 20 (c)

Energy density for a parallel plate capacitor $= \frac{1}{2}\varepsilon_0 E^2$ and volume = Ad

Total Energy = Energy Density × Volume

$= \left(\frac{1}{2}\varepsilon_0 E^2\right) \times (Ad)$

$= \frac{1}{2}\varepsilon_0 E^2 Ad$

Here, the right option is (a).

Sol.21 (b)

Here, $R_1 = R$ =?

$R_2 = 5\Omega, V = 10V$

And P=30W

Hence $P = \frac{V^2}{R_1} + \frac{V^2}{R_2}$

$\frac{10^2}{R} = 30 - \frac{10^2}{5}$

$\frac{100}{R} = 30 - 20$

$R = 10\Omega$

Thus, the right choice is (b).

Sol.22

Here, $E = 1(R + r) \Rightarrow E = IR + Ir$

And $E = V + Ir \;\; E = V + \frac{Er}{R+r} V = E - \frac{E}{R+r} \times r \;\; y = c - \frac{1}{x}$

The curve in option (c) represents this equations

Thus, the right choice is (c).

Sol.23 (b)

In this case, work Done

$W = MB(\cos\theta_1 - \cos\theta_2) = MB(\cos 0^0 - \cos 60^0) = MB\left(1 - \frac{1}{2}\right) = \frac{MB}{2}$

$MB = 2\sqrt{3J}$ (∵ given W = √3J)

$\tau = MB \sin 60^0 = \left(2\sqrt{3}\right)\left(\frac{\sqrt{3}}{2}\right)J = 3J$

The right option is (b).

Sol.24 (d)

Given equations are

$i = \frac{1}{\sqrt{2}}\sin(100\pi t)$

And $e = \frac{1}{\sqrt{2}\sin\left(100\pi t + \frac{\pi}{3}\right)}$

$\therefore i_0 = \frac{1}{\sqrt{2}} \text{and} V_0 = \frac{1}{\sqrt{2}}$

Average power is given by:

$P_{av} = V_{rms} \times i_{rms} \cos\Phi$

$= \frac{1}{2} \times \frac{1}{2} \times \cos 60^0$

$\because [i_{rms} = \frac{i_0}{\sqrt{2}} and\ V_{rms} = \frac{V_0}{\sqrt{2}}]$

$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\ \frac{1}{8} W$

The right option is (d).

Sol.25 (c)

$I = \left[\frac{1}{R}\frac{d\Phi}{dt}\right]$

$|d\Phi| = |IRdt|$

dΦ = (area of triangle)×R

$=\left(\frac{1}{2} \times 4 \times 0.1\right) \times 10 = 2Weber$

The right choice is (c).

Sol.26 (b)

We have: E=cB

So required ratio $\frac{E}{B} = c$

$\frac{E}{B} = \frac{1}{c}$

Therefore, the ratio of amptitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to reciprocal of speed of light.

Thus, the right choice is (b).

Sol. 27 (b)

Refer Fig. 5.34

$\mu = \frac{\sin(\frac{A+\delta m}{2})}{\sin A/2}$

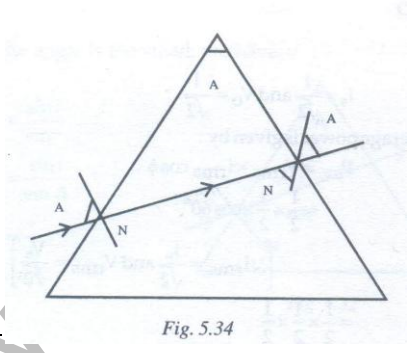


Fig. 5.34

$= \frac{\sin(\frac{A+A}{2})}{\sin A/2}$

The value of A can be 90 degrees maximum; its minimum value is 0 degrees. The value would vary between $\mu_{min} = \sqrt{2}$ and $\mu_{max} = 2$.

The right option is (b).

Sol.28 (a)

We have

$$\frac{1}{2}mv^2max = E - \Phi$$

Case (i) here case (i)

$$\frac{1}{2}mv_{1max}^2 = (1 - 0.5)eV$$

$$\frac{1}{2}mv_{2_m}^2 = (2.5 - 0.5)eV$$

Case (ii)

Hence, $\frac{v_{1max}^2}{v_2^2 max} = \frac{1}{4}$

$$\frac{v_{1max}}{v_{2max}} = \frac{1}{2}$$

The right option is (a).

Sol.29 (b)

Active fraction at instant t_2

$$\frac{1}{2^{t2}/T1/2} = \frac{1}{3}$$

Active fraction at instant t_1

$$\frac{1}{2^{t1}/T1/2} = \frac{2}{3}$$

$$\frac{2^{t_2}/t_1\ /2}{2^{t_2}/t_1\ /2} = 2$$

$$\frac{t_2}{2_{1/2}^T = 2^1}$$

$$\Rightarrow \frac{t_2 - t_1}{T_{\frac{1}{2}}} = 1$$

$\Rightarrow t_2 - t_1 = T_{1/2} = 50$days

The right option is (b).

Sol.30 (b)

$$V_g = \beta \frac{R_L}{R_i}$$

$$V_g = \frac{\Delta I_c}{\Delta I_B} \times \frac{R_L}{R_i}$$

$$= \frac{2 \times 10^{-3}}{40 + 10^{-6}} \times \frac{4 \times 10^3}{100}$$

= 2000

The right choice is (a).

Sol.31 (b)

Refer Table again. Now, refer to given ahead.

$Y = (A + B) - C$

Table-5-VI

A	B	C	Y=(A+B).C
0	0	0	0
1	0	0	0
0	1	0	0
0	1	0	0
0	1	1	1
1	0	1	1
1	1	1	1

C shoud be 1. Either A or B or A and B taken together must be 1. The right combination is A=1, B=0, C=1.

Thus, the right choice is (b).

Sol.32(c)

The gates shown are:

(i)OR

(ii) AND gate

(iii) NOT gate and

(iv) NAND gate

The right option is (c).

Sol.33 (a)

Momentum of a photon

$$p = \frac{hv}{c}$$

Hence, Recoil energy

$$E = \frac{p^2}{2M}$$

$$\therefore E = \frac{\left(\frac{hv}{c}\right)^2}{2M}$$

Or $E = \frac{h^2v^2}{2Mc^2}$

The right option is (a).

Sol.34 (a)

We know that the half-life of Cosomo-1 is 50 years and it decays into Cosmo-2

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{t/\,t_1\,/\,2}$$

$$\frac{1}{16} = \left(\frac{1}{2}\right)^{t/50}$$

t = 4 ×50

t = 200 years

The right choice is (a).

sol. 35 (c)

The energy stored in the condenser

$$U = \frac{1}{2}CV^2$$

$$U = \frac{1}{2}\left(\frac{A\varepsilon_0}{d}\right)(Ed)^2 \qquad \left(\because C = \frac{A\varepsilon_0}{d}\ and\ V = Ed\right)$$

$$U = \frac{1}{2}\varepsilon_0 E^2 Ad$$

The right choice is(c).

Sol.36.(c)

Electric power, $p=i^{2R}$

∴ Current, $I=\sqrt{\frac{P}{R}}$

For a resis tan ce of 9Ω we have

$$I_1 = \sqrt{\frac{36}{6}} = \sqrt{4} = 2A$$

$$I_2 = \frac{I_1 \times R}{6} = \frac{2 \times 9}{6} 3A$$

$$I - I_1 + I_2 = 2 + 3 = 5A$$

$$V_2 = IR_2 = 5 \times 2 = 10V$$

The right choice is (b)

Sol.37 (a)

Current $I= \frac{E}{R+r}$

Case (i) $2=\frac{E}{2+r}$

Case (ii) $0.5 =\frac{E}{9+r}$…. (ii)

From eqn. (i) and Eqn. (ii), we have

$$\frac{2}{0.5} = \frac{9+r}{2+r}$$

$$4 = \frac{9+r}{2+r}$$

3r = 1

$$r = \frac{1}{3}\Omega$$

The right choice is (a).

Sol. 38 (b)

According to leng's law, the direction of induced emf is such that it opposes the cause that produces it. This is the basic tenet of electromagnetic induction. The right choice is (b).

Sol.40(c)

By the concept of threshold minimum frequency needed for photoelectric emission.

$$\frac{1}{2}mv^2 = h(v - v_0)$$

$$v \leq V_0$$

The right choice is (c)

Sol.41 (c)

Given, e =200√2 sin 100t

$$C = 1\mu F$$

$$E_{rmf} = 200V$$

$$X_c = \frac{1}{\omega C} = \frac{1}{1 \times 10^{-6} \times 100} = 10^4 \Omega$$

$$i_{rms} = \frac{E_{rms}}{X_c}$$

$$i_{rms} = \frac{200}{X_c}$$

$$i_{rms} = \frac{200}{10^4} = 2 \times 10^{-2} A = 20mA$$

The right choice is (c).

Sol. 42 (b)

In general we have assumed that μ=1.5

So, f=20cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{20} = \frac{1}{v} + \frac{1}{30}$$

$$\frac{1}{v} = \frac{1}{20} - \frac{1}{30} = \frac{10}{600}\ v = 60cm$$

$$\frac{h_i}{h_0} = 2$$

$h_i = 2 \times |h_0|$ $h_i = 4\ cm$ **The right choice is (b).**

Sol.43 (d)

We know that:

$e = -L\frac{dt}{dt}$

During 0 to $\frac{T}{4}$, $\frac{di}{dt} = constan\ t$

So, e= negative

For $\frac{T}{4}\ to\frac{T}{2}, \frac{di}{dt} = 0$

e=0

For $\frac{T}{2}\ to\frac{3T}{4}, \frac{di}{dt} = constan\ t$

e = positive

the curve in option (d) apply shows these conditions.

The right choice is (d).

Sol. 44(a)

$tan\ \Phi = \frac{X_L}{RR} =$Lω

$\tan\Phi = \frac{3\Omega}{3\Omega}$

$\tan\Phi = 1$

$\Phi = \tan^{-1}(1)$

$\Phi = 45^0 \Rightarrow \quad \Phi = \frac{\pi}{4}$rad

The right choice is (a).

Sol. 45(d)

Decreasing order of wavelength of various rays Microwave > Infrared > Ultraviolet > Gamma

The right choice is (d).

PART B: CHEMISTRY

Sol.46 (a)

When benzaldehyde is treated with 50percent alkali, it undergoes oxidation to give an acid salt as wall as well as reduction to give an alcohol. This reaction is called **Cannizzaro'sReaction .**

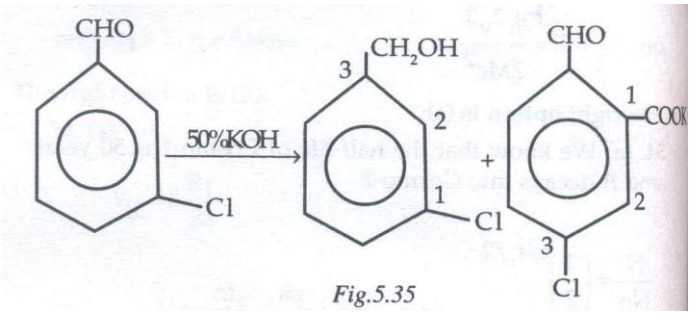


Fig.5.35

The right option is (a).

Sol. 47 (d)

When carbonyl compounds are treated with alcohol, they form hemiacetal (hemiketal and acetal/ketal). Refer Fig5.36.

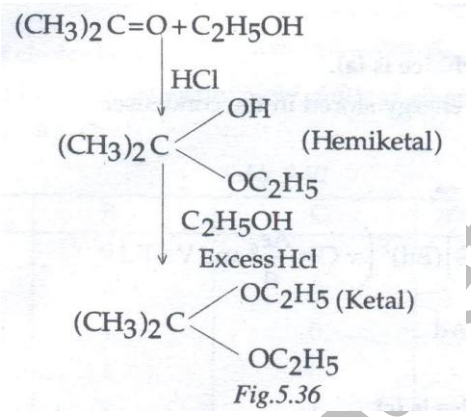


Fig.5.36

When this product is treated with ethyl alcohol in the presence of excess HCl (both being catalysts), the product so formed is $(CH_3)_2$ C $(OC_2H_5)_2$. The formation of hemiketal is a nuclephilicadition reaction.

The right option is (d).

Sol.48 (a)

For the FCC lattice, we have $4r = \sqrt{2a}$ $r = \frac{\sqrt{2}}{4}a = \frac{a}{2\sqrt{2}} = \frac{408}{2\sqrt{2}}$ = 144pm

Diameterd = 2r=2×144 pm =288pm

The right option is (a).

Sol.49 (d)

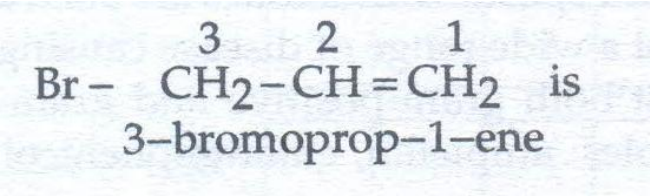
Condensation polymers are obtained by bifunctional molecules (monomers) with the elimination of smaller molecules whereas additional polymers are obtained from multiple bond containing monomers. Neoprene is a polymer of chloroprene

(CH_2=C (Cl)−CH=CH_2). So, it an addition polymer, not a condensation polymer.

The right option is (d).

Sol.50 (a)

In IUPAC system of nomenclature, halogen substituent, so the correct name of:



IUPAC Name: 3-bromo prop-1-ene.In the question given to us,it is 3-bromo prop-2-ene (which is incorrect). **Thus, the right option is (a).**

Sol. 51 (a)

Number of octahedral voids = number of atoms in the closely packed structure. Since, number of atoms = 1 So, number of octahedral voids = 1

Thus, the right option is (a).

Sol.52 (c)

Photochemical smog is formed in warm and sunny climates during day time due to the action of sunlight on primary pollutants. It contains nitrogen oxides, ozone, PAN, etc. they all are oxidizing agents. This causes irritation in eyes and throat.

Thus, the right option is (c).

Sol. 53 (b)

CH_3CHO and $C_6H_5CH_2CHO$ both being aliphatic aldehydes, they react with Tollen's reagents, Fehling solution and Benedict solution. So, these reagents cannot be used to distinguish these chemicals. CH_3CHO reacts with NaOH and I_2 to give yellow crystals of iodoform while $C_6H_5CH_2CHO$ does not react with it.

$CH_3CHO + 3I_2 + 4NaOH \rightarrow CHI_3 + HCOONA + 3NaI + 3H_2O$ $C_6H_5CH_2CHO + I_2 + NaOH \rightarrow$ Ni reaction Thus, CH_3CHO and $C_6H_5CH_2CHO$ can be distinguished with the help of the Iodoform Test.

Thus, the right option is (b).

Sol. 54 (b)

Lyophobic sols are unstable, so they are stabilized by adding some lyophilic colloides which protect them from precipitation. thus, lyophilic colloides which protect them from precipitation. Thus, lyophilic colloids are called **Protecting Colloids.** Their protecting power is expressed in terms of **Gold Number**. Lesser the Gold Number, the higher the protecting power will be.

The right option is (b).

Sol.55 (a)

Only those compounds exhibit optical isomerism which have chiral centre and / or absence of symmetry elements. (Chrial carbon is the carbon whose all the four valencies are satisfied by four different groups)Maleic acid does not exhibit optical isomerism.

The right option is (a).

Sol.56(b)

Nylon -66 is a fibre as the forces of attraction in it are due to H- bonding. It is not anelastomer. All other given statements are true. **The right option is (d).**

Sol.57 (d)

Acetaldehyde is the major culprit in hooch.

The right option is (d).

Sol.58 (c)

Refer Fig 5.37 and Fig. 5.38.

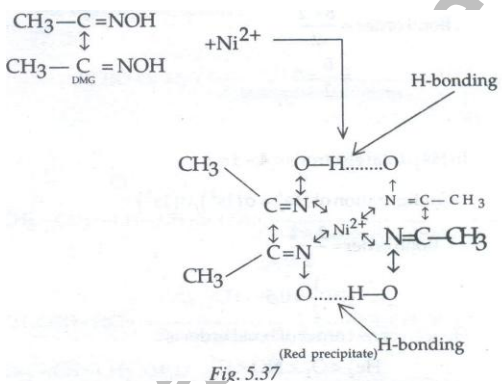


Fig. 5.37

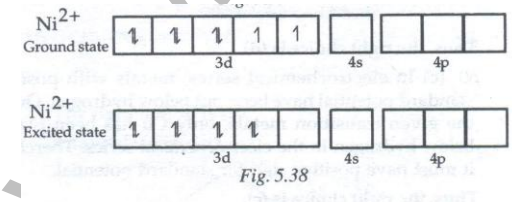


Fig. 5.38

$\Rightarrow$ $4sp^2$ hybridisation

The right option is (c).

Sol.59 (d)

Bond order= $\frac{N_b - N_a}{2}$

In NO, total electrons = 7+8=15

∴ Configuration of NO

KK, $\sigma(2s^2)$,$\sigma(2s^2)$, $\sigma(2p^2_z)$,$\pi(2p^2_x)$

= $\pi(2p^2_y)\pi(2p^1_x)$

∴ Bond order = $\frac{8-3}{2} = \frac{5}{2} = 2.5$

In O^-_2, total electrons =16 + 1=17

∴ Configuration of O^-_2

= KK, $\sigma(2s^2)$,$\sigma(2s^2)$, $\sigma(2p^2_z)$,$\pi(2p^2_x) \approx \pi(2p^2_y)\ \pi(2p^2_x)$

$\approx \pi(2p^1_y)$

∴ Bond order = $\frac{8-5}{2} = \frac{3}{2} = 1.5$

In C^{2-}_2, total electrons = 12+2=14

∴ Configuration of C^{2-}_2

KK, $\sigma(2s^2)$,$\sigma(2s^2)$, $\sigma(2p^2_z) \approx \pi(2p^2_x)$,$\pi(2p^2_y)$

∴ Bond order=$\frac{8-2}{2}$

In He^+_2, total electrons= 4-1=3

∴ Configuration of He^+_2 =$\sigma(1s^2)$,$\sigma(1s^2)$

∴ Bond order =$\frac{2-1}{2}$

$= \frac{1}{2} = 0.5$

Hence, correct order of bond orders is:

$He^+_2 < O^-_2 < NO < C^{2-}_2$

Thus, the right choice is (d).

Sol.60 (c)

In electrochemical series, metals with positive standard potential have been put below hydrogen. Out of given transition metals, only Cu has been placed below hydrogen in the electrochemical series. Therefore, it must have positive sign for standard potential.

Thus, the right choice is (c.)

Sol. 61 (c)

Transition metals show variable oxidation states due to which they can perform as catalysts.

E.g., $2SO_2 + O_2 \xrightarrow[catalyst]{V_2O_5} 2SO_3$

$SO_2 + \overset{+5}{V_2}O_5 \rightarrow SO_3 + \overset{+4}{V_2}O_4$

$\overset{+4}{V_2}O_4 + O_2 \rightarrow \overset{+5}{V_2}O_5$

Thus, the right choice is (c).

Sol. 62 (d)

(a) Antifertility drugs are used to control pregnancy. These drugs prevent conception or fertilization. Examples: Mifepristone, narethindrone, mestranol etc.
(b) Antihistamines are used for the relief of allergies. Examples: diphenlhydramine, chlorpheniramine, prometaxzine etc.
(c) Antiseptics are the used to reduce the number growth of microorganism e.g., dettol soap etc, whereas disinfectants kill bacteria and are for sterilization of inanimate objects like instruments utensils, cloths, floors etc. Examples: phenol, H2O2,So2, dettol, iodol, etc.
(d) Broad spectrum antibiotics are such antibiotics that acts against a wide range of disease causing bacteria. They act against both gram-positive and gram-negative bacteria. Examples: ampicllin, chloramphenicol etc.

The right choice is (d).

Sol. 63 (a)

In Rosenmund reaction, acid chloride reacts with H_2 in the presence of $Pd/BaSO_4$ to yield aldehyde (C_6H_5CHO).Refer Fig. 5.39

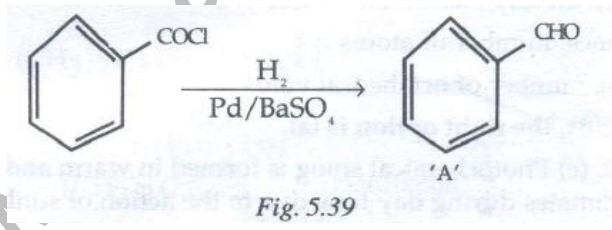


Fig. 5.39

The right option is (a).

Sol. 64 (b)

Biodegradable polymers have the tendency to break down and lose their initial integrity.

$H_2N - CH_2 - COOH + HNH(CH_2)_5COOH \; \Delta\downarrow - H_2O$

$[HN-CH_2-CO-NH-(CH_2)_5-CO]n$

Nylon-2-nylon-6

The right option is (b).

Sol. 65 (b)

$E_x^0 = -1.2V \; E_y^0 = +0.5V \; E_z^0 = -3.0V$

∴ Z > X > Y Higher the reduction potential, lesser the reducing power.

The right option is (b).

Sol.66 (c)

Aliminum hydroxide reacts with HCl present in stomach to make Aliminum chloride (salt) and water. Thus, as an antacid, it neutralizes the acid inside the stomach.

The right option is (a).

Sol.67 (c)

$\frac{x}{m} = p \times T$is the incorrect relationship. The correct relation is $\frac{x}{m} = \frac{p}{T}$.

The right option is (c).

Sol.68 (b)

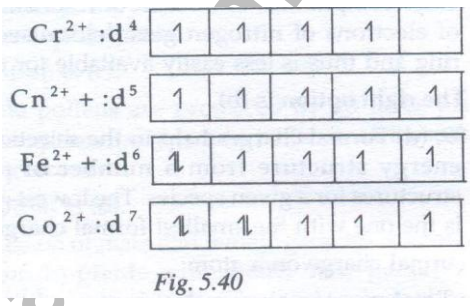


Fig. 5.40

Refer Fig. 5. 40.

∴ $[Co(H_2O_6)]^{2+}$ has minimum number of unpaired electrons and thus, minimum paramagnetic behavior.

The right option is (b).

Sol.70 (a)

Diphenylhydramine (Benadryl) is used as an antihistamine.

The right option is (a).

Sol. 71 (d)

C−H:0.109 nm

C = C: 0.134 nm

C – O: 0.143 nm

C – C: 0.154 nm

The correct bond length order is

C−H < C = C−O < C−C

The right option is (d).

Sol.72 (d)

Terylene is a polyesterbecause it is formed by the monomer units terephthalic acid and ethylene glyco.

The right option is (d).

Sol.73 (b)

The right option is (b).

Sol.74 (d)

The compound is 3 ethyl-3 propyl hex -1 –ene.

The right option is (d).

Sol.75 (d)

Reduction of nitrobenzene with Zn/NH_4Cl(neutral medium) gives Phenyl hydroxylamine. **Refer Fig. 5.41.**

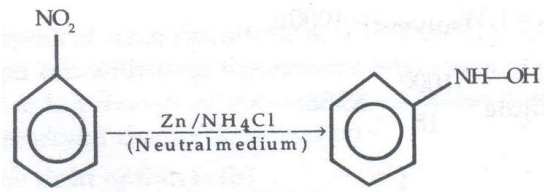


Fig. 5.41

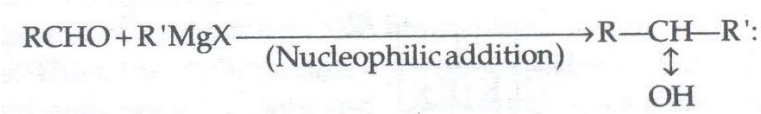
The right option is (d).

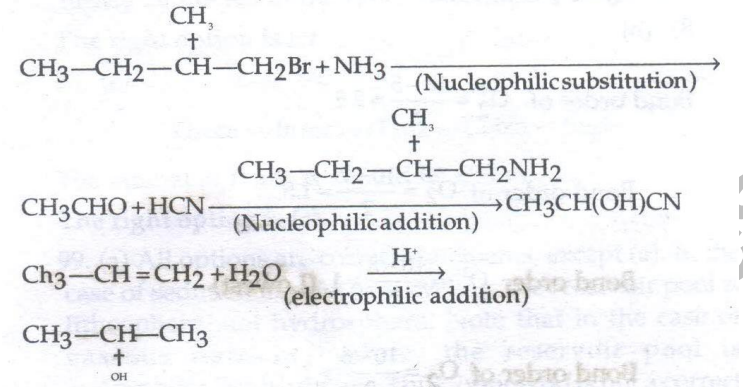
Sol.76 (b)

The complexes $[Co(NH_3)_6[Cr(CN)_6]$ and $[Cr(NH_3)_6[Co(CN)_6]$ are the examples of co-ordination isomerism. This isomerism occurs only in those complexes in which both cation and anion are complex. It occurs due to exchange of ligands between cation and anion.

The right option is (b).

Sol.77 (b)

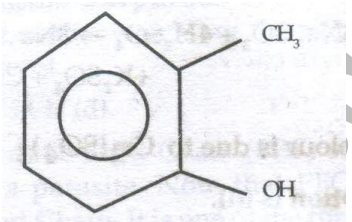




The right option is (b).

Sol.78 (a)

Refer Fig.5.42.



(o-cresol

Fig. 5.42

Due to +M effect of – OH group and hyperconjugation of $–Ch_3$ group, the benzene of o-cresol is a highly reactive ring towards electrophilic substitution.

The right option is (a).

Sol.79 (a)

1.00 molal aqueous solution = 1.0 mole in 1000 g water

n_{solute} =1; $W_{solvent}$ = 1000g.

$n_{solute} = \frac{1000}{18} = 55.56$

$x_{solute} = \frac{1}{1+55.56} = 0.0177$

The right option is (a).

Sol.80 (b)

$x_{solute} = \frac{1}{1+55.56} = 0.0177$

$$\frac{2NO(g)+O_2(g) \rightleftharpoons 2NO_2(g); K_2}{N_2(g)+2O_2(g) \rightleftharpoons 2NO_2(g); K = K_1 \times K_2} \quad \ldots (ii)$$

$\therefore$ For $No_2(g) \rightleftharpoons \frac{1}{2}N_2(g)+O_2(g);$

$K = \left[\frac{1}{K_1 K_2}\right]^{1/2}$

The right option is (b).

Sol.81 (b)

Bond order of $O_2^+ = \frac{10-5}{2} = 2.5$

Bond order of $O_2^- = \frac{10-7}{2} = 1.5$

Bond order $O_2^{2-} = \frac{10-8}{2} = 1$ (Lowest) Bond order of $O_2 = \frac{10-6}{2} = 2$

The right option is (b).

Sol. 82(d)

$k_2Cr_2O_7 + 3Na_2CO_3 + 4H_2SO_4 \rightarrow 3Na_2SO_4 + K_2SO_4 + Cr(SO_4)_3 + 4H_2O$ The green colour is due to $Cr_2(SO_4)_3$

The right option is (d).

Sol.83 (a)

$Ca(OCl)_2$ or calcium hypochlorite is the ative ingredient in bleaching powder which which releases chlorine.

The right option is (a).

Sol.84 (a)

Vitamins A, D and E are fat-soluble vitamins, whereas vitamins B-complex is a water-soluble vitamin.

The right option is (a).

Sol.85 (c)

During denaturation,secondary and tertiary structures of proteins are destroyed but the primary structure remains intact.

Heat, acid and alkali denature DNA molecule and double strand of DNA converts into single strand.

The right option is (c).

Sol.86 (a)

The structure is trans -2-chloro-3-iodo-2- protein. The right option is (a).

Sol.87 (d)

A-2, B-1, C-3, D-4

The right option is (d).

Sol.88 (b)

Compound shown in option (b) is most basic due to localised lone pair of electrons on nitrogen atom while in other compounds,

as a result of resonance, the lone pair of electrons of nitrogen gets delocalised over benzene ring and thus is less easily available for donation.

The right option is (b).

Sol.89 (d)

Formal charges help in the selection of the lowest energy structure form a number of possible lewis structures for a given species. The lowest energy structure is the one with the smallest formal chargeson atoms. Formal charge on a atom: = Total no. of valance electrons – non- bonding electrons - $\frac{1}{2}$ ×bonding electrons. For Lewis structure of SO_3**(refer Fig. 5.43)**, we have:

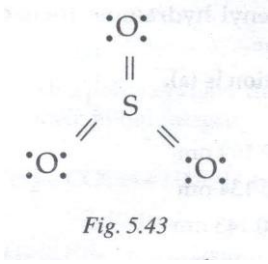


Fig. 5.43

Formal charge on S atom = $6 - 0 - \frac{1}{2} \times 12 = 0$

The right option is (d).

Sol. 90 (b)

(A) Plaster ofParis = $CaSO_4.\frac{1}{4}H_20$

(B) Epsomite = $MgSO_4.7H_2O$

(C) Kieserite = $MgSO_4H_2O$

(D) Gypsum = $CaSO_4.2H_2O$

The right option is (b).

PART C: BOTANY

Sol.91 (c)

It is believed that activity growing regions of plants (i.e., shoot apex and root apex) do not have viruses. Due to this big advantage, these regions are used in the production of virus free plants in through meristem culture technique.in meristem culture explants are taken from shott apex of shoot apical meristem. These explants more cytokinin than auxin containing more cytokininthanauxin hormone. Thus, meristem culture involves the development of an already existing shoot apical meristem and subsequently, the regeneration of adventitious root from the develop shoots.

The right option is (c).

Sol.92 (d)

Edible pollens are produced by all three plants mentioned in options (a),(b) and (c). Hence, all these three options are correct. **The right option is (d).**

Sol.93 (a)

The fusion of male and female gametes is known as **Fertilisation.** In plants with seeds, male gametes are bought to the egg having female gametophyte through a pollen tube. This process is called **Siphonogamy**. In this process, many pollen grains come to germinate over the stigma; their number is much larger than that of ovules. The pollen grain does not go down the stigma. Rather, its pollen tube goess down. This pollen tube eats up the solid part of the stigma and style. It does so by releasing pectinases and hydrolytic enzymes. The pollen tube travels intercellularly and chemotrophically along the concentration gradient of Ca-B- Inositol sugar complex. The concept of siphonogamy was put forth by Strasburger (1884).

The right option is (a).

Sol. 94 (a)

Autogamy involes pollination within the same flower, while geitonogamy involves transfer of pollen grains from the another of one flower to the stigma of another flower of the same plant. Both processes are prevented in papaya because it is a dioecious plant (i.e., male and female sex organs are born on separate plants) and it always needs cross- pollination.

The right option is (a).

Sol.95 (b)

Phosphorus cycle is a sedimentary biogeochemical cycle. It describes the movement of phosphorus through the lithosphere, hydrosphere and biosphere and the main reservoir pool is lithosphere. Atmosphere does not play any significant role in the movement of phosphorus because phosphorus and phosphorus based compounds are usually solids at the typical ranges of temperature and pressure found on Earth. The production of phosphine gas occurs only in specialized, local conditions.

The right option is (b).

Sol.96 (b)

Sporopolleninis a fatty substance present in the exine of pollen grains. It is resistant to microbial and chemical decomposition and microbial decomposition and can withstand the extreme environmental condition. Due to presence of sporopollenin, pollen grains are well preserved during fossilization.

The right option is (b).

Sol.97 (c)

There are natural exchanges between lithosphere and hydrosphere or atmosphere. These processes are painfully slow. The major exchange is through the carbon cycle in which producers absorb carbon and all living organisms release carbon dioxide into the atmosphere through respiration. The exchange of carbon dioxide is taking place incessantly between atmosphere and hydrosphere; in fact, oceans are acting as **Global Sinks,**for they helpin the absorption of carbon dioxide produced during the course of combustion. This cycling is self-regulated. However, deforestation and the combustion of fossil fuels have upset this self-regulated feedback system. These two activities are adding more than 6×10^{12} kilograms of carbon into the atmosphere on an annual basis. Thus, the carbon content of atmosphere is rising. It would melt polar ice caps and Alpine-region ice reserves. This can lead to a rise in the Mean Sea Level (MSL) by nearly 20 metres in the times to come.

The right option is (c).

Sol. 98 (c)

Green → Insect → Frog → Cobra → Eagle The animal at pint A should be Cobra.

The right option is (c).

Sol. 99 (a)

All option are correct statements, except (a). In the case of sedimentary nutrient cycling, the reservoir pool is lithosphere, not hydrosphere. Note that in the case of gaseous nutrient cycling, the reservoir pool is atmosphere/hydrosphere. Thus, option (a) is not a correct statement.

The right option is (a).

Sol.100 (d)

Monasuspurpureus is a yeast used in the production of statins which are the agents for lowering blood cholesterol. **The right option is (d).**

Sol. 101 (b)

A parasitic Food chain (PFC) starts with a host and ends in a parasite. Note that PFC is also termed **Auxiliary Food Chain.**It is one of the three food chains of the ecosystems, viz., **Detritus, parasitic** and **Grazing**. Refer **Fig5.44**

Producer → Parasite

Herbivore → Parasite

Carnivore → Parasite

Fig 5.44 Parasitic food chain in ecosystems

The right option is (b).

Sol.102 (d)

The Apocarpous condition arises when the number of carpels is two or more and they are free from each other. Examples: Clematis, Michelia (Magnoliaceae), Aconitum, Ranunculus (Buttercup). Etc.

The right option is (d).

Sol. 103 (d)

The vertical distribution of different species occupying different levels is called **Stratification.**Itrepresentsthestructuralunit of an ecosystem. For example, trees occupy top vertical strata or layer of a forest, shrubs the secons and herbs and grasses occupy the bottom layers.

The right option is (d).

Sol.104 (a)

Onion is a simple tunicated layered bulb while ginger is a straggling rhizome having uniparous cyme braching with sympodial axis.

The right option is (a).

Sol.105 (a)

Litter is mostly dried plant matter. Thus,option (a) is correct .all other options are incorrect. Detritus refers to the remains of plants and animals.it is not purely plant matter; so, option (b) is incorrect. Detritus is of two types – above ground and below ground; so, option (c) is incorrect. Litter is above the ground; so, option (d) is incorrect.

The right option is (a).

Sol.106 (c)

Several species of Glomus, including G. aggregatum, are cultured and sold as mycorrhizal inoculant for agricultural soils. Being endomycorrhize, it helps the plants in the absorption of nutrients especially phosphorus from soil.

The right option is (c).

Sol.107 (c)

Producers are at the first trophic level I the food chains of the world. They are autotrophic or photosynthetic organisms. They synthesise organic nutrients from inorganic raw material with the help of solar radiation to produce food (Carbohydrates) for themselves and heterotrophic organisms.

The right option is (c).

Sol.108(a)

Commellinabenghalensis or kankauoa bears aerial, chasmogamous (stigma and anthers exposed to pollinating agent). Insect- pollinated flowers and underground cleistogamous flowers are the bisexual flowers, which never open; they always remain closed. In such flowers, the anthers and stigma lie very close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma of the same flower i.e., autogamy occurs. So, these flowers produce assured see set, even in the absence of pollinators.

The right option is (a).

Sol. 109 (c)

Saccharomyces cerevisiae is known as baker's yeast and Saccharmyces ellipsoidens is called **Wine Yeast.**These are used in banking and brewing industries, respectively.

The right option is (c).

Sol.110 (b)

Anabaena azollae is a free-living nitrogen-fixing blue-green alga or cyanobacterium but it may also live symbiotically in the leaf cavities of Azalia, an aquatic, free floating, fresh water pteridophyte (fern). This cyanobactrium has nitrogenase enzyme. So, it can fix nitrogen. If this fern is grown in paddy (rice) fields, a remarkable 50 percent increase can be achieved in crop yield.

The right option is (b).

Sol.111 (b)

In monocot stem like Zea mays, vascular bundles are conjoint, collateral and closed.in vascular bundles, the lowermost protoxylem vessels and xylem paraenchyma cells dissolve forming a water containing schizolysigenous cavity called protoxylem cavity or lacuna or lysigenous cavity. Protoxylem cavity and protophleom may be absent in the smaller vascular bundles in maize.

The right option is (b).

Sol. 112 (a)

The coconut water obtained from the tender coconut is nothing but free nuclear endosperm (made up of thousands of nuclei) and the surrounding white kernel is the cellular endosperm.

The right option is (a).

Sol.113 (b)

Salvinia is a heterosporoues water fern. The microsporangia and megasporangia are borne within special reproductive structure called sporocarps. These are borneterminally in clusters on the segment of submerged leaves. Sporocarps are strictly monosporangiate. They bear either only microsporangia or megasporangia. Viroids are single stranded RNA molecules. The female reproductive organ is archegonia in gymnosperms.

The right option is (b).

Sol.114 (c)

A suspension culture comprises single cells and small groups of cells suspended in a liquid medium. Normally, the medium comprisesauxin2,4-D.the suspension culture must be regularly agitated at 100-250 RPM for getting best results. The rate of growth of suspension culture is higher than that of the callus culture.

The right option is (c).

Sol. 115 (d)

Sucrase is not used for plant tissue culture. Sucraseis not a hormone; it is a carbohydrate. All other options show the names of hormones that are used in plant tissue culture.

The right option is (d).

Sol.116 (c)

Cytokinins are popularly used in plant tissue culture. Their examples are – 6 benzylaminopurine,6-Dimethylallylaminpurine and Kinetin. ABA is Abcisic acid and it is a hormone used in plant tissue culture. putrescine is a polyamine and it is used in plant tissue culture.Indole-3-Butyric acid is an auxin; it is used in plant tissue culture.Among all options, there is only one cytokinin and it has been appended in option (c).

Thus, the right option is (c).

Sol. 117 (c)

Ethyl Methane sulpphonate (EMS) is a chemical mutagen. Sodium azide is also a chemical mutagen. Gamma rays are an example of physical mutagens. All of the options (a), (b) and (c) are not physical mutagens; only Gamma rays an example of the same.

The right option is (c).

Sol.118 (b)

During the course of tissue culture, somaclonal variation is observed. It is the genetic variation present plants that have been regenerated from a single culture. This variation has been employed a few good varieties of plants. These varieties have displayed features, viz.., resistance to diseases, stress tolerance, early maturation and better yield, better quality. Pollination, maturation and decay are not the apt terms in the paralance of tissue culture. Hence, they ought to be ruled out.

The right option is (b).

Sol. 119 (a)

Before pollination the protoplast of pollen grain divides into two unequal cells small generative cell and large tube. orvegeatlve cell. In some species the generative cell divides into two male gametes prior to dehiscence of pollen grain. Therefore, at the time of pollination, the pollen grain is either 2-called or 3—celled.

The right option is (a).

Sol. 120 (d)

The transfer of pollen grains from anther to stigma is called **Pollination.** Anemophily is a mode of pollination accomplished through wind while entomophily is the mode of pollination accomplished by insects like moth, butterfly, wasp, bee, etc. the plants with ovaries having only one or a few ovules are generally pollinated by wind but sometimes by insects.

The right option is (d).

Sol.121 (d)

Biodiversity is being threatened by reduction in space, smaller and fragmented habitat, excessive exploitation by man, climatic changes, etc. Scared grooves are useful for conserving rare and threatened species.

The right option is (d).

Sol. 122 (a)

Antisense RNA can be produced by inverting a DNA copy of an mRNA with respect to the promoter in an expression vector. This yields a full-length complementary copy of the mRNA sequence. Antisense RNA molecule are thought to interact with m RNA molecule by base pairing to form double stranded RNA.

The right option is (a).

Sol.123(d)

Spirulina is a fast growing non-toxic blue green alga rich inproteins, vitamin-B complex and minerals.it is cultivated in tanks as important traditional food. Mushrooms are a rich source of vitamins, proteins and minerals.

The right option is (d).

Sol.124 (d)

All options are correct, except option (d).Due to the presence of cobalt in our food and water, we can acquire diseases like diarroea, hypertension, bone defects and paralysis. The disease called **Minamata**(firstoccurence in 1992 at Minamata bay, Japan) occurs due to Hg. The diseases called **Itai-itai** (first occurence) in 1947 in Toyoma, Japan) occurs due to the presence of Cd.

The right option is (d).

Sol.125(c)

Gel electrophoresis is a technique to separate fragments of DNA. Because DNA fragments are negatively charged molecules, they can be separated by forcing them to move towards the anode under an electric field through a medium or matrix. Nowadays, the most commonly used matrix is agarose which is a natural polymer extracted from seaweeds (viz., Gelidium, Gracilaria, Gigartina, etc.)

The right option is (c).

Sol. 126 (c)

Tuber is oval or spherical swollen underground modified stem lacking adventitious roots. It possesses a number of spirally arranged XI depressions called **Eyes.** Each eye represents node and consists of 1-3 axillary buds in the axils of small, scaly leaves.

The right option is (c).

Sol. 127 (d)

Temperate forests are the forests found in the temperate climate zone.

The right option is (d).

Sol. 128 (d)

CAM plants are mostly succulent xerophytes. The stomata in these plants remain closed during the day. This helps to check transpiration. In this way, water is conserved. **The right option is (d).**

Sol. 129 (a)

Leghaemoglobinis an oxygen scavenger. It protects the nitrogen fixing enzyme nitrogenase.

The right option is (a).

Sol. 130 (d)

The amount of living matter present in an ecosystem in its different trophic levels is called **Standing Crop.** It is expressed in the form of number or biomass per unit area. Biomass is measured as either fresh weight or dry weight.

The right option is (d).

Sol. 131 (a)

A germplasm is a collection of genetic resources for an organisms. For plants, the germplasm may be stored as a seed collection. It includes diverse alleles of all the genes of an organisms.

The right option is (a).

Sol. 132 (d)

Rainwater is the purest form of water because evaporation of water and the movement of the water vapour to higher altitudes makes rainwater a pure compound. We have selected option (d) in this question but it is not without conditions. Acid rain can contaminate rainwater too. The acid drops mix with water molecules and cause damage to buildings, crops, fields and marble edifices. If acid rain is not checked, rainwater may also become contaminated (due to acids made by nitrogen and sulphur). Further, rainwater on the earth becomes contaminated in a jiffy, for there are many pollutants on the earth in water bodies and in soil.

The right option is (d).

Sol. 133 (b)

Fly ash comprises carbon particles most of them burnt. It does not have the ability to produce natural manure. Nearly 38 percent of fly ash is produced by thermal power plants. In these plants, it is trapped by Electro static precipitators (ESPs) which charge its particles and attach them to charged plates. The plates are scraped later. Fly ash is processed for making bricks. Thus, it is a good raw material for construction. Other options are not suitable for the use of fly ash.

The right option is (b).

Sol. 134 (c)

The guard cells of stomata in land plants are specialised epidermal cells that comprise chloroplatss. In the remaining epidermal cells, chloroplasts are absent. But chloroplasts of guard cells are capable of poor photosynthesis as there is absence of NADP reductase enzyme.

The right option is (c).

Sol. 135 (b)

If the pollen tube enters the ovule through its micropyle, the mode of entry is called**Porogamy.** If thepollen tube enters the ovule through its chalaza, the mode of entry is called **Chalazagamy.** If the pollen tube enters the ovule through its funicle, the mode of entry is called **Mesogamy**. Generative fertilization is called **Syngamy**or **True fertilization.** It gives rise to diploid zygote or oospore.

The right option is (b).

PART D: ZOOLOGY

Sol.136 (d)

Heterotrophic bacteria are most abundant in nature. Many of them have a significant impact on human affairs. These are helpful in making curd from milk .Lactobacillus sp.), production of antibiotic (like Streptomyces sp.) and fixing nitrogen in legume roots (like Rhizobium spe).

The right option is (d).

Sol.137 (a)

The process of cutting and ligating both the oviducts or fallopian tubes of female is called **Tubectomy.** It is a very reliable technique of birth control. Its failure rate is less than 1 percent.

The right option is (a).

Sol.138 (c)

Ori represents the site of origin of 31-replication, rap repesets the protiens that take part in the replication of plasmid. Hind ill and Eco RI are the recognition sites of restriction endonucleases. amp^R and tetRare the-antibiotic- resistant gene parts.

The right option is (c).

Sol.139 (a)

Transcription unit consists of promoter, structural gene and terminator. The inducer (lactose/ allolactose) is not a component of transcription unit.

The right option is (a).

Sol.140 (d)

Probes are 15-30 bases long radioactive labelled oligonucleotides (RNA or DNA) WI6 used for detecting complementary nucleotide sequences, disease diagnosisetc.

The right option is (d).

Sol.141 (a)

Convergent evolution involves the independent development of similar structures in organisms that not directly related. It is represented by analogous ogans, Examples: Eyes of octpus and mammals, wings of and birds, etc. In divergent evolution, a basic or becomes adapted through specialisation for performing different functions. It is represented by homologous organs. Example: The bones of forelimbs of vertebra (like seal's flipper, bat's wing, cat's paw horse's front and human hand), thorns of Bougainvillia and tendrils Gucurbita.

The right option is (a).

Sol. 142 (b)

In eukaryotes, the site of synthesis of most of the ribosomal RNA (rRNA) is nucleolus. The nucleolarorganizer contains many copies of ribosomal D,' (repetitive DNA). The RNA cistron of nucleolar DNA forms 45 S precursor with the help of RNA polymerase. This 45 S RNA undergoes cleavage with the help nucleases to give 18S, 28S and 5.8S rRNA units. Out different rRNAS, the 5S rRNA is not synthesized nucleolus. It is synthesized outside it.

The right option is (b).

Sol.143 (c)

The pachytene stage of prophase I of meiosis I is characterized by the appearance of recombination nodules the sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes. Cross over is the exchange of genetic material between homologous chromosomes. It is also an enzyme-mediated process and the enzyme involved is called **Recombinase.**

The right option is (c).

So.144 (d)

Contact inhibition is the natural process of arresting cell growth when two or more cells come in contract with each other. It is a property of normal cells. Cancer cells divide in an uncontrolled way. They do not display contactinhibition.

The right option is (d).

Sol. 145 (b)

In a pregnant female, high levels of HCG will maintain corpus luteum and stimulate it to secrete oestrogen and progesterone.

The right option is (b).

Sol.146 (d)

Linked genes show a test cross ratio of 1: 1 dihybrids. Thus, statement given in option (d) is incorrect. All other statements are correct.

The right option is (d).

Sol.147 (a)

Phagocytosis is an important feature of cellular innate immunity, performed by cells called phagocytes that engulf or eat pathogens or foreign particles. Common examples of these phagocytes are monocytes, macrophages, neutrophil granulocytes (often referred to as polymorphonuclear leukocytes or PMN or PML, because of the varying shapes of nucleus), tissue dendritic cells, mast cells, etc. Antitetanus and anti-snake bite injections are the examples of passive immunity.

The right option is (a).

Sol.148(d)

Interstitial cells or cells of Leydig are present in the connective tissue lying in between seminiferous tubules. These cells secrete oestradoestradiol-steroid e.g., testosterone. Androgens stimulate male characters, influence male sex and behavior (libido) and regulate the development, maturation and functions of male accessory sex organs.

The right option is (d).

Sol.149 (a)

Polymerase Chain Reaction (PCR) is used amplifying a DNA segment or to synthesize in vitro the multiple copies of gene (or DNA) of interest, using two sets of primers and the enzyme DNA polymerase. This enzyme is isolated from a bacterium Thermusaquaticus and it remains active during the high temperature but high temperature induced denaturation of double stranded DNA.

The right option is (a).

Sol.150 (d)

Nucleoside is made up of ribose sugar of nitrogenous base only. Uracil forms nucleoside with only ribose sugar. So, the option with category nucleoside component uracil is correct.

The right option is (d).

Sol.151(b)

If one strand of DNA has the sequence as ATCTG, the complementary sequence of mRNA will be UAGAC.

The right option is (b).

Sol.152 (d)

All the options mentioned in the question are correct features of sex-linked inheritance. It is criss-cross inheritance. The father does not pass the sex-linked allele to his son. The same is passed on to the daughter, though. Then, it reaches the grandson, hence this phenomenon is also called Diagynic. Males have only one X- that is transferred to the female offspring. Only the Y- chromosome of the father is transferred to the offspring. But this sex chromosome does not carry many alleles. Finally, traits governed by sex-linked recessive genes produce more disorders in males than they do in females. They express themselves in males even when represented by a single allele.

The right option is (d).

Sol.153 (d)

The first three options are the steps in the process of crossing over. Thus, they are correct. But Double Crossing Over is the odd man out here. In this process, crossing over occus at two points in the homologous pair of chromosomes. This concept has nothing to do with the three steps of crossing over.

The right option is (d).

Sol.154 (d)

All the three options are the advantages of gene regiulation. Further, gene regulation also helps in growth and differentiation. Finally, a number of related genes needed for a specific metabolic activity can be switched on or off at the same time.

The right option is (d).

Sol.155 (d)

Monohybrid cross with incomplete dominance shows both genotypic and phenotypic ratio as same (1: 2: 1).

The right option is (d).

Sol.156 (d)

The Human genome Project has been initiated for the complete analysis of the human genome and identification of all those genes that create genetic disorders in man. The project is in its nascent stage. It needs more reserach and scientifc inputs. Its completion would lead us to the complete alpha to omega of the human physiology. It would help us produce health and disease-free humans in the centuries to come. Reserach is also being done on plant and animal species and their genetic codes are also being found.

The right option is (d).

Sol.157(c)

More than 1,200 genes are creating problems for man. They lead to cardiovascular ailments, cancer (of various genres), diabetes (an endocrine disease),arthiritis, neurological ailments (like Alzeimer's disease) and many other disorders whose list cannot be appended because of the limitation of space. We have not been able to overpower AIDS, cancer, paralysis, lukaemia and a host of other killer diseases. The genes of these diseases are present in our bodies. As and when the conditions are conducive for their lethal actions and a few triggers are available for them to act, these killer genes cast their spell in the human body. The fight against terminal diseases is going on. Scientists are trying hard to identify and overpower such genes as make human life short or full of agony.

The right option is (c).

Sol. 158 (c)

Bt cotton is Genetically Modified (GM) cotton which has an incorporated gene extracted from the bacterium Bacillus thuringiensis. This B gene code for Bt toxin in plant tissues is harmful only to a small fraction of insects, most notably the larvae of lepidopterans, moths, butterflies, beetles, flies, etc. However, it is harmless to other forms of life. So, it is used for the biological control of pests/ diseases.

The right option is (c).

Sol.159 (c)

DNA fingerprinting is a technique of determining the nucleotide sequences of some specific areas of DNA that are unique to every person. Every person has a DNA fingerprint. It is the same for every cell and organ of any individual in question. It cannot be altered. The genomic DNA sequence of evevery person is unique.

The right option is (c).

Sol. 160 (a)

All living things have been made from protoplasm. It is also called Living Matter. Nearly 90 percent of living matter (protoplasm) is made of C, H, a and N. Traces of P and S are also present in protoplasm. The organic compounds present in protoplasm are--carbohydrates, proteins, lipids and nucleic acids.

The right option is (a).

Sol.161 (d)

Transcription is the process of synthesis of RNA on the DNA template. During transcription adenosine pairs with uracil. Repressor gene determines the transcription of structural gene. It codes for repressor protein. After synthesis the repressor molecule is diffused from the ribosome and bind to the operator in absence of inducer. The human genome has approximately 30,000 genes with 3.2 billion base pairs.

The right option is (d).

Sol. 162 (b)

Human hormonesare secreted by ductless glands that are also known as **Endocrine Glands.** These hormones trigger a host of vital reactions in our body. The hormones of vertebrates are similar in terms of chemical composition and action. If there is a deficiency of a hormone, the same can be taken as an injection to make up for the shortage. Example: Pancreas releases insulin ahich is used for regulating the blood sugar level in the human body.

The right option is (b).

Sol.163 (c)

The amount of energy accumulated in green plants through the process of photosynthesis is known as **Primary Productivity**. It may be Gross PP (total orgamc. matter synthslzed) or Net PP (the weight of orgamc matter stored). The rate of rsynthesls of orgamc matter by the consumers is known as Secondary Productivity.

The right option is (c).

Sol. 164 (b)

In biolistic or gene gun method, 1-2 microgram of tungsten or gold particles (called Microprojectiles) coated with DNA to be used for the transformation are accelerated to velocities that enable their entry into plant cells or nuclei. This technique is popular in plant species and can be used to deliver DNA into virtually all tissues.

The right option is (b).

Sol.165(a)

The integration of selectable marker with a gene of interest is helpful for identifying transformed cells. However, the presence of selectable marker gene for antibiotic resistance in a genetically modified organism that is released into enviornment is not desirable.

The right option is (a).

Sol.166 (d)

All the statements support the broad concept of Neo Lamarckism. Note that Lamarckism was the first theory of evolution. It was propounded by Jean Baptiste de Lamarck (1744-1829). Neo Lamarckism is an altered theory of Lamarck. Neo lamarckism also states that only those variations are passed on to offspring that also affectgerm cells, or where somatic cells make germ cells.

The right option is (d).

Sol.167(c)

All postulates are correct, except one. In option (c) it has been stated that no mutataion is inheritable. However, according to the Mutation Theory, all mutations are inheritable.

The right option is (c).

Sol. 168(a)

In some cases, hybrids may become sexual mature but they may be sterile. The mule is a hybrid the (male) donkey and (female) horse. This mule issterile. Further, the hiny is a hybrid of the (female) donkey art (female) horse. This hinny too is sterile.

The right option is (a).

Sol.169 (d)

DNA fingerprinting is individual specific DN.A identification which is made possible by the finding that no two people are likely to have the same number copies of repetitive DNA sequences of regions. The chromosomes of every human cells contain short, highly repeated DNA sequence (15nucleotide) called Minisatelliteand scatterd throughout.

The right option is (d).

Sol.170(c)

Colour blindness and haemophilia are two chief sex-linked or X-linked recessive diseases. The gene haemophilia goes to son from mother and to daughter from father. In this disease, the blood fails to clot w exposed to air result in continuous bleeding and leads death.

The right option is (c).

Sol. 171 (a)

Stabilising selection is also called **Balancing Selection**. This type of selection favoursan averge-sized individuals but eliminates small-sized individuals Itbrings down variation and thus it does not promote evolutionary change. But it maintains the mean value from generation to generation. If we draw a grapha curve odf the population, we shall obtain a bell-shapes curve.

The right option is (a).

Sol.172 (c)

In transient polymorphism, different morphs or forms exist in a population that is undergoing a strong selection pressure. The frequency of the phenotypic appearance of each form is determined by the intensity of the selection pressure. Transient polymorphism applicable in those cases in which one form is gradually being replaced by another.

The right option is (c).

Sol.173(c)

An embryo with about 64-cells and a cavity called**Blastocoel** is known as **Blastocyst**. It is composed of an outer envelope of cells-the trophoblast. Implantation is attachment of blastocyst to the uterine wall. This occurs 7 days after fertilization. It develops from 8-cell morula 16-cell morula and then, to 64-cell stage. The blastocyst sinks into a pit formed in the endometrium and get completely burried in the endometrium.

The right option is (c).

Sol.174

Producers lap up the energy of the sun whichis transformed into chemical form during the course of photosynthesis. Green plants are at the first trophic level. Herebivores are at the secondary trophic level and carnivores are at the third trophic level. Deer is herbivorous. Further, rabbit and rat are also herbivorous animals. But frog eats grassoppers; it is an omnivore.

Identify the right option on your own.

Sol. 175 (c)

Option (c) is not correct. Oestrogen is used for making oral contraceptives so that unwanted pregnancy could be checked. It is not used as an anthihistamine. Other options are the applications of steroids in various fields (for the sake of human welfare).

The right option is (c).

Sol.176 (d)

The restriction enzymes are also called Molecular Scissors or Cleaving Enzymes. They are used for breaking up DNA molecules. They are of three types.

The right option is (d).

Sol.177 (d)

Liver is the main source of vitamin B_{12}. We can also get it in small traces from milk, eeggs, meat and fish.

It is not present in vegetarian diet.

The right option is (d).

Sol. 178 (d)

Options (a),(b) and (c) are the examples of bioweapons. Some of them were used during two world Warstoo. The last option is a nature-friendly bacterium. It is used for nitrogen fixation. It is not a bio-weapon by any norm.

The right option is (d).

Sol.179 (d)

The fallopian tube is tube 10-12 cm long and extends from the periphery of each ovary to the uterus. The part closer to the ovary is the funnel shaped and is known as **Infundibulum.** The edges of the infundibulum posses finger like projections, called **Fimbriae** which help in collection of the ovum after ovulation. The uterus opens into vagina through a narrow cervix.

The right option is (d).

Sol. 180 (b)

SCPs are used for making wine and beer. They are extensively used in the bakery industry; yeast is an example in this context. However, they also produce toxic chemicals that are consumed by man and thus he falls sick. The nuc;leic acid produced by SCOs is also harmful to man. Their use ought ot be restricted. Bakery products should not be consumed in excess.

The right option is (b).