PHYSICS

Choose the correct answer :

1. Name of the physicist who said first the charge on a glass rod rubbed with silk as positive charge and charge on the rubber rod rubbed with fur as negative charge.

   (1) Benjamin Franklin

   (2) Henry Cavendish

   (3) Charles Augustin de Coulomb

   (4) Millikan

2. The ratio of electric force of interaction to gravitational force of interaction between two protons is of the order of (m_P = 1.67 × 10^{-27} kg)

   (1) 10^{36} (2) 10^{38}

   (3) 10^{42} (4) 10^{43}

3. n small drops of mercury, each of radius r and charge q, coalesce to form a big drop. The ratio of surface charge density of small drop with that of the big drop is

   (1) $n^{\frac{1}{3}}$ (2) $n^{-\frac{1}{3}}$

   (3) $n^{\frac{2}{3}}$ (4) $n^{-\frac{2}{3}}$

4. Four equal charges Q are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is

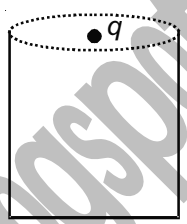
   (1) $\frac{Q}{4}\left(1+2\sqrt{2}\right)$

   (2) $-\frac{Q}{4}\left(1+2\sqrt{2}\right)$

   (3) $\frac{Q}{2}\left(1+2\sqrt{2}\right)$

   (4) $-\frac{Q}{2}\left(1+2\sqrt{2}\right)$

5. Find the flux of the electric field through the surface of the vessel, as shown in figure if a charge q is placed at centre of the open end of cylindrical vessel.



   (1) Zero (2) $\frac{q}{\varepsilon_0}$

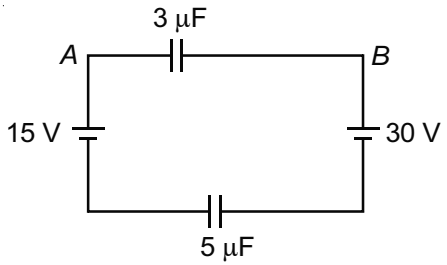
   (3) $\frac{q}{2\varepsilon_0}$ (4) $\frac{q}{3\varepsilon_0}$

6. Electric potential at any point is given by $v = -4x + 5y + \sqrt{15}z$ then magnitude of the electric field is

   (1) $\sqrt{56}$ (2) $\sqrt{40}$

   (3) $\sqrt{41}$ (4) 6

7. In the given figure find $V_A - V_B$.



   (1) 7 V

   (2) –7 V

   (3) 8 V

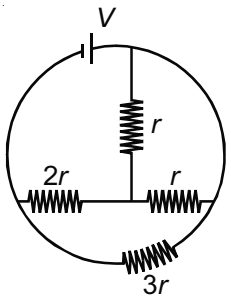
   (4) $-\frac{75}{8}$ V

8. A capacitor of capacity 5 μF is charged to 20 volt and a second capacitor of capacity 8 μF is charged to 15 V. If they are connected in parallel then amount of charge that flows from the 5 μF capacitor to 8 μF capacitor is

(1) $\frac{200}{13}$ μC (2) $\frac{-46}{3}$ μC

(3) 10 μC (4) –10 μC

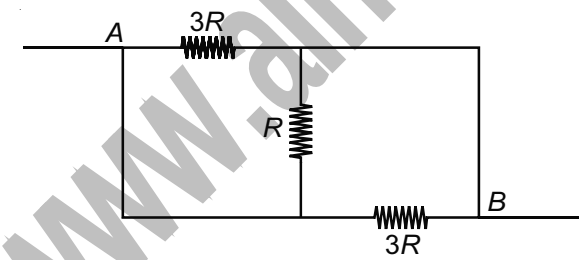
9. The total current supplied to the circuit by the battery is



(1) $\frac{11}{15}\frac{V}{r}$ (2) $\frac{2V}{3r}$

(3) $\frac{3V}{2r}$ (4) $\frac{13V}{11r}$

10. Resultant resistance of the circuit between point *A* and *B* is



(1) $\frac{R}{2}$ (2) $\frac{3R}{5}$

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

11. Two bulbs of rating 500 W and 200 W are manufactured to operate on 220 V line. The ratio of heat produced in 500 W and 200 W bulb when they are connected in series.

(1) $\frac{5}{2}$ (2) $\frac{2}{5}$

(3) $\frac{5}{7}$ (4) $\frac{2}{7}$

12. A proton moving with a velocity of 10^6 m/s describes a circle of radius *R* in a magnetic field. What will be the speed of an α-particle to describe a circle of same radius in the same magnetic field?

(1) 2×10^6 m/s (2) 0.5×10^6 m/s

(3) 4×10^5 m/s (4) 6×10^5 m/s

13. The sensitivity of a moving coil galvanometer increases with the decrease in

(1) Number of turns

(2) Area of coil

(3) Magnetic field

(4) Torque required for unit twist

14. Which of the following property makes soft iron as the suitable core for transformers?

(1) High hysterisis loss, low permeability

(2) High hysterisis loss, high permeability

(3) Low hysterisis loss, low permeability

(4) Low hysterisis loss, high permeability

15. A current of 4000 A is flowing at 220 V in the primary coil of a transformer. The voltage across the secondary is 10000 V and 10% of power is lost. What is the current through secondary?

(1) 8.8 A (2) 88 A

(3) 79.2 A (4) 80 A

16. Self inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitance of (approximately)

(1) 4 μF

(2) 2 μF

(3) 1 μF

(4) 8 μF

17. A photosensitive metallic surface has work function $h\nu_0$. If photons of energy $2h\nu_0$ fall on this surface, the electrons come out with a maximum velocity of 4×10^6 ms^{-1}. When the photon energy is increased to $5h\nu_0$, then maximum velocity of photoelectrons will be

(1) 2×10^7 ms^{-1}

(2) 2×10^6 ms^{-1}

(3) 8×10^5 ms^{-1}

(4) 8×10^6 ms^{-1}

18. If the critical angle be θ, then the Brewster's angle is

(1) $\sin^{-1}[\cot\theta]$

(2) $90 - \theta$

(3) $\tan^{-1}[\text{cosec}\,\theta]$

(4) $\sin^{-1}[\tan\theta]$

19. To achieve good contrast between maxima and minima in the interference pattern of Young's double slit experiment, the ratio of intensity of light emerging out of the two slits should be

(1) 1

(2) 2

(3) 3

(4) 4

20. A plano-convex lens is made of refractive index 1.6. The radius of curvature of curved surface is 60 cm. Focal length of the lens is

(1) 200 cm

(2) 100 cm

(3) 50 cm

(4) 400 cm

21. Refracting angle of a prism is θ and refractive index of the material of the prism is $\cot\frac{\theta}{2}$. The angle of minimum deviation is

(1) $180° - 2\theta$

(2) $90° - \theta$

(3) $180° + 2\theta$

(4) $180° - 3\theta$

22. For hydrogen atom if the energy of n^{th} orbit is E_n, then energy in the n^{th} orbit of a doubly ionized lithium atom will be

(1) $4\,E_n$

(2) $9\,E_n$

(3) $\frac{E_n}{9}$

(4) $\frac{E_n}{4}$

23. Two radioactive materials *A* and *B* 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 *A* to *B* will be $\frac{1}{e^2}$ after a time

(1) $\frac{1}{\lambda}$

(2) $\frac{1}{2\lambda}$

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

(4) $\frac{1}{4\lambda}$

24. Number of NaCl molecules present in the per unit cell of rock-salt is

(1) 4 (2) 6

(3) 2 (4) 1

25. The solutions of KCl, $BaCl_2$ and $FeCl_3$ each one of 0.5 m molality show boiling points T_1, T_2 and T_3. How are these temperatures related to one another?

(1) $T_3 < T_2 < T_1$ (2) $T_2 < T_1 < T_3$

(3) $T_2 < T_3 < T_1$ (4) $T_1 < T_2 < T_3$

26. Which of the following relation is correct?

(1) Molar Conductivity = $\frac{\text{Conductivity}}{\text{Cell constant}}$

(2) Conductivity = Conductance × Cell constant

(3) Conductance = Conductivity × Cell constant

(4) Eq. conductivity = Conductivity × Cell constant

27. Cottrell precipitator is used to

(1) Remove carbon from the smoke

(2) Burn the waste gases

(3) Study suspended particles in a gas

(4) Purifying city water supply

28. The spin only magnetic moment of an element can be calculated by (n = number of unpaired electron)

(1) $\mu = \sqrt{n(n-2)}\ \frac{h}{2\pi}$

(2) $\mu^2 = \sqrt{n(n+2)}\ \frac{h}{2\pi}$

(3) $\mu = \sqrt{n(n+2)}\ \frac{h}{2\pi}$

(4) $\frac{\mu^2}{n} = \sqrt{n+2}\ \frac{h}{2\pi}$

29. Which of the following will oxidise KI to KIO_3?

(1) $KMnO_4/H^+$

(2) $KMnO_4/OH^-$

(3) $K_2Cr_2O_7/H^+$

(4) MnO_2

30. M in $[ML_6]^{3+}$ has $(n-1)d^6$ configuration and +3 oxidation state. L is a strong ligand. The complex is likely to be

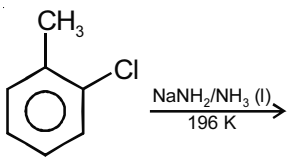
(1) Paramagnetic due to 1-unpaired electron

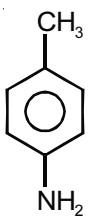
(2) Paramagnetic due to 2-unpaired electrons

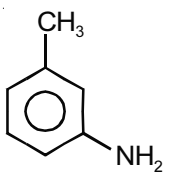
(3) Paramagnetic due to 4-unpaired electrons

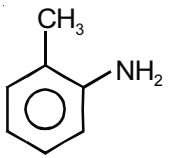
(4) Diamagnetic

31. What is the product of the following reaction?



(1) 

(2) 

(3) 

(4) Both (2) & (3)

32. In the Victor Meyer's test of alcohols, $CH_3 - CH_2 - OH$ gives red colour due to the formation of the product

(1) $CH_3CH_2 - \underset{\displaystyle NO_2}{\underset{|}{C}} = N - \bar{O}\,Na^+$

(2) $CH_3 - CH_2 - \underset{\displaystyle NO_2}{\underset{|}{CH}} - COONa$

(3) $CH_3 - CH_2 - \underset{\displaystyle NH_2}{\underset{|}{C}} = N - \bar{O}\,Na^+$

(4) $CH_3 - CH_2 - \underset{\displaystyle N = O}{\underset{|}{C}} = N - \bar{O}\,Na^+$

33. The number of isomers possible (structural only) for $C_4H_{11}N$ is

(1) 4 (2) 8

(3) 6 (4) 7

34. The ease of hydrolysis of the acid derivatives is in the order

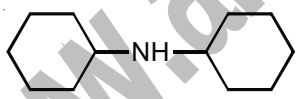
(1) $RCOCl > RCONH_2 > (RCO)_2O > RCOOR'$

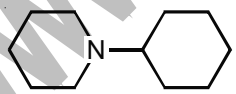
(2) $(RCO)_2O > RCOCl > RCONH_2 > RCOOR'$

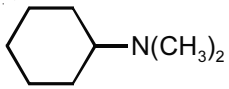
(3) $(RCO)_2O > RCOOR' > RCOCl > RCONH_2$

(4) $RCOCl > (RCO)_2O > RCOOR' > RCONH_2$

35. Which of the following gives precipitates with Hinsberg reagent?

(1) 

(2) 

(3) 

(4) $(CH_3)_3N$

36. Mendius reaction converts acetonitrile into

(1) Methanamine

(2) Ethanamine

(3) Propan-1-amine

(4) Propan-2-amine

37. The class of polymers that has weakest intermolecular forces is

(1) Fibres

(2) Elastomers

(3) Thermosetting polymers

(4) Thermoplastic polymers

38. Out of the following, select the derivative of carbohydrates

(1) Penicillin

(2) Cephalosporin

(3) Streptomycin

(4) Chloromycetin

39. Reaction of which of the chemical with glucose shows the ring structure of glucose and absence of CHO group?

(I) NH_2OH, (II) $NaHSO_3$, (III) Schiff's reagent

(1) I only

(2) II only

(3) Both I and II

(4) I, II and III

40. Which of the following method can be used for the reduction of aldehydes to hydrocarbons?

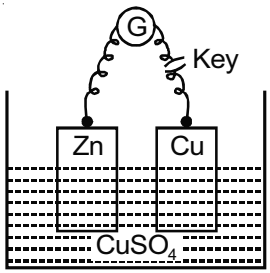
(1) Zn-Hg/HCl

(2) $NH_2 - NH_2/KOH/glycol/\Delta$

(3) HI/Red/P/Δ

(4) All of these

41. In the arrangement shown below, what will happen when the key is pressed to on-position?



(1) Current will flow in the wire from Zn to Cu

(2) Current will flow in the wire from Cu to Zn

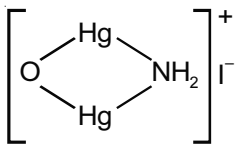
(3) Cu^{2+} ions will move towards Cu metal

(4) No current will flow

42. The presence of NH_3 or NH_4^+ can be detected by using test with Nessler's reagent, whereby brown ppt. of Millon's base are produced. The formula of compound appearing as brown ppt. is

(1) K_2HgI_4/KOH

(2) HgI_2

(3) 

(4) All of these

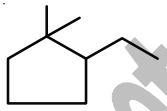
43. Which of the following statement is incorrect?

(1) Cl in ClO_3^- is sp^3 hybridised

(2) Xe in XeO_3 is sp^2 hybridised

(3) S in H_2SO_4 is sp^3 hybridised

(4) P in PCl_5 is sp^3d hybridised

44. IUPAC name of  is

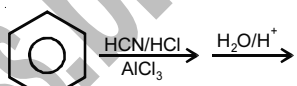
(1) 1-Ethyl-2,2-dimethylcyclopentane

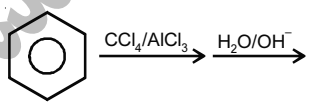
(2) 2-Ethyl-1,1-dimethylcyclohexane

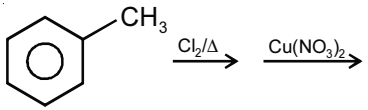
(3) 2-Ethyl-1,1-dimethylcyclopentane

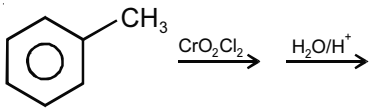
(4) 1-Ethyl-2,2-dimethylcyclohexane

45. Which of the following will not give benzaldehyde?

(1) 

(2) 

(3) 

(4) 

BIOLOGY

46. Potato is multiplied vegetatively by

(1) Rhizome (2) Tuber

(3) Bulb (4) Sucker

47. Identify the **incorrect** statement.

(1) All organisms have to reach a certain stage of growth and maturity in their life before they reproduce sexually. That period of growth is called reproductive phase

(2) Gametes are haploid though the parent plant body from which they arise may be either haploid or diploid

(3) In algae, bryophytes and pteridophytes, water is the medium through which the gamete transfer takes place

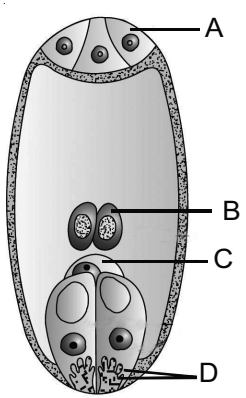
(4) Further development of the zygote depends on the type of life cycle the organism has and the environment it is exposed to

48. The wall of microsporangium which nourishes the developing pollen grains is

(1) Epidermis (2) Endothecium

(3) Middle layer (4) Tapetum

49. Identify A, B, C and D in the given diagram w.r.t. embryo sac.



(1) A–Antipodal cells
B–Central cell
C–Egg
D–Synergids

(2) A–Egg apparatus
B–Polar nuclei
C–Antipodal cell
D–Filliform apparatus

(3) A–Antipodal cells
B–Polar nuclei
C–Egg
D–Filliform apparatus

(4) A–Antipodal cells
B–Secondary nucleus
C–Egg
D–Synergids

50. Pollination by water is quite rare in flowering plants and is limited to about

(1) 40 genera
(2) 30 genera
(3) 35 genera
(4) 25 genera

51. All seeds are albuminous, **except**

(1) Wheat, Maize (2) Barley, Castor
(3) Sunflower, Cocount (4) Pea, Groundnut

52. Mendel crossed pure tall (dominant) plant with pure dwarf (recessive) plant. The F_2 generation from the cross should show

(1) 50% tall and 50% dwarf
(2) All tall plants
(3) 75% tall plants and 25% dwarf plants
(4) All dwarf plants

53. Given below are the few characteristic features of a genetic disorder

a. Short statured with small round head
b. Furrowed tongue
c. Partially open mouth
d. Retarded physical, psychomotor and mental development

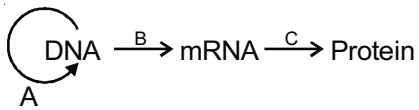
The genetic disorder is

(1) Sickle cell anaemia (2) Down's syndrome
(3) Turner's syndrome (4) Phenyl ketonuria

54. A man with blood group AB, marries a woman with blood group O. The possible blood group of the offsprings is/are

(1) AB, O (2) A, B
(3) A, B, AB (4) A, B, O

55. Identify A, B and C w.r.t. the central dogma of molecular biology.



	A	B	C
(1)	Replication	Translation	Transcription
(2)	Transduction	Transformation	Translation
(3)	Reverse Transcription	Transcription	Translocation
(4)	Replication	Transcription	Translation

56. DNA dependent DNA polymerases catalyse polymerisation in _____ direction.

(1) $5' \rightarrow 3'$

(2) $3' \rightarrow 5'$

(3) Both $5' \rightarrow 3'$ & $3' \rightarrow 5'$

(4) Either $5' \rightarrow 3'$ or $3' \rightarrow 5'$

57. Match the following

	Column-I		Column-II
a.	One codon codes for only one amino acid	(i)	Universal
b.	Same from bacteria to humans	(ii)	No punctuation
c.	Some amino acids are coded by more than one codon	(iii)	Unambiguous
d.	Codon is read in mRNA in a contiguous fashion	(iv)	Degenerate

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

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

58. Identify the **incorrect** statement w.r.t. Human Genome Project.

(1) The average gene consists of 3000 bases

(2) More than 2 percent of the genome codes for proteins

(3) The functions are unknown for over 50 percent of the discovered genes

(4) 1.4 million locations are there with single base DNA differences

59. The variety of wheat resistance to leaf and stripe rust is

(1) Pusa Swarnim (2) Himgiri

(3) Pusa Komal (4) Pusa Shubhra

60. Virus-free plants can be obtained from

(1) Apical and axillary meristem culture

(2) Embryo culture

(3) Pollen culture

(4) Organ culture

61. Statins, blood-cholesterol lowering agents, are produced by

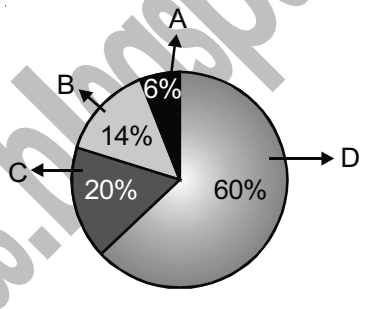
(1) *Monascus purpureus*

(2) *Trichoderma polysporum*

(3) *Aspergillus niger*

(4) *Acetobacter aceti*

62. Given below is the relative contribution of various green house gases to total global warming. Identify A, B, C & D.



	A	B	C	D
(1)	CO_2	CH_4	CFC	N_2O
(2)	N_2O	CFC	CH_4	CO_2
(3)	CFC	N_2O	CO_2	CH_4
(4)	CH_4	CO_2	N_2O	CFC

63. The blend of polyblend and bitumen, when used to lay roads, enhanced road life by a factor of

(1) Two (2) Three

(3) Four (4) One

64. Given below is an equation describing increase or decrease in population size (N) during a unit time period t [dN/dt]

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$$

It represents

(1) Logistic growth

(2) Exponential growth

(3) Mortality

(4) Natality

65. Which of the following is not an example of Commensalism?

(1) Orchid growing on a mango branch

(2) Sea anemone and clown fish

(3) Barnacles growing on the back of a whale

(4) In South American lakes between visiting flamingoes and resident fishes

66. The pyramid of biomass in sea is generally

(1) Upright (2) Inverted

(3) Spindle (4) Triangular

67. Identify the correct statement

(1) A community that is in near equilibrium with the environment is called climax community

(2) In the successive seral stages there is an increase in the number of species but there is decrease in total biomass

(3) Primary succession begins in area where natural biotic communities have been destroyed

(4) Secondary succession is slower than primary succession

68. Match the following:

Column-I	Column-II
a. The Earth Summit	(i) Canada
b. World Summit	(ii) Johannesburg
c. Montreal Protocol	(iii) Rio de Janeiro

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

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

69. Meiocytes are diploid in nature but gametes are haploid. What will be the chromosomes number in butterfly meiocyte cell?

(1) 380

(2) 8

(3) 46

(4) 12

70. Which of the following structure does not participate in the formation of male sex accessory ducts system?

(1) Rete testis (2) Epididymis

(3) Vas deferens (4) Urethra

71. The funnel shaped part of human female fallopian tube, which is present closer to the ovary is called

(1) Fimbrae (2) Foreskin

(3) Fornix (4) Infundibulum

72. Which hormone released from corpus luteum is essential for maintenance of the endometrium of human female?

(1) Estrogen (2) Progesteron

(3) Relaxin (4) Testosteron

73. During embryonic development of human embryo, heart is formed at

(1) Fourth month (2) Sixth month

(3) First month (4) Third month

74. Which of the following is used as barrier method in human family planning program?

(1) Vaults (2) LNG-20

(3) Saheli pills (4) Multiload 375 IUDs

75. Who amongst the following demonstrated through the experiments that life comes only from pre-existing life?

(1) Oparin (2) Haldane

(3) Louis Pasteur (4) S.L. Miller

76. Darwin was influenced by reading the book “An essays on Population”, which was written by

(1) Charles Lyell (2) Thomas Rev Malthus

(3) Hugo de Vries (4) Hardy-Weinberg

77. The Neanderthal man lived in near east and central Asia between 1,00,000 – 40,000 years back and had a brain size of

(1) 1100 cc (2) 1650 cc

(3) 900 cc (4) 1400 cc

78. Which of the following is considered to be in direct line of human evolution and was more man like?

(1) Proconsul (2) *Dryopithecus*

(3) *Ramapithecus* (4) *Australopithecus*

79. *Plasmodium* is responsible for causing malaria. Out of different type of malaria, the malignant malaria is caused by

(1) *Plasmodium vivax*

(2) *Plasmodium malariae*

(3) *Plasmodium ovale*

(4) *Plasmodium falciparum*

80. *Wuchereria bancrofti* cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels and the disease is called

(1) Elephantiasis (2) Ascariasis

(3) Amoebiasis (4) Typhoid

81. Which of the following statement is/are true?

a. Insulin chains and antibody monomer chains are attached through disulphide bond

b. Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection

c. Acid in stomach, saliva in the mouth, tears work as physiological barriers in innate immunity

(1) a & b (2) b & c

(3) a & c (4) All of these

82. Which of the following is chemically known as diacetyl morphine?

(1) Heroin (2) Cocaine

(3) Hashish (4) LSD

83. Marijuana effects on cardiovascular system of the body. Marijuana is obtained from which plant?

(1) *Erythroxylum coca* (2) *Cannabis sativa*

(3) *Papaver somniferum* (4) *Atropa belladona*

84. Prolonged intake of alcohol can cause

(1) Emphysema (2) Cirrhosis

(3) Tuberculosis (4) Mumps

85. At what stage, fertilized eggs are recovered non surgically and transferred to surrogate mothers?

(1) 32 cell stage (2) 100-112 cell stage

(3) 8-32 cell stage (4) After implantation

86. Which of the following is **not** marine fish?

(1) *Catla* (2) *Hilsa*

(3) Sardines (4) Pomfrets

87. Those enzymes which cut DNA at specific locations are called restriction endonuclease or molecular scissors. Which of the following restriction endonuclease is the first to be discovered?

(1) EcoR I (2) BamH I

(3) Hind II (4) Sal I

88. What is the correct sequence done during amplification of gene by PCR method?

(1) Annealing → Denaturation → Extension

(2) Extension → Annealing → Denaturation

(3) Denaturation → Annealing → Extension

(4) Annealing → Extension → Denaturation

89. During downstream processing which process can not be done?

(1) Separation and purification

(2) Product has to be formulated with suitable preservatives

(3) Quality control testing for each product

(4) Separation and isolation of DNA fragments by gel electrophoresis

90. Which nematode infects the roots of tobacco plants and causes a great reduction in yield?

(1) *Meloidegyne incognitia*

(2) *Bacillus thuringiensis*

(3) *Ancylostoma duodenale*

(4) *Trichuris trichura*

❑ ❑ ❑

1. The number of free electrons per 10 mm of an ordinary copper wire is 2×10^{21}. The average drift speed of the electrons is 0.25 mm/s. The current flowing is:

A. 0.8 A B. 8 A C. 80 A D. 5 A

2. Which of the following cells is more likely to be damaged due to short circuiting?

A. Daniel B. Dry C. Acid D. Fuel

3. A gas expands from 5 litre to 105 litre at a constant pressure $100 N/m^2$. The work done is

A. 1 Joule B. 4 Joule C. 8 Joule D. 10 Joule

4. The Helium nuclei can be formed from

A. Hydrogen nuclei by process of chain reaction B. Hydrogen nuclei through nuclear fission
C. Hydrogen nuclei through nuclear fusion D. None of these

5. In the atom bomb dropped by Americans in 1945 on Nagasaki, Japan, the fissionable material used was

A. Helium 4 B. Plutonium 239 C. Uranium 235 D. Uranium 233

6. The engine of a truck moving a straight road delivers constant power. The distance travelled by the truck in time t is proportional to

A. t B. t^2 C. $\sqrt{t}$ D. $t^{3/2}$

7. The velocity of electron in ground state of hydrogen atom is

A. 2×10^5 m/s B. 2×10^6 m/s C. 2×10^7 m/s D. 2×10^8 m/s

8. The radius of the first orbit of the electron in a hydrogen atom is 5.3×10^{-11} m; then the radius of the second orbit must be

A. 15.9×10^{-11} m B. 10.6 x 10 m C. 21.2×10^{-11} m D. 42.4×10^{-11} m

9. A person pushes a rock of 10^{10}Kg mass by applying a force of only 10N for just 4 seconds. The work done is

A. 1000 Joule B. 0 J C. nearly zero D. positive

10. One can take pictures of objects which are completely invisible to the eye using camera films which are sensitive to

A. ultra-violet rays B. sodium light C. visible light D. infra-red rays

11. Light from a 100 watt filament bulb is passed through an evacuated glass tube containing sodium vapour at a high temperature. If the transmitted light is viewed through a spectrometer, we will observe

A. D_1 and D_2 lines of sodium with good intensity B. dark lines where D_1 and D_2 lines should have been observed
C. continuous radiation from the bulb only D. the entire emission spectrum of sodium

12. Under the action of a constant force, a particle is experiencing a constant acceleration. The power is

A. zero B. positive
C. negative D. increasing uniformly with time

13. If in a plane convex lens the radius of curvature of the convex surface is 10 cm and the focal length of the lens is 30 cm, the refractive index of the material of the lens will be

A. 1.5 B. 1.66 C. 1.33 D. 3

14. A plane convex lens has radius of curvature 30 cm. If the refractive index is 1.33, the focal length of lens is

A. 10 cm B. 90 cm C. 30 cm D. 60 cm

15. A beam of light is converging towards a point *I* on a screen. A plane parallel plate of glass (thickness in the direction of the beam = *t*, refractive index = μ) is introduced in the path of the beam. The convergence point is shifted by

A. t (μ - 1) away B. t (1 + 1/μ) away C. t (1 - 1/μ) nearer D. t (1 + 1/μ) nearer

16 . In Young's double silt experiment the separation between the silts is halved and the distance between the silts and screen is doubled. The fringe width will be

A. unchanged B. halved C. doubled D. quadrupled

17. Wavelength of red light is λ_r, violet rays is λ_v and X -ray is λ_x then the order of wavelengths is

A. $\lambda_x > \lambda_v > \lambda_r$ B. $\lambda_v > \lambda_x > \lambda_r$ C. $\lambda_r > \lambda_x > \lambda_v$ D. $\lambda_r > \lambda_v > \lambda$

18. The amount of work done by the labourer who carries *n* bricks, each of mass *m*, to the roof of a house whose height is *h* is

A. *n mgh* B. *mgh*/*n* C. zero D. *ghn*/*m*

19. In LCR circuit in the state of resonance, which of the following statements is correct ? (cos ϕ)=

A. 0 B. 0.5 C. 1 D. None of these

20. In LCR circuit, phase difference between voltage and current cannot be

A. 80° B. 90° C. 145° D. 0°

21. If speed is plotted along x-axis and Kinetic energy against y-axis, then the graph obtained has a shape similar to that of

A. circle B. ellipse C. hyperbola D. parabola

22. A magnetic needle lying parallel to a magnetic field requires *w* units of work to turn it through 60°. The torque needed to maintain the needle in this position will be

A. ($\sqrt{3}$) w B. w

C. $(\sqrt{3}w)/2$ D. 2w

23. A vertical straight conductor carries a current vertically upwards. A point *p* lies to the east of it at a small distance and another point *Q* lies to west of it at the same distance. The magnetic field at *p* is

A. greater than at *Q* B. same as at *Q*

C. less than at *Q* D. greater or less at *Q* depending upon the strength of the current

24. In a parallel arrangement if $(R_1 > R_2)$, the power dissipated in resistance R_1 will be

A. less than R_2 B. same as R_2 C. more than R_2 D. none of these

25. For a fuse wire to be installed in the supply line in a house which one of the following is immaterial ?

A. the specific resistance of the material of the fuse wire B. the diameter of the fuse wire

C. the length of the fuse wire D. none of these

26. If *V* is voltage applied, E_a is emf drop across the armature, the armature current of a d.c. motor I_a is given by

A. $(V + E_a)/R_a$ B. E_a/R_a C. $V- E_a/R_a$ D. V/R_a

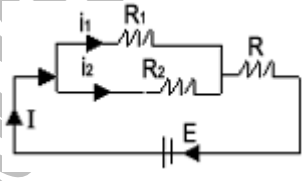
27. The current of 2.0 amperes passes through a cell of e.m.f. 1.5 volts having internal resistance of 0.15Ω . The potential difference measured in volts across both the terminals of the cell will be

A. 1.35 B. 1.50 C. 1.00 D. 1.20

28. In this circuit, current ratio i_1/i_2 depends upon

A. R_1, R_2 and R B. R, R_1, R_2 and E

C. R_1 and R_2 D. E and R



29. A cell of emf *E* is connected across a resistance *r*. The potential difference between the terminals of the cell is found to be *V*. The internal resistance of the cell must be

A. 2(E - V)V/r B. 2(E - V)r/E C. (E - V) r/V D. (E- V)/r

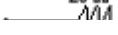
30. Copper and germanium are both cooled to 70 K from room temperature, then

A. resistance of copper increases while that of germanium decreases B. resistance of copper decreases while that of germanium increases

C. resistance of both decreases D. resistance of both increases

31. The potential difference between the points A and B of the electrical circuit given is

A. 1.5 V B. 1.0 V



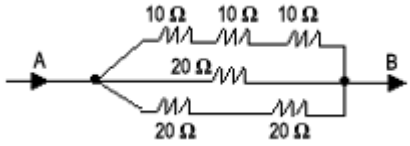
32. A moving coil galvanometer has a resistance of 9.8Ω and gives a full scale deflection when a current of 10 mA passes tbrough it. The value of the shunt required to convert it into a mini ammeter to measure current upto 500 mA is

A. 0.02Ω B. 0.2Ω C. 2Ω D. 0.4Ω

33. The total electrical resistance between the points *A* and *B* of the circuit shown in the figure is

A. 9.02 Ω A. 15 Ω

C. 30 Ω D. 100 Ω



34. If the plates of a charged parallel plate capacitor are pulled away from each other

A. capacitance increases B. energy increases C. voltage increases D. voltage decreases

35. A parallel plate capacitor is charged by connecting its plates to the terminals of a battery. The battery remains connected and a glass plate is interposed between the plates of the capacitor, then

A. the charge on plates will be reduced

B. the charge on plates will increase

C. the potential difference between the plates of the capacitor will be reduced

D. the potential difference between the plates of the capacitor will increase

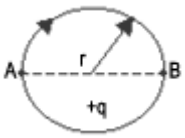
36. A person weighing 70Kg wt lifts a mass of 30 Kg to the roof of a building 10 m high. If he takes 50 sec to do so,then the power spent is

A. 19.6 W B. 196 W C. 300 W D. 50 W

37. Work done in carrying a charge *q* from *A* to *B* along a semi-circle is

A. $2\pi rq$ B. $4\pi rq$

C. πrq D. 0



38. A particle *A* has charge +*q* and particle B has charge +4*q* with each of them having the same mass m. When allowed to fall from rest through same electrical potential difference, the ratio of their speed $V_A : V_B$ will become

A. 2:1 B. 1:2 C. 1:4 D. 4:1

39. The electric field at a small distance *R* from an infinitely long plane sheet is directly proportional to

A. $R^2/2$ B. R/2 C. R^{-2} D. none of these

40. In the diagram, the electric field intensity will be zero at a distance

A. between -q and +2q charge B. towards +2q on the line drawn

C. away from the line towards +2q D. away from the line towards -q

41. Wein's displacement law is given by

A. λ_m = constant B. T/λ_m = constant C. $\lambda_m T$ = constant D. $T = \lambda_m$ = constant

42. If two electrons are forced to come closer to each to each other, then the potential energy

A. becomes zero B. increases C. decreases D. becomes infinite

43. The specific heat at constant pressure is greater than that of the same gas at constant volume because

A. at constant volume work is done in expanding the gas

B. at constant pressure work is done in expanding the gas

C. the molecular attraction increases more at constant pressure

D. the molecular vibration increases more at constant pressure

44. The specific heats of CO_2 at constant pressure and constant volume are 0.833 J/kg.K and 0.641 J/kg.K respectively. If molecular weight of CO_2 is 44, what is the universal constant *R?*

A. 4.19×10^7 erg/cal B. 848.8 J/gm/K C. 8.448 J/mol/K D. 4.19 J/cal

45. The freezing point of the liquids decreases when pressure is increased, if the liquid

A. expands while freezing B. contracts while freezing

C. does not change in volume while freezing D. none

46. The equation of a transverse wave on a stretched string is given by

$y = 0.05 \sin \pi (2t/0.002 - x/0.1)$ where x and y are expressed in metres and t in sec.

The speed of the wave is

A.100 m/sec B. 50 m/s C. 200 m/s D. 400 m/s

47. The ratio of velocity of the body to the velocity of sound is called

A. Magic number B. Laplace number C. Natural number D. Mach number

48. Television signals on earth cannot be received at distances greater than 100 km from the transmission station. The reason behind this is that

A. the receiver antenna is unable to detect the signal at a distance greater than 100 km

B. the TV programme consists of both audio and video signals

C. the TV signals are less powerful than radio signals

D. the surface of earth is curved like a sphere

49. A ball is thrown from a height of *h* m with an initial downward velocity v_0. It hits the ground, loses half of its Kinetic energy & bounces back to the same height. The value of v_0 is

A. $\sqrt{2gh}$ B. $\sqrt{gh}$ C. $\sqrt{3gh}$ D. $\sqrt{2.5gh}$

50. A thick rope of rubber of density 1.5 x 10^3 kg/m^3 and Young's modulus 5 x 10^6 N/m^2, 8m in length, when hung from ceiling of a room, the increase in length due to its own weight is

A. 9.6 x 10^{-3}m B. 19.2 x 10^{-5}m C. 9.6cm D. 9.6mm

51. Water is falling on the blades of a turbine at a rate 6000Kg/min. The height of the fall is100m. What is the power gained by the turbine?

A. 10KW B. 6KW C. 100KW D. 600KW

52. If momentum of alpha-particle, neutron, proton, and electron are the same, the minimum K.E. is that of

A. alpha-particle B. neutron C. proton D. electron

53. An electric motor while lifting a given load produces a tension of 4500 N in the cable attached to the load. If the motor winds the cable at the rate of 2m/s, then power must be

A. 9 kW B. 15 kW C. 225 kW D. 9000 H.P

54. If an electric iron electrons are accelerated through a potential difference of V volts. Taking electronic charge and mass to be respectively *e* and *m*, the maximum velocity attained by the electrons is

A. 2eV/√m B. √(2eV)/*m* C. 2*m*/*eV* D. v^2/8*em*

55. A particle is moving on a circular track of radius 20 cm with a constant speed of 6 m/s. Its acceleration is

A. 0 B. 180 m/s^2 C. 1.2 m/s^2 D. 36 m/s^2

56. A satellite of the earth is revolving in a circular orbit with a uniform speed *v*. If gravitational force suddenly disappears, the satellite will:

A. continue to move with the speed *v* along the original orbit

B. move with the velocity *v* tangentially to the original orbit

C. fall downward with increasing velocity

D. ultimately come to rest somewhere on the original orbit

57. The kinetic energy *K* of a particle moving along a circle of radius *R* depends on the distance covered *s* as $K = as^2$. The force acting on the part1cle is

A. $2as^2/R$ B. $2as(1 + s^2/R)^{1/2}$ C. $as(1 + s^2/R^2)^{1/2}$ D. None of these

58. Einstein was awarded Nobel Prize for his work in

A. Photoelectric effect B. Special theory of relativity

C. General theory of relativity D. None of these

59. One second is defined to be equal to

A. 1650763.73 periods of the Krypton clock B. 652189.63 periods of the Krypton clock

C. 1650763.73 periods of the Cesium clock D. 9192631770 periods of the Cesium clock

60. The dimensions of energy and torque respectively are
A. ML^2T^{-2} and ML^2T^{-2} B. MLT^2 and ML^2T^{-2} C. ML^2T^{-2} and MLT^{-2} D. MLT^{-2} and MLT^{-2}

61. When Benzene diazonium chloride reacts with hypophosphorous acid, it produces
A. benzene B. phenol C. phenylphosphite D. phenylphosphate

62. The reaction of aliphatic primary amine with nitrous acid in cold produces
A. nitrile B. alcohol C. diazonium salt D. secondary amine

63. Ethylamine can be prepared by the action of bromine and caustic potash on
A. acetamide B. propionamide C. formamide D. methyl cyanide

64. The aldol condensation of acetaldehyde results in the formation of
A. $CH_3COCHOHCH_3$ B. $CH_3CHOHCH_2CHO$ C. $CH_3CH_2CHOHCHO$ D. CH_3CH_2OH + CH_3COOH

65. Which compound reacts fastest with Lucas reagent at room temperature?
A. Butan-l-ol B. Butan-2-ol C. 2-Methyl propan-l-ol D. 2-Methyl propan-2-ol

66. The reaction with D_2O, $(CH_3)_3CMgCl$ produces
A. $(CH_3)_3CD$ B. $(CH_3)_3CO$ C. $(CD_3)_3CD$ D. $(CD_3)_3COD$

67. The reaction with alcoholic potash, l-chlorobutane gives
A. 1-Butene B. 1-Butanol C. 2-Butene D. 2-Butanol

68. The active nitrating agent during nitration of benzene is
A. NO_3^- B. HNO_2^- C. NO_2^- D. HNO_3

69. The number of sigma and pi bonds in 1-buten-3-yne are
A. 5 sigma and 5 pi B. 7 sigma and 3 pi C. 8 sigma and 2 pi D. 6 sigma and 4 pi

70. The most stable carbonium ion among the cations is
A. sec-butyl B. ter-butyl C. n-butyl D. none of these

71. How many optically active stereo-isomers are possible for butane-2, 3-diol?
A. 1 B. 2 C. 3 D. 4

72. B.P. and M.P. of inert gases are
A. high B. low C. very high D. very low

73. $[CO(NH_3)_5Br]\ SO_4$ and $[CO(NH_3)_5\ SO_4]\ Br$ are examples of which type of isomerism ?
A. Linkage B. Geometrical C. Ionization D. Optical

74. The valency of Cr in the complex $[Cr(H_2O)_4\ Cl_2]^+$ is
A. 3 B. 1 C. 6 D. 5

75. In Nessler's reagent, the ion is
A. Hg^{+} B. Hg^{2+} C. HgI_2^{2-} D. HgI_4^{2-}

76. In solid $CuSO_4.5H_2O$, copper is co-ordinated to
A. five water molecules B. four water molecules C. one sulphate ion D. one water molecule

77. Which of the following is a weak acid?
A. HCl B. HBr C. HP D. HI

78. When SO_2 is passed through acidified $K_2Cr_2O_7$ solution,
A. the solution turns blue B. the solution is decolourised
C. SO_2 is reduced D. green $Cr_2(SO_4)_3$ is formed

79. Which of the following has lowest boiling point?
A. H_2O B. H_2S C. H_2Se D. H_2Te

80. Nitric oxide is prepared by the action of dil. HNO_3 on
A. Fe B. Cu C. Zn D. Sn

81. The laughing gas is
A. nitrous oxide B. nitric oxide C. nitrogen trioxide D. nitrogen pentaoxide

82. Ordinary glass is
A. sodium silicate B. calcium silicate
C. calcium and Sodium silicate D. copper silicate

83. The chemical name of phosgene is
A. Phosphene B. Carbonyl chloride C. Phosphorous oxychloride D. Phosphorous trichloride

84. Which one of the following is strongest Lewis acid?
A. BF_3 B. BCl_3 C. BBr_3 D. BI_3

85. Three centred bond is present in
A. NH_3 B. B_2H_6 C. BCl_3 D. $AlCl_3$

86. Plaster of Paris is
A. $CaSO_4.H_2O$ B. $CaSO_4.2H_2O$ C. $CaSO_4.1/2\ H_2O$ D. $CaSO_4.3/2\ H_2O$

87. Rocky impurities present in a mineral are called
A. flux B. gangue C. matte D. slag

88. Free hydrogen is found in
A. acids B. water C. marsh gas D. water gas

89. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water; the

sodium ions are exchanged with

A. H^+ B. K^+ C. SO_4^{2-} D. Mg^{2+}

90. On passing 0.3 faraday of electricity through aluminium chloride, the amount of aluminium metal deposited on cathode is (Al = 27)

A. 0.27 g B. 0.3 g C. 2.7 g D. 0.9 g

91. The migration of colloidal particles under influence of an electric field is known as

A. Electro-osmosis B. Brownian movement C. Cataphoresis D. Dialysis

92. In a colloidal state, particle size ranges from

A. 1 to 10 A^o B. 20 to 50 A^o C. 10 to 1000 A^o D. 1 to 280 A^o

93. The half-life of a first order reaction is 69.35. The value of rate constant of the reaction is

A. 1.05^{-1} B. 0.15^{-1} C. 0.015^{-1} D. 0.0015^{-1}

94. Heat of neutralisation of a strong acid and strong base is always

A. 13.7 Kcal/mol B. 9.6 Kcal/mol C. 6 Kcal/mol D. 11.4 Kcal/mol

95. In exothermic reactions,

A. $H_R = H_P$ B. $H_R > H_P$ C. $H_R < H_P$ D. None of the above

96. Which is a buffer solution?

A. $CH_3COOH + CH_3COONa$ B. $CH_3COOH + CH_3COONH_4$ C. $CH_3COOH + NH_4Cl$ D. NaOH + NaCl

97. The pH of 0.01 M solution of HCl is

A. 1.0 B. 2.0 C. 10.0 D. 11.0

98. In which of the following case does the reaction go fastest to completion?

A. $k = 10^2$ B. $k = 10^{-2}$ C. k = 10 D. k = 1

99. What quantity of limestone ($CaCO_3$) on heating will give 28 kg of CaO?

A. 1000 kg B. 56 kg C. 44 kg D. 50 kg

100. The percentage of oxygen in NaOH is

A. 40 B. 16 C. 18 D. 10

101. If we take 44 g of CO_2 and 14 g of N_2, what will be the mole fraction of CO_2 in the mixture?

A. 1/5 B. 1/3 C. 1/2 D. 1/4

102. The molarity of a solution of Na_2CO_3 having 5.3 g/250 ml of solution is

A. 0.2 M B. 2 M C. 20 M D. 0.02 M

103. A gas is initially at 1 atm pressure. To compress it to 1/2th of its initial volume, pressure to be applied is

A. 1 atm B. 4 atm C. 2 atm D. 1/4 atm

104. The value of *R* in calorie/degree/mole is
A. 0.0831 B. 8.31 C. 8.31×10^7 D. 1.987

105. Which of the following possesses zero resistance at 0 K?
A. Conductors B. Semi-conductors C. Super-conductors D. Insulators

106. CsCl has lattice of the type
A. ccp B. fcc C. bcc D. hcp

107. In the reaction between sodium and chlorine to form sodium chloride,
A. sodium atom is reduced B. sodium ion is reduced C. chlorine atom is reduced D. chloride ion is reduced

108. Octahedral molecular shape exists in _____ hybridisation.
A. sp^3d B. sp^3d^2 C. sp^3d^3 D. sp^2d^2

109. NH_3 and BF_3 form an adduct readily because they form
A. a co-ordinate bond B. a covalent bond C. an ionic bond D. a hydrogen bond

110. Diagonal relationship exists between
A. Li and Mg B. Na and Mg C. K and Mg D. Al and Mg

111. Which element has the highest electro-negativity?
A. F B. He C. Ne D. Na

112. Loss of a -particle is equivalent to
A. loss of two neutrons only B. loss of two protons only
C. loss of two neutrons and loss of two protons D. none of the above

113. Stable compounds in + 1 oxidation state are formed by
A. B B. Al C. Ga D. Th

114. Sodium hexametaphosphate is used as
A. a cleansing agent B. an insecticide C. a water softner D. an iron exchange resin

115. The strongest acid is
A. $ClO_3(OH)$ B. $ClO_2(OH)$ C. $SO(OH)_2$ D. $SO_2(OH)_2$

116. Which one among the following pairs of ions cannot be separated by H_2S in dilute hydrochloric acid?
A. Bi^{3+}, Sn^{4+} B. Al^{3+}, Hg^{2+} C. Zn^{2+}, Cu^{2+} D. Ni^{2+}, Cu^{2+}

117. The alkane would have only the primary and tertiary carbon is

A. Pentane B. 2-methylbutane C. 2, 2-dimethylpropane D. 2, 3-dimethylbutane

118. The product of reaction of alcoholic silver nitrite with ethy1 bromide is
A. ethane B. ethene C. nitroethane D. ethyl a1coho1

119. Formy1 chloride has not been so prepared. Which one of the following can function as formyl chloride in formulation?
A. HCHO + HCl B. $HCOOCH_3$ + HCl C. CO + HCl D. $HCONH_2$ + HCl

120. Amongst the following, the most basic compound is
A. Benzylarnine B. Aniline C. Acetanilide D. p-Nitroaniline

121. If the roots of $x^2 - bx + c = 0$ are consecutive integers, then $b^2 - 4c$ is equal to
A. 4 B. 3 C. 2 D. 1

122. Condition that the two lines represented by the equation $ax^2 + 2hxy + by^2 = 0$ to the perpendicular is
A. a = - b B. ab = 1 C. a = b D. ab = -1

123. If $A \subseteq B$, then $A \cap B$ is equal to
A. B^c B. A^c C. B D. A

124. In order that the function $f(x) = (x + 1)^{\cot x}$ is continuous at x = 0, f(0) must be defined as
A. f(0) = 0 B. f(0) = e C. f(0) = 1/e D. none of the above

125. The eccentricity of the ellipse $16x^2 + 7y^2 = 112$ is
A. 4/3 B. 7/16 C. $3/\sqrt{7}$ D. 3/4

126. If z_1, z_2, z_3 are three complex numbers in A.P., then they lie on
A. a circle B. an ellipse C. a straight line D. a parabola

127. If $[(a^2 + 1)^2]/(2a - i) = x + iy$, then $x^2 + y^2$ is equal to
A. $[(a^2 + 1)^4]/(4a^2 + 1)$ B. $[(a + 1)^2]/(4a^2 + 1)$ C. $[(a^2 - 1)^2]/(4a^2 - 1)^2$ D. none of the above

128. The vertices of a triangle are (0, 0), (3, 0) and (0, 4). Its orthocentre is at
A. (3/2, 2) B. (0, 0) C. (1, 4/3) D. none of the above

129. The eccentricity of the conic $9x^2 - 16y^2 = 144$ is
A. 5/4 B. 4/3 C. 4/5 D. $\sqrt{7}$

130. The vertices of a triangle are (0, 3), (-3, 0) and (3, 0). The co-ordinates of its orthocentre are

A. (0, 2) B. (0, -3) C. (0, 3) D. (0, -2)

131. If t is the parameter for one end of a focal chord of the parabola $y^2 = 4ax$, then its length is
A. $a[t - (1/t)]$ B. $a[t + (1/t)]$ C. $a[t - (1/t)]^2$ D. $a[t + (1/t)]^2$

132. The value of $\cos^2\theta + \sec^2\theta$ is always
A. equal to 1 B. less than 1
C. greater than or equal to 2 D. greater than 1, but less than 2

133. The number of points of intersection of $2y = 1$ and $y = \sin x$, $-2\pi \le x \le 2\pi$ is
A. 2 B. 3 C. 4 D. 1

134. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$, then $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 =$
A. 0 B. 1 C. 2 D. 3

135. The number of solutions in $0 \le x \le \pi/2$ of the equation $\cos 3x \tan 5x = \sin 7x$ is
A. 5 B. 7 C. 6 D. none of the above

136. One end of a diameter of the circle $x^2 + y^2 - 4x - 2y - 4 = 0$ is (5, -6), the other end is
A. (4, -9) B. (-9, -4) C. (4, 9) D. (9, -4)

137. The set of values of m for which both the roots of the equation $x^2 - (m + 1)x + m + 4 = 0$ are real and negative consists of all m, such that
A. $-3 \ge m$ or $m \ge 5$ B. $-3 < m \le 5$ C. $-4 < m \le -3$ D. $-3 < m \le -1$

138. Let $P_n(x) = 1 + 2x + 3x^2 + \ldots\ldots + (n + 1)x^n$ be a polynomial such that n is even. Then the number of real roots of $P(x) = 0$ is
A. 1 B. n C. 0 D. none of the above

139. The next term of the sequence 1, 3, 6, 10, ... is
A. 16 B. 13 C. 15 D. 14

140. If H is the harmonic mean between P and Q, then H/P + H/Q is
A. (P + Q)/PQ B. PQ/(P + Q) C. 2 D. none of the above

141. A class is composed of two brothers and six other boys. In how many ways can all the boys be seated at a round table so that the two brothers are not seated besides each other?
A. 4320 B. 3600 C. 720 D. 1440

142. The binomial coefficient of the 4th term in the expansion of $(x - q)^5$ is
A. 15 B. 20 C. 10 D. 5

143. For $x \ne 0$, the term independent of x in the expansion of $(x - x^{-1})$ is equal to

A. $^{2n}C_n$ B. $[(-1)^n]\ [^{2n}C_n]$ C. $[(-1)^n]\ [^{2n}C_{n+1}]$ D. $^{2n}C_{n+1}$

144. k $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ **is equal to**

A. $\begin{vmatrix} a_1 & b_1 & kc_1 \\ a_2 & kb_2 & c_2 \\ ka_3 & b_3 & c_3 \end{vmatrix}$

B. $\begin{vmatrix} ka_1 & kb_1 & kc_1 \\ ka_2 & kb_2 & kc_2 \\ ka_3 & kb_3 & kc_3 \end{vmatrix}$

C. $\begin{vmatrix} ka_1 & b_1 & c_1 \\ ka_2 & b_2 & c_2 \\ ka_3 & b_3 & c_3 \end{vmatrix}$

D. $\begin{vmatrix} ka_1 & b_1 & c_1 \\ a_2 & kb_2 & c_2 \\ a_3 & b_3 & kc_3 \end{vmatrix}$

145. One root of the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix}$ **= 0 is which of the following?**

A. 2/3 B. 8/3 C. 16/3 D. 1/3

146. If | A | = $\begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ **and | B | =** $\begin{vmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{vmatrix}$ **, then**

A. | A | = 2 | B | B. | A | = | B | C. | A | = - | B | D. none of the above

147. Equation of the sphere with centre (1, -1, 1) and radius equal to that of sphere $2x^2 + 2y^2 + 2z^2 - 2x + 4y - 6z = 1$ is

A. $x^2 + y^2 + z^2 - 2x + 2y - 2z + 1 = 0$ B. $x^2 + y^2 + z^2 + 2x - 2y + 2z + 1 = 0$

C. $x^2 + y^2 + z^2 - 2x + 2y - 2z - 1 = 0$ D. none of the above

148. Equation of the line passing through the point (1, 1, 1) and parallel to the plane 2x + 3y + 3z + 5 = 0 is

A. (x - 1)/1 = (y - 1)/2 = (z - 1)/1 B. (x - 1)/-1 = (y - 1)/1 = (z - 1)/-1

C. (x - 1)/3 = (y - 1)/2 = (z - 1)/1 D. (x - 1)/2 = (y - 1)/3 = (z - 1)/1

149. If a, b, c are constants such that a and c are of opposite signs and r is the correlation coefficient between x and y, then the correlation coefficient between ax + b and cy + d is
A. (a/c)r B. r C. - r D. (c/a)r

150. From a deck of 52 cards, the probability of drawing a court card is
A. 3/13 B. 1/4 C. 4/13 D. 1/13

151. A binomial probability distribution is symmetrical if p, the probability of success in a single trial, is
A. > 1/2 B. < 1/2 C. < q, where q = 1 - p D. = 1/2

152. The binomial distribution whose mean is 10 and S.D. is $2\sqrt{2}$ is
A. $(4/5 + 1/5)^{50}$ B. $(4/5 + 1/5)^{1/50}$ C. $(4/5 + 5/1)^{50}$ D. none of the above

153. tan (cot $^{-1}$x) is equal to
A. $\pi/4 - x$ B. cot (tan $^{-1}$x) C. tan x D. none of the above

154. If f(x) is an odd periodic function with period 2, then f(4) equals
A. - 4 B. 4 C. 2 D. 0

155. The function $f(x) = [(x^3 + x^2 - 16x + 20)]/(x - 2)$ is not defined for x = 2. In order to make f(x) continuous at x = 2, f(2) should be defined as
A. 0 B. 1 C. 2 D. 3

156. Let f and g be differentiable functions satisfying g'(a) = 2, g(a) = b, and fog = 1 (identity function). Then f'(b) is equal to
A. 0 B. 2/3 C. 1/2 D. none of the above

157. A cone of maximum volume is inscribed in a given sphere. Then the ratio of the height of the cone to the diameter of the sphere is
A. 3/4 B. 1/3 C. 1/4 D. 2/3

158. The function is decreasing in the interval
A. $-\infty < x < -10/3$ B. $0 < x < \infty$ C. $-3 < x < 3$ D. $-10/3 < x < 0$

159. Suppose that f''(x) is continuous for all x and $\int_0^1 tf'(t)\,dt = 0$, f(0) = f'(1). If then the value of f(1) is
A. 3 B. 2 C. 9/2 D. none of the above

160. Integrating factor of differential equation cos x (dy/dx) + y sin x = 1 is
A. sin x B. sec x C. tan x D. cos x

161. If $\int_0^a dx/(1 + 4x^2) = \pi/8$, then the value of a is

A. $\pi/2$ B. 1/2 C. $\pi/4$ D. 1

162. The maximum value of (log x)/x is

A. 2/e B. 1/e C. 1 D. e

163. If one root of the equation $x^2 + px + 12 = 0$ is 4, while the equation $x^2 + px + q = 0$ has equal roots, then the value of q is

A. 49/4 B. 4/49 C. 4 D. none of the above

164. The sum of the series 1/2 + 1/3 + 1/6 + ... to 9 terms is

A. -5/6 B. -1/2 C. 1 D. -3/2

165. The sum of all two digit numbers, which are odd is

A. 2475 B. 2530 C. 4905 D. 5049

166. How many ten digit numbers can be formed by using the digits 3 and 7 only?

A. ${}^{10}C_1 + {}^{9}C_2$ B. 2^{10} C. ${}^{10}C_2$ D. 10!

167. If x and y are real and different and $u = x^2 + 4y^2 + 9z^2 - 6xyz - 3zx - 2xy$, then u is always

A. non-negative B. zero C. non-positive D. none of the above

168. If a be a non-zero vector, then which of the following is correct?

A. a . a = 0 B. a . a > 0 C. a . a ≥ 0 D. a . a ≤ 0

169. If two vectors a and b are parallel and have equal magnitudes, then

A. they are equal B. they are not equal C. they may or may not be equal D. they do not have the same direction

170. In a triangle, the lengths of the two larger sides are 10 and 9 respectively. If the angles are in A.P., then the length of the third side can be

A. $5 \pm \sqrt{6}$ B. $3\sqrt{3}$ C. 5 D. none of the above

171. The three lines $3x + 4y + 6 = 0$, $\sqrt{2}x + \sqrt{3}y + 2\sqrt{2} = 0$, and $4x + 7y + 8 = 0$ are

A. sides of a triangle B. concurrent C. parallel D. none of the above

172. The pole of the straight line $9x + y - 28 = 0$ with respect to the circle $2x^2 + 2y^2 - 3x + 5y - 7 = 0$ is

A. (3, 1) B. (1, 3) C. (3, -1) D. (-3, 1)

173. If the sets A and B are defined as $A = \{ (x, y) : y = e^x, x \in R \}$, $B = \{ (x, y) : y = x, x \in R \}$, then

A. $A \cup B = A$ B. $A \cap B = \phi$ C. $A \subseteq B$ D. $B \subseteq A$

174. The value of the integral $\int_0^{2a} \{ f(x)/[f(x) + f(2a - x)] \}dx$ is equal to

A. a B. 2a C. 3a D. none of the above

175. The slope of the normal at the point $(at^2, 2at)$ of the parabola $y^2 = 4ax$ is

A. 1/t B. t C. - t D. -1/t

176. If z is any complex number such that $| z + 4 | \leq 3$, then the greatest value of $| z + 1 |$ is

A. 2 B. 6 C. 0 D. - 6

177. The equation $\cos x + \sin x = 2$ has

A. only one solution B. two solutions

C. no solution D. infinite number of solutions

178. The most general value of θ, which satisfies both the equations $\tan \theta = -1$ and $\cos \theta = 1/\sqrt{2}$ will be

A. $n\pi + (7\pi/4)$ B. $n\pi + (-1)^n (7\pi/4)$ C. $2n\pi + (7\pi/4)$ D. none of the above

179. A spherical ball of radius r placed on the ground subtends an angle of 60^o at a point A of the ground. Then the distance of the point A from the centre of the ball is

A. 3r B. 2r C. 4r D. none of the above

180. In a triangle ABC, $a^2 \cos 2B + b^2 \cos 2A + 2ab \cos (A - B)$ is equal to

A. c B. c^2 C. 2c D. none of the above

1. Sun releases energy by the process of

A. nuclear fusion | B. nuclear disintegration | C. nuclear fission | D. spontaneous combustion

2. The number of atoms per unit cell in a *sc*, *bcc*, and *fcc* are

A. 1, 2 and 4 respectively
B. 8, 6 and 10 respectively
C. 1, 4 and 2 respectively
D. 2, 4 and 1 respectively

3. In a diode, at saturation current, the plate resistance is

A. zero | B. constant and finite | C. infinite | D. variable but finite

4. An *n*-type and a *p*-type silicon semi-conductor can be obtained by doping pure silicon with

A. sodium and magnesium respectively
B. phosphorous and boron respectively
C. indium and sodium respectively
D. boron and arsenic respectively

5. When the plate voltage of a triode is 150 V, its cut off voltage is -5 V. On increasing the plate voltage to 200 V, the cut off voltage can be

A. -4.5V | B. -5.0V | C. + 2.3 V | D. -6.06 V

6. In a diode vacuum tube, the plate current is 5 mA when the plate voltage is 160 V. A grid is introduced between the plate and cathode and a voltage of -2 V is applied to it. The plate current then become

A. 20 mA | B. 10 mA | C. 4mA | D. 7.5mA

7. A long spring is stretched by 2cm. Its potential energy is V. If the spring is stretched by 10cm, its potential energy would be

A. V/25 B. V/5 C. 5V D. 25V

8. The length of a rod as measured by an observer moving with respect to it is half of its proper length. The speed of the observer with respect to rod is

A. $3/2\ c\ ms^{-1}$ | B. $c/2\ ms^{-1}$ | C. $(\sqrt{3})/2\ c\ ms^{-1}$ | D. $1/\sqrt{2}\ c\ ms^{-1}$

9. A + μ -meson with a proper half-life of 1.8×10^{-6} s is moving with a speed of 0.9 c with respect to an earth observer. The half-life of this μ -meson according to an observer sitting on it is

A. 1.8×10^{-6} s | B. $1.8 \times \sqrt{0.19} \times 10^{-6}$ s | C. $1.8/\sqrt{0.19} \times 10^{-6}$ s | D. $1.8 \times 0.19 \times 10^{6}$ s

10. The mass per nucleon in an ordinary hydrogen atom is

A. l/l6th mass per nucleon in an oxygen atom
B. slightly greater than the mass per nucleon in an oxygen atom
C. the same as mass per nucleon in an oxygen atom
D. slightly smaller than the mass per nucleon in an oxygen atom

11. Consider the following nuclear reaction

$_2He^4 + {}_ZX^A = {}_{Z+2}Y^{A+3} + W$

What particle does *W* denote ?

A. electron B. positron C. proton D. neutron

12. The function of graphite and the control rods in a nuclear reactor are
A. to produce neutrons and to shield the reactor
B. to slow down the neutrons and to absorb the excess neutrons respectively
C. to absorb the excess neutrons and to shield the reactor respectively
D. to absorb neutrons and to reduce the energy of the neutrons respectively

13. In the first observed nuclear reaction, $_7N^{14}$ was bombarded with α -particles. The reaction could be represented as
$_7N^{14} + _2He^4 = X + _1H^1$
The element in this reaction is
A. $_8O^{17}$ B. $_8F^{17}$ C. $_8N^{17}$ D. $_8Ne^{17}$

14. In a Bucherer's experiment, the specific charge of some β particles is found to be 1/4th of the value determined by J.J. Thomson. The speed of these β particles is
A. √ 5/4 c B. √ 15/4 c C. 1/4 c D. c

15. When the mass is rotating in a plane about a fixed point, its angular momentum is directed along
A. the radius B. the tangent to orbit
C. line at an angle of 45° to the plane of rotation D. the axis of rotation

16. A photo-cell with a constant p.d. of *V* volts across it, is illuminated by a point source from a distance 25 cm. When the source is moved to a distance of 1 m, the electrons emitted by the photo-cell
A. carry 1/4th their previous energy B. are 1/16th as numerous as before
C. are 1/4th as numerous as before D. carry 1/4th their previous momentum

17. A convex lens of focal length 40 cm is in contact with a concave lens of focal length 25 cm. The power of combination is
A. -1.5*D* B. -6.5*D* C. 1.5 *D* D. 6.5 *D*

18. A prism splits a beam of white light into its seven constituent colours. This is so because
A. phase of different colour is different B. amplitude of different colours is different
C. energy of different colours is different D. velocity of different colours is different

19. A prism has a refracting angle of 60° when a ray of light is incident on its face at *45°*, it suffers minimum deviation. The angle of minimum deviation is
A. 30° B. 60° C. 45° D. 90°

20. A car driver sees an image of a bus in his driving mirror, which has a radius of curvature of 4 m. The bus which is 10 m long, is parallel

to and following the car in front of the bus 18 m from the mirror. The apparent length of the bus as seen in the mirror is

A. 700 mm B. 670 mm C. 800 cm D. 800 mm

21. A single slit of width d is placed in the path of a beam of wavelength λ . The angular width of principal maximum obtained is

A. d/λ B. λ/d C. $2\lambda/d$ D. $2d/\lambda$

22. A closed tube, partly filled with a liquid & set horizontal, is rotated about a vertical axis passing through its centre. In the process, the moment of inertia of the system about its axis would

A. increase always
B. decrease always
C. remain constant
D. increase if tube is less than half filled, decrease otherwise

23. In an A.C. circuit the instantaneous current through and voltage across a capacitor are represented as $I = I_0 \sin(\omega t + \pi/4)$ and $v = V_0 \sin(\omega t + \pi/8)$ respectively. The current leads the voltage by

A. $\pi/4$ B. $3\pi/8$ C. $\pi/2$ D. $\pi/8$

24. A transformer having 2100 turns in the primary and 4200 turns in the secondary has an a.c. source of 120 V, 10 A connected to its primary. Then the secondary voltage and current are

A. 240 V and 5 A B. 120 V and 10 A C. 240 V and 10 A D. 120 V and 20 A

25. When a magnet falls through a metal ring, acceleration through the metal ring during the free falls is

A. less than g throughout its fall
B. less than g when it is above the ring and more than g when it is below the ring
C. more than g throughout its fall
D. more than g when it is above the ring and less than g when it is below the ring

26. A copper rod is suspended in a non-homogeneous magnetic field region. The rod when in equilibrium, will then align itself

A. in the region where the magnetic field is strongest
B. in the direction in which it was originally suspended
C. in the region where the magnetic field is weakest and parallel to the direction of the magnetic field there
D. none of these

27. The substance which shows permanent magnetism is called

A. anti-ferromagnetic B. paramagnetic C. diamagnetic D. ferromagnetic

28. A magnetic substance is heated to 800 K and then cool down slowly to 300 K, then it

A. retains its magnetism
B. retains its magnetism below curie points

C. does not retain magnetism D. none of these

29. Two heater wires of equal length are first connected in series and then in parallel. The ratio of heat produced in the two cases is

A. 2 : 1 B. 1 : 2 C. 4 : 1 D. 1 : 4

30. A galvanometer with a coil resistance of 100Ω gives a full-scale deflection when a current of 1 mA is passed through it. The resistance of the shunt needed to convert this galvanometer into an ammeter 5 of range 10 A is nearly

A. 0.01Ω B. 0.001Ω C. 0.1Ω D. 0.099Ω

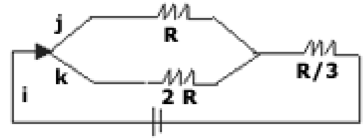
31. The resistance of a 50 cm long wire is 10Ω . The wire is stretched to uniform wire of length 100 cm. The resistance now will be

A. 15Ω B. 30Ω C. 20Ω D. 40Ω

32. In the given circuit, the currents *i*, *j*, and *k* are in the ratio

A. 1:2:3 B. 3:2:1

C. 2:1:3 D. 3:1:2



33. A conducting sphere of radius *R* is given a charge *Q*. Consider three points *B* at the surface, *A* at centre and *C* at a distance *R/2* from the center. The electric potential at these points are such that

A. $V_A = V_B = V_C$ B. $V_A = V_B \neq V_C$ C. $V_A \neq V_B \neq V_C$ D. $V_A \neq V_B = V_C$

34. The mass of a proton is 1847 times that of an electron. An electron and a proton are projected into a uniform electric field in a direction of right angles to the direction of the field with the same initial kinetic energy. Then

A. both the trajectories will be equally curved

B. the proton trajectory will be less curved than the electron trajectory

C. the electron trajectory will be less curved than the proton trajectory

D. the relative curving of the trajectories will be dependent on the value of initial kinetic energy

35. The wavelength of maximum radiation from the moon is 14 x 10^{-6} m. If the value of the constant in Wein's displacement law is 0.00293 mK, the surface temperature of moon is

A. 207 K B. 146 K C. 227 K D. 103.5 K

36. A given mass of gas is subjected to an external pressure of 0.5 x 10^{10} N/m^2. If $K = 10^{10}$Nm^{-2}, the ratio of the density before and after applying the pressure is

A. 1 : 1 B. 1 : 2 C. 2 : 1 D. 1 : 4

37. The heat reservoir of an ideal Carnot engine is at 800 K and its sink is at 400 K. The amount of heat taken in it in one second to produce useful mechanical work at the rate of 750 K is

A. 2250 J B. 1125 J C.1500 J D. 750 J

38. A Carnot engine, with its cold body at 17°C has 50% efficiency. If the temperature of its hot body is now increased by 145°C, the efficiency becomes

A. 55% B. 60% C. 40% D. 45%

39. A wire of length 1m increases in length by 10^{-4}m when heated through 10^{2} degree celsius. The coefficient of volume expansion of the wire is

A. 2×10^{-6} B. 1×10^{-6} C. 3×10^{-6} D. 4×10^{-6}

40. The pitch of a sound wave is related to its

A. frequency B. amplitude C. velocity D. beats

41. A mass *m* is hung to a string. After some time, it was observed that mass *m* moves up from its initial position; this is due to

A. decrease in temperature B. increase in temperature C. the statement is wrong D. change in humidity

42. A light spring of force constant 8 Nm^{-1} is cut into two equal halves and the two are connected in parallel; the equivalent force constant of the system is

A. 16 Nm^{-1} B. 32 Nm^{-1} C. 8 Nm^{-1} D. 24 Nm^{-1}

43. A light spring of constant *k* is cut into two equal parts. The spring constant of each part is

A. *k* B. 2*k* C. *k*/2 D. 4*k*

44. A wave equation which gives the displacement along y-direction is given by $y = 10^{-4} \sin(60t + x)$ where *x* and *y* are in meters and *t* is time in seconds. This represents a wave

A. travelling with a velocity of 300 ms^{-1} in the -ve *x*-direction

B. of wavelength π meters

C. of frequency 30/π hertz

D. of amplitude 10^{4} meter travelling along the positive *x*-direction

45. The periodic times *T* of a simple pendulum are observed for different length *l*. If a graph of log *T* against log l is plotted, the slope of the graph is

A. 2 B. 1/2

C. $\sqrt{2}$ D. $1/\sqrt{2}$

46. Ordinarily, the value of coefficient of restitution varies from

A. 0 to1 B. 0 to 0.5 C. –1 to +1 D. -0.5 to +0.5

47. *In* a gravitational field, if a body is bound with earth, then total mechanical energy it has is

A. *a* +ve value B. a zero value C. a -ve value D. K.E. less than P.E.

48. The mass of a planet is twice the mass of earth and diameter of the planet is thrice the diameter of the earth, then the acceleration due to gravity on the planet's surface is

A. $g/2$ B. $2g$ C. $2g/9$ D. $3g/\sqrt{2}$

49. A stationary bomb explodes into two parts of masses 3 kg and 1 kg. The total K.E. of the two parts after explosion is 2400J. The K.E. of the smaller part is

A 600 J B 1800 J C 1200 J D 2160 J

50. In a perfectly elastic collision

A. both momentum and K.E. are conserved B. only momentum is conserved

C. only K.E. is conserved D. neither K.E. nor momentum is conserved

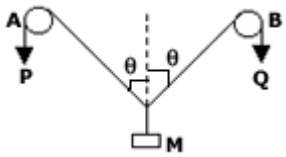
51. A bullet of mass 7g is fired at a velocity of 900 ms^{-1} from a rifle of mass 3.5 kg. What is the recoil velocity of the rifle?

A 0.9 ms^{-1} B 180 ms^{-1} C 900 ms^{-1} D 1.8 ms^{-1}

52. In the arrangement shown in the figure, P and Q are in inflexible strings moving downward with uniform speed U, pulleys A and B are fixed. Mass M move upwards with a speed of

A. 2 U cos θ B. U/cos θ

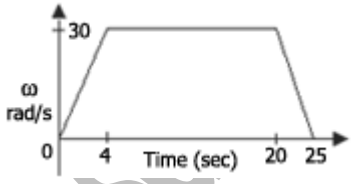
C. 2U/cos θ D. U cos θ



53. The figure shows the angular velocity-time graph of a flywheel. The angle, in radians, through which the flywheel turns during 25 sec is

A. 75 B 480

C. 615 D. 750



54. A ball is dropped from the top of a building 100m high. At the same instant another ball is thrown upwards with a velocity of 40 ms^{-1} from the bottom of the building. The two balls will meet after

A. 5 sec B. 2.5 sec C. 2 sec D. 3 sec

55. A train accelerating uniformly from rest attains a maximum speed of 40 ms^{-1} in 20 seconds. It travels at this speed for 20 seconds and is brought to rest with uniform retardation in further 40 seconds. What is the average velocity during this period?

A. 80/3 ms^{-1} B. 40 ms^{-1} C. 25 ms^{-1} D. 30 ms^{-1}

56. Two bodies are held and separated by 19.8m vertically one above the other. They are released simultaneously to fall freely under gravity. After 2 seconds, the relative distance between them is:

A. 14.9m B. 19.6m C. 19.8m D. 39.2m

57. A particle starts with a velocity of 2 ms^{-1} and moves in a straight line with a retardation of 0.1 ms^{-2}. The time at which the particle is 1.5 m far from the starting point is

A. 10 sec B. 20 sec C. 30 sec D. 40 sec

58. The units of current in C.G.S. system is

A. 1 A B. 1/10 A C. 1/100 A D. 1/1000 A

59. The units of electric field are

A. volt/metre B. $volt^2$/metre C. volt x metre D. $metre^2$

60. The unit of moment of inertia is

A. kg-m B. kg-m^2 C. kg/m D. kg/m^2

61. Fischer Tropsch process is used for the manufacture of

A. synthetic petrol B. thermosetting plastics C. ethanol D. benzene

62. Brown ring test is used to detect

A. iodide B. nitrate C. iron D. bromide

63. Carbohydrates are used by body mainly

A. for obtaining vitamins B. as source of energy

C. for all its developmental needs D. for building muscles

64. The polymer containing an amide group is

A. Nylon B. Polythene C. Polystyrene D. Terylene

65. The organic compound used as antiknock agent in petroleum is

A. $(C_2H_5)_4Pb$ B. TNT C. CH_3MgBr D. $(C_2H_5)_2Hg$

66. Carbyl amine test is used in the detection of

A. aliphatic 2^o amine B. aromatic 1^o amine

C. aliphatic 1^o amine D. both aliphatic and aromatic 1^o amines

67. Aromatic primary amine when treated with cold HNO_2 gives

A. benzyl alcohol B. nitro benzene C. benzene D. diazonium salt

68. Which of petroleum corresponds to kerosene oil?
A. C_{15} - C_{18} B. C_{10} - C_{12} C. C_5 - C_9 D. C_1 - C_4

69. Aldehydes and ketones can be distinguished by
A. bromoform B. solubility in water C. Tollen's test D. Mollich test

70. Aspirin is obtained by the reaction of CH_3COCl with
A. phenol B. benzoic Acid C. benzaldehyde D. salicylic acid

71. Correct order of the size of iodine species is
A. $I > I^- > I^+$ B. $I^- > I > I^+$ C. $I^+ > I > I^-$ D. $I^- > I^+ > I$

72. Nitrolin is a name given to
A. $CaCN_2 + C$ B. $Ca_3(PO_4)_2$ C. $Ca(CN)_2$ D. $Ca(NO_3)_2$

73. The pair of compound, which cannot exit together, is
A. $NaHCO_3$ and NaOH B. Na_2CO_3 and NaOH C. Na_2CO_3 and $NaHCl_3$ D. $NaHCO_3$ and NaCl

74. One of the constituents of the german silver is
A. Ag B. Cu C. Mg D. Al

75. Which compound is optically active?
A. 4-chloro, l-hydroxy butane B. 3^o butyl alcohol
C. Secondary butyl amine D. n-butyl alcohol

76. Plumbo solvancy implies dissolution of lead in
A. bases B. acids C. ordinary water D. $CuSO_4$ sol

77. Indigo dye belongs to
A. Vat dye B. Mordant dye C. Direct dye D. Ingrain dye

78. Dipole moment is shown by
A. 1, 4-dichloro benzene B. cis, 1, 2-dichloro ethane
C. trans, -1, 2-dichloro, 2-pentene D. trans, -1, 2-dichloro ether

79. When acetylene is passed through H_2SO_4 containing $HgSO_4$, it gives
A. ethyl alcohol B. acetic Acid C. acetaldehyde D. ethylene

80. The compound, which does not leave any residue on heating, is
A. $NaNO_3$ B. NH_4NO_3 C. $CuSO_4$ D. $AgNO_3$

81. Which of the following alloys contain only Cu and Zn?
A. Bronze B. Brass C. Gun metal D. Bell metal

82. Gold number is a measure of the

A. stability of a colloidal system
B. efficiency of a protective colloids
C. coagulating power of colloids
D. size of the colloidal particle

83. Whose name is not associated with the development of Periodic Table?

A. Prout's B. Newlands C. Rutherford D. Loother Meyer

84. Polarisibility of halide ions increases in the order

A. F^-, I^-, Br^-, Cl^- B. Cl^-, Br^-, I^-, F^- C. I^-, Br^-, Cl^-, F^- D. F^-, Cl^-, Br^-, I^-

85. Acetylene molecules contain

A. 5σ bond B. 4σ bond and 1π bond C. 3σ and 2π D. 3σ and 3π

86. The oxidation number of S in $NO_2S_4O_6$ is

A. - 2.5 B. 2.5 C. - 10 D. + 10

87. In ideal gas equation, the dimension of R is

A. mole-atm/K B. litre/mole C. litre-atm/K/mole D. erg/K

88. An element X which occurs in the first short period has an outer electronic structure s^2p^1. What are the formula and acid-base character of its oxides?

A. XO_3, basic B. X_2O_3, basic C. X_2O_3, acidic D. XO_2, acidic

89. The uncertainty in the position of a moving bullet of mass 10 gm is 10^{-5} m. Calculate the uncertainty in its velocity.

A. 5.2 x 10^{-28}m/sec B. 3.0 x 10^{-28}m/sec C. 5.2 x 10^{-22}m/sec D. 3 x 10^{-22}m/sec

90. Which is not paramagnetic?

A. O_2 B. O_2^+ C. O_2^{2-} D. O_2^-

91. What is wrongly stated about electrochemical series?

A. It is the representation of element in order of increasing or decreasing standard electrode reduction potential
B. It does not compare the relative reactivity of metals
C. It compares relative strengths of oxidising agents
D. H_2 is centrally placed element

92. Which pairs of ions are isoelectronic?

A. F^- and Cl^- B. F^- and O^- C. Na^+ and K^+ D. Na^+ and Mg^{+2}

93. The ionization energy of N_2 is more than that of O_2 because

A. of the extra stability of half filled p-orbitals in N_2
B. of the smaller size of N_2
C. the former contains less number of electrons
D. the former is less electronegative

94. Stainless steel is an alloy of iron with

A. 8% Cr, 5% Mn B. 10% Ni, 2% Mn, C. 2%Cr, 3%C D. 12%Cr, 1%N

95. Highest pH (14) is given by

A. 0.1 M H_2SO_4 B. 0.1 M NaOH C. 1 N NaOH D. 1 N HCl

96. N_2 atom has 3 unpaired electrons, because of

A. Hund's Rule B. Uncertaintity Principle C. Pauli's Exclusion Principle D. Aufbau's Rule

97. A group of atoms can function as a ligand only when

A. it is a small molecule B. it has an unshared electron pair

C. it is a negatively charged ion D. it is positively charged ion

98. When potassium dichromate crystals are heated with conc. HCl,

A. O_2 is evolved B. Chromyl chloride vapours are evolved

C. Cl_2 is evolved D. No reaction takes place

99. Aluminium is more reactive than Fe. But Al is less easily corroded than iron because

A. Al is noble metal B. Fe forms both mono and divalent ions

C. Al forms a protective oxide layer D. Fe undergoes reaction easily with H_2O

100. The ratio of C_v/C_p for inert gas is

A. 1.33 B. 1.66 C. 2.13 D. 1.99

101. The pH of blood is

A. less than 6 B B. greater than 7 and less than 6

C. greater than 8 and less than 9 D. greater than 10

102. Sodium carbonate is manufactured by Solvay process. The recycled products are

A. CO_2 and NH_3 B. CO_2 and NH_4Cl C. NaCl D. $CaC1_2$ and CaO

103. Among the following which is the weakest base?

A. NaOH B. $Ca(OH)_2$ C. KOH D. $Zn(OH\}_2$

104. The set of quantum number not applicable for an electron in an atom is

A. n = 1, l = 1, m = 1, S = +1/2 B. n = 1, l = 0, m = 0, S = +1/2

C. n = 1, l = 0, m = 0, S = - 1/2 D. n = 2, l = 0, m = 0, S = +1/2

105. The conversion of A $\rightarrow$ B follows second order kinetics, tripling the concentration of A will increase the rate of formation of B by a factor of

A. 1/4 B. 2 C. 1/2 D. 9

106. Amino group in the benzene group can be protected by
A. arylation B. salfoniation C. chlorination D. acetylation

107. The light radiation with discrete quantities of energy is called
A. electron B. photon C. positron D. meson

108. How many primary amines are possible for the formula $C_4H_{11}N$?
A. 1 B. 2 C. 3 D. 4

109. Base catalysed aldol condensation occurs with
A. propanaldehyde B. benzaldehyde
C. 2, 2-dimethyl propionaldehyde D. none of the above

110. A sample of chloroform before being used as an anaesthetic is tested by
A. Fehling's solution
B. ammonical cuprous chloride
C. silver nitrate solution
D. silver nitrate solution after boiling with alcoholic potassium hydroxide

111. 1-chlorobutane on reaction with alcoholic potash gives
A. 1-butene B. 1-butanol C. 2-butene D. 2-butanol

112. The halogen which is most reactive in the halogenation of alkanes under sunlight is
A. chlorine B. bromine C. iodine D. fluorine

113. The highest b.p. is expected for
A. iso octane B. only ketone C. n-octane D. n-butane

114. The bond between carbon atom (1) and carbon atom (2) in compound $N\equiv C\text{-}CH=CH_2$ involves the hybrids as
A. sp^3 and sp^2 B. sp^3 and sp C. sp and sp^2 D. sp and sp

115. If two compounds have the same empirical formula but different molecular formula, they must have
A. different percentage composition B. different molecular weight
C. same viscosity D. same vapour density

116. Optical isomerism is shown by
A. Butanol-1 B. Butanol-2 C. Butene-1 D. Butene-2

117. The ion that cannot be precipitated by both HCl and H_2S is
A. Pb^{2+} B. Cu^{+} C. Ag^{+} D. Sn^{2+}

118. The aqueous solution of the following salts will be coloured in case of
A. B. $LiNO_3$ C. D. $ArCl_3$

$Zn(NO_3)_2$ $CO(NO_3)_2$

119. The highest degree of paramagnetism per mole of the compound at 25^oC will be shown by
A. $MnSO_4.7H_2O$ B. $COCl_2.6H_2O$ C. $FeCl_3.4H_2O$ D. $NiCl_2.6H_2O$

120. Bromine can be liberated from KBr solution by the action of
A. iodine solution B. chlorine water C. sodium chloride D. potassium iodide

121. If A and B be any two sets, then $(A \cup B)'$ is equal to
A. $A \cap B$ B. $A \cup B$ C. $A' \cap B'$ D. $A' \cup B'$

122. If A = {1, 2, 3, 4}then which of the following are functions from A to itself?
A. $f_4 = \{ (x, y) : x + y = 5 \}$ B. $f_3 = \{ (x, y) : y < x \}$
C. $f_2 = \{ (x, y) : x + y > 4 \}$ D. $f_1 = \{ (x, y) : y = x + 1 \}$

123. The solution of $6 + x - x^2 > 0$ is
A. $-1 < x < 2$ B. $-2 < x < 3$ C. $-2 < x < -1$ D. none of the above

124. If $z = x + iy$ and $\omega = \frac{1 - iz}{z - i}$, then $|\omega| = 1$ implies that in the complex plane,
A. z lies on the unit circle B. z lies on the imaginary axis
C. z lies on the real axis D. none of the above

125. The first term of a G.P., whose second term is 2 and sum to infinity is 8, will be
A. 6 B. 3 C. 4 D. 1

126. Equation of circle having diameters $2x - 3y = 5$ and $3x - 4y = 7$, and radius 8 is
A. $x^2 + y^2 - 2x + 2y - 62 = 0$ B. $x^2 + y^2 + 2x + 2y - 2 = 0$
C. $x^2 + y^2 + 2x - 2y + 62 = 0$ D. none of the above

127. A and B are points in the plane such that PA/PB = K (constant) for all P on a circle. The value of K cannot be equal to
A. -1/2 B. 1/2 C. -1 D. 1

128. If the centroid and circumcentre of a triangle are (3, 3) and (6, 2) respectively, then the orthocentre is
A. (-3, 5) B. (-3, 1) C. (3, -1) D. (9, 5)

129. If $\sin x + \cos x = 1/5$, $0 \le x \le \pi$, then $\tan x$ is equal to

A. - 4/3 or -3/4 B. 4/3 C. 4/5 D. none of the above

130. If r_1, r_2, r_3 in a triangle be in H.P., then the sides are in
A. H.P. B. A.P. C. G.P. D. none of the above

131. $\cot \theta = \sin 2\theta$ ($\theta \neq n\pi$, n integer) if θ equals
A. 45^o and 90^o B. 45^o and 60^o C. 90^o only D. 45^o

132. If $a = (b - c) \frac{\sin \frac{b - c}{2}}{} = \sec \theta$, then
A. $\cos \theta$ B. $\cot \theta$ C. $\tan \theta$ D. $\sin \theta$

133. The average of n numbers x_1, x_2, x_3, ..., x_n is M. If x_n is replaced by x', then new average is
A. $\frac{M - x_n + x'}{n}$ B. $\frac{(n - 1)M + x'}{n}$
C. $\frac{nM - x_n + x'}{n}$ D. $M - x_n + x'$

134. In an entrance test, there are multiple choice questions. There are four possible answers to each question of which one is correct. The probability that a student knows the answer to a question is 90%. If he gets the correct answer to a question, then the probability that he was guessing is
A. 1/9 B. 36/37 C. 1/37 D. 47/40

135. The value of $\tan [\cos^{-1} (4/5) + \tan^{-1} (2/3)]$ is
A. 16/7 B. 6/17 C. 7/16 D. none of the above

136. $\lim_{x \to k^-} x - [x]$, where k is an integer, is equal to
A. -1 B. 1 C. 0 D. 2

137. The values of x where the function $f(x) = \frac{\tan x}{\log (x - 2)}$ is discontinuous are given by

$x^2 - 4x + 3$

A. $(-\infty, 2) \cup \{3, n\pi, n \geq 1\}$ B. $(-\infty, 2)$

C. $(-\infty, 2) \cup \{2n\pi, \pi/2, n = 1\}$ D. none of the above

138. If $y = x + e^x$, then $\frac{d^2x}{dy^2}$ is

A. $\frac{1}{(1 + e^x)^2}$ B. $-\frac{e^x}{(1 + e^x)^2}$

C. $-\frac{e^x}{(1 + e^x)^3}$ D. e^x

139. At $x = 5\pi/6$, $f(x) = 2 \sin 3x + 3 \cos 3x$ is

A. zero B. maximum C. minimum D. none of the above

140. If $a < 0$, the function $(e^{ax} + e^{-ax})$ is a strictly monotonically decreasing function for values of x is given by

A. $x < 1$ B. $x > 1$ C. $x < 0$ D. $x > 0$

141. $\int [\sin (\log x) + \cos (\log x)] dx$ is equal to

A. $\sin (\log x) + \cos (\log x) + c$ B. $\sin (\log x) + c$

C. $x \cos (\log x) + c$ D. none of the above

142. $\int_{-1/2}^{1/2} |x \cos \pi/2 x| dx$ is

A. 0 B. 1 C. $(\pi\sqrt{2} + 4\sqrt{2} - 8)/\pi^2$ D. none of the above

143. Solution of differential equation $xdy - ydx = 0$ represents

A. parabola whose vertex is at origin B. circle whose centre is at origin

C. a rectangular hyperbola D. straight line passing through origin

144. If $h(x) = f(x) + f(-x)$, then $h(x)$ has got an extreme value at a point where $f'(x)$ is

A. even function B. odd function C. zero D. none of the above

145. If $x = 1/3$, then the greatest term in the expansion of $(1 + 4x)^8$ is

A. 3rd term B. 6th term C. 5th term D. 4th term

146. Roots of $x^2 + k = 0$, $k < 0$ are

A. real and equal B. rational C. real and distinct D. equal

147. In a quadratic equation with leading coefficient 1, a student reads the coefficient 16 of x strongly as 19 and obtains the roots as -15 and - 4. The correct roots are

A. 8, 8 B. 6, 10 C. - 6, - 10i D. - 8, - 8

148. The value of m for which the equation $x^2 - mx^2 + 3x - 2 = 0$ has two roots equal in magnitude but opposite in sign is

A. 4/5 B. 3/4 C. 2/3 D. 1/2

149. If $1/(b-a) + 1/(b-c) = 1/a + 1/c$, then a, b, c are in

A. H.P. B. G.P. C. A.P. D. none of the above

150. If every term in G.P. is positive and also every term in the sum of two proceeding terms, then the common ratio of the G.P. is

A. $(1 - \sqrt{5})/2$ B. $(\sqrt{5} +1)/2$ C. $(\sqrt{5} - 1)/2$ D. 1

151. If $y = - (x^3 + x^6/2 + x^9/3 + ...)$, then

A. $x^3 = 1 - e^y$ B. $x^3 = \log(1 + y)$ C. $x^3 = e^y$ D. $x^3 = 1 + e^y$

152. Vinay, Manish, Rahul, and Sumit have to give speeches in a class. The teacher can arrange the order of their presentation in

A. 12 ways B. 24 ways C. 4 ways D. 256 ways

153. There are n (>2) points in each of two parallel lines. Every point on one line is joined to every point on the other line by a line segment drawn within the lines. The number of points (between the lines) in which these segments intersect is

A. ${}^nC_2 \times {}^nC_2$ B. ${}^{2n}C_2 - 2({}^nC_2)$ C. ${}^{2n}C_2 - 2({}^nC_1) + 2$ D. none of the above

154. The number of ways in which 7 persons can sit around a table so that all shall not have the same neighbours in any two arrangements is

A. 360 B. 720 C. 270 D. 180

155. The length of sub normal to the parabola $y^2 = 4ax$ at any point is equal to

A. $a\sqrt{2}$ B. $2\sqrt{2}a$ C. $a/\sqrt{2}$ D. 2a

156. The expansion of $(8 - 3x)^{3/2}$ in terms of power of x is valid only if

A. $x > 8/3$ B. $| x | < 8/3$ C. $x < 3/8$ D. $x < 8/3$

157. If $y = - (x^3/2 + x^3 - x^4/4 + ...)$, then x is

A. $e^y - 1$ B. $\log(1 +$ C. $e^y + 1$ D. e^y

y)

158. If a, b, c are in G.P., then $\log_a m$, $\log_b m$, $\log_c n$ are in
A. G.P. B. H.P. C. A.P. D. none of the above

159. If A is a matrix of order 3 x 4, then each row of A has
A. 12 elements B. 3 elements C. 7 elements D. 4 elements

160. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$, $n \in N$, then A^{4n} equals

A. $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$

161. If α , β , γ are the roots of the equation $x^2 + px + q = 0$, then the value of the determinant

$$\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$$ **is**

A. q B. 0 C. p D. $p^2 - 2q$

162. If A, B, C are any three matrices, then A' + B' + C' is equal to
A. A + B + C B. (A + B + C)' C. - (A + B + C) D. a null matrix

163. If A is any matrix, then the product A.A, i.e., A^2 is defined only when A is a matrix of order
A. m > n B. m = n C. m < n D. m ≥ n

164. The area of the parallelogram of which $\vec{i}$ and $\vec{i}+\vec{j}$ are adjacent is
A. √2 B. 1/2 C. 2 D. 1

165. If the direction cosines of line are (1/c, 1/c, 1/c), then
A. 0 < c < 1 B. c > 2 C. c > 0 D. ± √ 3

166. The sine of the angle between the straight line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ and the plane 2x - 2y + z = 5 is
A. 10/(6√5) B. 4/(5√2) C. √ 2/10 D. (2√ 3)/5

167. Constant term in the expansion of $(x - 1/x)^{10}$ is
A. 152 B. - 152 C. - 252 D. 252

168. The latus rectum of the ellipse $5x^2 + 9y^2 = 45$ is
A. 5/3 B. 10/3 C. (2√5)/3 D. √5/3

169. $i^2 + i^4 + i^6 +$ ..... (2n + 1) terms =
A. - 1 B. 1 C. - i D. i

170. If the sum of the series 2, 5, 8, 11, ... is 60100, then n is
A. 100 B. 200 C. 150 D. 250

171. Two of the lines represented by the equation $ay^4 + bxy^3 + cx^2y^2 + dx^3y + ex^4 = 0$ will be perpendicular, then
A. $(b + d)(ad + be) + (e - a)^2(a + c + e) = 0$ B. $(b + d)(ad + be) + (e + a)^2(a + c + e) = 0$
C. $(b - d)(ad - be) + (e - a)^2(a + c + e) = 0$ D. $(b - d)(ad - be) + (e + a)^2(a + c + e) = 0$

172. The probability that an event A happens on trial of an experiment is 0.4. Three independent trials of the experiment are formed. The probability that the event A happens at least once is
A. 0.936 B. 0.784 C. 0.904 D. 0.984

173. The numbers are selected at random from 1, 2, 3, ... 100 and are multiplied, then the

probability correct to two places of decimals that the product thus obtained is divisible by 3, is

A. 0.55 B. 0.44 C. 0.22 D. 0.33

174. If $p^2 + q^2 = 1$ and $m^2 + n^2 = 1$, then

A. $|p_m + q_n| \leq 0$ B. $|p_m + q_n| \leq 1$ C. $|p_q + mn| > 1$ D. $|p_q + mn| < 2$

175. In a football championship, there were played 153 matches. Every two team played one match with each other. The number of teams participating in the championship is

A. 9 B. 11 C. 13 D. 18

176. The solution of $|(x - 1) + 2| = 1$ is

A. 1 B. 2 C. 5 D. ϕ

177. The equation $\log_e x + \log_e (1 + x) = 0$ can be written as

A. $x^2 + x - e = 0$ B. $x^2 + x - 1 = 0$ C. $x^2 + x + 1 = 0$ D. $x^2 + xe - e = 0$

178. Both the roots of the equation $(x - b)(x - c) + (x - a)(x - c) + (x - a)(x - b) = 0$ are always

A. positive B. negative C. real D. imaginary

179. The value of tan x/tan 3x whenever defined never lies between

A. 1/3 and 3 B. 1/4 and 4 C. 1/5 and 5 D. 5 and 6

180. Given $(a + d) > (b + c)$ where a, b, c, d are real numbers, then

A. a, b, c, d are in A.P.

B. 1/a, 1/b, 1/c, 1/d are in A.P.

C. (a + b), (b + c), (c + d), (a + d) are in A.P.

D. 1/(a + b), 1/(b + c), 1/(c + d), 1/(a + d) are in A.P.

1. The radius of curvature of a spherical surface is measured using

A. a spherometer B. spectrometer C. screw gauge D. slide callipers

2. If the dimensions of length are expressed as G^x, C^y, h^z, where G, C, h are universal gravitational constant, speed of light and Plank's constant respectively, then

A. $x = 1/2$, $y = 1/2$ B. $x = 1/2$, $z = 1/2$ C. $y = 1/2$, $z = 3/2$ D. $y = + 3/2$, $z = 1/2$

3. The dimensional formula of electric field strength is:

A. $MLT^{-2} I^{-1}$ B. $MLT^{-3}A^{-1}$ C. $T^{-2}A^{-1}$ D. $MLTA^{-2}$

4. *A* man throws a ball in air in such a way that when the ball is in its maximum height he throws another ball. If the balls are thrown after the time difference of 1 sec, then what wilt be the height attained by them

A. 19.6 m B. 9.8 m C. 4.9 m D. 2.45 m

5. If the velocity time graph of a body is a straight line sloping downwards, the body has

A. acceleration B. declaration C. zero acceleration D. constant acceleration

6. Which one of the following equations represents the motion of body with finite constant acceleration?

A. $y = at$ B. $y = at + bt^2$ C. $y = at + bt^2 + ct^3$ D. $y = at + bt$

7. What is the magnitude of the velocity of the body when it is projected horizontally from a point above the ground after 0.2 seconds?

A. $\sqrt{2}$ ms^{-1} B. $2\sqrt{2}$ ms^{-1} C. $3\sqrt{2}$ ms^{-1} D. $4\sqrt{2}$ ms^{-1}

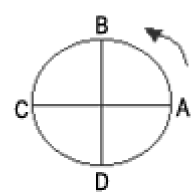
8. A string can withstand a tension of 25 N. What is the greatest speed at which a body of mass 1 kg can be whirled in a horizontal circle using 1 m length of the string?

A. 25 ms^{-1} B. 5 ms^{-1} C. 75 ms^{-1} D. 10 ms^{-1}

9. An object tied to a piece of string is whirled in a vertical circle, at constant speed. The tention in the string is maximum at

A. *A* B. *B*

C. *C* D. *D*



10. The maximum force of friction that comes into play is called

A. limiting friction B. kinetic friction C. static friction D. minimum friction

11. A body of mass 5 Kg is raised vertically to a height of 10 m by a force of 170 N. The final velocity of the body is

A. 15 ms^{-1} B. 17 ms^{-1} C. 20 ms^{-1} D. 22 ms^{-1}

12. A cyclist moving at a speed of 17.64 km/h describes a circle of radius 9.8 m. If the cyclist is held in balance, the co-efficient of friction between the tyre and the ground is

A. 0.25 B. 0.29 C. 0.36 D. 0.35

13. Two bodies with masses m_1 and m_2 have equal kinectic energies. If P_1 and P_2 are their respective momenta, then $P_1 = P_2$ is

A. $m_1 : m_2$ B. $m_2 : m_1$ C. $m_1^2 : m_2^2$ D. $\sqrt{m_1} : \sqrt{m_2}$

14. In elastic collision,

A. only energy is conserved B. only momentum is conserved

C. both energy and momentum is conserved D. none of these

15. The velocity of a particle whose kinetic energy is equal to the rest energy is

A. (1/2) C B. C C. $\sqrt{3}/3$ D. $\sqrt{3}\,C$

16. The propeller of a ship makes 350 rev. while its speed increases from 200 rpm to 500 rpm. Then the time taken for this is

A. 1 min B. 1.2 minute C. 5.3 seconds D. 53 seconds

17. The K.E. needed to project a body from the earth's surface to infinity is

A. mgR B. 2 mgR C. 1/2 (mgR) D. 1/4 (mgR)

18. The distance of two planets from the sun are 10^{13} and 10^{12} meters respectively. The ratio of time period of these two planets is

A. $\sqrt{10}$ B. $1/\sqrt{10}$ C. 100 D. $10\sqrt{10}$

19. Poisson ratio is the ratio of

A. the linear strain to the lateral strain B. the lateral strain to the linear strain

C. the linear stress to the lateral stress D. the lateral stress to the linear stress

20. Two wires L and M are of the same material and of the same length, but the diameter of L is twice that of M stretching force applied to L is four times that of M. Then the ratio of the elongation of L to that of M is

A. 1 : 4 B. 4 : 1 C. 1 : 1 D. 2 : 1

21. Which of the substance breaks just beyond the elastic limit?

A. Elastic B. Malleable C. Brittle D. Ductile

22. A stone of mass 16 kg is attached to a string 144-meter-long and is whirled in a horizontal circle. The maximum tension the string can stand is 16 N. The maximum velocity of revolution that can be given to the stone without breaking it will be

A. 12 ms^{-1} B. 14 ms^{-1}

C. 16 ms^{-1} D. 20 ms^{-1}

23. A vessel containing 0.1 m^3 of air at 76 cm of Hg pressure is connected to an evacuated vessel of capacity 0.09 m^3. The resultant air pressure is

A. 20 cm of Hg B. 30 cm of Hg C. 40 cm of Hg D. 50 cm of Hg

24. Two gases *A* and *B* having the same temperature *T*, same pressure *P* and the same volume *V* are mixed. If the mixture is at the same temperature *T* and occupies a volume *V*, the pressure of the mixture is

A. *P* B. 2*P* C. *P*/2 D. 4*P*

25. A solid ball of metal has spherical cavity inside it. If the ball is heated, the volume of the cavity will

A. increase B. decrease C. remain the same D. disappear

26. If the law of heat conduction is written in the form of Ohm's law, then the quantity similar to electrical resistance is

A. A/dλ B. Ad/λ C. Aλ/d D. d/Aλ

27. The work done from 250 cals of heat is

A. 1045 ergs B. 1045 joules C. 1045 watt D. 1045 N

28. The time taken by a particle executing S.H.M of period *T* to move the mean position to half the maximum displacement is

A. *T*/2 B. *T*/4 C. *T*/8 D. *T*/12

29. Let *g* be the acceleration due to gravity at earth's surface and *K* be the rotational K.E. of the earth. Suppose the earth's radius decreases by 2%, then

A. *g* decreases by 2% and *K* decreases by 4% B. *g* decreases by 4% and *K* increases by 2%
C. *g* increases by 4% and *K* decreases by 4% D. decreases by 4% and *K* increases by 4%

30. A particle of mass *m* is hanging vertically by an ideal spring of force constant *K*. If the mass is made to oscillate vertically, its total energy is

A. maximum at the extreme position B. maximum at the equilibrium
C. minimum at the equilibrium D. same at all position

31. Velocity of sound in CO_2 is less than in hydrogen because

A. CO_2 is heavier than hydrogen B. CO_2 is a compound and hydrogen is an element
C. CO_2 is more soluble in water D. CO_2 can be more easily liquefied

32. The velocity of sound in air at room temperature is 110 m/sec. The length of the wave coming from a vibrating fork at frequency 275 is

A. 0.4 m B. 100 m C. 825 m D. 1375 m

33. The temperature at which velocity of sound in air is double its velocity at 0°C is

A. 435°C B. 694°C C. 781°C D. 819°C

34. Static electricity is produced by

A. induction B. friction

C. both induction and friction D. none of the above

35. Surface charge density on a pear shaped conductor is

A. maximum in the middle position B. maximum near the tapering end

C. maximum near the broad end D. equal throughout the surface

36. A given charge situated at a certain distance from an electric dipole in the end on position experiences a force *F*. If the distance of the charge is doubled, the force acting on the charge will be

A. 2*F* B. *F*/2 C. *F*/4 D. *F*/8

37. A piece of fuse wire melts when the current is 5 A. The energy produced then is 1 J/s. The resistance of the fuse in ohm is

A. 0.04 B. 0.1 C. 0.5 D. 10

38. The gravitational force between two point masses m_1 and m_2 at separation r is given by $F = (m_1 m_2)/r^2$ Then constant *K*

A. depends on systems of units only B. depends on medium between masses only

C. depends of both masses and units D. none of these

39. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of

A. each of them increases B. each of them decreases

C. copper increases and germanium decreases D. germanium increases and copper decreases

40. In a given thermocouple, the temperature of the cold junction is 20°C, while the neutral temperature is 27°C. What will be the temperature of immersion ?

A. 420°C B. 425°C C. 520°C D. 525°C

41 When different parts of a metal are kept at different temperature and current is passed through it, heat is either evolved or absorbed. The effect is called

A. Peltier effect B. Seebeck effect C. Thompson effect D. Joule effect

42. A storage battery is to be charged from a d.c. supply which terminal of the battery be connected to the positive side of the line

A. positive B. negative

C. both positive and negative
D. first negative and after the lapse of 5 minutes positive

43. The force between two parallel wires carrying currents in the same direction is a
A. force of attraction
B. force of repulsion
C. no resultant force between the wires
D. resultant force acting perpendicular to the flow of wires

44. The motion of an electric charge produces
A. only an electric field
B. only a magnetic field
C. both magnetic and electric field
D. none of the above

45. An ammeter is connected in series with a 2V circuit containing a 2V battery when the switch is closed, the ammeter shows high deflection and comes to zero. The circuit may contain a
A. resistance of 20Ω
B. fuse
C. diode
D. triode

46. Ferromagnetic substances have
A. very high permeability and susceptibility
B. low permeability but high susceptibility
C. high permeability and low susceptibility
D. none of these

47. The permeability of the paramagnetic substance is
A. very large
B. very small
C. negative
D. small but more than 1

48. When a material is subjected to a small field *H*, the intensity of magnetisation is proportional to
A. $\sqrt{H}$
B. H
C. H^2
D. $1/\sqrt{H}$

49. In a capacitance circuit the resistance is
A. ωC
B. $1/\omega C$
C. $1/\sqrt{\omega} C$
D $\sqrt{\omega} \times C$

50. In electromagnetic induction, the induced e.m.f. is independent of
A. change of flux
B. time
C. number of lines of force
D. resistance of the cells

51. A coil of area *A* is kept perpendicular to a magnetic field *B*. If coil is rotated by 180^0, then change in the flux will be
A. BA
B. zero
C. $2BA$
D. $3BA$

52. The displacement current flows in the dielectric of a capacitor when the P.D. across its plates
A. is increasing with time
B. is not decreasing with time
C. has assured a constant value
D. becomes zero

53. Electromagnetic waves
A. are longitudinal waves
B. travel in free space at the speed of light
C. are produced by
D. travel with the same

charges moving with uniform velocity — speed in all media

54. The frequency of visible light is of the order of
A. 10^8 Hz B. 10^{18} Hz C. 10^{15} Hz D. 10^{12} Hz

55. A concave mirror of focal length 15cm forms an image at a distance of 40 cm from it. The distance of the object from the mirror is
A. 10 cm B. 20 cm C. 24 cm D. 30 cm

56. Binoculars are made conveniently short by making use of right angled isosceles prism of glass. In a normal pair of binoculars, the number of prism is
A. 1 B. 2 C. 4 D. 5

57. A ray incident on a 60° prism of refractive index $\sqrt{2}$ suffers minimum deviation. The angle of incidence is
A. 0° B. 45° C. 60° D. 75°

58. Two electron beams having velocities in the ratio of 1 : 2 are subjected separately to identical magnetic field. The ratio of deflection produced is
A. 4 : 1 B. 1 : 2 C. 1 : 4 D. 2 : 1

59. The ray used for determining the crystal structure of solid is
A. α -ray B. β -ray C. γ -ray D. X-ray

60. For the structural analysis of crystals X-ray are used because
A. X-rays have wavelength of the order of the inter-atomic spacing
B. X-rays are highly penetrating radiation
C. wavelength of X-rays is of order of nuclear size
D. X-rays are coherent radiation

61. The ratio of the molar amounts of H_2S needed to precipitate the metal ions from 20 ml each of 1 M Cd $(NO_3)_2$ and 0.5 M $CuSO_4$ is
A. 2:1 B. 1:1 C. 1:2 D. indefinite

62. Among the following elements, which one has the highest value of first ionization potential?
A. Argon B. Barium C. Cesium D. Oxygen

63. Which of the following concepts best explains that o-nitrophenol is more volatile than p-nitrophenol?
A. Resonance B. Conjugation C. Hydrogen binding D. Covalent bonding

64. Which of the following statements is false?
A. Ionic compounds generally have low m.p.and b.p.
B. Carbon tetrachloride is a non-polar molecule

C. Anhydrous $AlCl_3$ is a covalent substance
D. A molecule represents a more stable state as compared to individual atoms

65. The chemical species having same number of electrons in the outermost and penultimate shell is

A. Al^{3+} B. O^{2-} C. Na^{+} D. Cl^{-}

66. The solution was prepared by dissolving 0.0005 mol of $Ba(OH)_2$ in 100 ml of the solution. If the base is assume to ionize completely, the pOH of the solution will be

A. 10 B. 12 C. 2 D. unpredictable

67. In which of the following neutralization will the enthalpy of neutralization be the smallest?

A. H_3PO_4 with NaOH B. NaOH and CH_3OOH C. NaOH with HCl D. HCl with NH_4OH

68. The pH of 10^{-8} M NaOH will be

A. 6.96 B. 7.04 C. 12.0 D. 8

69. Gas deviates from ideal gas nature because molecules

A. attract each other B. contain covalent bond
C. show Brownian movement D. are colourless

70. Among the following reactions, the fastest one is

A. precipitation of silver chloride by mixing silver nitrate and sodium chloride solutions
B. burning of coal
C. rusting of iron in moist air
D. conversion of monoclinic sulphur to rhombic sulphur

71. When 5.0 g of $BaCl_2$ is dissolved in water to have 10^6 g of solution. The concentration of solution is

A. 5M B. $5gmL^{-1}$ C. 2.5 ppm D. 5 ppm

72. The unit of electrochemical equivalent is

A. coulomb/gram B. gm-ampere C. gm./coulomb D. gm-$ampere^{-1}$

73. Adsorption increases when

A. temperature remains constant B. temperature increases
C. temperature decreases D. none of the above

74. The number of hours required for a current of 3.0 A to decompose electrically 18 g of water is

A. 12 hours B. 24 hours C. 6 hours D. 18 hours

75. The number of electrons per second, which pass through a cross section of a copper wire carrying 10 -16 A, is

A. 16×10^{-2} e/s B. 1.6×10^{-3} C. 60 e/s D. 625 e/s

76. 20 ml of HCl having certain normality neutralizes exactly 1.0 g $CaCO_3$. The normality of acid is

A. 0.1 N B. 1.0 N C. 0.5 N D. 0.01 N

77. The alkali metal used in photoelectric cell is

A. Cs B. Fr C. K D. Rb

78. Calcium is extracted from

A. fused $CaSO_4$ B. fused $Ca_3(PO_4)_3$ C. fused $CaCl_2$ D. aqueous $CaCl_2$ solution

79. $SbCl_3$ upon hydrolysis yields

A. $Sb(OH)_3$ B. SbO^+ C. Sb^{+3} D. None of the above

80. Which of the following trioxides can exist as monomer molecule?

A. SO_3 in gaseous state B. TeO_3 C. SeO_3 in all states D. SO_3 in solid state

81. Pure chlorine is obtained

A. by heating $PtCl_4$

B. by heating a mixture of NaCl and MnO_2 with conc. H_2SO_4

C. by heating MnO_2 with HCl

D. by treating bleaching powder with HCl

82. Which of the following gases is used in very low temperature thermometers?

A. N_2 B. H_2 C. Ne D. He

83. Number of nucleons in D_2 molecule is

A. 4 B. 1 C. 2 D. 3

84. There is no s-s bond in

A. $S_2O_7^{2-}$ B. $S_2O_3^{2-}$ C. $S_2O_4^{2-}$ D. $S_2O_5^{2-}$

85. The ratio of C_p/C_v for inert gas is

A. 1.66 B. 1.33 C. 1.99 D. 2.13

86. Electrolytic reduction method is used in the extraction of

A. highly electropositive elements B. transition metals

C. noble metals D. highly electronegative elements

87. The metal that is extracted from sea water is

A. Mg B. Au C. Ca D. Fe

88. The compound having blue colour is
A. $HgSO_4$ B. $PbSO_4$ C. $CuSO_4.5H_2O$ D. $CuSO_4$

89. Which of the following is known as 'Wol-framite'?
A. $Na_2CO_3 + K_2CO_3$ B. $FeWO_4$ C. SnO_2 D. 98% pure Zinc

90. Within each transition series, the oxidation state
A. first decreases till the middle of period and then increases
B. decreases regularly in moving from left to right
C. first increases till the middle of period and then decreases
D. none of the trend is correct

91. Which of the following properties of graphite and diamond are identical?
A. Density B. Crystal structure C. Atomic weight D. Electrical conductivity

92. Which of the following is an example of co-polymer?
A. PAN B. PTFE C. Polythene D. Buna-S

93. The reagent which forms crystalline osazone derivative when reacted with glucose is
A. Hydroxylamine B. Benedict solution C. Fehling solution D. Phenylhydrazine

94. To which class of dyes does phenolphthalein belong?
A. Phthalein dyes B. Triphenyl methane dyes C. Nitro dyes D. Azo dyes

95. Peroxo linkage is present in
A. $H_2S_2O_8$ B. H_2SO_3 C. $H_2S_2O_7$ D. H_2SO_4

96. Tautomerism is exhibited by
A. RCH_2NO_2 B. R_3CNO_2 C. $(CH_3)_2NH$ D. $(CH_3)_3CNO$

97. Latest technique for purification, isolation and separation of organic substances is
A. chromatography B. sublimation C. crystallization D. distillation

98. Lactic acid looses optical activity when reduced with red P and HI because
A. racemic mixture is formed B. spatial arrangement is changed
C. symmetry of the molecule is destroyed D. chirality of the molecule is destroyed

99. In order to convert aniline into chlorobenzene, the reagents needed are
A. $Cl_2/AlCl_3$ B. Cl_2/CCl_4 C. $NaNO_2/HCl$ and CuCl D. CuCl

100. Which of the following alcohol on dehydration with conc. H_2SO_4 will yield 2-butene?
A. 2-methyl-2-propanol B. 2-methyl-2-butanol C. 2-propanol D. Sec. Butyl alcohol

101. A compound A has a molecular formula C_2Cl_3OH. It reduces Fehling solution and an oxidation gives a monocarboxylic acid B. It can be obtained by the action of chlorine on ethyl alcohol. A is

A. Chloral B. Chloroform C. Methyl chloride D. Monochloroacetic acid

102. Which of the following will yield Benzaldimine hydrochloride?

A. benzonitrile and $SnCl_2$/HCl B. nitrobenzene and $SnCl_2$/HCl

C. benzene and hydrazine D. hydrazine and HCl

103. Isopropyl alcohol is heated on a water bath with the suspension of bleaching powder. Which of the following products will be formed?

A. Propene B. Ethanol C. Isopropyl chloride D. Trichloromethane

104. Which of the following compounds is least basic?

A. $C_6H_5NH_2$ B. $C_2H_5NH_2$ C. CH_3NH_2 D. NH3

105. Iodine dissolves in KI solution due to the formation of

A. I^+ B. I^- C. I_2^- D. I_3^-

106. Hydrogen sulphide exhibits

A. acidic properties B. basic properties C. oxidising properties D. none of the above

107. White Phosphorus reacts with caustic soda. The products are pH_3 and NaH_2PO_2. This reaction is an example of

A. oxidation B. reduction C. oxidation and reduction D. neutralisation

108. Ammonia solution dissolves fairly in

A. Hg_2Cl_2 B. $PbCl_2$ C. $Cu(OH)_2$ D. AgI

109. Amongst the trihalides of nitrogen, which one is the least basic?

A. NF_3 B. NCl_3 C. NBr_3 D. NI_3

110. Among the various allotropes of carbon,

A. diamond is the hardest B. graphite is the hardest C. lamp black is the hardest D. coke is the hardest

111. Bone charcoal is used for decolourising sugar because it

A. reduces colouring matter B. oxidises colouring matter

C. absorbs colouring matter D. none of the above

112. Tin (II) chloride is used as a

A. mordant in dying B. catalyst C. oxidising agent D. none of the above

113. Inert pair effect is most prominent in
A. aluminium B. boron C. gallium D. thallium

114. In the alumino thermite process, aluminium acts as
A. an oxidising agent B. a flux C. a reducing agent D. a solder

115. The correct structure of mercurous ion is
A. Hg^{+} B. Hg^{2+} C. Hg_2^{+} D. Hg_2^{2+}

116. Which one of the following is purely ionic?
A. Sodium chloride B. Beryllium chloride C. Lithium chloride D. Carbon tetrachloride

117. A compound 'A' on heating gives a colourless gas. The residue is dissolved in water to obtain B. Excess CO_2 is passed through aqueous solution of B, when C is formed. C on gentle heating gives back A. The compound A is
A. $NaHCO_3$ B. Na_2CO_3 C. $Ca(HCO_3)_2$ D. $CaCO_3$

118. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively
A. H_2, O_2 B. O_2, H_2 C. O_2, Na D. O_2, SO_2

119. The metals occurring in the form of their compound in the earth's crust are called
A. matters B. minerals C. alloys D. gangue

120. A commercial sample of hydrogen peroxide is labelled as 10 volume. Its percentage strength is nearly
A. 1% B. 3% C. 10% D. 90%

121. If $(1 + x)^n = P_0 + P_1 + P_2x + P_2x^2 + ... + P_nx^n$, then the value of $P_0 - P_2 + P_4 - .....$ is
A. $2^n \cos n\pi/4$ B. $2^{n/2} \cos n\pi/4$ C. $2^{n/2} \sin n\pi/4$ D. $2^n \sin n\pi/4$

122. If a, b, c and x are real numbers, then $x^2 + 2bx + c$ will be positive if
A. $b^2 > c$ B. $b^2 < c$ C. $b^2 > 4c$ D. $b^2 < 4c$

123. The one of the values of $(-i)^{1/3}$ is
A. $(1/2)(\sqrt{3} - i)$ B. $(-1/2)(\sqrt{3} + i)$ C. $\pm (1/2)(\sqrt{3} + i)$ D. none of the above

124. Let A = R ≈ {m}and B = R ≈ {n}, where R is a set of real numbers. Let f(x) = (x - n)/(x - m), then f is (where m, n are any integers)
A. one-one onto B. many one onto C. one-one into D. many one into

125. Cards are dealt one by one from a well shuffled pack until an ace appears. The probability that exactly n cards are dealt with before the first ace appears is

A. $[4(51 - n)(50 - n)(49 - n)]/(13.51.50.49)$ B. $4/(52 - n)$
C. $[48 - (n - 1)]/(52 - n)$ D. none of the above

126. A determinant is chosen at random from the set all determinants of order 2 with element 0 and only. The probability that the value of determinant chosen is positive, is
A. 11/18 B. 11/14 C. 13/16 D. 3/16

127. The value of the integral $\int_0^2 |1 - x|\,dx$ equals

A. 1 B. 2 C. 4 D. 0

128. The domain of the function $f(x) = \sin^{-1}\left[\log_2 (x^2/2)\right]$ is

A. $[-2, 2] \approx \{0\}$ B. $[-1, 1] \approx \{0\}$ C. $[-2, 2]$ D. $[-1, 1]$

129. $\lim_{x \to 0} (1 - x)\,[(\tan \pi x)/2]$ equals

A. $\pi/2$ B. $2/\pi$ C. $\pi - 2$ D. $\pi + 2$

130. The function $f(x) = |x|/x$; $x \neq 0$ and $f(x) = 1$; $x = 0$ is discontinuous at
A. $x = 0$ B. $x = 1$ C. $x = 2$ D. $x = -2$

131. If $x = a(t - \sin t)$, $y = a(t - \cos t)$, then d^2y/dx^2 is equal to
A. $(1/4a)(\text{cosec}^2 t/2)$ B. $(1/4a)(\text{cosec}^3 t/2)$ C. $-[(1/4a)(\text{cosec}^2 t/3)]$ D. $-[(1/4a)(\text{cosec}^4 t/2)]$

132. If x, y, and z are arithmetic, geometric, and harmonic means respectively of two distinct position numbers, then
A. $z < y < x$ B. $x < y < z$ C. $x < z < y$ D. $x > z > y$

133. All the solutions of the equation $16xy + x^2 + y^2 - 8x - 8y - 20 = 0$ represents
A. a straight line B. pair of straight lines C. a circle D. a parabola

134. The solution set of an inequality $5 - 15y > 125$, $y \in R$ is
A. $\{ y \mid y \in R \}$ B. $\{ y \mid y > 6 \}$ C. $\{ y \mid y < -8 \}$ D. $\{ y \mid y \in 8 \,\&\, y \in 9 \}$

135. Unit vector in the xy-plane that makes an angle of 45^o with the vector $i + j$ and an angle of 60^o with the vector $3i - 4j$ is
A. i B. 2i C. $\sqrt{2}i$ D. none of the above

136. Given the line $(x + 3)/2 = (y - 4)/3 = (z + 5)/2$ and the plane $4x - 2y$

- z = 1,then the line is

A. perpendicular to the plane
B. inclined with 60^o to the plane
C. inclined with 45^o to the plane
D. parallel to the plane

137. $\lim_{x \to 0} [x \sin x + \log (1 - x)^x]/x^3$ equals

A. 1/2 B. - 1/2 C. 1/4 D. - 1/4

138. Four numbers are such that the first three are in A.P., while the last three are in G.P. The first number is 6 and common ratio of G.P. is 1/2, then the numbers are

A. 2, 4, 6, 8 B. 6, 4, 2, 1 C. 6, 4, 3, 2 D. 6, 9, 3, 1

139. If the arithmetic and geometric mean of two distinct positive numbers are A and G respectively, then their harmonic mean is

A. $A/\sqrt{G}$ B. A/G^2 C. G^2/A D. $\sqrt{A/G}$

140. The area bounded by the straight lines y = 1, x + y = 2, and x - y = 2 is

A. 11 B. 11/2 C. 1/2 D. 2/11

141. The value of $5^2 \log_{25} 5$ is

A. 4 B. 5 C. 6 D. 8

142. If the angle of intersection between the curves $y = x^2$ and $y^2 = 4x$, then the point of intersection is

A. (0, 0) B. (0, 1) C. (1, 0) D. (1, 1)

143. The pair of points which lie on the same side of the straight line 3x - 8y = 7 is

A. (-4, -3), (1, 1) B. (0, 1), (3, 0) C. (-1, -1), (3, -7) D. (-1, -1), (3, 7)

144. The equation $x^2 - 8x + 16 = 0$ has

A. coincident root B. imaginary root C. unequal root D. none of the above

145. If b = 3, c = 4 and $B = \pi/4$, then the number of triangles that can be formed is

A. 1 B. 2 C. 3 D. none of the above

146. $\lim_{\theta \to 0} (\tan m\theta)/m$ equals

A. θ B. $-\theta$ C. θ^2 D. 0

147. The range of the function f(x)[1 - x] - 1 = 0 is

A. a set of irrational numbers
B. a set of rational numbers

C. a set of real numbers D. none of the above

148. If a, b, c are in A.P., then
A. 1/(a - b) = 1/(b - c) B. (a - b)/(b - c) = 2 C. (a - c)/2 = b D. b + c = 2a

149. The sum of all numbers greater than 1000 formed by using the digits 1, 3, 5, 7, no digit repeated in any number is
A. 106656 B. 101276 C. 82171 D. 81273

150. The vertices of a triangle are represented by the complex numbers 4 - 2i, -1 + 4i, and 6 + i, then the complex number representing the centroid of a triangle is
A. 3 + i B. 3 - i C. 9 + i D. 9 - i

151. $\sin(\pi + \theta)\sin(\pi - \theta)\operatorname{cosec}^2\theta$ is equal to
A. $\sin\theta$ B. $\cos\theta$ C. 1 D. -1

152. In a triangle ABC, $[(b^2 - c^2)/a]\cos A + [(c^2 - b^2)/a]\cos B + [(a^2 - b^2)/a]\cos C$ is equal to
A. abc B. 1/abc C. $a^2b^2c^2$ D. 0

153. If ex-radii r_1, r_2, r_3 of a triangle ABC are in H.P., then the sides of the triangle are in
A. A.P. B. G.P. C. H.P. D. none of the above

154. The vertices of a triangle are A(6, 4), B(4, -3) and C(-2, 3), which one of the following is true for triangle ABC?
A. an isosceles triangle B. an equilateral triangle C. a right angled triangle D. none of the above

155. The length of tangent from (5, 1) to the circle $x^2 + y^2 - 6x + 4y + 3 = 0$ is
A. 7 B. 14 C. 28 D. 36

156. If $\vec{a}$ = i + 2j + k and $\vec{b}$ = 4i + 3j - 2k, then the projection of b on a is
A. $2/\sqrt{29}$ B. $5/\sqrt{29}$ C. $3/\sqrt{29}$ D. 2

157. Which one is true?
A. P(A/B) = P(A) + P(AB) B. P(A/B) = P(A) - P(B) C. P(A/B) = [P(AB)]/P(B) D. P(A/B) = P(A) - P(B/A)

158. If $y = (1/2)[\log(\tan x)]$, then the value of dy/dx at $x = \pi/4$ is
A. 1 B. 0 C. -1 D. ∞

159. If $y = (\tan x + \sec x)^x$, then dy/dx is equal to
A. x secx B. y secx C. m secx D. mxy

160. The equation $2x^2 + 3x + 1 = 0$ has
A. rational root B. irrational root C. equal root D. none of the above

161. A bag contains 6 red, 5 green, and 7 white balls. The probability of choosing a red or a white ball is
A. 1/3 B. 11/13 C. 13/18 D. 3/8

162. $\int (x + 2)/(x + 4)\, dx$ is equal to
A. $1/2[\tan^{-1}(x - 2/x)] + c$ B. $\tan^{-1}x + c$ C. $1/2[\tan^{-1}(2/x)] + c$ D. none of the above

163. The length intercepted on the line $3x + 4y + 1 = 0$ by the circle $(x - 1)^2 + (y - 4)^2 = 25$ is
A. 3 B. 4 C. 5 D. 6

164. The period of the function $\cos[(3/5)\alpha] - \sin[(2/7)\alpha]$ is
A. 7π B. 10π C. 70π D. 3π

165. The minimum value of x^x is attained when x is equal to
A. - e B. + e C. e^2 D. 1/e

166. If a, b, c and u, v, w are complex numbers representing the vertices of two triangles such that $c = (1 - r)a + rb$ and $w = (1 - r)u + rv$, where r is a complex number, then the two triangles are
A. similar B. congruent C. equal in area D. equal bases

167. In a triangle ABC, if r and R are the in-radius and circum-radius respectively, then $(a \cos A + b \cos B + c \cos C)/(a + b + c)$ is
A. r/R B. R/r C. R^2/r D. r^2/R

168. $\int [(x + \sin x)/(1 + \cos x)]\, dx$ is equal to
A. $x \tan(x/2)$ B. $x \tan(x/2) + c$ C. $\log(1 + \cos x) + c$ D. $x \log(\cos x) + c$

169. The differential coefficient of $f[\log(x)]$ when $f(x) \log x$ is
A. $x \log x$ B. $x/(\log x)$ C. $1/(x \log x)$ D. $(\log x)/x$

170. If $x = 9 \sin 2\theta (1 + \cos 2\theta)$ and $y = b \cos 2\theta (1 - \cos 2\theta)$, then the value of dy/dx is
A. $(b \tan \theta)/a$ B. $a/(b \tan \theta)$ C. $(a \tan \theta)/b$ D. $ab \tan \theta$

171. The number of solution of the equation $(\tan x + \sec x = 2 \cos x)$ lying in the interval $(0, 2\pi)$ is
A. 0 B. 1 C. 2 D. 3

172. If θ and ϕ are angles in the first quadrant such that $\tan \theta = 1/7$ and $\sin \phi = 1/\sqrt{10}$, then

A. $\theta + 2\phi = 90^o$ B. $\theta + 2\phi = 60^o$ C. $\theta + 2\phi = 30^o$ D. $\theta + 2\phi = 45^o$

173. If $a \cos 2\theta + b \sin 2\theta = c$ has a and b as its solution, then the value of $\tan \alpha + \tan \beta$ is
A. $(c + a)/2b$ B. $2b/(c + a)$ C. $(c - a)/2b$ D. $b/(c + a)$

174. The perimeter of a certain sector of a circle is equal to the length of the arc of a semi-circle having the same radius, the angle of the sector is
A. 65^o 24' B. 64^o 24' C. 63^o 24' D. 62^o 24'

175. The value of $\tan^{-1}x + \cot^{-1}x$ is
A. $\pi/3$ B. $\pi/6$ C. $2\pi/3$ D. 2π

176. If a circle cuts a rectangular hyperbola $xy = c^2$ in A, B, C, D and the parameters of these four points be t_1, t_2, t_3 and t_4 respectively, then
A. $t_1 t_2 = t_3 t_4$ B. $t_1 t_2 t_3 t_4 = 1$ C. $t_1 = t_2$ D. $t_3 = t_4$

177. If the normal to $y^2 = 12x$ at (3, 6) meets the parabola again in (27, -8) and the circle on the normal chord as diameter is
A. $x^2 + y^2 + 30x + 12y - 27 = 0$ B. $x^2 + y^2 + 30x + 12y + 27 = 0$
C. $x^2 + y^2 - 30x - 12y - 27 = 0$ D. $x^2 + y^2 - 30x + 12y - 27 = 0$

178. If the normal any point P on the ellipse cuts the major and the minor axes in G and g respectively and C be the centre of the ellipse, then
A. $a^2 (CG)^2 + b^2 (Cg)^2 = (a^2 - b^2)^2$ B. $a^2 (CG)^2 - b^2 (Cg)^2 = (a^2 - b^2)^2$
C. $a^2 (CG)^2 - b^2 (Cg)^2 = (a^2 + b^2)^2$ D. none of the above

179. The point of intersection of the tangent at the end of the latus rectum of the parabola $y^2 = 4x$ is
A. (-1, 1) B. (1, 1) C. (-1, 0) D. (0, 0)

180. If a, b, c are distinct positive numbers, then the expression $(b + c - a)(c + a - b)(a + b - c) - abc$ is
A. positive B. negative
C. both negative and positive D. none of the above

Physics

1.The slit width, when a light of wavelength 6500Åis incident on a slit, if first minima for red light is at 300
a) 1×10^{-6}m b) 5.2×10^{-6}m c) 1.3×10^{-6}m d) 2.6×10^{-6}m

2.Newton's rings are observed by keeping a spherical surface of 100cm radius on a plane glass plate. The wave length of light used is 5880Å.If the diameter of the 15th bright ring is 0.59cm, the diameter of the 5th ring is
a) 0.226cm b) 0.446cm c) 0.336cm d) 0.556cm

3.The resulting intensity after interference of two coherent waves represented by y1a1cost and y2a2cos2t will be
a) a1−a2 b) a1+a2 c) a12−a22 d) a12+a22

4.In a young's experiment, one of the slit is covered with a transparent sheet of thickness 3.6×10^{-3}cm due to which position of central fringe shifts to a position originally occupied by 30th bright fringe. The refractive index of the sheet, if λ=6000Å is
a) 1.5 b) 1.2 c) 1.3 d) 1.7

5.In young's double slit experiment with monochromatic light of wave length 600nm, the distance between slits is 10^{-3}m. For changing fringe width by 3×10^{-5}m
a) the screen is moved away from the slits by 5cm b) the screen is moved by 5cm towards the slits c) the screen is moved by 3cm towards the slits d) both (a) and (b) are correct

6.When two coherent monochromatic light beams of intensities I and 4I are superimposed, what are the maximum and minimum possible intensities in the resulting beams?
a) 5I and I b) 5I and 3I c) 9I and I d) 9I and 3I

7.In young's double slit experiment when violet light of wave length 4358Å is used, then 84 fringes are seen in the field of view, but when sodium light of certain wave length is used, then 62 fringes are seen in the field of view, the wave length of sodium light is
a) 6893Å b) 5904Å c) 5523Å d) 6429Å

8.In an interference pattern the position of zeroth order maxima is 4.8mm from a certain point P on the screen. The fringe width is 0.2mm. The position of second maxima from point P is
a) 5.1 mm b) 5 mm c) 40 mm d) 5.2 mm

9.If young's double slit experiment is performed in water,
a) the fringe width will decreases b) the fringe width will increase c) the fringe width will remain unchanged d) there will be no fringe

10.The first diffraction minimum due to single slit diffraction is θ, for a light of wave length 5000Å. If the width of the slit is 1×10^{-4}cm, then the value of θ is
a) 300 b) 450 c) 600 d) 150

11.2 non-coherent sources emit light beam of intensities I and 4I. The maximum and minimum intensities in the resulting beam are
a) 9I and 3I b) 9I and 5I c) 5I and I d) 5I and 3I

12.Light propagates 2cm distance in glass of refractive index 1.5 in time t0. In the same time t0, light propagates a distance of 2.25 cm in a medium. The refractive index of the medium is
a) 4/3 b) 3/2 c) 8/3 d) none of these

13.Two wave fronts are emitted from coherent sources of path difference between them is 2.1 micron. Face difference between the wave fronts at that point is 7.692 π. Wave length of light emitted by source will be
a) 5386Å b) 5400Å c) 5460Å d) 5892Å

14.A spherical air bubble in water will act as
a) convex lens b) concave lens c) glass plate d) plano convex lens

15.A concave lens can be used as a simple magnifier if the object lies

a) beyond f b) within the focal length c) between f and 2f d) at 2f

16.For an equilateral prism the angle of minimum deviation is 300. Then the refractive index of the material of the prism is

a) 1/2 b) 2 c) 2 d) 22

17.Luminous flux is expressed in

a) Lumen b) Candela c) Weber d) Lue

18.Light travels through a glass plate of thickness d. If n is the refractive index of glass and c is the velocity of light in vacuum, the time taken by light to travel through the glass plate is

a) n/cd b) nc/d c) nd/c d) ndc

19.What is the magnification when an object is placed at 2f of a convex mirror

a) 1/3 b) 2/3 c) 1 d) 3/2

20.A tank is filled with water upto a height of 12.5 cm. The apparent depth of a needle at the bottom of the tank is (n of water =1.33)

a) 12.5 cm b) 9.4 cm c) 16.6 cm d) 11.17 cm

21.A man under water in a lake is viewing a boy standing on the bank of the lake. Then for him the boy appears to be

a) shorter b) taller c) of the same size d) 16 cm

22.A convex mirror placed at a distance of 20 cm from a candle forms a virtual image at the same position as that formed by a plane mirror at a distance of 12 cm from the candle. What is the focal length of the convex mirror?

a) 20 cm b) 15 cm c) 10 cm d) 5 cm

23.When light travels from 1 medium to another that remains unaltered is

a) speed b) wave length c) frequency d) intensity

24.The length of a telescope is 100 cm and magnification is 19. The focal length of the objective and eye piece are

a) 90 cm and 10 cm b) 85 cm and 1 cm c) 95 cm and 25 cm d) None of the above

25.In a compound microscope the object produces a magnification 10 and eyepiece produces a magnification 5. The overall magnification produced by the compound microscope is

a) 2 b) 5 c) 2 d) 50

26.The colour of the sky is due to

a) scattering of light b) refraction of light c) interference of light d) reflection of light

27.An object is placed at a distance f/2 from a convex lens of focal length f. The image will be at

a) 3f/2, real and inverted b) one of the foci, virtual, double the size of the object c) f/2, real and inverted d) f, virtual and erect

28.Two thin convex lenses of focal length 10 cm and 15 cm are combined together, the focal length of the combination is

a) 25cm b) 12.5cm c) 15cm d) 6cm

29.The focal length of a convex lens is minimum for

a) red b) violet c) blue d) green

30.A biconvex lens of focal length 20 cm is cut out into two plano-convex lenses. The focal length of each part is

a) 10 cm b) 20 cm c) 30 cm d) 40 cm

31.The minimum distance between the object and its real image formed by a convex lens of focal length f is

a) 1.5 f b) f c) 4 f d) 3 f

32.The refractive index of prism depends on

a) angle of the prism b) deviation produced by the prism c) intensity of light d) wave length of light

33.It is possible to observe total internal reflection when light travels from

a) air to water b) air to glass c) water to glass d) glass to water

34.A concave lens has focal length f. A real object placed at a distance f in front of the lens from the pole produces an image
a) at infinity b) at f c) at f/2 d) at 2/f
35.The image formed by a plane mirror is
a) real and same size as the object b) virtual, same size as the object c) real and magnified d) none of these
36.The limit of resolution of the eye is one minute at a distance x from the eye. Two persons stand with a lateral separation of 3cms. To see the two persons just resolved by the naked eye, x should be about
a) 20km b) 15km c) 10km d) 30km
37.In the displacement method of measuring the focal length of a convex lens, the length of the images in the two positions of the lens between the object and the screen is 9cm and 4cm respectively. The length of the object is
a) 6.25 cm b) 1.5 cm c) 6 cm d) 36 cm
38.The refracting angle of a prism is A and the refractive index of the material of the prism cot A/2, the angle of minimum deviation is
a) 180-A b) 180-3A c) 90-A d) 180-2A
39.A ray of light travels from vacuum into a medium of refractive index n. The angle of incidence is found to be twice the angle of refraction. The angle of incidence is
a) cos−1n/2 b) 2cos−1n/2 c) 2sin−1n d) 2sin−1n/2
40.An object placed at distance 'a' from the focus of a convex lens forms its real image at a distance 'b' from the focus. The focal length of the mirror is
a) ab b) ab c) a+b2 d) ab
41.The distance between a point source of light and a screen is doubled. The intensity of light on the screen will be
a) Four times the original value b) half of the original value c) two times the original value d) one quarter the original value.
42.From the following which one is used for studying ultra violet light?
a) prism of crown glass b) prism of flint glass c) prism of quartz d) prism with combination of flint and crown glass
43.Electromagnetic waves are
a) longitudinal waves b) transverse waves c) neither longitudinal nor transverse d) stationary waves
44.If there are no atmosphere the average temperature on the surface of the earth would be
a) lower b) higher c) same as now d) 00C
45.displacement current was first produced by
a) Ampere b) Henry c) Maxwell d) base
46.Pick out the odd one which has extremely short wave length much shorter than that of visible light and can be emitted from the nucleus of an atom.
a) UV radiation b) beta radiation c) γ radiation d) infra red radiation
47.The TV transmission tower in Delhi has a height of 240m. The distance upto when the broadcast can be received [taking radius of earth to be 6.4×106m]
a) 100 km b) 60 km c) 55 km d) 50 km
48.All the members of electro magnetic spectrum have same
a) frequency b) velocity c) wave length d) wave number
49.Infra red spectrum lies between
a) radio and micro wave region b) visible and UV region c) micro wave and visible region d) UV and X-ray region
50.Choose the waves relevant to telecommunications.
a) ultra violet b) visible c) infra red d) micro waves

MATHS

Q. 1. The mean of the numbers a, b, 8, 5, 10 is 6 and the variance is 6.80 . Then which one of the following gives possible values a and b?

i. a = 1, b = 6
ii. a = 3, b = 4
iii. a = 0, b = 7
iv. a = 5, b = 2

Sol.

$$Mean = \frac{\sum x}{n} = 6$$

$$Variance = \frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2 = 6.8$$

$$- \frac{a^2 + b^2 + 64 + 25 + 100}{5} - 36 - 6.8$$

$$\Rightarrow a^2 + b^2 + 189 - 180 = 34$$

$$\Rightarrow a^2 + b^2 = 25$$

Possible values of a and b is given by (2)

Q. 2. The vector $\vec{a} = a\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of the vectors $\vec{b} = \hat{i} + \hat{j}$ and $+\vec{c} = \hat{j} + \hat{k}$ and bisects the angle between $\vec{b}$ and $\vec{c}$. Then which one of the following gives possible values of α and β?

i. $\alpha = 2, \beta = 1$
ii. $\alpha = 1, \beta = 1$
iii. $\alpha = 2, \beta = 2$
iv. $\alpha = 1, \beta = 2$

Sol.

As $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar

$\therefore [\vec{a}\ \vec{b}\ \vec{c}] = 0$

$0r, \alpha + \beta = 2 \qquad (i)$

Also $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$

$\therefore \vec{a} = \lambda(\vec{b} + \vec{c})$

$or, \vec{a} = \lambda\left(\frac{\hat{i} + 2\vec{j} + \vec{k}}{\sqrt{2}}\right) \qquad (ii)$

But $\vec{a} = \alpha\vec{2} + 2\vec{j} + \beta\vec{k}$

Hence $\lambda = \sqrt{2}$ and $\alpha = 1, \beta = 1$

Which also satisfy (i)

$\therefore$ Correct answer is (2)

Q. 3.

The non − zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are related by $\vec{a} = 8\vec{b}$ and $\vec{c} = -7\vec{b}$

Then the angle between $\vec{a}$ and $\vec{c}$ is

i. $\frac{\pi}{2}$
ii. π
iii. 0
iv. $\frac{\pi}{4}$

Sol. The sign of $\vec{a}$ and $\vec{c}$ are opposite. Hence they are parallel but directions are opposite.

Therefore angle between $\vec{a}$ and $\vec{c}$ is π

$\therefore$ correct answer is (2)

Q. 4. The line passing through the points (5, 1, a) and (3, b, 1) crosses the yz-plane at the point $\left(0, \frac{17}{2}, \frac{-13}{2}\right)$. *Then*

i. a = 6, b = 4
ii. a = 8, b = 2
iii. a = 2, b = 8
iv. a = 4, b = 6

Sol. Equation of line through (5, 1, a) and (3, b, 1) is

$$\frac{x-5}{-2}=\frac{y-1}{b-1}=\frac{z-a}{1-a}=\lambda$$

any point on (i) is

$$\{5-2\lambda, 1+(b-1)\lambda, a+(1-a)\lambda\} \qquad (ii)$$

$$As\left(0,\frac{17}{2},-\frac{13}{2}\right) lies\ on\ \ (i)$$

$$5-2\lambda=0\Rightarrow\alpha=\frac{5}{2} \qquad (iii)$$

$$1+(b-1)\times\frac{5}{2}=\frac{17}{2}$$

$$or,\ 2+5b-5=17$$

$$or,\ b=4$$

$$and\ a+(1-a)\times\frac{5}{2}=-\frac{13}{2}$$

$$or,\ 2a+5-5a=-13$$

$$or,\ a=6$$

$$\therefore Correct\ answer\ is\ (1)$$

Q. 5. If the straight lines $\frac{x-1}{k}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x-2}{3}=\frac{y-3}{k}=\frac{z-1}{2}$ intersect at a point, then the integer k is equal to

i. 2
ii. 2
iii. 5
iv. 5

Sol. As the given lines intersect

$$\therefore \begin{vmatrix} 2-1 & 3-2 & 1-3 \\ k & 2 & 3 \\ 3 & k & 2 \end{vmatrix}=0$$

$$Or,\ \begin{vmatrix} 1 & 1 & 2 \\ k & 2 & 3 \\ 3 & k & 2 \end{vmatrix}=0$$

$$or,\ k=-5, 5/2$$

$$Integer\ is -5\ only$$

$$\therefore Correct\ answer\ is\ (3)$$

Q. 6. The differential of the family of circles with fixed radius 5 units and centre on the line y = 2 is

i. $(y-2)^2\,y'^2 = 25-(y-2)^2$
ii. $(x\quad 2)^2\,y'^2 = 25\quad (y\quad 2)^2$
iii. $(x-2)\,y'^2 = 25-(y-2)^2$
iv. $(y-2)\,y'^2 - 25-(y-2)^2$

Sol. The required equation of circle is

$$(x-a)^2+(y-2)^2=25 \qquad (i)$$

differentiating we get

$$2(x-a)+2(y-2)y'=0$$

$$or,\ a=x+(y-2)y' \qquad (ii)$$

putting a in (i)

$$\{x-x-(y-2)y'\}^2+(y-2)^2=25$$

$$or,\ (y-2)^2y'^2=25-(y-2)^2$$

$\therefore$ *The correct answer is* (1)

Q. 7. Let a, b, c be any real numbers. Suppose that there are real numbers x, y, z not all zero such that $x=cy+bz,\ y=az+cx$ *and* $z=bx+ay$. *Then* $a^2+b^2+c^2+2abc$ *is equal to*

i. 0
ii. 1
iii. 2
iv. - 1

Sol.

$$x=cy+bz\Rightarrow x-cy-bz=0 \qquad (i)$$

$$y=az+bx\Rightarrow bx-y+az=0 \qquad (ii)$$

$$z=bx+ay\Rightarrow bx+ay-z=0 \qquad (iii)$$

Eliminating x, y, z from (i), (ii) and (iii) we get

$$\begin{vmatrix}1 & -c & -b\\ c & -1 & a\\ b & a & -1\end{vmatrix}=0$$

$$or,\ a^2+b^2+c^2+2abc=1.$$

$\therefore$ *The correct answer is* (2)

Q. 8. Let A be a square matrix all of whose entries are integers. Then which one of the following is true?

i. $If \det A = \pm 1, then A^{-1} exists and all its entries are$ int $egers$

ii. $If \det A = \pm 1, then A^{-1} need not exist$

iii. $If \det A = \pm 1, then A^{-1} exist but all its entries are not necessarily$ int $egers$

iv. $If \det A = \pm 1, then A^{-1} exist and all its entries are non-$ int $egers$

Sol. The obvious answer is (1).

Q. 9. The quadratic equations $x^2 - 6x\,a = 0 \text{ and } x^2 - cx + 6 = 0$ and have one root in common. The other roots of the first and second equations are integers in the ratio 4 : 3. Then the common root is

i. 3
ii. 2
iii. 1
iv. 4

Sol.

$Let\ the\ roots\ of\ x^2 - 6x + a = 0$

$be\ \alpha\ and\ 4\beta\ and\ that\ of\ x^2 - cx + 6 = 0\ be\ \alpha\ and\ 3\beta$

$\therefore \alpha + 4\beta = 6 \quad (i)$

$4\alpha\beta = a \quad (ii)$

$\alpha + 3\beta = c \quad (iii)$

$3\alpha\beta = 6 \quad (iv)$

Using (ii) & (iv)

$$\frac{4}{3} = \frac{a}{6} \Rightarrow a = 8$$

$Then \quad x^2 - 6x + a = 0$

$reduces\ to$

$$x^2 - 6x + 8 = 0$$

$$x = \frac{6 \pm \sqrt{36 - 32}}{2}$$

$$= \frac{6 \pm 2}{2} = 4, 2$$

$\therefore \alpha = 2, \beta = 1$

$\therefore Correct\ answer\ is\ (2)$

Q. 10. How many different words can be formed by jumbling the letters in the word MISSISSIPPI in which no two S are adjacent?

i. $6.8.{}^{7}C_{4}$

ii. $7.{}^{6}C_{4}.{}^{8}C_{4}$

iii. $8.{}^{6}C_{4}.{}^{7}C_{4}$

iv. $6.7.{}^{8}C_{4}$

Sol. M = 1, I = 4, P = 2

These letters can be arranged by

$$\frac{(1+4+2)!}{1!\,4!\,2!} = 7\ {}^{6}C_{4}\ ways$$

The remaining 8 gaps can be filled by 4 S by ${}^{8}C_{4}\ ways$

$\therefore$ *Total no. of ways* $= 7\ {}^{6}C_{4} \quad {}^{8}C_{4}$

$\therefore$ *Correct answer is* (2)

Q. 11.

Let $I = \int_{0}^{1} \frac{\cos x}{\sqrt{x}}\,dx$. *Then which one of the following is true?*

i. $I < \frac{2}{3}$ *and* $J > 2$

ii. $I < \frac{2}{3}$ *and* $J < 2$

iii. $I > \frac{2}{3}$ *and* $J > 2$

iv. $I < \frac{2}{3}$ *and* $J > 2$

Sol.

$We\ Know \frac{\sin x}{x} < 1,\ when\ x \in (0,1)$

$\therefore \frac{\sin x}{\sqrt{x}} < \sqrt{x}$

$\Rightarrow \int_0^1 \frac{\sin x}{\sqrt{x}}\,dx < \int_0^1 \sqrt{x}\,dx$

$\Rightarrow \int_0^1 \frac{\sin x}{\sqrt{x}}\,dx < \frac{2}{3}$

$Also,\ \cos x < 1,\ when\ x \in (0,1)$

$\therefore \frac{\cos x}{\sqrt{x}} < \frac{1}{\sqrt{x}}$

$\Rightarrow \int_0^1 \frac{\cos x}{\sqrt{x}}\,dx < \int \frac{1}{\sqrt{x}}\,dx$

$\int_0^1 \frac{\cos x}{\sqrt{x}}\,dx < 2$

$\therefore I < \frac{2}{3}\ and\ J < 2$

$\therefore Correct\ answer\ is\ (4)$

Q. 12. The area of the plane region bounded by the curve $x + 2y^2 = 0\ and\ 3y^2 = 1\ is\ equal\ to$

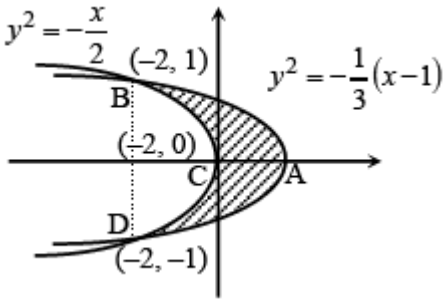
i. $\frac{2}{3}$

ii. $\frac{4}{3}$

iii. $\frac{5}{3}$

iv. $\frac{1}{3}$

Sol.



$$x+2y^2=0\Rightarrow y^2=-\frac{x}{2}$$

$$x+3y^2=1\Rightarrow y^2=-\frac{1}{3}(x-1)$$

$$\therefore -\frac{x}{2}=-\frac{1}{3}(x-1)$$

$$or,\quad -\frac{x}{2}=-\frac{x}{3}+\frac{1}{3}$$

$$or,\quad \frac{x}{3}-\frac{x}{2}=\frac{1}{3}$$

$$or,\quad -\frac{x}{6}=\frac{1}{3}$$

$$or,\quad x=-2$$

$$\therefore y^2=1\Rightarrow y=\pm 1$$

Area of the region BCA

$$=\left|\int_0^1\left\{\left(-2y^2\right)-\left(1-3y^2\right)\right\}dy\right|$$

$$=\left|\int_0^1\left(y^2-1\right)dy\right|$$

$$=\left|\left[\frac{y^3}{3}-y\right]_0^1\right|$$

$$=\left|\frac{1}{3}-1\right|=\frac{2}{3}$$

Hence area of the region bounded by the curve is equal to $2\times\frac{2}{3}=\frac{4}{3}$

Correct answer is (2)