Question Paper with Solution

BIOLOGY

51. Which one of the following is **correct** pairing of a body part and the kind of muscle tissue that moves it ?

(1) Biceps of upper arm – Smooth muscle fibres

(2) Abdominal wall – Smooth muscle

(3) Iris – Involuntary smooth muscle

(4) Heart wall – Involuntary unstriated muscle

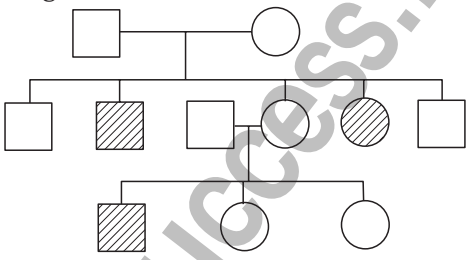
∴ **Correct choice : (2)**

52. The epithelial tissue present on the inner surface of bronchioles and fallopian tubes is:

(1) Glandular **(2)** Ciliated **(3)** Squamous **(4)** Cuboidal

∴ **Correct choice : (2)**

53. Study the pedigree chart given below:



What does it show ?

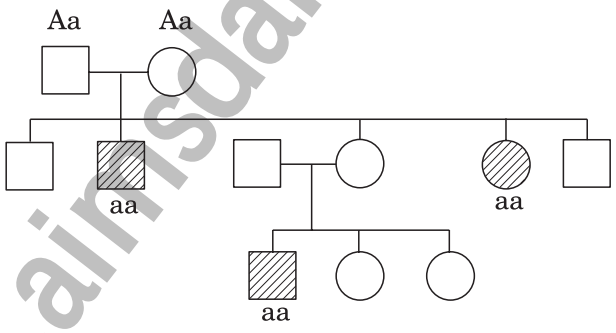
(1) Inheritance of a condition like phenylketonuria as an autosomal recessive trait

(2) The pedigree chart is wrong as this is not possible

(3) Inheritance of a recessive sex-linked disease like haemophilia

(4) Inheritance of a sex-linked inborn error of metabolism like phenylketonuria

Sol:



Parents needs to be heterozygous as two of their children are known to be sufferer of the disease. It cannot be recessive sex-linked inheritance because then the male parent would also be sufferer.

∴ **Correct choice : (1)**

54. Manganese is required in:

(1) Plant cell wall formation

(2) Photolysis of water during photosynthesis

(3) Chlorophyll synthesis

(4) Nucleic acid synthesis

∴ **Correct choice : (2)**

55. Polyethylene glycol method is used for:

(1) Biodiesel production **(2)** Seedless fruit production

(3) Energy production from sewage **(4)** Gene transfer without a vector

∴ **Correct choice : (4)**

56. The floral formula $\oplus\ \varphi\ K_{(5)}\ \overset{\frown}{C}_{(5)}\ A_5\ \underline{G(2)}$ is that of:

(1) Soybean **(2)** Sunnhemp **(3)** Tobacco **(4)** Tulip

Sol: Soyabean and Sunnhemp have monocarpellary pistil and tulip has trimerous flower and perianth.

∴ **Correct choice : (3)**

57. Which one of the following groups of animals is bilaterally symmetrical **and** triploblastic ?

(1) Aschelminthes (round worms) **(2)** Ctenophores

(3) Sponges **(4)** Coelenterates (Cnidarians)

∴ **Correct choice : (1)**

58. Which one of the following is commonly used in transfer of foreign DNA into crop plants ?

(1) Meloidogyne incognita **(2) Agrobacterium tumefaciens**

(3) Penicillium expansum **(4) Trichoderma harzianum**

∴ **Correct choice : (2)**

59. Which one of the following is the **correct** matching of the events occurring during menstrual cycle ?

(1) Proliferative phase : Rapid regeneration of myometrium and maturation of Graafian follicle.

(2) Development of corpus luteum : Secretory phase and increased secretion of progesterone.

(3) **Menstruation** : breakdown of myometrium and ovum not fertilised.

(4) **Ovulation** : LH and FSH attain peak level and sharp fall in the secretion of progesterone.

∴ **Correct choice : (2)**

60. Which one is the wrong pairing for the disease and its causal organism ?

(1) Black rust of wheat – **Puccinia graminis**

(2) Loose smut of wheat – **Ustilago nuda**

(3) Root-knot of vegetables – **Meloidogyne sp**

(4) Late blight of potato – **Alternaria solani**

∴ **Correct choice : (4)**

61. Global agreement in specific control strategies to reduce the release of ozone depleting substances, was adopted by:

(1) The Montreal Protocol (2) The Koyoto Protocol

(3) The Vienna Convention (4) Rio de Janeiro Conference

∴ **Correct choice : (1)**

62. What is **true** about Bt toxin ?

(1) Bt protein exists as active toxin in the **Bacillus**.

(2) The activated toxin enters the ovaries of the pest to sterilise it and thus prevent its multiplication.

(3) The concerned **Bacillus** has antitoxins.

(4) The inactive protoxin gets converted into active form in the insect gut.

∴ **Correct choice : (4)**

63. **Peripatus** is a connecting link between:

(1) Mollusca and Echinodermata (2) Annelida and Arthropoda

(3) Coelenterata and Porifera (4) Ctenophora and Platyhelminthis

∴ **Correct choice : (2)**

64. T.O. Diener discovered a:

(1) Free infectious DNA (2) Infectious protein

(3) Bacteriophage (4) Free infectious RNA

Sol: T.O. Diener discovered viroid which is free infectious RNA.

∴ **Correct choice : (4)**

65. Seminal plasma in humans is rich in:

(1) fructose and calcium but has no enzymes

(2) glucose and certain enzymes but has no calcium

(3) fructose and certain enzymes but poor in calcium

(4) fructose, calcium and certain enzymes

∴ **Correct choice : (3)**

66. A fruit developed from hypanthodium inflorescence is called:

(1) Sorosis **(2)** Syconus **(3)** Caryopsis **(4)** Hesperidium

∴ **Correct choice : (2)**

67. The cell junctions called tight, adhering and gap junctions are found in:

(1) Connective tissue **(2)** Epithelial tissue

(3) Neural tissue **(4)** Muscular tissue

∴ **Correct choice : (2)**

68. What will happen if the stretch receptors of the urinary bladder wall are totally removed ?

(1) Micturition will continue

(2) Urine will continue to collect normally in the bladder

(3) There will be no micturition

(4) Urine will not collect in the bladder

Sol: Micturition is same as urination. Urination is the act of passing urine which is a reflex phenomenon. As urine accumulates in bladder the stretch receptors are activated that pass the stimulus to the spinal cord. In the absence of stretch receptors the urine would get collected and probably overflow.

∴ **Correct choice : (3)**

69. If a live earthworm is pricked with a needle on its outer surface without damaging its gut, the fluid that comes out is:

(1) coelomic fluid **(2)** haemolymph **(3)** slimy mucus **(4)** excretory fluid

∴ **Correct choice : (1)**

70. The most popularly known blood grouping is the ABO grouping. It is named ABO and not ABC, because "O" in it refers to having:

(1) overdominance of this type on the genes for A and B types

(2) one antibody only – either anti-A or anti-B on the RBCs

(3) no antigens A and B on RBCs

(4) other antigens besides A and B on RBCs

∴ **Correct choice : (3)**

71. One of the synthetic auxin is:

(1) IAA **(2)** GA **(3)** IBA **(4)** NAA

∴ **Correct choice : (4)**

72. A person likely to develop tetanus is immunised by administering:

(1) Preformed antibodies **(2)** Wide spectrum antibiotics

(3) Weakened germs **(4)** Dead germs

Sol: Tetanus toxoid is a vaccine consisting of growth products of **Clostridium tetani** treated with formaladehyde serving as an active immunising agent. Hence is is weakened germs.

∴ **Correct choice : (3)**

73. Alzheimer disease in humans is associated with the deficiency of:

(1) glutamic acid

(2) acetylcholine

(3) gamma aminobutyric acid (GABA)

(4) dopamine

∴ **Correct choice : (2)**

74. Biochemical Oxygen Demand (BOD) in a river water:

(1) has no relationship with concentration of oxygen in the water.

(2) gives a measure of **salmonella** in the water.

(3) increases when sewage gets mixed with river water.

(4) remains unchanged when algal bloom occurs.

∴ **Correct choice : (3)**

75. The genetic defect – adenosine deaminase (ADA) deficiency may be cured **permanently** by:

(1) administering adenosine deaminase activators.

(2) introducing bone marrow cells producing ADA into cells at early embryonic stages.

(3) enzyme replacement therapy.

(4) periodic infusion of genetically engineered lymphocytes having functional ADA cDNA.

∴ **Correct choice : (2)**

76. Compared to blood our lymph has:

(1) plasma without proteins **(2)** more WBCs and no RBCs

(3) more RBCs and less WBCs **(4)** no plasma

∴ **Correct choice : (2)**

77. Sickle cell anemia is:

(1) caused by substitution of valine by glutamic acid in the beta globin chain of haemoglobin

(2) caused by a change in a single base pair of DNA

(3) characterized by elongated sickle like RBCs with a nucleus

(4) an autosomal linked dominant trait

∴ **Correct choice : (2)**

78. Which of the following plant species you would select for the production of bioethanol ?

(1) Zea mays **(2) Pongamia** **(3) Jatropha** **(4) Brassica**

∴ **Correct choice : (3)**

79. When breast feeding is replaced by less nutritive food low in proteins and calories; the infants below the age of one year are likely to suffer from:

(1) Rickets **(2)** Kwashiorkor **(3)** Pellagra **(4)** Marasmus

∴ **Correct choice : (2)**

80. A young infant may be feeding entirely on mother's milk which is white in colour but the stools which the infant passes out is quite yellowish. What is this yellow colour due to ?

(1) Bile pigments passed through bile juice

(2) Undigested milk protein casein

(3) Pancreatic juice poured into duodenum

(4) Intestinal juice

∴ **Correct choice : (1)**

81. Which one of the following has maximum genetic diversity in India?

(1) Mango **(2)** Wheat **(3)** Tea **(4)** Teak

∴ **Correct choice : (2)**

82. Oxygenic photosynthesis occurs in:

(1) Oscillatoria **(2) Rhodospirillum**

(3) Chlorobium **(4) Chromatium**

∴ **Correct choice : (1)**

83. There is no DNA in:

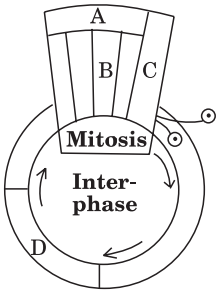
(1) Mature RBCs **(2)** A mature spermatozoan

(3) Hair root **(4)** An enucleated ovum

Sol: An enucleated ovum has DNA in mitochondria.

∴ **Correct choice : (1)**

84. Given below is a schematic break-up of the phases / stages of cell cycle:



Which one of the following is the **correct** indication of the stage/phase in the cell cycle ?

(1) C-Karyokinesis **(2)** D-Synthetic phase

(3) A-Cytokinesis **(4)** B-Metaphase

∴ **Correct choice : (2)**

85. Tiger is **not** a resident in which one of the following national park ?

(1) Sunderbans **(2)** Gir

(3) Jim Corbett **(4)** Ranthambhor

∴ **Correct choice : (2)**

86. Which one of the following statements is **true** regarding digestion and absorption of food in humans ?

(1) Fructose and amino acids are absorbed through intestinal mucosa with the help of carrier ions like Na^+.

(2) Chylomicrons are small lipoprotein particles that are transported from intestine into blood capillaries.

(3) About 60% of starch is hydrolysed by salivary amylase in our mouth.

(4) Oxyntic cells in our stomach secrete the proenzyme pepsinogen.

∴ **Correct choice : (1)**

87. Synapsis occurs between:

(1) mRNA and ribosomes **(2)** spindle fibres and centromere

(3) two homologous chromosomes **(4)** a male and a female gamete

∴ **Correct choice : (3)**

88. Given below is a diagrammatic sketch of a portion of human male reproductive system. Select the correct set of the names of the parts labelled A, B, C, D.

	A	B	C	D
(1)	vas deferens	seminal vesicle	prostate	bulbourethral gland
(2)	vas deferens	seminal vesicle	bulbourethral gland	prostate
(3)	ureter	seminal vesicle	prostate	bulbourethral gland
(4)	ureter	prostate	seminal vesicle	bulbourethral gland

∴ **Correct choice : (1)**

89. What is **not** true for genetic code?

(1) It is nearly universal

(2) It is degenerate

(3) It is unambiguous

(4) A codon in mRNA is read in a non-contiguous fashion

∴ **Correct choice : (4)**

90. Which one of the following plants is monoecious?

(1) Pinus **(2) Cycas** **(3)** Papaya **(4) Marchantia**

∴ **Correct choice : (1)**

91. Cyclic photophosphorylation results in the formation of

(1) ATP and NADPH **(2)** ATP, NADPH and O_2

(3) ATP **(4)** NADPH

∴ **Correct choice : (3)**

92. The letter T in T-lymphocyte refers to:

(1) Thalamus **(2)** Tonsil **(3)** Thymus **(4)** Thyroid

∴ **Correct choice : (3)**

93. Foetal ejection reflex in human female is induced by:

(1) release of oxytocin from pituitary

(2) fully developed foetus and placenta

(3) differentiation of mammary glands

(4) pressure exerted by amniotic fluid

∴ **Correct choice : (2)**

94. Anatomically fairly old dicotyledonous root is distinguished from the dicotyledonous stem by

(1) Absence of secondary phloem **(2)** Presence of cortex

(3) Position of protoxylem **(4)** Absence of secondary xylem

∴ **Correct choice : (3)**

95. Plasmodesmata are :

(1) Locomotary structures

(2) Membranes connecting the nucleus with plasmalemma

(3) Connections between adjacent cells

(4) Lignified cemented layers between cells

∴ **Correct choice : (3)**

96. Removal of introns and joining the exons in a defined order in a transcription unit is called:

(1) Tailing **(2)** Transformation **(3)** Capping **(4)** Splicing

∴ **Correct choice : (4)**

97. Phylogenetic system of classification is based on :

(1) Morphological features **(2)** Chemical constituents

(3) Floral characters **(4)** Evolutionary relationships

∴ **Correct choice : (4)**

98. Which part of human brain is concerned with the regulation of body temperature?

(1) Cerebellum **(2)** Cerebrum

(3) Hypothalamus **(4)** Medulla Oblongata

∴ **Correct choice : (3)**

99. Semiconservative replication of DNA was first demonstrated in:

(1) Escherichia coli **(2) Streptococcus pneumoniae**

(3) Salmonella typhimurium **(4) Drosophila melanogaster**

∴ **Correct choice : (1)**

100. Which one of the following pairs of animals comprises 'jawless fishes'?

(1) Mackerals and Rohu **(2)** Lampreys and hag fishes

(3) Guppies and hag fishes **(4)** Lampreys and eels

∴ **Correct choice : (2)**

101. Which of the following is a pair of viral diseases ?

(1) Common Cold, AIDS **(2)** Dysentery, Common Cold

(3) Typhoid, Tuberculosis **(4)** Ringworm, AIDS

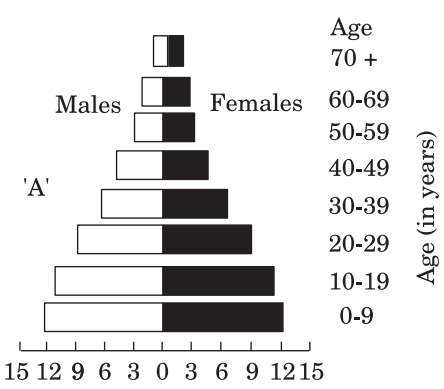
∴ **Correct choice : (1)**

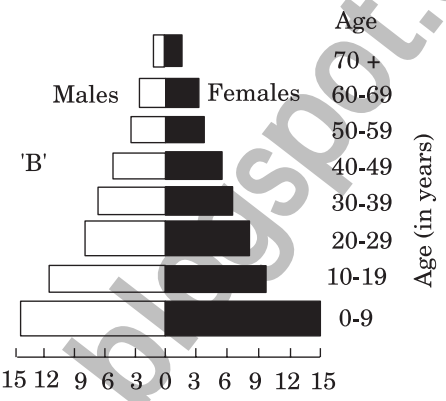
102. Aerobic respiratory pathway is **appropriately** termed:

(1) Parabolic **(2)** Amphibolic **(3)** Anabolic **(4)** Catabolic

∴ **Correct choice : (2)**

103. A country with a high rate of population growth took measures to reduce it. The **Figure** below shows age-sex pyramids of populations A and B twenty years apart. Select the **correct** interpretation about them:





Interpretations:

(1) "B" is earlier pyramid and shows stabilised growth rate.

(2) "B" is more recent showing that population is very young.

(3) "A" is the earlier pyramid and no change has occurred in the growth rate.

(4) "A" is more recent and shows slight reduction in the growth rate.

∴ **Correct choice : (4)**

104. Cytoskeleton is made up of:

(1) Callose deposits **(2)** Cellulosic microfibrils

(3) Proteinaceous filaments **(4)** Calcium carbonate granules

Sol: Cytoskeleton is made up of microfilaments and microtubules whose major constituents are actin and tubulin respectively.

∴ **Correct choice : (3)**

105. An example of axile placentation is:

(1) Dianthus **(2)** Lemon **(3)** Marigold **(4) Argemone**

∴ **Correct choice : (2)**

106. Which one of the following has haplontic life cycle ?

(1) Polytrichum **(2) Ustilago**

(3) Wheat **(4) Funaria**

∴ **Correct choice : (2)**

107. Steps taken by the Government of India to control air pollution include:

(1) compulsory PUC (Pollution Under Control) certification of petrol driven vehicles which tests for carbon monoxide and hydrocarbons.

(2) permission to use only pure diesel with a maximum of 500 ppm sulphur as fuel for vehicles.

(3) use of non-polluting Compressed Natural Gas (CNG) only as fuel by all buses and trucks.

(4) compulsory mixing of 20% ethyl alcohol with petrol and 20% biodiesel with diesel.

∴ Correct choice : (1)

108. Which one of the following is considered important in the development of seed habit?

(1) Heterospory **(2)** Haplontic life cycle

(3) Free-living gametophyte **(4)** Dependent sporophyte

∴ Correct choice : (1)

109. The annular and spirally thickened conducting elements generally develop in the protoxylem when the root or stem is:

(1) elongating **(2)** widening **(3)** differentiating **(4)** maturing

∴ Correct choice : (4)

110. The **correct** sequence of plants in a hydrosere is:

(1) **Volvox** ⟶ **Hydrilla** ⟶ **Pistia** ⟶ **Scirpus** ⟶ **Lantana** ⟶ Oak

(2) **Pistia** ⟶ **Volvox** ⟶ **Scirpus** ⟶ **Hydrilla** ⟶ Oak ⟶ **Lantana**

(3) Oak ⟶ **Lantana** ⟶ **Volvox** ⟶ **Hydrilla** ⟶ **Pistia** ⟶ **Scirpus**

(4) Oak ⟶ **Lantana** ⟶ **Scirpus** ⟶ **Pistia** ⟶ **Hydrilla** ⟶ **Volvox**

∴ Correct choice : (1)

111. Stroma in the chloroplasts of higher plant contains:

(1) Light-dependent reaction enzymes

(2) Ribosomes

(3) Chlorophyll

(4) Light-independent reaction enzymes

∴ Correct choice : (4)

112. A health disorder that results from the deficiency of thyroxine in adults and characterised by (i) a low metabolic rate, (ii) increase in body weight and (iii) tendency to retain water in tissues is:

(1) simple goitre **(2)** myxoedema **(3)** cretinism **(4)** hypothyroidism

Sol: Deficiency of thyroxine in **adults** is specifically called **Myxoedema** characterised by low metabolic rate, increase in body weight and tendency to retain water in tissues.

∴ **Correct choice : (2)**

113. Mannitol is the stored food in:

(1) Porphyra **(2) Fucus** **(3) Gracillaria** **(4) Chara**

∴ **Correct choice : (2)**

114. Which one of the following pairs is **wrongly** matched ?

(1) Alcohol – nitrogenase **(2)** Fruit juice – pectinase

(3) Textile – amylase **(4)** Detergents – lipase

∴ **Correct choice : (1)**

115. Which of the following is **not** used as a biopesticide ?

(1) Trichoderma harzianum **(2)** Nuclear Polyhedrosis Virus (NPV)

(3) Xanthomonas campestris **(4) Bacillus thuringiensis**

∴ **Correct choice : (3)**

116. Which one of the following is a vascular cryptogam?

(1) Ginkgo **(2) Marchantia** **(3) Cedrus** **(4) Equisetum**

∴ **Correct choice : (4)**

117. In a standard ECG which one of the following alphabets is the **correct** representation of the respective activity of the human heart?

(1) S – start of systole **(2)** T – end of diastole

(3) P – depolarisation of the atria **(4)** R – repolarisation of ventricles

∴ **Correct choice : (3)**

118. Uric acid is the chief nitrogenous component of the excretory products of:

(1) Earthworm **(2)** Cockroach **(3)** Frog **(4)** Man

∴ **Correct choice : (2)**

119. Guard cells help in:

(1) Transpiration **(2)** Guttation

(3) Fighting against infection **(4)** Protection against grazing

∴ **Correct choice : (1)**

120. Montreal Protocol aims at:

(1) Biodiversity conservation

(2) Control of water pollution

(3) Control of CO_2 emission

(4) Reduction of ozone depleting substances

∴ **Correct choice : (4)**

121. DDT residues are rapidly passed through food chain causing biomagnification because DDT is:

(1) moderately toxic **(2)** non-toxic to aquatic animals

(3) water soluble **(4)** lipo soluble

∴ **Correct choice : (4)**

122. Vegetative propagation in mint occurs by:

(1) Offset **(2)** Rhizome **(3)** Sucker **(4)** Runner

∴ **Correct choice : (3)**

123. Select the **incorrect** statement from the following:

(1) Galactosemia is an inborn error of metabolism

(2) Small population size results in random genetic drift in a population

(3) Baldness is a sex-limited trait

(4) Linkage is an exception to the principle of independent assortment in heredity

∴ **Correct choice : (3)**

124. Cotyledons and testa respectively are edible parts in:

(1) walnut and tamarind **(2)** french bean and coconut

(3) cashew nut and litchi **(4)** groundnut and pomegranate

∴ **Correct choice : (4)**

125. Which one of the following statements is **correct** ?

(1) Benign tumours show the property of metastasis.

(2) Heroin accelerates body functions.

(3) Malignant tumours may exhibit metastasis.

(4) Patients who have undergone surgery are given cannabinoids to relieve pain.

∴ **Correct choice : (3)**

126. The **correct** sequence of spermatogenetic stages leading to the formation of sperms in a mature human testis is:

(1) spermatogonia – spermatocyte – spermatid – sperms

(2) spermatid – spermatocyte – spermatogonia – sperms

(3) spermatogonia – spermatid – spermatocyte – sperms

(4) spermatocyte – spermatogonia – spermatid – sperms

∴ **Correct choice : (1)**

127. Use of anti-histamines and steroids give a quick relief from:

(1) Nausea **(2)** Cough **(3)** Headache **(4)** Allergy

∴ **Correct choice : (4)**

128. Chipko movement was launched for the protection of:

(1) Forests **(2)** Livestock **(3)** Wet lands **(4)** Grasslands

∴ **Correct choice : (1)**

129. Which one of the following is the most likely root cause why menstruation is not taking place in regularly cycling human female ?

(1) maintenance of the hypertrophical endometrial lining

(2) maintenance of high concentration of sex hormones in the blood stream

(3) retention of well-developed corpus luteum

(4) fertilisation of the ovum

∴ **Correct choice : (4)**

130. Globulins contained in human blood plasma are primarily involved in:

(1) osmotic balance of body fluids **(2)** oxygen transport in the blood

(3) clotting of blood **(4)** defence mechanisms of body

∴ **Correct choice : (4)**

131. Palisade parenchyma is **absent** in leaves of :

(1) Mustard **(2)** Soybean **(3)** Gram **(4)** Sorghum

∴ **Correct choice : (4)**

132. In barley stem vascular bundles are:

(1) closed and scattered **(2)** open and in a ring

(3) closed and radial **(4)** open and scattered

∴ **Correct choice : (1)**

133. Which one of the following is the **correct** matching of three items and their grouping category ?

Items	Group
(1) ilium, ischium, pubis	– coxal bones of pelvic girdle
(2) actin, myosin, rhodopsin	– muscle proteins
(3) cytosine, uracil, thiamine	– pyrimidines
(4) malleus, incus, cochlea	– ear ossicles

∴ **Correct choice : (1)**

134. Somaclones are obtained by

(1) Plant breeding **(2)** Irradiation

(3) Genetic engineering **(4)** Tissue culture

∴ **Correct choice : (4)**

135. In the case of peppered moth **(Biston betularia)** the black-coloured form became dominant over the light-coloured form in England during industrial revolution. This is an example of :

(1) appearance of the darker coloured individuals due to very poor sunlight

(2) protective mimicry

(3) inheritance of darker colour character acquired due to the darker environment

(4) natural selection whereby the darker forms were selected

Sol: This is a phenomenon of industrial melanism. The moths rested during day time when their predators (birds) are active. During industrial revolution, the surrounding areas were covered with soot and hence dark forms got camouflaged. This offered protection to dark forms when coal was used. Later when electricity was source of energy the environment became lighter (absence of soot) and more of the paler forms of moth were sighted.

∴ **Correct choice : (2)**

136. Transgenic plants are the ones:

(1) generated by introducing foreign DNA into a cell and regenerating a plant from that cell.

(2) produced after protoplast fusion in artificial medium.

(3) grown in artificial medium after hybridization in the field.

(4) produced by a somatic embryo in artificial medium.

∴ **Correct choice : (1)**

137. Which one of the following pairs of food components in humans reaches the stomach totally undigested?

(1) Starch and fat **(2)** Fat and cellulose

(3) Starch and cellulose **(4)** Protein and starch

∴ **Correct choice : (2)**

138. A change in the amount of yolk and its distribution in the egg will affect:

(1) Pattern of cleavage

(2) Number of blastomeres produced

(3) Fertilization

(4) Formation of zygote

∴ **Correct choice : (1)**

139. Middle lamella is composed mainly of:

(1) Muramic acid **(2)** Calcium pectate

(3) Phosphoglycerides **(4)** Hemicellulose

∴ **Correct choice : (2)**

140. Elbow joint is an example of:

(1) hinge joint **(2)** gliding joint

(3) ball and socket joint **(4)** pivot joint

∴ **Correct choice : (1)**

141. Which of the following is a symbiotic nitrogen fixer ?

(1) Azotobacter **(2) Frankia** **(3) Azolla** **(4) Glomus**

∴ **Correct choice : (2)**

142. Whose experiments cracked the DNA and discovered unequivocally that a genetic code is a "triplet"?

(1) Hershey and Chase **(2)** Morgan and Sturtevant

(3) Beadle and Tatum **(4)** Nirenberg and Mathaei

∴ **Correct choice : (4)**

143. Which one of the following types of organisms occupy more than one trophic level in a pond ecosystem ?

(1) Fish **(2)** Zooplankton **(3)** Frog **(4)** Phytoplankton

Sol: Fish could be primary consumer as well as secondary consumer.

∴ **Correct choice : (1)**

144. Which one of the following acids is a derivative of carotenoids ?

(1) Indole-3-acetic acid **(2)** Gibberellic acid

(3) Abscisic acid **(4)** Indole butyric acid

∴ **Correct choice : (3)**

145. The bacterium **Bacillus thuringiensis is** widely used in contemporary biology as:

(1) Insecticide

(2) Agent for production of dairy products

(3) Source of industrial enzyme

(4) Indicator of water pollution

∴ **Correct choice : (1)**

146. An example of a seed with endosperm, perisperm, and caruncle is:

(1) coffee **(2)** lily **(3)** castor **(4)** cotton

∴ **Correct choice : (3)**

147. Reduction in vascular tissue, mechanical tissue and cuticle is characteristic of :

(1) Mesophytes **(2)** Epiphytes **(3)** Hydrophytes **(4)** Xerophytes

∴ **Correct choice : (3)**

148. Point mutation involves:

(1) Change in single base pair **(2)** Duplication

(3) Deletion **(4)** Insertion

∴ **Correct choice : (1)**

149. Which one of the following **correctly** describes the location of some body parts in the earthworm **Pheretima ?**

(1) Four pairs of spermathecae in 4 – 7 segments.

(2) One pair of ovaries attached at intersegmental septum of 14^{th} and 15^{th} segments.

(3) Two pairs of testes in 10^{th} and 11^{th} segments.

(4) Two pairs of accessory glands in 16 – 18 segments.

∴ **Correct choice : (3)**

150. The kind of tissue that forms the supportive structure in our pinna (external ears) is also found in:

(1) nails **(2)** ear ossicles **(3)** tip of the nose **(4)** vertebrae

∴ **Correct choice : (3)**

CBSE PM/PD 2009

PHYSICS

1. In the nuclear decay given below:

${}^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y \longrightarrow {}^{A-4}_{Z-1}B^{*} \longrightarrow {}^{A-4}_{Z-1}B$, the particles emitted in the sequence are:

(1) γ, β, α **(2)** β, γ, α

(3) α, β, γ **(4)** β, α, γ

Sol: ${}^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y : \beta,\ {}^{A}_{Z+1}Y \longrightarrow {}^{A-4}_{Z-1}B^{*} : \alpha,\ {}^{A-4}_{Z-1}B^{*} \longrightarrow {}^{A-4}_{Z-1}B : \gamma$

(β, α, γ)

$\therefore$ **Correct choice : (4)**

2. A thin circular ring of mass M and radius R is rotating in a horizontal plane about an axis vertical to its plane with a constant angular velocity ω. If two objects each of mass m be attached gently to the opposite ends of a diameter of the ring, the ring will then rotate with an angular velocity:

(1) $\frac{\omega M}{M + 2m}$ **(2)** $\frac{\omega(M + 2m)}{M}$

(3) $\frac{\omega M}{M + m}$ **(4)** $\frac{\omega(M - 2m)}{M + 2m}$

Sol: $I_1 \omega_1 = I_2 \omega_2,\ I_1 = MR^2,\ I_2 = MR^2 + 2mR^2$

$\therefore\ \omega_2 = \frac{I_1}{I_2}\omega = \frac{M}{M + 2m}\omega.$

$\therefore$ **Correct choice : (1)**

3. In thermodynamic processes which of the following statements is **not** true?

(1) In an isochoric process pressure remains constant

(2) In an isothermal process the temperature remains constant

(3) In an adiabatic process PV^{γ} = constant

(4) In an adiabatic process the system is insulated from the surroundings

Sol: Pressure constant: – isobaric, not isochoric

$\therefore$ **Correct choice : (1)**

4. The number of photo electrons emitted for light of a frequency ν (higher than the threshold frequency ν_0) is proportional to:

(1) Threshold frequency (ν_0) **(2)** Intensity of light

(3) Frequency of light (ν) **(4)** $\nu - \nu_0$

Sol: Saturation current $\propto$ intensity

$\therefore$ **Correct choice : (2)**

5. A simple pendulum performs simple harmonic motion about $x = 0$ with an amplitude a and time period T. The speed of the pendulum at $x = \frac{a}{2}$ will be:

(1) $\frac{\pi a}{T}$ **(2)** $\frac{3\pi^2 a}{T}$

(3) $\frac{\pi a\sqrt{3}}{T}$ **(4)** $\frac{\pi a\sqrt{3}}{2T}$

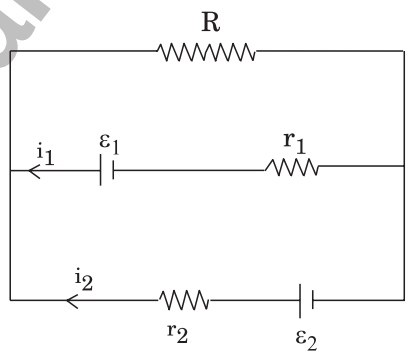
Sol: Speed $v = \omega\sqrt{a^2 - x^2}$, $x = \frac{a}{2}$

$$\therefore v = \omega\sqrt{a^2 - \frac{a^2}{4}} = \omega\sqrt{\frac{3a^2}{4}}$$

$$= \frac{2\pi}{T}\cdot\frac{a\sqrt{3}}{2} = \frac{\pi a\sqrt{3}}{T}$$

$\therefore$ **Correct choice : (3)**

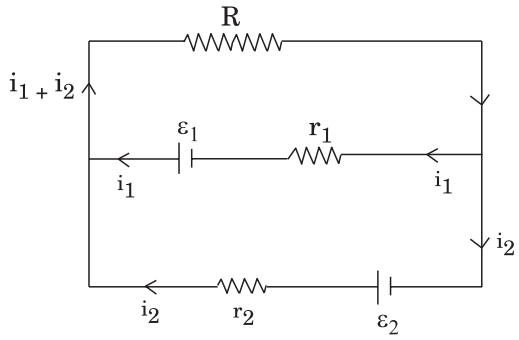
6. See the electric circuit shown in this **Figure**. Which of the following equations is a correct equation for it?



(1) $\varepsilon_2 - i_2 r_2 - \varepsilon_1 - i_1 r_1 = 0$ **(2)** $-\varepsilon_2 - (i_1 + i_2) R + i_2 r_2 = 0$

(3) $\varepsilon_1 - (i_1 + i_2) R + i_1 r_1 = 0$ **(4)** $\varepsilon_1 - (i_1 + i_2) R - i_1 r_1 = 0$

Sol:



$\varepsilon_1 - (i_1 + i_2)R - i_1 r_1 = 0.$

$\therefore$ **Correct choice : (4)**

7. A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 m/s^2. The mass of this body must be:

(1) 10 kg **(2)** 20 kg **(3)** $10\sqrt{2}$ kg **(4)** $2\sqrt{10}$ kg

Sol: $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$,

$|F| = \sqrt{36 + 64 + 100} = 10\sqrt{2}$ N

$a = 1\ ms^{-2}$

$\therefore\ m = \dfrac{10\sqrt{2}}{1} = 10\sqrt{2}$ kg

$\therefore$ **Correct choice : (3)**

8. The symbolic representation of four logic gates are given below:

(i)

(ii)

(iii)

(iv)

The logic symbols for OR, NOT and NAND gates are respectively:

(1) (iv), (i), (iii) **(2)** (iv), (ii), (i) **(3)** (i), (iii), (iv) **(4)** (iii), (iv), (ii)

$\therefore$ **Correct choice : (2)**

9. If $\vec{F}$ is the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin, then:

(1) $\vec{r} \cdot \vec{\tau} > 0$ and $\vec{F} \cdot \vec{\tau} < 0$

(2) $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{F} \cdot \vec{\tau} = 0$

(3) $\vec{r} \cdot \vec{\tau} = 0$ and $\vec{F} \cdot \vec{\tau} \neq 0$

(4) $\vec{r} \cdot \vec{\tau} \neq 0$ and $\vec{F} \cdot \vec{\tau} = 0$

Sol: $\vec{\tau} = \vec{r} \times \vec{F} \Rightarrow \vec{r} \cdot \vec{\tau} = 0 \qquad \vec{F} \cdot \vec{\tau} = 0$

∴ Correct choice : (2)

10. The two ends of a rod of length L and a uniform cross-sectional area A are kept at two temperatures T_1 and T_2 ($T_1 > T_2$). The rate of heat transfer, $\frac{dQ}{dt}$ through the rod in a steady state is given by:

(1) $\frac{dQ}{dt} = \frac{k(T_1 - T_2)}{LA}$ **(2)** $\frac{dQ}{dt} = k\,L\,A\,(T_1 - T_2)$

(3) $\frac{dQ}{dt} = \frac{k\,A(T_1 - T_2)}{L}$ **(4)** $\frac{dQ}{dt} = \frac{kL(T_1 - T_2)}{A}$

Sol: $\frac{dQ}{dt} = \frac{kA(T_1 - T_2)}{L}$

∴ Correct choice : (3)

11. A p-n photodiode is fabricated from a semiconductor with a band gap of 2.5 eV. It can detect a signal of wavelength:

(1) 4000 nm **(2)** 6000 nm **(3)** 4000 Å **(4)** 6000 Å

Sol: $\lambda_{max} = \frac{hc}{E} = \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{2.5 \times 1.6 \times 10^{-19}} \simeq 5000$ Å

$\lambda < \lambda_{max} = 4000$ Å

∴ Correct choice : (3)

12. If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be:

(1) Velocity if a = 1, b = 0, c = – 1

(2) Acceleration if a = 1, b = 1, c = – 2

(3) Force if a = 0, b = – 1, c = – 2

(4) Pressure if a = 1, b = – 1, c = – 2

Sol: Pressure $= \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$

$\Rightarrow a = 1, b = -1, c = -2.$

$\therefore$ **Correct choice : (4)**

13. A transistor is operated in common-emitter configuration at $V_c = 2$ V such that a change in the base current from 100 μA to 200 μA produces a change in the collector current from 5 mA to 10 mA. The current gain is:

(1) 100 **(2)** 150 **(3)** 50 **(4)** 75

Sol: $\Delta I_E = \Delta I_B + \Delta I_C$

$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

$$\Delta I_C = 5 \times 10^{-3} \text{ A}$$

$$\Delta I_B = 100 \times 10^{-6} \text{ A}$$

$$\beta = \frac{5}{100} \times 1000 = 50$$

$\therefore$ **Correct choice : (3)**

14. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is:

(1) 4 ms^{-2} upwards. **(2)** 4 ms^{-2} downwards.

(3) 14 ms^{-2} upwards. **(4)** 30 ms^{-2} downwards.

Sol: $2000\,a = 28000 - 20000 = 8000$

$$a = \frac{8000}{2000} = 4 \text{ ms}^{-2} \uparrow$$

$\therefore$ **Correct choice : (1)**

15. Four identical thin rods each of mass M and length ℓ, form a square frame. Moment of inertia of this frame about an axis through the centre of the square and perpendicular to its plane is :

(1) $\frac{2}{3} M\ell^2$ **(2)** $\frac{13}{3} M\ell^2$ **(3)** $\frac{1}{3} M\ell^2$ **(4)** $\frac{4}{3} M\ell^2$

Sol: $\frac{mL^2}{12} + \frac{mL^2}{4} = \frac{4mL^2}{12} = \frac{mL^2}{3}$

Total M.I. $= 4 \times \frac{mL^2}{3}$

$\therefore$ **Correct choice : (4)**

16. Each of the two strings of length 51.6 cm and 49.1 cm are tensioned separately by 20 N force. Mass per unit length of both the strings is same and equal to 1 g/m. When both the strings vibrate simultaneously the number of beats is:

(1) 7 **(2)** 8 **(3)** 3 **(4)** 5

Sol: $f_1 = \frac{1}{2\ell_1}\sqrt{\frac{T}{m}}$, $f_2 = \frac{1}{2\ell_2}\sqrt{\frac{T}{m}}$, $f_2 - f_1 = \frac{1}{2}\sqrt{\frac{T}{m}}\frac{(\ell_1 - \ell_2)}{\ell_1 \ell_2}$

$\sqrt{\frac{T}{m}} = \sqrt{\frac{20}{10^{-3}}} = \sqrt{2} \times 10^2 = 1.414 \times 100 = 141.4$

$\frac{\ell_1 - \ell_2}{\ell_1 \ell_2} = \frac{(51.6 - 49.1) \times 10^2}{51.6 \times 49.1} = \frac{2.5 \times 10^2}{50 \times 50} = \frac{1}{10}$

$\therefore f_2 - f_1 = \frac{1}{2} \times 141.4 \times \frac{1}{10} = 7$ beats

$\therefore$ **Correct choice : (1)**

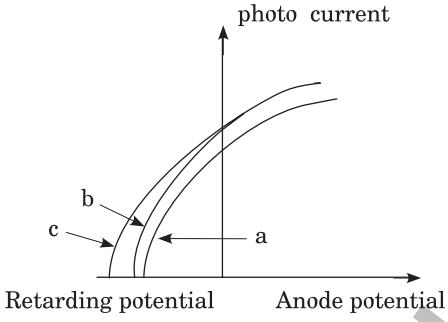
17. The number of beta particles emitted by a radioactive substance is twice the number of alpha particles emitted by it. The resulting daughter is an:

(1) isomer of parent **(2)** isotone of parent

(3) isotope of parent **(4)** isobar of parent

$\therefore$ **Correct choice : (3)**

18. The **Figure** shows a plot of photo current versus anode potential for a photo sensitive surface for three different radiations. Which one of the following is a **correct** statement?



(1) curves (a) and (b) represent incident radiations of same frequency but of different intensities.

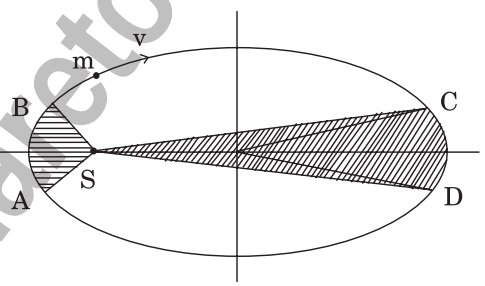
(2) curves (b) and (c) represent incident radiations of different frequencies and different intensities.

(3) curves (b) and (c) represent incident radiations of same frequency having same intensity.

(4) curves (a) and (b) represent incident radiations of different frequencies and different intensities.

∴ Correct choice : (1)

19. The **Figure** shows elliptical orbit of a planet **m** about the sum S. The shaded area SCD is twice the shaded area SAB. If $\mathbf{t_1}$ is the time for the planet of move from C to D and $\mathbf{t_2}$ is the time to move from A to B then:



(1) $t_1 = 4t_2$ **(2)** $t_1 = 2t_2$ **(3)** $t_1 = t_2$ **(4)** $t_1 > t_2$

Sol: SCD : $A_1 - t_1$ (areal velocity constant)

SAB : $A_2 - t_2$

$$\frac{A_1}{t_1} = \frac{A_2}{t_2},\ t_1 = t_2 \cdot \frac{A_1}{A_2},\ A_1 = 2A_2$$

$$\therefore t_1 = 2t_2$$

∴ Correct choice : (2)

20. A black body at 227°C radiates heat at the rate of 7 Cals/cm^{2}s. At a temperature of 727°C, the rate of heat radiated in the same units will be:

(1) 50 **(2)** 112 **(3)** 80 **(4)** 60

Sol: $E = \sigma T^4$,

$$\frac{E_2}{E_1} = \left(\frac{T_2}{T_1}\right)^4 = \left(\frac{1000}{500}\right)^4 = 16$$

$T_1 = 500$ K

$T_2 = 1000$ K

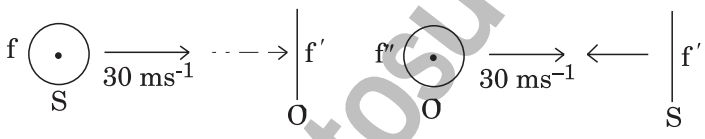
$\therefore E_2 = 16 \times 7 = 112$ cal/cm^2 s.

$\therefore$ **Correct choice : (2)**

21. The driver of a car travelling with speed 30 m/sec towards a hill sounds a horn of frequency 600 Hz. If the velocity of sound in air is 330 m/s, the frequency of reflected sound as heard by driver is:

(1) 555.5 Hz **(2)** 720 Hz **(3)** 500 Hz **(4)** 550 Hz

Sol:

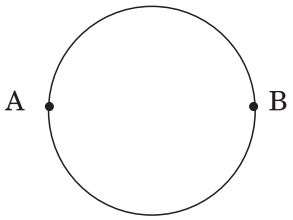


$$f' = \frac{v}{v - 30} f,\ f'' = \frac{v + 30}{v} f' = \frac{v + 30}{v - 30} f = \frac{360}{300} \times 600$$

$= 720$ Hz

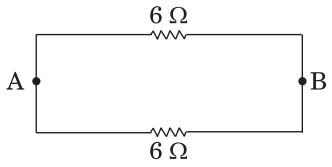
$\therefore$ **Correct choice : (2)**

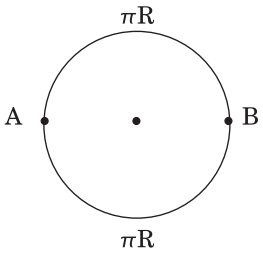
22. A wire of resistance 12 ohms per meter is bent to form a complete circle of radius 10 cm. The resistance between its two diametrically opposite points, A and B as shown in the **Figure**, is:



(1) 3 Ω **(2)** 6 π Ω **(3)** 6 Ω **(4)** 0.6 π Ω

Sol:





$2\pi R \longrightarrow 12\ \Omega$

$\therefore\ R = \dfrac{6 \times 6}{12} = 3\ \Omega$

$\therefore$ **Correct choice : (1)**

23. A rectangular, a square, a circular and an elliptical loop, all in the (x – y) plane, are moving out of a uniform magnetic field with a constant velocity, $\vec{V} = v\hat{i}$. The magnetic field is directed along the negative z axis direction. The induced **emf**, during the passage of these loops, out of the field region, will not remain constant for:

(1) the circular and the elliptical loops.

(2) only the elliptical loop.

(3) any of the four loops.

(4) the rectangular, circular and elliptical loops.

Sol: As the loop leaves the magnetic field, area in magnetic field decreases for all loops, so induced emf does not remain constant. (Any of four loops)

$\therefore$ **Correct choice : (3)**

24. A galvanometer having a coil resistance of 60 Ω shows full scale deflection when a current of 1.0 amp passes through it. It can be converted into an ammeter to read currents upto 5.0 amp by:

(1) putting in series a resistance of 15 Ω

(2) putting in series a resistance of 240 Ω

(3) putting in parallel a resistance of 15 Ω

(4) putting in parallel a resistance of 240 Ω

Sol: $G = 60\ \Omega$, $I_g = 1.0$ A, $I = 5$ A.

$I_g G = (I - I_g) S$,

$$S = \frac{I_g G}{I - I_g} = \frac{1}{5 - 1} \times 60 = 15\ \Omega$$

putting 15 Ω in parallel.

$\therefore$ **Correct choice : (3)**

25. Power dissipated in an LCR series circuit connected to an a.c source of **emf** ε is:

(1) $\dfrac{\varepsilon^2\sqrt{R^2+\left(Lw-\dfrac{1}{Cw}\right)^2}}{R}$ **(2)** $\dfrac{\varepsilon^2\left[R^2+\left(Lw-\dfrac{1}{Cw}\right)^2\right]}{R}$

(3) $\dfrac{\varepsilon^2 R}{\sqrt{R^2+\left(Lw-\dfrac{1}{Cw}\right)^2}}$ **(4)** $\dfrac{\varepsilon^2 R}{\left[R^2+\left(Lw-\dfrac{1}{Cw}\right)^2\right]}$

Sol: Power dissipated in series LCR: $P = I^2R = \dfrac{\varepsilon^2}{|Z|^2}R = \dfrac{\varepsilon^2 R}{\left[R^2+\left(\omega L-\dfrac{1}{\omega C}\right)^2\right]}$

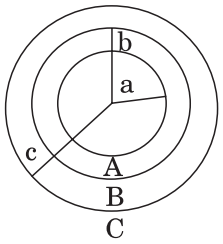
$\therefore$ **Correct choice : (4)**

26. Three concentric spherical shells have radii a, b and c (a < b < c) and have surface charge densities σ, $-\sigma$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for c = a + b, we have:

(1) $V_C = V_B \neq V_A$ **(2)** $V_C \neq V_B \neq V_A$

(3) $V_C = V_B = V_A$ **(4)** $V_C = V_A \neq V_B$

Sol: c = a + b.



$$v_A = \frac{\sigma Q}{\varepsilon_0} - \frac{\sigma b}{\varepsilon_0} + \frac{\sigma c}{\varepsilon_0} = \frac{\sigma}{\varepsilon_0}[c-(b-a)]$$

$$V_B = \frac{-\sigma b}{\varepsilon_0} + \frac{1}{4\pi\varepsilon_0}\cdot\frac{\sigma\times 4\pi a^2}{b} + \frac{\sigma c}{\varepsilon_0}$$

$$= \frac{\sigma}{\varepsilon_0}\left[c-\frac{(b^2-a^2)}{b}\right]$$

$$V_C = \frac{\sigma c}{\varepsilon_0} - \frac{1}{4\pi\varepsilon_0}\cdot\frac{\sigma\times 4\pi b^2}{c} + \frac{1}{4\pi\varepsilon_0}\cdot\frac{\sigma\times 4\pi a^2}{c} = \frac{\sigma}{\varepsilon_0}\left[c-\frac{(b^2-a^2)}{c}\right]$$

$$= \frac{\sigma}{\varepsilon_0}[c-(b-a)]$$

$V_A = V_C \neq V_B$

$\therefore$ **Correct choice : (4)**

27. An engine pumps water continuously through a hose. Water leaves the hose with a velocity **v** and **m** is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water?

(1) mv^2 **(2)** $\frac{1}{2} mv^2$ **(3)** $\frac{1}{2} m^2v^2$ **(4)** $\frac{1}{2} mv^3$

Sol: m : mass per unit length

$\therefore$ rate of mass per sec $= \frac{mx}{t} = mv.$

Rate of K.E. $= \frac{1}{2} (mv)\, v^2 = \frac{1}{2} mv^3$

$\therefore$ Correct choice : (4)

28. A bar magnet having a magnetic moment of 2×10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field B = 6×10^{-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° from the field is:

(1) 12 J **(2)** 6 J **(3)** 2 J **(4)** 0.6 J

Sol: Work done = MB $(\cos \theta_1 - \cos \theta_2)$

$= nB\left(1 - \frac{1}{2}\right) = \frac{2 \times 10^4 \times 6 \times 10^{-4}}{2} = 6$ J

$\therefore$ Correct choice : (2)

29. In a Rutherford scattering experiment when a projectile of charge z_1 and mass M_1 approaches a target nucleus of charge z_2 and mass M_2, the distance of closest approach is r_0. The energy of the projectile is:

(1) directly proportional to $z_1 z_2$

(2) inversely proportional to z_1

(3) directly proportional to mass M_1

(4) directly proportional to $M_1 \times M_2$

$\therefore$ Correct choice : (1)

30. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per sec. On the average at a target irradiated by this beam is:

(1) 3×10^{16} **(2)** 9×10^{15} **(3)** 3×10^{19} **(4)** 9×10^{17}

Sol: $\lambda = 667 \times 10^{-9}$ m, $P = 9 \times 10^{-3}$ W

$$P = \frac{Nhc}{\lambda}, \text{ N : No. of photons emitted/sec.}$$

$$N = \frac{9 \times 10^{-3} \times 667 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^{8}}$$

$$= \frac{9 \times 6.67 \times 10^{-10}}{3 \times 6.6 \times 10^{-26}} \simeq 3 \times 10^{16}/\text{sec}$$

∴ **Correct choice : (1)**

31. A wave in a string has an amplitude of 2 cm. The wave travels in the + ve direction of x axis with a speed of 128 m/sec. and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is:

(1) $y = (0.02)$ m $\sin (15.7x - 2010t)$

(2) $y = (0.02)$ m $\sin (15.7x + 2010t)$

(3) $y = (0.02)$ m $\sin (7.85x - 1005t)$

(4) $y = (0.02)$ m $\sin (7.85x + 1005t)$

Sol: $A = 2$ cm, $\frac{\omega}{k} = 128 \text{ ms}^{-1}$, $5\lambda = 4$, $\lambda = \frac{4}{5}$ m

$y = A \sin (kx - \omega t)$,

$$k = \frac{2\pi}{\lambda} = \frac{2\pi \times 5}{4} = \frac{31.4}{4} = 7.85$$

$y = 0.02$ m $\sin (7.857 - 1005\ t)$

$\omega = 128 \times 7.85 = 1005$

∴ **Correct choice : (3)**

32. Which one of the following equations of motion represents simple harmonic motion?

(1) acceleration $= -k(x + a)$

(2) acceleration $= k(x + a)$

(3) acceleration $= kx$

(4) acceleration $= -k_0x + k_1x^2$

Where k, k_0, k_1 and a are all positive.

Sol: $a = -kX$, $X = x + a$.

∴ **Correct choice : (1)**

33. A student measures the terminal potential difference (V) of a cell (of **emf** $\in$ and internal resistance r) as a function of the current (I) flowing through it. The slope, and intercept, of the graph between V and I, then, respectively, equal:

(1) $-$ r and $\in$ **(2)** r and $-\in$ **(3)** $-\in$ and r **(4)** $\in$ and $-$ r

Sol: $V + ir = E$

$V = V_A - V_B$

$E - ir$

$\frac{\partial V}{\partial i} = -r,\ i = 0, v = E$

$\therefore$ slope $= -r$, intercept $= E$

$\therefore$ **Correct choice : (1)**

34. If a diamagnetic substance is brought near the north or the south pole of a bar magnet, it is:

(1) repelled by the north pole and attracted by the south pole

(2) attracted by the north pole and repelled by the south pole

(3) attracted by both the poles

(4) repelled by both the poles

$\therefore$ **Correct choice : (4)**

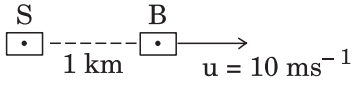
35. A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus?

(1) 40 ms^{-1} **(2)** 25 ms^{-1} **(3)** 10 ms^{-1} **(4)** 20 ms^{-1}

Sol: Let v be the relative velocity of scooter w.r.t b as

$v = v_S - v_B$

$\therefore v_S = v + v_B,\ v = \frac{1000}{100} = 10\ ms^{-1}$



$\therefore$ velocity of scooter $= 20\ ms^{-1}$

$\therefore$ **Correct choice : (4)**

36. Sodium has body centred packing. Distance between two nearest atoms is 3.7 Å. The lattice parameter is:

(1) 4.3 Å **(2)** 3.0 Å **(3)** 8.6 Å **(4)** 6.8 Å

Sol: $3.7 = \frac{\sqrt{3}}{2}\, a$

$$a = \frac{2 \times 3.7}{\sqrt{3}} = 4.3 \text{ Å}$$

∴ Correct choice : (1)

37. The internal energy change in a system that has absorbed 2 Kcals of heat and done 500 J of work is:

(1) 6400 J **(2)** 5400 J **(3)** 7900 J **(4)** 8900 J

Sol: $Q = \Delta U + W$

$\Delta U = Q - W = 2 \times 4.2 \times 1000 - 500 = 8400 - 500$

$= 7900$ J

∴ Correct choice : (3)

38. Three capacitors each of capacitance C and of breakdown voltage V are joined in series. The capacitance and breakdown voltage of the combination will be:

(1) 3C, $\frac{V}{3}$ **(2)** $\frac{C}{3}$, 3V **(3)** 3C, 3V **(4)** $\frac{C}{3}$, $\frac{V}{3}$

Sol: $Q = CV$

$V_{eff} = V + V + V = 3\,V$

$$\frac{1}{C_{eff}} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C} \Rightarrow C_{eff} = \frac{C}{3}$$

$\left(\frac{C}{3},\ 3V\right)$

∴ Correct choice : (2)

39. 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 a velocity of 12 ms^{-1} and 2 kg second part moving with a velocity of 8 ms^{-1}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be:

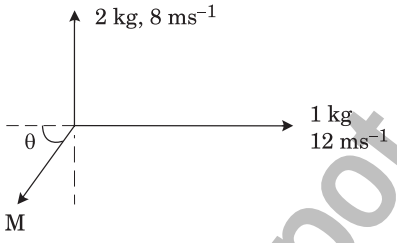
(1) 7 kg **(2)** 17 kg **(3)** 3 kg **(4)** 5 kg

Sol: $Mv \cos\theta = 12$

$Mv \sin\theta = 16$

$\tan\theta = \frac{16}{12} = \frac{4}{3}$

$M = \frac{12 \times 5}{4 \times 3} = \frac{60}{12} = 5$ kg



∴ **Correct choice : (4)**

40. A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10 seconds is S_1 and that covered in the first 20 seconds is S_2, then:

(1) $S_2 = 3S_1$ **(2)** $S_2 = 4S_1$ **(3)** $S_2 = S_1$ **(4)** $S_2 = 2S_1$

Sol: $s_1 = \frac{1}{2} a \times t_1^2$, $s_2 = \frac{1}{2} a \times t_2^2$

$\therefore \frac{s_1}{s_2} = \left(\frac{t_1}{t_2}\right)^2 = \left(\frac{10}{20}\right)^2 = \frac{1}{4}$

$s_2 = 4\, s_1$

∴ **Correct choice : (2)**

41. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? ($g = 10$ m/s^2)

(1) 30 J **(2)** 40 J **(3)** 10 J **(4)** 20 J

Sol: $\frac{1}{2} mv^2 - mgh = \frac{1}{2} \times 1 \times 400 - 1 \times 18 \times 10$

$= 200 - 180 = 20$ J

∴ **Correct choice : (4)**

42. A conducting circular loop is placed in a uniform magnetic field 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced emf in the loop when the radius is 2 cm is:

(1) 4.8 π μV **(2)** 0.8 π μV **(3)** 1.6 π μV **(4)** 3.2 π μV

Sol: $e = -B\frac{d}{dt}(\pi r^2) = -B\,\pi\,2r\,\frac{dr}{dt}$

$r = 2$ cm, $e = -0.04 \times 3.14 \times 2 \times 2 \times 10^{-2} \times 2 \times 10^{-3} = -0.04 \times 25.12 \times 10^{-7}$

$= 100.48 \times 10^{-7}$

$= 32\,\pi \times 10^{-7}$

$= 3.2\,\pi \times 10^{-6}\ V = 3.2\,\pi\,\mu V$

∴ Correct choice : (4)

43. The magnetic force acting on a charged particle of charge $-2\ \mu C$ in a magnetic field of 2T acting in y direction, when the particle velocity is

$(2\hat{i} + 3\hat{j}) \times 10^6\ ms^{-1}$, is:

(1) 4 N is z direction **(2)** 8 N is y direction

(3) 8 N in z direction **(4)** 8 N in – z direction

Sol: $\vec{F} = q\left(\vec{V} \times \vec{B}\right) = -2 \times 10^{-6}\ C\ [2 \times 2 \times 10^6] = -8$ N z-axis

∴ Correct choice : (4)

44. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i} + 2\hat{j} + \hat{k}$ and $-3\hat{i} - 2\hat{j} + \hat{k}$, respectively. The centre of mass of this system has a position vector:

(1) $-2\hat{i} - \hat{j} + \hat{k}$ **(2)** $2\hat{i} - \hat{j} - 2\hat{k}$ **(3)** $-\hat{i} + \hat{j} + \hat{k}$ **(4)** $-2\hat{i} + 2\hat{k}$

Sol: $\vec{R} = \frac{m_1\vec{R}_1 + m_2\vec{R}_2}{\left(m_1 + m_2\right)} = \frac{1}{4}\left[-8\hat{i} - 4\hat{j} + 4\hat{k}\right] = -2\,\hat{i} - \hat{j} + \hat{k}$

∴ Correct choice : (1)

45. The electric potential at a point (x, y, z) is given by $V = -x^2y - xz^3 + 4$

The electric field $\vec{E}$ at that point is:

(1) $\vec{E} = \hat{i}\,2xy + \hat{j}\,(x^2 + y^2) + \hat{k}\,(3xz - y^2)$

(2) $\vec{E} = \hat{i}z^3 + \hat{j}\,xyz + \hat{k}\,z^2$

(3) $\vec{E} = \hat{i}\,(2xy - z^3) + \hat{j}\,xu^2 + \hat{k}\,3z^2\,x$

(4) $\vec{E} = \hat{i}\,(2xy + z^3) + \hat{j}x^2 + \hat{k}\,3xz^2$

Sol: $\vec{E} = -\frac{\partial V}{\partial r} = \left[-\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}\right]$

$$= \left[(2xy + z^3)\hat{i} + \hat{j}\,x^2 + \hat{k}\,3xz^2\right]$$

∴ Correct choice : (4)

46. The mean free path of electrons in a metal is 4×10^{-8} m. The electric field which can given on an average 2 eV energy to an electron in the metal will be in units of V/m:

(1) 5×10^{-11} **(2)** 8×10^{-11} **(3)** 5×10^{7} **(4)** 8×10^{7}

Sol: $E = \frac{V}{d} = \frac{2}{4 \times 10^{-8}} = 0.5 \times 10^{8} = 5 \times 10^{7}\ Vm^{-1}$

∴ Correct choice : (3)

47. The ionization energy of the electron in the hydrogen atom in its ground state is 13.6 eV. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between:

(1) n = 3 to n = 1 states **(2)** n = 2 to n = 1 states

(3) n = 4 to n = 3 states **(4)** n = 3 to n = 2 states

Sol: $\frac{n(n-1)}{2} = 6$

$n^2 - n - 12 = 0$

$(n - 4)(n + 3) = 0$ or $n = 4$

∴ Correct choice : (3)

48. Under the influence of a uniform magnetic field, a charged particle moves with constant speed V in a circle of radius R. The time period of rotation of the particle:

(1) depends on R and not on V

(2) is independent of both V and R

(3) depends on both V and R

(4) depends on V and not on R

Sol: $T = \frac{2\pi m}{qB}$

∴ Correct choice : (2)

49. The electric field part of an electromagnetic wave in a medium is represented by $E_x = 0$;

$$E_y = 2.5 \frac{N}{C} \cos\left[\left(2\pi \times 10^6 \frac{rad}{m}\right) t - \left(\pi \times 10^{-2} \frac{rad}{s}\right) x\right];$$

$E_z = 0$. The wave is:

(1) moving along x direction with frequency 10^6 Hz and wave length 100 m.

(2) moving along x direction with frequency 10^6 Hz and wave length 200 m.

(3) moving along – x direction with frequency 10^6 Hz and wave length 200 m.

(4) moving along y direction with frequency $2\pi \times 10^6$ Hz and wave length 200 m.

Sol: $E_y = E_0 \cos(\omega t - kx)$

$\omega = 2\pi f = 2\pi \times 10^6 \quad \therefore f = 10^6$ Hz

$\frac{2\pi}{\lambda} = k = \pi \times 10^{-2}\ m^{-1}, \ \lambda = 200$ m

∴ Correct choice : (2)

50. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value k. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be:

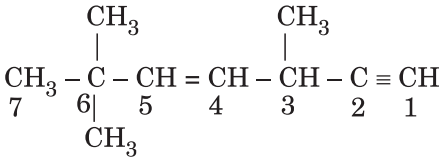
(1) 2 Mg/k **(2)** 4 Mg/k **(3)** Mg/2k **(4)** Mg/k

Sol: $ka = mg$

$a = \frac{mg}{k}$

∴ Correct choice : (4)

151. The state of hybridization of C_2, C_3, C_5 and C_6 of the hydrocarbon,



is in the following sequence:

(1) sp^3, sp^2, sp^2 and sp

(2) sp, sp^2, sp^2 and sp^3

(3) sp, sp^2, sp^3 and sp^2

(4) sp, sp^3, sp^2 and sp^3

Sol: sp, sp^3, sp^2, sp^3

∴ Correct choice : (4)

152. Oxidation numbers of P in PO_4^{3-}, of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$, are respectively:

(1) + 3, + 6 and + 5

(2) + 5, + 3 and + 6

(3) − 3, + 6 and + 6

(4) + 5, + 6 and + 6

Sol: PO_4^{3-} (P = + 5)

SO_4^{2-} (S = + 6)

$Cr_2O_7^{2-}$ (Cr = + 6)

∴ Correct choice : (4)

153. Lithium metal crystallises in a body centred cubic crystal. If the length of the side of the unit cell of lithium is 351 pm, the atomic radius of the lithium will be:

(1) 151.8 pm **(2)** 75.5 pm **(3)** 300.5 pm **(4)** 240.8 pm

Sol: $a\sqrt{3} = 4r$

$$r = \frac{a\sqrt{3}}{4} = \frac{351 \times 1.732}{4} = 151.98 \text{ pm}$$

∴ Correct choice : (1)

154. Which of the following reactions is an example of nucleophilic susbtitution reaction?

(1) $2\,RX + 2\,Na \longrightarrow R - R + 2\,NaX$

(2) $RX + H_2 \longrightarrow RH + HX$

(3) $RX + Mg \longrightarrow RMgX$

(4) $RX + KOH \longrightarrow ROH + KX$

Sol: X^- is replaced by OH^-

∴ Correct choice : (4)

155. In the case of alkali metals, the covalent character decreases in the order:

(1) MF > MCl > MBr > MI **(2)** MF > MCl > MI > MBr

(3) MI > MBr > MCl > MF **(4)** MCl > MI > MBr > MF

Sol: MI > MBr > MCl > MF. As the size of the anion decreases covalency decreases

∴ Correct choice : (3)

156. Which one of the elements with the following outer orbital configurations may exhibit the largest number of oxidation states?

(1) $3d^5 4s^1$ **(2)** $3d^5 4s^2$ **(3)** $3d^2 4s^2$ **(4)** $3d^3 4s^2$

Sol: The configuration $3d^5\ 4s^2$ can have various oxidation states upto + 7.

∴ Correct choice : (2)

157. The stability of + 1 oxidation state increases in the sequence:

(1) Tl < In < Ga < Al **(2)** In < Tl < Ga < Al

(3) Ga < In < Al < Tl **(4)** Al < Ga < In < Tl

Sol: The order is due to 'inert pair effect'

∴ Correct choice : (4)

158. Given:

(i) $Cu^{2+} + 2e^- \longrightarrow Cu,\ E^o = 0.337\ V$

(ii) $Cu^{2+} + e^- \longrightarrow Cu^+,\ E^o = 0.153\ V$

Electrode potential, E^o for the reaction, $Cu^+ + e^- \longrightarrow Cu$, will be:

(1) 0.90 V **(2)** 0.30 V **(3)** 0.38 V **(4)** 0.52 V

Sol: $Cu^{2+} + 2e^- \longrightarrow Cu$; $\Delta G^o = -nE^o F = -2 \times F \times 0.337 = -0.674\ F$

$Cu^+ \longrightarrow Cu^{2+} + e^-$; $\Delta G^o = -nE^o F = -1 \times F \times -0.153 = 0.153\ F$

$Cu^+ + e^- \longrightarrow Cu$; $\Delta G^o = -0.521\ F = -nE^oF$; $n = 1$, $E^o = +0.52$ V

∴ **Correct choice : (4)**

159. For the reaction, $N_2 + 3H_2 \longrightarrow 2NH_3$, if $\frac{d[NH_3]}{dt} = 2 \times 10^{-4}$ mol L^{-1} s^{-1}, the value of $\frac{-d[H_2]}{dt}$ would be:

(1) 4×10^{-4} mol L^{-1} s^{-1} **(2)** 6×10^{-4} mol L^{-1} s^{-1}

(3) 1×10^{-4} mol L^{-1} s^{-1} **(4)** 3×10^{-4} mol L^{-1} s^{-1}

Sol: $-\frac{1}{3}\frac{d[H_2]}{dt} = \frac{1}{2}\frac{d[NH_3]}{dt}$

$$\frac{-d[H_2]}{dt} = \frac{3}{2}\frac{d[NH_3]}{dt} = \frac{3}{2} \times 2 \times 10^{-4} = 3 \times 10^{-4} \text{ mol } L^{-1} s^{-1}$$

∴ **Correct choice : (4)**

160. Consider the following reaction,

$$\text{ethanol} \xrightarrow{PBr_3} X \xrightarrow{\text{alc. KOH}} Y \xrightarrow[\text{(ii) } H_2O,\ \text{heat}]{\text{(i) } H_2SO_4 \text{ room temperature}} Z;$$

the product Z is:

(1) $CH_3CH_2 - O - CH_2 - CH_3$ **(2)** $CH_3 - CH_2 - O - SO_3H$

(3) CH_3CH_2OH **(4)** $CH_2 = CH_2$

Sol:

$$CH_3CH_2OH \xrightarrow{PBr_3} CH_3CH_2Br \xrightarrow{\text{alc.KOH}} CH_2 = CH_2$$

$$CH_2 = CH_2 \xrightarrow{\text{(i) } H_2SO_4} CH_3 - CH_2 - HSO_4$$

$$CH_3 - CH_2 - HSO_4 \xrightarrow[\text{heat}]{H_2O} CH_3CH_2OH$$

∴ **Correct choice : (3)**

161. The energy absorbed by each molecule (A_2) of a substance is 4.4×10^{-19} J and bond energy per molecule is 4.0×10^{-19} J. The kinetic energy of the molecule per atom will be:

(1) 2.2×10^{-19} J **(2)** 2.0×10^{-19} J

(3) 4.0×10^{-20} J **(4)** 2.0×10^{-20} J

Sol: K.E per atom $= \dfrac{\left(4.4 \times 10^{-19}\right) - \left(4.0 \times 10^{-19}\right)}{2} = \dfrac{0.4 \times 10^{-19}}{2} = 2.0 \times 10^{-20}$

$\therefore$ **Correct choice : (4)**

162. Amongst the elements with following electronic configurations, which one of them may have the highest ionization energy?

(1) Ne $[3s^2 3p^2]$ **(2)** Ar $[3d^{10} 4s^2 4p^3]$

(3) Ne $[3s^2 3p^1]$ **(4)** Ne $[3s^2 3p^3]$

Sol: Smallest atom having half filled p-sub shell has highest I_0 value

$\therefore$ **Correct choice : (4)**

163. In the reaction

$BrO_3^-(aq) + 5\ Br^-_{(aq)} + 6H^+ \rightarrow 3\ Br_2(1) + 3\ H_2O_{(1)}$. The rate of appearance of bromine (Br_2) is related to rate of disappearance of bromide ions as following:

(1) $\dfrac{d\left(Br_2\right)}{dt} = -\dfrac{5}{3}\dfrac{d\left(Br^-\right)}{dt}$

(2) $\dfrac{d\left(Br_2\right)}{dt} = \dfrac{5}{3}\dfrac{d\left(Br^-\right)}{dt}$

(3) $\dfrac{d\left(Br_2\right)}{dt} = \dfrac{3}{5}\dfrac{d\left(Br^-\right)}{dt}$

(4) $\dfrac{d\left(Br_2\right)}{dt} = -\dfrac{3}{5}\dfrac{d\left(Br^-\right)}{dt}$

Sol: $\frac{1}{3}\frac{d\left[Br_2\right]}{dt} = -\frac{1}{5}\frac{d\left[Br^-\right]}{dt}$

$\frac{d\left[Br_2\right]}{dt} = -\frac{3}{5}\frac{d\left[Br^-\right]}{dt}$

∴ **Correct choice : (4)**

164. A 0.0020 m aqueous solution of an ionic compound $Co(NH_3)_5(NO_2)Cl$ freezes at – 0.00732 °C. Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be ($k_f = -1.86°C/m$)

(1) 3 **(2)** 4 **(3)** 1 **(4)** 2

Sol: $\Delta T_f = i \times k_f \times m$

$i = \frac{\Delta T_f}{k_f \times m} = \frac{0.00732}{1.86 \times 0.002} = 2$

∴ **Correct choice : (4)**

165. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas?

(1) Dipole-dipole interaction **(2)** Covalent bonds

(3) London dispersion force **(4)** Hydrogen bonding

∴ **Correct choice : (4)**

166. Which of the following oxides is **not** expected to react with sodium hydroxide?

(1) CaO **(2)** SiO_2 **(3)** BeO **(4)** B_2O_3

∴ **Correct choice : (1)**

167. The segment of DNA which acts as the instrumental manual for the synthesis of the protein is:

(1) ribose **(2)** gene **(3)** nucleoside **(4)** nucleotide

∴ **Correct choice : (2)**

168. Maximum number of electrons in a subshell of an atom is determined by the following:

(1) $2\ell + 1$ **(2)** $4\ell - 2$ **(3)** $2n^2$ **(4)** $4\ell + 2$

Sol: The number of sub shell is $(2\ell + 1)$. The maximum number of electrons in the sub shell is $2(2\ell + 1) = (4\ell + 2)$

∴ **Correct choice : (4)**

169. Half life period of a first-order reaction is 1386 seconds. The specific rate constant of the reaction is:

(1) $0.5 \times 10^{-2}\ s^{-1}$ **(2)** $0.5 \times 10^{-3}\ s^{-1}$

(3) $5.0 \times 10^{-2}\ s^{-1}$ **(4)** $5.0 \times 10^{-3}\ s^{-1}$

Sol: $t_{1/2} = \frac{0.693}{k}$; $k = \frac{0.693}{1386} = 0.5 \times 10^{-3}\ s^{-1}$

∴ **Correct choice : (2)**

170. Which one of the following is employed as a tranquilizer?

(1) Naproxen **(2)** Tetracycline

(3) Chlorpheninamine **(4)** Equanil

∴ **Correct choice : (4)**

171. Al_2O_3 is reduced by electrolysis at low potentials and high currents. If 4.0×10^4 amperes of current is passed through molten Al_2O_3 for 6 hours, what mass of aluminium is produced? (Assume 100% current efficiency. At. mass of Al = 27 g mol^{-1})

(1) 8.1×10^4 g **(2)** 2.4×10^5 g **(3)** 1.3×10^4 g **(4)** 9.0×10^3 g

Sol: Total current = $4.0 \times 10^4 \times 6 \times 60 \times 60$ C

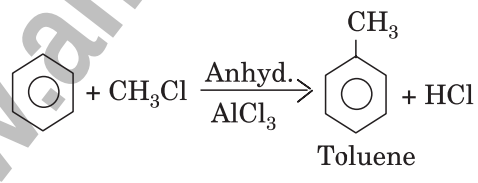
96500 C liberates 9 g of Al (1 g. eq)

$(4 \times 10^4 \times 6 \times 60 \times 60)$ C liberates 8.1×10^4 g of Al

∴ **Correct choice : (1)**

172. Benzene reacts with CH_3Cl in the presence of anhydrous $AlCl_3$ to form:

(1) Chlorobenzene **(2)** Benzylchloride **(3)** Xylene **(4)** Toluene

Sol: 

Toluene

∴ **Correct choice : (4)**

173. Which of the following is **not** permissible arrangement of electrons in an atom?

(1) $n = 5, \ell = 3, m = 0, s = +1/2$

(2) $n = 3, \ell = 2, m = -3, s = -1/2$

(3) $n = 3, \ell = 2, m = -2, s = -1/2$

(4) $n = 4, \ell = 0, m = 0, s = -?$

Sol: For $\ell = 2$, m cannot have -3 value

$\therefore$ **Correct choice : (2)**

174. The dissociation constants for acetic acid and HCN at 25°C are 1.5×10^{-5} and 4.5×10^{-10} respectively. The equilibrium constant for the equilibrium

$CN^- + CH_3COOH \rightleftharpoons HCN + CH_3COO^-$ would be:

(1) 3.0×10^{-5} **(2)** 3.0×10^{-4} **(3)** 3.0×10^{4} **(4)** 3.0×10^{5}

Sol: $CH_3COOH \rightleftharpoons CH_3COO^- + H^+ ; K_a = 1.5 \times 10^{-5}$

$H^+ + CN^- \rightleftharpoons HCN; \dfrac{1}{K_a} = \dfrac{1}{4.5 \times 10^{-10}}$

$\therefore K_a$ for $CN^- + CH_3COOH \rightleftharpoons CH_3COO^- + HCN$ is

$$\frac{1.5 \times 10^{-5}}{4.5 \times 10^{-10}} = \frac{1}{3} \times 10^{5} = 3.33 \times 10^{4}$$

$\therefore$ **Correct choice : (3)**

175. Propionic acid with $Br_2 | P$ yields a dibromo product. Its structure would be:

(1) $H - \underset{\displaystyle Br}{\overset{\displaystyle Br}{\overset{|}{\underset{|}{C}}}} - CH_2COOH$ **(2)** $CH_2Br - CH_2 - COBr$

(3) $CH_3 - \underset{\displaystyle Br}{\overset{\displaystyle Br}{\overset{|}{\underset{|}{C}}}} - COOH$ **(4)** $CH_2\,Br - CHBr - COOH$

Sol: α hydrogen is substituted by bromine

$\therefore$ **Correct choice : (3)**

176. The values of ΔH and ΔS for the reaction, $C_{(graphite)} + CO_{2\ (g)} \longrightarrow 2CO_{(g)}$ are 170 kJ and 170 JK^{-1}, respectively. This reaction will be spontaneous at

(1) 910 K **(2)** 1110 K **(3)** 510 K **(4)** 710 K

Sol: $\Delta G = \Delta H - T\,\Delta S$

$0 = (170 \times 10^3\ J) - T\ (170\ JK^{-1})$

$T = 1000\ K$

For spontaneity, ΔG is – ve

Hence T should be > 1000 K

∴ **Correct choice : (2)**

177. Copper crystallises in a face-centred cubic lattice with a unit cell length of 361 pm. What is the radius of copper atom in pm?

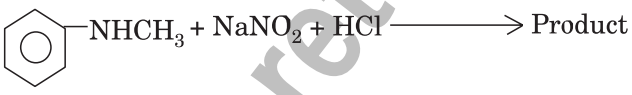
(1) 157 **(2)** 181 **(3)** 108 **(4)** 128

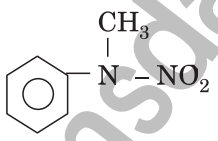
Sol: $a\ \sqrt{2} = 4\ r$

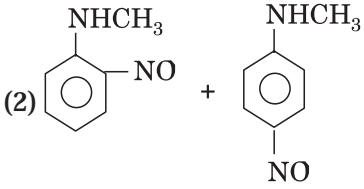
$$r = \frac{a \times 1.414}{4} = \frac{361 \times 1.414}{4} = 128\ pm$$

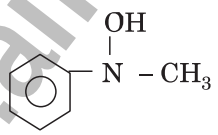
∴ **Correct choice : (4)**

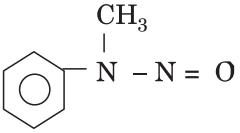
178. Predict the product:



(1) 

(2) 

(3) 

(4) 

Sol: Secondary amine with ($NaNO_2$ + HCl) gives a nitroso product

∴ **Correct choice : (4)**

179. $H_2COH \cdot CH_2OH$ on heating with periodic acid gives:

(1) 2 HCOOH

(2) $\begin{matrix} CHO \\ | \\ CHO \end{matrix}$

(3) $2 \begin{matrix} H \diagdown \\ \quad\quad C = O \\ H \diagup \end{matrix}$

(4) $2\ CO_2$

Sol: $\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix} \xrightarrow{HIO_4} CH_2O + CH_2O$

∴ **Correct choice : (3)**

180. According to MO theory which of the following lists ranks the nitrogen species in terms of increasing bond order?

(1) $N_2^{2-} < N_2^- < N_2$

(2) $N_2 < N_2^{2-} < N_2^-$

(3) $N_2^- < N_2^{2-} < N_2$

(4) $N_2^- < N_2 < N_2^{2-}$

Sol: Bond order $N_2 = 3$

$N_2^- = 2.5$

$N_2^{2-} = 2.0$

∴ **Correct choice : (1)**

181. Out of TiF_6^{2-}, COF_6^{3-}, Cu_2Cl_2 and $NiCl_4^{2-}$ (Z of Ti = 22, CO = 27, Cu = 29, Ni = 28) the colourless species are:

(1) Cu_2Cl_2 and $NiCl_4^{2-}$

(2) TiF_6^{2-} and Cu_2Cl_2

(3) COF_6^{3-} and $NiCl_4^{2-}$

(4) TiF_6^{2-} and COF_6^{3-}

Sol: Cu_2Cl_2 ($Cu^+ = 3d^{10}$)

TiF_6^{2-} ($Ti^{4+} = 3d^0$)

∴ **Correct choice : (2)**

182. Which of the following molecules acts as a Lewis acid?

(1) $(CH_3)_2O$ **(2)** $(CH_3)_3P$ **(3)** $(CH_3)_3N$ **(4)** $(CH_3)_3B$

Sol: $(CH_3)_3B$ – is electron deficient

∴ **Correct choice : (4)**

183. The IUPAC name of the compound having the formula $CH \equiv C - CH = CH_2$ is:

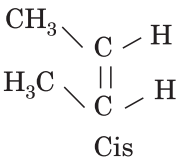
(1) 1-butyn-3-ene **(2)** but-1-yne-3-ene **(3)** 1-butene-3-yne **(4)** 3-butene-1-yne

∴ **Correct choice : (3)**

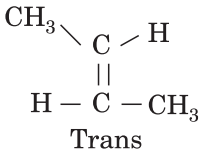
184. Which of the following compounds will exhibit cis-trans (geometrical) isomerism?

(1) Butanol **(2)** 2-Butyne **(3)** 2-Butenol **(4)** 2-Butene

Sol:



Cis



Trans

∴ **Correct choice : (4)**

185. Which of the following **does not** show optical isomerism?

(1) $[CO(NH_3)_3Cl_3]^0$ **(2)** $[CO\ (en)\ Cl_2\ (NH_3)_2]^+$

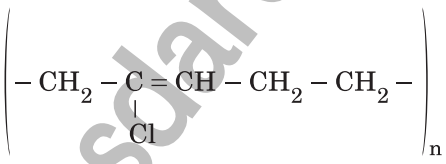
(3) $[CO\ (en)_3]^{3+}$ **(4)** $[CO\ (en)_2Cl_2]^+$ (en = ethylenediamine)

∴ **Correct choice : (1)**

186. Structures of some common polymers are given. Which one is **not** correctly presented?

Neoprene

(1)



(2) Terylene

(3) Nylon 66

$-[NH(CH_2)_6\ NH\ CO\ (CH_2)_4 - CO -]_2$

(4) Teflon

$-(CF_2 - CF_2 -)_n$

Sol: Correct representation is $\left(-CH_2 - \underset{\underset{Cl}{|}}{C} = CH - CH_2 - \right)_n$

∴ **Correct choice : (1)**

187. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at 298 K. Hydrolysis constant of ammonium chloride is:

(1) 6.50×10^{-12} **(2)** 5.65×10^{-13}

(3) 5.65×10^{-12} **(4)** 5.65×10^{-10}

Sol: $K_h = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{1.77 \times 10^{-5}} = 5.65 \times 10^{-10}$

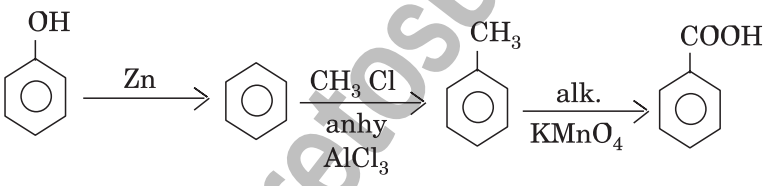
∴ **Correct choice : (4)**

188. Consider the following reaction:

$$\text{Phenol} \xrightarrow[\text{Zn dust}]{} X \xrightarrow[\text{Anhydrous } AlCl_3]{CH_3Cl} Y \xrightarrow{\text{Alkaline } KMnO_4} Z \ ,$$

the product Z is:

(1) Benzaldehyde **(2)** Benzoic acid **(3)** Benzene **(4)** Toluene

Sol: 

∴ **Correct choice : (2)**

189. The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mhos cm^2 and at infinite dilution is 400 mhos cm^2. The dissociation constant of this acid is:

(1) 1.25×10^{-6} **(2)** 6.25×10^{-4} **(3)** 1.25×10^{-4} **(4)** 1.25×10^{-5}

Sol: $\alpha = \frac{\Lambda}{\Lambda_D} = \frac{8.0}{400} = 2 \times 10^{-2}$

$$K_a = \frac{C\alpha^2}{(1-\alpha)} \approx C\alpha^2 = \frac{1}{32} \times \left(2 \times 10^{-2}\right)^2 = 1.25 \times 10^{-5}$$

∴ **Correct choice : (4)**

190. The straight chain polymer is formed by:

(1) hydrolysis of CH_3SiCl_3 followed by condensation polymerisation

(2) hydrolysis of $(CH_3)_4Si$ by addition polymerisation

(3) hydrolysis of $(CH_3)_2SiCl_2$ followed by condensation polymerisation

(4) hydrolysis of $(CH_3)_3SiCl$ followed by condensation polymerisation

∴ **Correct choice : (3)**

191. From the following bond energies:

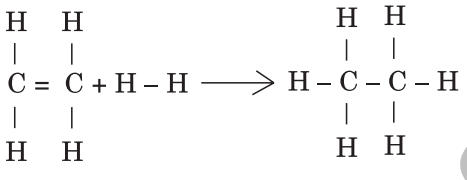
H – H bond energy: 431.37 kJ mol^{-1}

C = C bond energy: 606.10 kJ mol^{-1}

C – C bond energy: 336.49 kJ mol^{-1}

C – H bond energy: 410.50 kJ mol^{-1}

Enthalpy for the reaction,



will be:

(1) – 243.6 kJ mol^{-1} **(2)** – 120.0 kJ mol^{-1}

(3) 553.0 kJ mol^{-1} **(4)** 1523.6 kJ mol^{-1}

Sol: $[(4 \times 410.5) + 606.1 + 431.3)] - [(6 \times 410.5) + 336.49)] = -120.0$ kJ mol^{-1}

∴ **Correct choice : (2)**

192. 10 g of hdyrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be:

(1) 3 mol **(2)** 4 mol **(3)** 1 mol **(4)** 2 mol

Sol: $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$

$\frac{10}{2}$ $\quad$ $\frac{64}{32}$

= 5 mol $\quad$ = 2 mol

Oxygen is the limiting agent. Hence 4 mole of water formed

∴ **Correct choice : (2)**

193. Among the following which is the strongest oxidising agent?

(1) Br_2 **(2)** I_2 **(3)** Cl_2 **(4)** F_2

∴ **Correct choice : (4)**

194. In which of the following molecules / ions BF_3, NO_2^-, NH_2^- and H_2O, the central atom is sp^2 hybridized?

(1) NH_2^- and H_2O **(2)** NO_2^- and H_2O

(3) BF_3 and NO_2^- **(4)** NO_2^- and NH_2^-

∴ **Correct choice : (3)**

195. Nitrobenzene can be prepared from benzene by using a mixture of conc. HNO_3 and conc. H_2SO_4 in the mixture, nitric acid acts as a/an:

(1) acid **(2)** base **(3)** catalyst **(4)** reducing agent

Sol: $HO\,NO_2 + H_2SO_4 \longrightarrow NO_2^+ + H_2O + HSO_4^-$

Nitric acid acts as a base by accepting a proton.

∴ **Correct choice : (2)**

196. Which of the following complex ions is expected to absorb visible light?

(1) $[Ti\,(en)_2(NH_3)_2]^{4+}$ **(2)** $[Cr\,(NH_3)_6]^{3+}$

(3) $[Zn\,(NH_3)_6]^{2+}$ **(4)** $[Sc\,(H_2O)_3\,(NH_3)_3]^{3+}$

(At. no. Zn = 30, Sc = 21, Ti = 22, Cr = 24)

Sol: Cr^{3+} in the complex has unpaired electrons in the d orbital

∴ **Correct choice : (2)**

197. What is the $[OH^-]$ in the final solution prepared by mixing 20.0 mL of 0.050 M HCl with 30.0 mL of 0.10 M $Ba(OH)_2$?

(1) 0.40 M **(2)** 0.0050 M **(3)** 0.12 M **(4)** 0.10 M

Sol: No. of m. equivalent of HCl = $20 \times 0.05 = 1.0$

No. of m. equivalent of $Br\,(OH)_2 = 30 \times 0.1 \times 2 = 6.0$

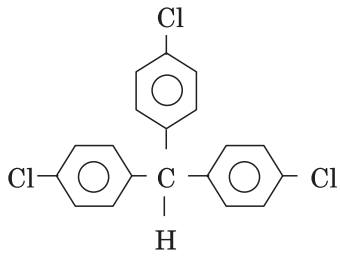
After neutralization, no. of milli equivalents in 50 ml. of solution = $(6 - 1) = 5$

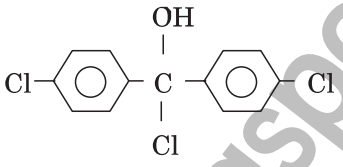
No. of m. equivalent of OH^- is 5 in 50 ml

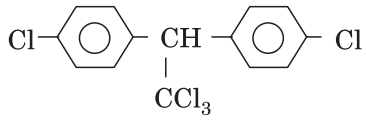
$[OH^-] = \frac{5 \times 100}{50} \times 10^{-3}$ (i.e.,) = 0.1 M

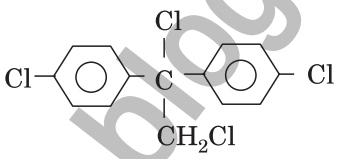
∴ **Correct choice : (4)**

198. Trichloroacetaldehyde, CCl_3CHO reacts with chlorobenzene in presence of sulphuric acid and produces:

(1) 

(2) 

(3) 

(4) 

∴ **Correct choice : (3)**

199. For the reaction A + B ⟶ products, it is observed that:

(a) on doubling the initial concentration of A only, the rate of reaction is also doubled and

(b) on doubling the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction.

The rate of this reaction is given by:

(1) rate = k [A] $[B]^2$ **(2)** rate = k $[A]^2$ $[B]^2$

(3) rate = k [A] [B] **(4)** rate = k $[A]^2$ [B]

Sol: When concentration A is doubled, rate is doubled. Hence order with respect to A is one.

When concentrations of both A and B are doubled, rate increases by 8 times hence total order is 3

∴ rate = k $[A]^1$ $[B]^2$

order = 1 + 2 = 3

∴ **Correct choice : (1)**

200. Which of the following hormones contains iodine?

(1) testosterone **(2)** adrenaline **(3)** thyroxine **(4)** insulin

∴ **Correct choice : (3)**