CBSE

MEDICAL ENTRANCE

SOLVED PAPER / 1999

Physics

1. If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ the value of c is :
   (a) 1
   (b) $\sqrt{0.11}$
   (c) $\sqrt{0.01}$
   (d) 0.39

2. A person swims in a river aiming to reach exactly opposite point on the bank of a river. His speed of swimming is 0.5 m/s at an angle 120° with the direction of flow of water. The speed of water in stream is :
   (a) 1.0 m/s
   (b) 0.5 m/s
   (c) 0.25 m/s
   (d) 0.43 m/s

3. The escape velocity of a sphere of mass m is given by (G = universal gravitational constant, M_e = mass of earth and R_e = radius of earth) :
   (a) $\sqrt{\dfrac{GM_e}{R_e}}$
   (b) $\sqrt{\dfrac{2GM_e}{R_e}}$
   (c) $\sqrt{\dfrac{2Gm}{R_e}}$
   (d) $\dfrac{GM_e}{R_e^2}$

4. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/h. The centripetal force is :
   (a) 250 N
   (b) 750 N
   (c) 1000 N
   (d) 1200 N

5. The moment of inertia of a disc of mass M and radius R about a tangent to its rim in its plane is :
   (a) $\dfrac{2}{3}MR^2$
   (b) $\dfrac{3}{2}MR^2$
   (c) $\dfrac{4}{5}MR^2$
   (d) $\dfrac{5}{4}MR^2$

6. The dimensional formula for magnetic flux is :
   (a) $[ML^2T^{-2}A^{-1}]$
   (b) $[ML^3T^{-2}A^{-2}]$
   (c) $[M^0L^{-2}T^2A^{-2}]$
   (d) $[ML^2T^{-1}A^2]$

7. Two racing cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that each makes a complete circle in the same time t. The ratio of the angular speeds of the first to the second car is :
   (a) 1 : 1
   (b) $m_1 : m_2$
   (c) $r_1 : r_2$
   (d) $m_1m_2 : r_1r_2$

8. What is the linear velocity if angular velocity vector $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and position vector $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$?
   (a) $6\hat{i} + 2\hat{j} - 3\hat{k}$
   (b) $-18\hat{i} - 13\hat{j} + 2\hat{k}$
   (c) $18\hat{i} + 13\hat{j} - 2\hat{k}$
   (d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

9. The force on a rocket moving with a velocity 300 m/s is 210 N. The rate of consumption of fuel of rocket is :
   (a) 0.7 kg/s
   (b) 1.4 kg/s
   (c) 0.07 kg/s
   (d) 10.7 kg/s

10. Two bodies with kinetic energies in the ratio 4 : 1 are moving with equal linear momentum. The ratio of their masses is :
    (a) 1 : 2
    (b) 1 : 1
    (c) 4 : 1
    (d) 1 : 4

11. The time period of a simple pendulum is 2 s. If its length is increased by 4 times, then its period becomes :
    (a) 16 s
    (b) 12 s
    (c) 8 s
    (d) 4 s

12. Three identical metal balls each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed with centres of three balls joined. The centre of mass of the system is located at :
    (a) horizontal surface
    (b) centre of one of the balls
    (c) line joining the centres of any two balls
    (d) point of intersection of the medians

13. If 1 g of steam is mixed with 1 g of ice, then the resultant temperature of the mixture is :
   (a) 270°C   (b) 230°C
   (c) 100°C   (d) 50°C

14. The coefficients of linear expansions of brass and steel are α_1 and α_2 respectively. When we take a brass rod of length l_1 and a steel rod of length l_2 at 0°C, then the difference in their lengths $(l_2 - l_1)$ will remain the same at all temperatures if :
   (a) $\alpha_1 l_1 = \alpha_2 l_2$ (b) $\alpha_1 l_2 = \alpha_2 l_1$
   (c) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (d) $\alpha_1 l_2^2 = \alpha_2 l_1^2$

15. An ideal gas at 27°C is compressed adiabatically to $\frac{8}{27}$ of its original volume. The rise in temperature is $\left(\gamma = \frac{5}{3}\right)$:
   (a) 475°C   (b) 402°C
   (c) 275°C   (d) 375°C

16. The degrees of freedom of a molecule of a triatomic gas are :
   (a) 2   (b) 4
   (c) 6   (d) 8

17. Ozone layer blocks the radiations of wave length :
   (a) less than 3×10^{-7} m
   (b) equal to 3×10^{-7} m
   (c) more than 3×10^{-7} m
   (d) all of the above

18. Two waves of wavelength 50 cm and 51 cm produce 12 beats/s. The speed of sound is :
   (a) 306 m/s   (b) 331 m/s
   (c) 340 m/s   (d) 360 m/s

19. When air is replaced by a dielectric medium of constant K, the maximum force of attraction between two charges, separated by a distance :
   (a) decreases K times
   (b) increase K times
   (c) remains unchanged
   (d) becomes $\frac{1}{K^2}$ times

20. In bringing an electron towards another electron, the electrostatic potential energy of the system :
   (a) decreases
   (b) increases
   (c) remains same
   (d) becomes zero

21. A parallel plate condenser with oil (dielectric constant 2) between the plates has capacitance C. If oil is removed, the capacitance o capacitor becomes :
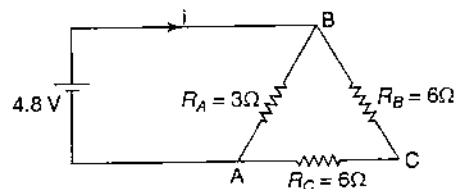   (a) $\sqrt{2}C$ (b) $2C$ (c) $\frac{C}{\sqrt{2}}$ (d) $\frac{C}{2}$

22. The effective capacitance between points X and Y of figure shown is :
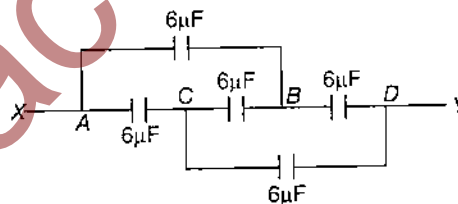
   (a) $6\,\mu F$ (b) $12\,\mu F$
   (c) $18\,\mu F$ (d) $24\,\mu F$

23. The current (I) in the given circuit is :

   (a) 1.6 A   (b) 2 A
   (c) 0.32 A   (d) 3.2 A

24. The resistance of a discharge tube is :
   (a) zero   (b) ohmic
   (c) non-ohmic   (d) infinity

25. In metre-bridge the balancing length from lef is found to be 20 cm when standard resistanc of 1Ω is in right gap. The value of unknow resistance is :
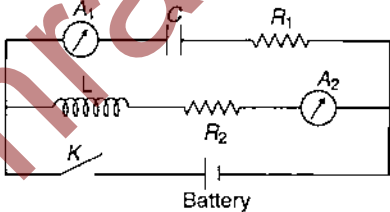   (a) 0.25Ω (b) 0.4Ω
   (c) 0.5Ω (d) 4Ω

26. A potentiometer consists of a wire of lengt 4m and resistance $10\,\Omega$. It is connected to cell of emf 2V. The potential gradient of wir is :
   (a) 0.5 V/m   (b) 2 V/m
   (c) 5 V/m   (d) 10 V/m

27. Colours of thin soap bubbles are due to :
   (a) refraction   (b) dispersion
   (c) interference   (d) diffraction

28. A plano-convex lens is made of material of refractive index 1.6. The radius of curvature of the curved surface is 60 cm. The focal length of the lens is :
    (a) 50 cm   (b) 100 cm
    (c) 200 cm   (d) 400 cm

29. The refractive index of the material of the prism is $\sqrt{3}$, then the angle of minimum deviation of the prism is :
    (a) 30°   (b) 45°   (c) 60°   (d) 75°

30. The wavelength of light of frequency 100 Hz is :
    (a) 2×10^6 m   (b) 3×10^6 m
    (c) 4×10^6 m   (d) 5×10^6 m

31. The photoelectric work function for a metal surface is 4.125 eV. The cut-off wavelength for this surface is :
    (a) 4125 Å   (b) 3000 Å
    (c) 6000 Å   (d) 2062.5 Å

32. When intensity of incident light increases :
    (a) photo-current increases
    (b) photo-current decreases
    (c) kinetic energy of emitted photoelectrons increases
    (d) kinetic energy of emitted photoelectrons decreases

33. If a long hollow copper pipe carries a current, then magnetic field is produced :
    (a) inside the pipe only
    (b) outside the pipe only
    (c) both inside and outside the pipe
    (d) no where

34. A straight wire of diameter 0.5 mm carrying a current of 1A is replaced by another wire of diameter 1 mm carrying the same current. The strength of magnetic field far away is :
    (a) twice the earlier value
    (b) one-half of the earlier value
    (c) one quarter of the earlier value
    (d) same as earlier value

35. Magnetic field due to 0.1A current flowing through a circular coil of radius 0.1m and 1000 turns at the centre of the coil is :
    (a) 0.2 T   (b) 2×10^{-4} T
    (c) 6.28×10^{-4} T   (d) 9.8×10^{-4} T

36. A diamagnetic substance is brought near a strong magnet, then it is :
    (a) attracted by a magnet
    (b) repelled by a magnet
    (c) repelled by north pole and attracted by south pole
    (d) attracted by north pole and repelled by south pole

37. A bar magnet of magnetic moment $\vec{M}$ is placed in a magnetic field of induction $\vec{B}$. The torque exerted on it is :
    (a) $\vec{M} \ \vec{B}$ (b) $-\vec{M} \ \vec{B}$
    (c) $\vec{M} \times \vec{B}$ (d) $-\vec{M} \times \vec{B}$

38. The internal resistance of a cell of emf 2 V is 0.1Ω. It is connected to a resistance of 3.9 Ω. The voltage across the cell will be :
    (a) 0.5 V   (b) 1.9 V
    (c) 1.95 V   (d) 2 V

39. The electromagnetic radiations are caused by :
    (a) a stationary charge
    (b) uniformly moving charges
    (c) accelerated charges
    (d) all of the above

40. In a circuit inductance L and capacitance C are connected as shown in figure. A_1 and A_2 are ammeters. When key K is pressed to complete the circuit, then just after closing key (K), the reading of current will be :

Battery

    (a) zero in both A_1 and A_2
    (b) maximum in both A_1 and A_2
    (c) zero in A_1 and maximum in A_2
    (d) maximum in A_1 and zero in A_2

41. Which of the following when added as an impurity into silicon produces n-type semiconductor ?
    (a) P   (b) Al   (c) B   (d) Mg

42. In a junction diode, the holes are due to :
    (a) protons   (b) extra electrons
    (c) neutrons   (d) missing electrons

43. Depletion layer consists of :
    (a) electrons
    (b) protons
    (c) mobile charge carriers
    (d) immobile ions

44. Alpha particles are :
    (a) 2 free protons
    (b) helium atoms
    (c) singly ionised helium atoms
    (d) doubly ionised helium atoms

45. In forward bias the width of depletion layer in a *p-n* junction diode :
    (a) increases
    (b) decreases
    (c) remains constant
    (d) first increases then decreases

46. When a proton is accelerated through 1V its kinetic energy will be :
    (a) 1540 eV   (b) 13.6 eV
    (c) 1 eV   (d) zero

47. In *p*-type semiconductor, the major charge carriers are :
    (a) holes   (b) electrons
    (c) protons   (d) neutrons

48. In one α and 2β-emissions :
    (a) mass number reduces by 2
    (b) mass number reduces by 6
    (c) atomic number reduces by 2
    (d) atomic number remains unchanged

49. Sodium has body centred packing. If the distance between two nearest atoms is 3.7 Å then the lattice parameter is :
    (a) 3.3 Å   (b) 3.9 Å
    (c) 4.3 Å   (d) 4.8 Å

50. The following circuit represents :
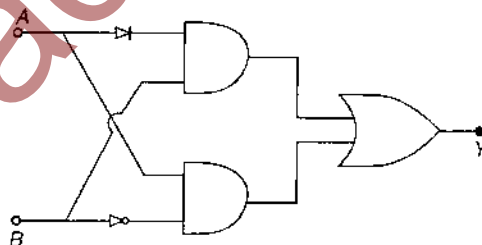
    (a) OR gate   (b) XOR gate
    (c) AND gate   (d) NAND gate

Chemistry

51. Which of the following configuration is correct for iron ?
    (a) $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5$
    (b) $1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2 3d^5$
    (c) $1s^2, 2s^2 2p^6, 3s^2 3p^6, 4s^2 3d^7$
    (d) $1s^2, 2s^2 2p^6, 3s^2 3p^6, 3d^6, 4s^2$

52. Which of the following has more unpaired *d*-electrons?
    (a) Zn^+ (b) Fe^{2+}
    (c) N^{3+} (d) Cu^+

53. Oxidation state of Fe in Fe_3O_4 is :
    (a) $\dfrac{3}{2}$ (b) $\dfrac{4}{5}$
    (c) $\dfrac{5}{4}$ (d) $\dfrac{8}{3}$

54. If 0.15 g of solute, dissolved in 15 g of solvent, is boiled at a temperature higher by 0.216°C, than that of the pure solvent, the molecular weight of the substance is (molal elevation constant for the solvent is 2.16°C) :
    (a) 1.01   (b) 10
    (c) 10.1   (d) 100

55. How many gram of dibasic acid (mol. wt. 200) should be present in 100 mL of the aqueous solution to give 0.1 N ?
    (a) 1 g   (b) 2 g
    (c) 10 g   (d) 20 g

56. At 25°C and 730 mm pressure, 380 ml of dry oxygen was collected. If the temperature is constant, what volume will the oxygen occupy at 760 mm pressure?
    (a) 365 mL   (b) 2 g
    (c) 10 g   (d) 20 g

57. For a first-order reaction, the half-life period is independent of :
    (a) initial concentration
    (b) cube root of initial concentration
    (c) first power of final concentration
    (d) square root of final concentration

58. The uncertainty in momentum of an electron is 1×10^{-5} m/s. The uncertainty in its position will be ($h = 6.62 \times 10^{-34}$ kg m^2/s) :
    (a) 1.05×10^{-28} m   (b) 1.05×10^{-20} m
   (c) 5.27×10^{-30} m   (d) 5.25×10^{-28} m

59. Who modified Bohr's theory by introducing elliptical orbits for electron path ?
    - (a) Hund
    - (b) Thomson
    - (c) Rutherford
    - (d) Sommerfeld

60. The de-Broglie wavelength of a particle with mass 1g and velocity 100 m/s is :
    - (a) 6.63×10^{-33} m
    - (b) 6.63×10^{-34} m
    - (c) 6.63×10^{-35} m
    - (d) 6.65×10^{-36} m

61. The concentration of $[H^+]$ and concentration of $[OH^-]$ of a 0.1 M aqueous solution of 2% ionised weak monobasic acid is :
    [ionic product of water = 1×10^{-14}]
    - (a) 0.02×10^{-3} M and 5×10^{-11} M
    - (b) 1×10^{-3} M and 3×10^{-11} M
    - (c) 2×10^{-3} M and 5×10^{-12} M
    - (d) 3×10^{-2} M and 4×10^{-13} M

62. The strongest conjugate base is :
    - (a) NO_3^-
    - (b) Cl^-
    - (c) SO_4^{2-}
    - (d) CH_3COO^-

63. The specific conductance of a 0.1 N KCl solution at 23° C is 0.012 ohm^{-1} cm^{-1}. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant will be :
    - (a) 0.142 cm^{-1}
    - (b) 0.66 cm^{-1}
    - (c) 0.918 cm^{-1}
    - (d) 1.12 cm^{-1}

64. Which of the following is most acidic ?
    - (a) N_2O_5
    - (b) P_2O_5
    - (c) As_2O_5
    - (d) Sb_2O_5

65. The structure of H_2O_2 is :
    - (a) planar
    - (b) non-planar
    - (c) spherical
    - (d) linear

66. Which one of the following statements is wrong for gases ?
    - (a) Gases do not have a definite shape and volume
    - (b) Volume of the gas is equal to volume of container confining the gas
    - (c) Confirmed gas exerts uniform pressure on the walls of its container in all directions
    - (d) Mass of gas cannot be determined by weighing a container in which it is enclosed

67. In an endothermic reaction, the value of ΔH is :
    - (a) zero
    - (b) positive
    - (c) negative
    - (d) constant

68. In the reaction
    $$S(s) + \frac{3}{2} O_2(g) \longrightarrow SO_3(g) + 2x \text{ kcal}$$
    and $SO_2(g) + \frac{1}{2} O_2(g) \longrightarrow SO_3(s) + y \text{ kcal}$
    the heat of formation of SO_2 is :
    - (a) $(x + y)$
    - (b) $(x - y)$
    - (c) $(2x + y)$
    - (d) $(2x - y)$

69. Which of the following elements has maximum electron affinity?
    - (a) Cl
    - (b) Br
    - (c) I
    - (d) F

70. The most suitable method of the separation of a mixture of *ortho* and *para*-nitrophenol mixed in the ratio of 1 : 1 is :
    - (a) distillation
    - (b) crystallisation
    - (c) vaporisation
    - (d) colour spectrum

71. Sulphur = 35 (34.96903 amu) emits a β-particle but no γ-ray. The product is chlorine = 35 (34.96885 amu). The maximum energy emitted by the β-particle is :
    - (a) 16.758 MeV
    - (b) 1.6758 MeV
    - (c) 0.16758 MeV
    - (d) 0.016758 MeV

72. The type of hybridisation of boron in diborane is :
    - (a) sp-hybridisation
    - (b) sp^2-hybridisation
    - (c) sp^3-hybridisation
    - (d) sp^3d^2-hybridisation

73. Purification of aluminium, by electrolyte refining, is known as :
    - (a) Hall's process
    - (b) Baeyer's process
    - (c) Hoope's process
    - (d) Serpeck's process

74. Bell-metal is an alloy of :
    - (a) Cu + Pb
    - (b) Cu + Sn
    - (c) Cu + Zn
    - (d) Cu + Ni

75. Which of the following does not show electrical conduction ?
    - (a) Potassium
    - (b) Graphite
    - (c) Diamond
    - (d) Sodium

76. Which of the following phosphorus is the most reactive ?
    - (a) Red phosphorus
    - (b) White phosphorus
    - (c) Scarlet phosphorus
    - (d) Violet phosphorus

77. Cassiterite is an ore of :
    - (a) Mn
    - (b) Ni
    - (c) Sb
    - (d) Sn

78. Which of the following is used in the preparation of chlorine ?
    - (a) Only MnO_2
    - (b) Only $KMnO_4$
    - (c) Both MnO_2 and $KMnO_4$
    - (d) Either MnO_2 and $KMnO_4$

79. Percentage of lead in lead pencil is :
(a) zero   (b) 20   (c) 80   (d) 70

80. In which of the following compounds transition metal has zero oxidation state ?
(a) $[Fe(CO)_5]$ (b) $NH_2 . NH_2$
(c) $NOClO_4$ (d) CrO_5

81. When acetylene is passed through dil. H_2SO_4 in presence of $HgSO_4$, the compound formed is :
(a) ether   (b) ketone
(c) acetic acid   (d) acetaldehyde

82. The solubility of a saturated solution of calcium fluoride is 2×10^{-4} mol/L. Its solubility product is :
(a) 12×10^{-2} (b) 14×10^{-4}
(c) 22×10^{-11} (d) 32×10^{-12}

83. The vapour pressure of benzene at a certain temperature is 640 mm. of Hg. A non-volatile and non-electrolyte solid, weighing 2.175g is added to 39.08g of benzene. If the vapour pressure of the solution is 600 mm of Hg, what is the molecular weight of solid substance ?
(a) 49.50   (b) 59.60
(c) 69.40   (d) 79.82

84. The number of atoms in 4.25g of NH_3 is approximately :
(a) 1×10^{23} (b) 2×10^{23}
(c) 4×10^{23} (d) 6×10^{23}

85. In the following radioactive decay, $_{92}X^{232} \longrightarrow {}_{89}Y^{220}$, how many α and β particles are ejected from X to Y ?
(a) 3α and 2β (b) 5α and 3β
(c) 3α and 3β (d) 5α and 5β

86. The half-life of $_6C^{14}$, $(\lambda = 2.31 \times 10^4$ per year) is :
(a) 2×10^2 year   (b) 3×10^3 year
(c) 3.3×10^4 year   (d) 4×10^3 year

87. Ethyl chloride is converted into diethyl ether by:
(a) Wurtz synthesis
(b) Grignard reaction
(c) Perkin's reaction
(d) Williamson's synthesis

88. In the reaction
$$CH_3CN + 2H \xrightarrow[SnCl_2]{HCl} X \xrightarrow{Boiling H_2O} Y,$$
the term Y is :

(a) acetone   (b) ethanamine
(c) acetaldehyde   (d) dimethyl amine

89. An organic compound containing C, H and N gave the following analysis C = 40% H = 13.33% and N = 46.67%. Its empirical formula would be :
(a) CHN   (b) C_2H_2N
(c) CH_4N (d) C_2H_7N

90. In Friedel-Craft's alkylation, besides $AlCl_3$ the other reactants are :
(a) $C_6H_6 + NH_2$ (b) $C_6H_6 + CH_4$
(c) $C_6H_6 + CH_3Cl$ (d) $C_6H_6 + CH_3COCl$

91. Phenyl isocyanides are prepared from which of the following reaction ?
(a) Rosenmund's reaction
(b) Carbylamine reaction
(c) Reimer-Tiemann reaction
(d) Wurtz reaction

92. The decomposition of organic compounds, in the presence of oxygen and without the development of odoriferous substances, is called :
(a) decay   (b) N_2-fixation
(c) nitrification   (d) denitrification

93. Which of the following is the sweetest sugar ?
(a) Sucrose   (b) Glucose
(c) Fructose   (d) Maltose

94. Aldol condensation will not take place in :
(a) HCHO   (b) CH_3CHO
(c) CH_3COCH_3 (d) CH_3CH_2CHO

95. Gammexane is :
(a) chlorobenzene
(b) benzyl chloride
(c) bromobenzene
(d) benzene hexachloride

96. Amides can be converted into amines by a reaction named after :
(a) Perkin
(b) Claisen
(c) Hofmann
(d) Kekule

97. Which one of the following compounds will react with $NaHCO_3$ solution to give sodium salt and carbon dioxide ?
(a) Acetic acid
(b) n-hexanol
(c) Phenol
(d) Both (b) and (c)

98. Which of the following compounds will be more easily attacked by an electrophile ?

(a)

(b)

(c)

(d)
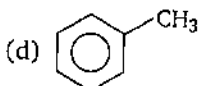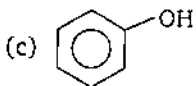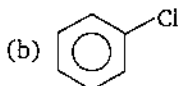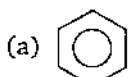
99. Terylene is a condensation polymer of ethylene glycol and :
  (a) benzoic acid   (b) phthalic acid
  (c) salicylic acid   (d) terephthalic acid

100. Natural rubber is a polymer of :
  (a) butadiene
  (b) ethyne
  (c) styrene
  (d) isoprene

Biology

101. In soil, water available for plants is :
  (a) capillary water
  (b) chemically bound water
  (c) gravitational water
  (d) hygroscopic water

102. The plant which bears clinging roots is :
  (a) *Podostemon*   (b) Orchid
  (c) *Trapa*   (d) Screw pine

103. Which of the following organisms is likely to have more concentration of DDT in its body ?
  (a) Primary producers
  (b) Herbivores
  (c) Carnivores
  (d) Top carnivores

104. Secretion of progesterone by corpus luteum is initiated by :
  (a) thyroxine   (b) LH
  (c) MSH   (d) testosterone

105. The respiratory centres which control inspiration and expiration are located in :
  (a) spinal cord   (b) diencephalon
  (c) cerebellum   (d) medulla oblongata

106. The term aquaculture means :
  (a) aspergillosis   (b) inland fisheries
  (c) marine fisheries   (d) both (b) and (c)

107. The proteins are synthesized at :
  (a) ribosomes   (b) mitochondria
  (c) centrosomes   (d) Golgi bodies

108. Which of the following is the main category of mutation ?
  (a) Somatic mutation
  (b) Genetic mutation
  (c) Zygotic mutation
  (d) All of the above

109. In human beings, multiple genes are involved in the inheritance of :
  (a) skin colour   (b) phenylketonuria
  (c) colour blindness (d) sickle cell anaemia

110. Ligament is a :
  (a) modified yellow elastic fibrous tissue
  (b) inelastic white fibrous tissue
  (c) modified white fibrous tissue
  (d) none of the above

111. The middle piece of the sperm contains :
  (a) proteins   (b) centriole
  (c) nucleus   (d) mitochondria

112. In which of the following would you place the plants having vascular tissue lacking seeds ?
  (a) Gymnosperms   (b) Algae
  (c) Pteridophytes   (d) Bryophytes

113. Which of the following has single membrane ?
  (a) Mitochondria   (b) Nucleus
  (c) Cell wall   (d) Spherosomes

114. Sympathetic nervous system induces :
  (a) heart-beat
  (b) secretion of digestive juices
  (c) secretion of saliva
  (d) all of the above

115. The book 'Genera Plantarum' was written by :
  (a) Hutchinson
  (b) Bessey
  (c) Engler and Prantl
  (d) Bentham and Hooker

116. In operon concept, regulator gene functions as :
  (a) repressor   (b) inhibitor
  (c) regulator   (d) all of these

117. Casparian strips are found in :
    (a) hypodermis　　(b) endodermis
    (c) periderm　　　(d) epidermis

118. Fish which eradicate the mosquito larva are :
    (a) Cutter fish　　(b) *Anabus*
    (c) *Gambusia*　　(d) Rohu

119. A pair of insectivorous plants is :
    (a) Venus fly trap and *Rafflesia*
    (b) *Nepenthes* and bladderwort
    (c) *Drosera* and *Rafflesia*
    (d) *Dionaea* and *Viscum*

120. A system of classification in which a large number of traits are considered is :
    (a) phylogenetic system
    (b) artificial system
    (c) natural system
    (d) synthetic system

121. Hybridoma cells are :
    (a) product of spore formation in bacteria
    (b) hybrid cells resulting from myeloma cells
    (c) nervous cells of frog
    (d) only cells having oncogenes

122. The antherozoids of *Funaria* are :
    (a) monociliated　　(b) biciliated
    (c) multiciliated　　(d) aciliated

123. In DNA when AGCT occurs, their association is as per which of the following pair ?
    (a) AC-GT　　　(b) AG-CT
    (c) AT-GC　　　(d) All of these

124. In 1984, Bhopal gas tragedy was caused due to the leakage of :
    (a) potassium isocyanate
    (b) sodium monoxide
    (c) sodium thiocyanate
    (d) methyl isocyanate

125. An average person not doing hard work requires energy per day about :
    (a) 2800 kcal　　(b) 2000 kcal
    (c) 1000 kcal　　(d) 750 kcal

126. Phenomenon of 'Industrial melanism' demonstrates :
    (a) reproductive isolation
    (b) induced mutation
    (c) natural selection
    (d) geographical isolation

127. A marriage between normal-visioned man and colourblind woman will produce offspring :
    (a) 50% colourblind sons and 50% carrier daughters
    (b) colourblind sons and carrier daughters
    (c) normal males and carrier daughters
    (d) colourblind sons and 50% carrier daughters

128. The problem due to Rh$^+$ factor arises when the blood of two (Rh$^+$ and Rh$^-$) mix-up :
    (a) during pregnancy
    (b) through transfusion
    (c) in a test tube
    (d) both (a) and (b)

129. Active immunity means :
    (a) resistance developed after disease
    (b) increasing quantity of blood
    (c) resistance developed before disease
    (d) increasing rate of heart-beat

130. Haemophilic man marries a normal woman. Their offspring will be :
    (a) all boys haemophilic
    (b) all normal
    (c) all girls haemophilic
    (d) all haemophilic

131. Which of the following is mismatched ?
    (a) Vitamin K—beri-beri
    (b) Vitamin D—rickets
    (c) Vitamin C—scurvy
    (d) Vitamin A—xeropthalmia

132. Glucose is carried from digestive tract to liver by :
    (a) pulmonary vein　(b) hepatic portal vein
    (c) hepatic artery　(d) none of these

133. The canal system is a characteristic feature of :
    (a) echinoderms　　(b) helminthes
    (c) coelenterates　(d) sponges

134. Cholecystokinin and duocrinin are secreted by :
    (a) adrenal cortex　(b) thyroid gland
    (c) pancreas　　　(d) intestine

135. Tablets to prevent contraception contain :
    (a) progesterone　(b) FSH
    (c) LH　　　　　(d) both (b) and (c)

136. Hybridization between Tt × tt gives rise to the progeny of ratio :
    (a) 1 : 1　　　　(b) 1 : 2 : 1
    (c) 1 : 2　　　　(d) 4 : 1

137. Which part of the world has high density of organisms ?
    (a) Deciduous forests
    (b) Grasslands
    (c) Savannas
    (d) Tropical rain forests

138. Some of the enzymes, which are associated in converting fats into carbohydrates are present in :
    (a) microsomes (b) liposomes
    (c) Golgi bodies (d) glyoxysomes

139. Photosynthetic bacteria have pigments in :
    (a) chromoplasts (b) leucoplasts
    (c) chloroplasts (d) chromatophore

140. Dichotomous branching is found in :
    (a) *Marchantia* (b) fern
    (c) liverworts (d) *Funaria*

141. Edible part of litchi is :
    (a) pericarp (b) fleshy aril
    (c) mesocarp (d) endosperm

142. Koch's postulates are not applicable to :
    (a) Cholera (b) Leprosy
    (c) TB (d) Diphtheria

143. The maximum biomagnification would be in which of the following in case of aquatic ecosystem ?
    (a) Fishes (b) Phytoplanktons
    (c) Birds (d) Zooplanktons

144. The joint between atlas and axis is called :
    (a) pivot joint (b) hinge joint
    (c) saddle joint (d) angular joint

145. Land mass occupied by forests is about :
    (a) 60% (b) 30%
    (c) 22% (d) 11%

146. The process of series of changes from larva to adult, after embryonic development is called :
    (a) regeneration (b) metamorphosis
    (c) growth (d) ageing

147. The *Pneumococcus* experiment proves that :
    (a) DNA is the genetic material
    (b) RNA sometime controls the production of DNA and proteins
    (c) bacteria undergo binary fission
    (d) bacteria do not reproduce sexually

148. ABA is involved in :
    (a) dormancy of seeds
    (b) increased cell division
    (c) root elongation
    (d) shoot elongation

149. DNA is mainly found in :
    (a) nucleus only
    (b) cytoplasm only
    (c) nucleus and cytoplasm
    (d) nucleolus

150. Which of the following is true about bryophytes ?
    (a) They are thalloid
    (b) They possess archegonia
    (c) They contain chloroplasts
    (d) All of the above

151. The eukaryotic genome differs from the prokaryotic genome because :
    (a) DNA is complexed with histones in prokaryotes
    (b) repetitive sequences are present in eukaryotes
    (c) genes in the former cases are organised into operons
    (d) DNA is circular and single stranded in prokaryotes

152. Carbon dioxide acceptor in C_3-plants is :
    (a) PGA (b) RuDP
    (c) PEP (d) none of these

153. The antibodies are :
    (a) germs (b) carbohydrates
    (c) proteins (d) lipids

154. Temperature changes in the environment affect most of the animals which are :
    (a) homoeothermic (b) aquatic
    (c) poikilothermic (d) desert living

155. The term 'humulin' is used for :
    (a) human insulin (b) powerful antibiotic
    (c) isoenzyme (d) hydrolytic enzyme

156. The gonadotropic hormones are produced in :
    (a) interstitial cells of testes
    (b) adrenal cortex
    (c) adenohypophysis of pituitary
    (d) posterior part of thyroid

157. Which cranial nerve has the highest number of branches ?
    (a) Facial nerve (b) Trigeminal
    (c) Vagus nerve (d) None of these

158. Haemoglobin is a type of :
    (a) carbohydrate (b) vitamin
    (c) skin pigment (d) respiratory pigment

159. After ovulation, Graafian follicle regresses into :
    (a) corpus luteum (b) corpus callosum
    (c) corpus albicans (d) corpus artesia

160. Which is the principal cation in the plasma of the blood ?
    (a) Magnesium (b) Sodium
    (c) Potassium (d) Calcium

161. Which of the following is pollution related disorder ?
    (a) Fluorosis   (b) Leprosy
    (c) Pneumonicosis   (d) Silicosis

162. Which of the following are homologous organs ?
    (a) Nails of human being and claws in animals
    (b) Wings of bird and wings of insect
    (c) Wings of bird and hand of human
    (d) Wings of bat and wings of cockroach

163. Which of the following is a secondary pollutant ?
    (a) Aerosol   (b) CO
    (c) PAN   (d) CO_2

164. Due to which of the following organism yield of rice has been increased ?
    (a) *Anabaena*   (b) *Bacillus polymyxa*
    (c) *Bacillus popilliae* (d) *Sesbania*

165. Which of the following is regarded as a unit of nervous tissue ?
    (a) Myelin sheath   (b) Axons
    (c) Dendrites   (d) Neurons

166. To which of the following family do folic acid and pantothenic acid belong ?
    (a) Vitamin C   (b) Vitamin K
    (c) Vitamin A   (d) Vitamin B complex

167. Which of the following is mainly responsible for extinction of wild life ?
    (a) Destruction of habitats
    (b) Pollution of air and water
    (c) Hunting for flesh
    (d) All of the above

168. Life-span of a worker bee is :
    (a) 10 weeks   (b) 10 days
    (c) 6 weeks   (d) 15 days

169. The junction between the axon of one neuron and the dendrite of the next is called :
    (a) junction point   (b) a synapse
    (c) a joint   (d) constant bridge

170. Which of the following is the use of lichens in case of pollution ?
    (a) Lichens are not related with pollution
    (b) They act as bioindicators of pollution
    (c) They treat the polluted water
    (d) They promote pollution

171. Bryophytes comprise :
    (a) small sporophyte phase generally parasitic on gametophyte
    (b) sporophyte of longer duration

    (c) dominant phase of gametophyte which produces spores
    (d) dominant phase of sporophyte which is parasitic

172. Energy transfer from one trophic level to other in a food chain is :
    (a) 20%   (b) 10%
    (c) 2%   (d) 1%

173. The rate of photosynthesis is higher in :
    (a) red light
    (b) blue light
    (c) green light
    (d) very high light

174. The process of replication in plasmid DNA, other than initiation, is controlled by :
    (a) mitochondrial gene
    (b) bacterial gene
    (c) plasmid gene
    (d) none of the above

175. The closing and opening of the leaves of *Mimosa pudica* is due to :
    (a) chemonastic movement
    (b) thermonastic movement
    (c) seismonastic movement
    (d) hydrotropic movement

176. Green house effect refers to :
    (a) production of cereals
    (b) cooling of earth
    (c) trapping of UV rays
    (d) warming of earth

177. Which of the following is related to genetic engineering ?
    (a) Mutation   (b) Plasmid
    (c) Plastid   (d) Heterosis

178. The first transgenic crop was :
    (a) cotton   (b) pea
    (c) tobacco   (d) flax

179. The thickening of walls of arteries are called :
    (a) arthritis   (b) atherosclerosis
    (c) anaeurysm   (d) both (a) and (c)

180. Rate of heart-beat is determined by :
    (a) Purkinje fibres
    (b) Papillary muscles
    (c) SA node
    (d) AV node

181. The endosperm of gymnosperm is :
    (a) polyploid   (b) haploid
    (c) triploid   (d) diploid

182. Angiosperm to which the largest flowers belong is :
  (a) partial root parasite
  (b) total stem parasite
  (c) total root parasite
  (d) partial root parasite

183. DDT is :
  (a) a non-degradable pollutant
  (b) an antibiotic
  (c) a biodegradable pollutant
  (d) not a pollutant

184. Initiation codon in eukaryotes is :
  (a) AUG   (b) AGU
  (c) UAG   (d) GAU

185. Which part of body secretes the hormone secretin ?
  (a) Oesophagus   (b) Duodenum
  (c) Stomach   (d) Ileum

186. Brunner's glands are present in :
  (a) stomach   (b) duodenum
  (c) oesophagus   (d) ileum

187. The Minimata disease in Japan was caused through pollution of water by :
  (a) methyl isocyanate
  (b) mercury
  (c) lead
  (d) cyanide

188. The new verieties of plants are produced by :
  (a) selection and hybridisation
  (b) selection and introduction
  (c) mutation and selection
  (d) introduction and mutation

189. The aquatic fern, which is an excellent biofertiliser, is :
  (a) *Azolla*   (b) *Pteridium*
  (c) *Salvinia*   (d) *Marsilia*

190. Diabetes is due to :
  (a) iodine deficiency
  (b) hormonal deficiency
  (c) Na^+ deficiency
  (d) enzyme deficiency

191. Tendon is made up of :
  (a) adipose tissue
  (b) modified white fibrous tissue

  (c) areolar tissue
  (d) yellow fibrous connective tissue

192. The function of oxytocin is to help in :
  (a) growth   (b) lactation
  (c) child birth   (d) gametogenesis

193. Aquatic reptiles are :
  (a) ammonotelic
  (b) ureotelic
  (c) ureotelic in water
  (d) ureotelic over land

194. Which of the following is not found in birds ?
  (a) Hind-limb   (b) Pectoral girdle
  (c) Pelvic girdle   (d) Fore-limb

195. A gene pair hides the effect of another gene. This phenomenon is called :
  (a) epistasis   (b) segregation
  (c) mutation   (d) dominance

196. Columella is a specialised structure found in the sporangium of :
  (a) *Spirogyra*   (b) *Rhizopus*
  (c) *Ulothrix*   (d) None of these

197. The type of placentation in which ovary is syncarpous, unilocular and ovules on sutures is called :
  (a) marginal placentation
  (b) parietal placentation
  (c) axile placentation
  (d) superficial placentation

198. The blood group with antibody-a and antibody-b is :
  (a) B   (b) A
  (c) O   (d) AB

199. Net gain of ATP molecules during aerobic respiration is :
  (a) 36 molecules
  (b) 60 molecules
  (c) 38 molecules
  (d) 48 molecules

200. In prokaryotes, the genetic material is :
  (a) linear DNA without histones
  (b) linear DNA with histones
  (c) circular DNA with histones
  (d) circular DNA without histones

 NSWERS

➠ PHYSICS

1. (b)	2. (c)	3. (b)	4. (c)	5. (d)	6. (a)	7. (a)	8. (b)	9. (a)	10. (d)
11. (d)	12. (d)	13. (c)	14. (a)	15. (d)	16. (c)	17. (a)	18. (a)	19. (a)	20. (b)
21. (d)	22. (a)	23. (b)	24. (c)	25. (a)	26. (a)	27. (c)	28. (b)	29. (c)	30. (b)
31. (b)	32. (a)	33. (b)	34. (d)	35. (c)	36. (b)	37. (c)	38. (c)	39. (c)	40. (d)
41. (a)	42. (d)	43. (d)	44. (d)	45. (b)	46. (c)	47. (a)	48. (d)	49. (c)	50. (b)

➠ CHEMISTRY

51. (d)	52. (b)	53. (d)	54. (d)	55. (a)	56. (a)	57. (a)	58. (c)	59. (d)	60. (a)
61. (c)	62. (d)	63. (b)	64. (a)	65. (b)	66. (d)	67. (b)	68. (d)	69. (a)	70. (a)
71. (c)	72. (c)	73. (c)	74. (b)	75. (c)	76. (b)	77. (d)	78. (c)	79. (a)	80. (a)
81. (d)	82. (d)	83. (c)	84. (d)	85. (c)	86. (b)	87. (d)	88. (c)	89. (c)	90. (c)
91. (b)	92. (a)	93. (c)	94. (a)	95. (d)	96. (c)	97. (a)	98. (c)	99. (d)	100. (d)

➠ BIOLOGY

101. (a)	102. (b)	103. (d)	104. (b)	105. (d)	106. (d)	107. (a)	108. (b)	109. (a)	110. (b)
111. (d)	112. (c)	113. (d)	114. (a)	115. (d)	116. (a)	117. (b)	118. (c)	119. (b)	120. (c)
121. (b)	122. (b)	123. (c)	124. (d)	125. (a)	126. (c)	127. (b)	128. (d)	129. (a)	130. (b)
131. (a)	132. (b)	133. (d)	134. (d)	135. (a)	136. (a)	137. (d)	138. (d)	139. (d)	140. (a)
141. (b)	142. (b)	143. (d)	144. (a)	145. (b)	146. (b)	147. (a)	148. (a)	149. (a)	150. (d)
151. (b)	152. (c)	153. (c)	154. (c)	155. (a)	156. (c)	157. (c)	158. (d)	159. (a)	160. (b)
161. (d)	162. (c)	163. (c)	164. (a)	165. (d)	166. (d)	167. (d)	168. (a)	169. (b)	170. (b)
171. (a)	172. (b)	173. (a)	174. (b)	175. (c)	176. (d)	177. (b)	178. (c)	179. (b)	180. (c)
181. (b)	182. (c)	183. (a)	184. (a)	185. (b)	186. (b)	187. (b)	188. (a)	189. (a)	190. (b)
191. (b)	192. (c)	193. (b)	194. (d)	195. (a)	196. (b)	197. (b)	198. (c)	199. (c)	200. (d)

HINTS & SOLUTIONS

Physics

1. Key Idea : *Modulus of unit vector is 1.*
Let we represent the unit vector by $\hat{n}$. We also know that the modulus of unit vector is 1 *i.e.*,
$|\hat{n}| = 1$

∴ $\quad |\hat{n}| = |0.5\hat{i} + 0.8\hat{j} + c\hat{k}| = 1$

or $\quad \sqrt{(0.5)^2 + (0.8)^2 + c^2} = 1$

or $\quad 0.25 + 0.64 + c^2 = 1$

or $\quad 0.89 + c^2 = 1$
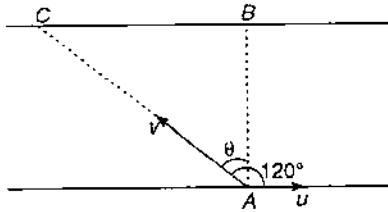
or $\quad c^2 = 1 - 0.89 = 0.11$

∴ $\quad c = \sqrt{0.11}$

NOTE : In the given unit vector $\hat{i}, \hat{j}$ and $\hat{k}$ are orthogonal unit vectors in mutually perpendicular directions.

2. Let u be the speed of stream and v the speed of person starts from A and wants to reach at point B directed opposite to A.

As given, v makes an anlge of $120°$ with direction of flow u, the resultant of v and u is along AB. From figure

$$u = v \sin \theta = v \sin 30°$$

$$\therefore \quad u = \frac{v}{2} = \frac{0.5}{2} \quad (v = 0.5 \text{ m/s})$$

$$= 0.25 \text{ m/s}$$

3. Key Idea : *If an energy equal to the binding energy of sphere on earth's surface is given to it in form of kinetic energy, it escapes the gravitational field of earth.*

The binding energy of sphere of mass m (say) on the surface of earth kept at rest is $\dfrac{GM_e m}{R_e}$. To escape it from earth's surface, this much energy in the form of kinetic energy is supplied to it.

So, $\quad \dfrac{1}{2} m v_e^2 = \dfrac{GM_e m}{R_e}$

or $\quad v_e = \text{escape velocity} = \sqrt{\dfrac{2GM_e}{R_e}}$

Here, R_e = radius of earth, M_e = mass of earth.

4. The centripetal force required for a car (mass m) to take a sharp turn of radius r with velocity v is

$$F = \frac{mv^2}{r}$$

Given, $m = 500$ kg,

$v = 36$ km/h $= 36 \times \dfrac{5}{18} = 10$ m/s, $r = 50$ m

Hence, $\quad F = \dfrac{500 \times (10)^2}{50} = 1000$ N

5. Moment of inertia of a disc about its diameter is

$$I_d = \frac{1}{4} MR^2$$

Now, according to perpendicular axis theorem moment of inertia of disc about a tangent passing through rim and in the plane of disc is

$$I = I_d + MR^2$$

$$= \frac{1}{4} MR^2 + MR^2$$

$$= \frac{5}{4} MR^2$$
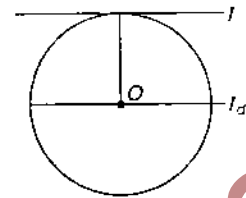
6. Magnetic flux (ϕ) through a surface of area (A) is the total number of magnetic lines of induction passing through that area normally. Mathematically, magnetic flux

$$\phi = BA \qquad \qquad \text{....(i)}$$

but magnetic force

$$F = Bil$$

or $\qquad B = \dfrac{F}{il}$

putting the value of B in Eq. (i), we have

$$\phi = \frac{F}{il} A$$

Thus, dimensions of $\phi = \dfrac{[MLT^{-2}][L^2]}{[AL]}$

$$= [ML^2 T^{-2} A^{-1}]$$

7. Angular speed

$$= \frac{\text{Angle traversed in one revolution}}{\text{Time-period}}$$

So, $\qquad \omega = \dfrac{2\pi}{t}$

As T is same for both racing cars, therefore angular speed ω is same for both cars.

i.e., $\qquad \dfrac{\omega_1}{\omega_2} = 1$

or $\qquad \omega_1 : \omega_2 = 1 : 1$

8. The relation between linear velocity $\vec{v}$, angular velocity $\vec{\omega}$ and position vector $\vec{r}$ is :

$$\vec{v} = \vec{\omega} \times \vec{r}$$

$$= (3\hat{i} - 4\hat{j} + \hat{k}) \times (5\hat{i} - 6\hat{j} + 6\hat{k})$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -4 & 1 \\ 5 & -6 & 6 \end{vmatrix}$$

$$= \hat{\mathbf{i}} \begin{vmatrix} -4 & 1 \\ -6 & 6 \end{vmatrix} - \hat{\mathbf{j}} \begin{vmatrix} 3 & 1 \\ 5 & 6 \end{vmatrix} + \hat{\mathbf{k}} \begin{vmatrix} 3 & -4 \\ 5 & -6 \end{vmatrix}$$

$$= (-24 + 6)\,\hat{\mathbf{i}} - (18 - 5)\,\hat{\mathbf{j}} + (-18 + 20)\,\hat{\mathbf{k}}$$

$$= -18\hat{\mathbf{i}} - 13\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$$

Alternative :

$$\vec{\mathbf{v}} = \vec{\omega} \times \vec{\mathbf{r}}$$

$$= (3\hat{\mathbf{i}} - 4\hat{\mathbf{j}} + \hat{\mathbf{k}}) \times (5\hat{\mathbf{i}} - 6\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$$

$$= (3 \times 5)\,(\hat{\mathbf{i}} \times \hat{\mathbf{i}}) + [3 \times (-6)]\,(\hat{\mathbf{i}} \times \hat{\mathbf{j}})$$
$$+ (3 \times 6)\,(\hat{\mathbf{i}} \times \hat{\mathbf{k}})$$
$$+ (-4 \times 5)\,(\hat{\mathbf{j}} \times \hat{\mathbf{i}}) + (-4 \times -6)\,(\hat{\mathbf{j}} \times \hat{\mathbf{j}})$$
$$+ (-4 \times 6)\,(\hat{\mathbf{j}} \times \hat{\mathbf{k}}) + (1 \times 5)\,(\hat{\mathbf{k}} \times \hat{\mathbf{i}})$$
$$+ (1 \times -6)\,(\hat{\mathbf{k}} \times \hat{\mathbf{j}}) + (1 \times 6)\,(\hat{\mathbf{k}} \times \hat{\mathbf{k}})$$

Use $\hat{\mathbf{i}} \times \hat{\mathbf{j}} = -\hat{\mathbf{j}} \times \hat{\mathbf{i}} = \hat{\mathbf{k}}$

$$\hat{\mathbf{j}} \times \hat{\mathbf{k}} = -\hat{\mathbf{k}} \times \hat{\mathbf{j}} = \hat{\mathbf{i}}$$

and $\hat{\mathbf{k}} \times \hat{\mathbf{i}} = -\hat{\mathbf{i}} \times \hat{\mathbf{k}} = \hat{\mathbf{j}}$

Thus, $\vec{\mathbf{v}} = 0 + (-18)\,(\hat{\mathbf{k}}) + (18)\,(-\hat{\mathbf{j}})$
$$+ (-20)\,(-\hat{\mathbf{k}}) + 0 + (-24)\,(\hat{\mathbf{i}}) + (5)\,(\hat{\mathbf{j}})$$
$$+ (-6)\,(-\hat{\mathbf{i}}) + 0$$
$$= -18\hat{\mathbf{k}} - 18\hat{\mathbf{j}} + 20\hat{\mathbf{k}} - 24\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 6\hat{\mathbf{i}}$$
$$= -18\hat{\mathbf{i}} - 13\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$$

9. Thrust force on the rocket

$$F_t = v_r \left(-\frac{dm}{dt}\right) \qquad \text{(upwards)}$$

Rate of combustion of fuel

$$-\frac{dm}{dt} = \frac{F_t}{v_r}$$

Given, $F_t = 210$ N, $v_r = 300$ m/s

$$\therefore \quad -\frac{dm}{dt} = \frac{210}{300} = 0.7 \text{ kg/s}$$

10. The kinetic energy of a body of mass m moving with velocity v is

$$K = \frac{1}{2} mv^2$$

Its linear momentum

$$p = mv$$

$$\therefore \quad K = \frac{1}{2m}\,(mv)^2$$

or $\qquad K = \frac{p^2}{2m}$

$$\therefore \qquad \frac{K_1}{K_2} = \frac{p_1^2}{2m_1} \times \frac{2m_2}{p_2^2}$$

but $p_1 = p_2$ (given)

So, $\qquad \dfrac{K_1}{K_2} = \dfrac{m_2}{m_1}$

or $\qquad \dfrac{m_1}{m_2} = \dfrac{K_2}{K_1} = \dfrac{1}{4}$

Thus, $\qquad m_1 : m_2 = 1 : 4$

11. Time period of simple pendulum

$$T = 2\pi \sqrt{\frac{l}{g}}$$

i.e., $\qquad T \propto \sqrt{l}$

Hence, $\qquad \dfrac{T_2}{T_1} = \sqrt{\dfrac{l_2}{l_1}}$ ...(i)

Given, $l_2 = 4l_1$, $T_1 = 2$ s

Substituting the values in Eq. (i), we get

$$T_2 = \sqrt{\frac{4l_1}{l_1}} \times 2 = 2 \times 2 = 4 \text{ s}$$

12. The whole mass of the ball will be concentrated at the centre of the ball. All the three balls are identical, i.e., the balls have same mass. On each vertex of equilateral triangle PQR, same mass is kept. Therefore, centre of mass of the triangle is the centre of mass of the system which is point of intersection of the medians of the triangle.
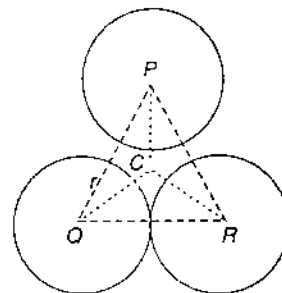
13. Heat required by 1g ice at 0°C to melt into 1g water at 0°C,

$$Q_1 = mL \qquad (L = \text{latent heat of fusion})$$

$$= 1 \times 80 = 80 \text{ cal} \qquad (L = 80 \text{ cal/g})$$

Heat required by 1g of water at 0°C to boil at 100°C,

$$Q_2 = mc\Delta\theta \qquad (c = \text{specific heat of water})$$

$$= 1 \times 1\,(100 - 0) \qquad (c = 1 \text{ cal/g °C})$$

$$= 100 \text{ cal}$$

Thus, total heat required by 1g of ice to reach a temperature of 100°C,

$$Q = Q_1 + Q_2$$
$$= 80 + 100 = 180 \text{ cal}$$

Heat available with 1g of steam to condense into 1g of water at 100°C,

$$Q' = mL' \qquad (L' = \text{latent heat of vaporisation})$$
$$= 1 \times 536 \text{ cal} \qquad (L' = 536 \text{ cal/g})$$
$$= 536 \text{ cal}$$

Obviously, the whole steam will not be condensed and ice will attain temperature of 100°C. Thus, the mixture of temperature is 100°C.

14. Linear expansion coefficient

$$= \frac{\text{change in length}}{\text{original length } \times \text{ rise in temperature}}$$

or $$\alpha = \frac{\Delta l}{lt}$$

or $$\Delta l = l\alpha t$$

For brass rod, $\Delta l_1 = l_1 \alpha_1 t$

For steel rod, $\Delta l_2 = l_2 \alpha_2 t$

Since, $l_2 - l_1 = $ constant (given)

So, $\Delta l_2 - \Delta l_1 = 0$

or $\Delta l_2 = \Delta l_1$

∴ $l_2 \alpha_2 t = l_1 \alpha_1 t$

As $t \neq 0$, hence

$$l_2 \alpha_2 = l_1 \alpha_1$$

15. In adiabatic process

$$PV^\gamma = \text{constant} \qquad \ldots(i)$$

Ideal gas equation is,

$$PV = RT \qquad \text{(for one mole)}$$

or $$P = \frac{RT}{V} \qquad \ldots(ii)$$

$$(R = \text{gas constant})$$

From Eqs. (i) and (ii), we have

$$\left(\frac{RT}{V}\right) V^\gamma = \text{constant}$$

$$T V^{\gamma - 1} = \text{constant} \qquad \ldots(iii)$$

So, $$T_1 V_1^{\gamma - 1} = T_2 V_2^{\gamma - 1}$$

or $$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma - 1} \qquad \ldots(iv)$$

Given, $T_1 = 27°C = 27 + 273 = 300$ K

$\dfrac{V_2}{V_1} = \dfrac{8}{27}, \gamma = \dfrac{5}{3}$

Substituting in Eq. (i), we get

$$\frac{T_2}{300} = \left(\frac{27}{8}\right)^{5/3 - 1}$$

or $$\frac{T_2}{300} = \left[\left(\frac{3}{2}\right)^3\right]^{2/3}$$

or $$\frac{T_2}{300} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

∴ $$T_2 = \frac{9}{4} \times 300 = 675 \text{ K} = 402°C$$

Thus, rise in temperature

$$= T_2 - T_1 = 402 - 27 = 375\,°C$$

16. Key Idea : *A triatomic molecule can rotate about any of three co-ordinate axes.*

The molecule of a triatomic gas has a tendency of rotating about any of three co-ordinate axes. So, it has 6 degrees of freedom, 3 translational and 3 rotational. At high enough temperature a
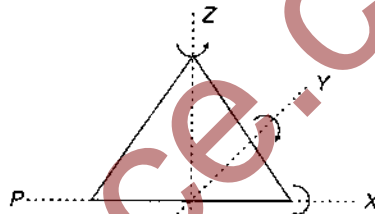
triatomic molecule has 2 vibrational degrees of freedom. But as temperature requirement is not given, so we answer simply by assuming triatomic gas molecule at room temperature. Thus,
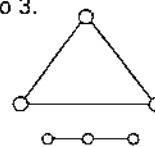
$$f = 6$$

(3 translational + 3 rotational) at room temperature.

Alternative : For non linear triatomic gas, $N = 3$ and restrictions k are also 3.

∴ $f = 3N - k$
$= 3 \times 3 - 3 = 6$

For linear triatomic gas $k = 2$

∴ $f = 3 \times 3 - 2 = 7$

17. Ozone layer extends from 30 km to nearly 50 km above the earth's surface in ozone sphere. This layer absorbs the major part of ultraviolet radiations coming from the sun and does not allow them to reach the earth's surface.

The range of ultraviolet radiations is 100 Å to 4000 Å. Thus, it blocks the radiations of wavelength less than 3×10^{-7} m (or 3000 Å).

18. Number of beats $= 12/s$

$$n_1 - n_2 = 12$$

or $\qquad \dfrac{v}{\lambda_1} - \dfrac{v}{\lambda_2} = 12$

or $\qquad v\left(\dfrac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2}\right) = 12$

or $\qquad v = \dfrac{12\lambda_1 \lambda_2}{\lambda_2 - \lambda_1}$

Given, $\lambda_1 = 50$ cm $= 0.50$ m

$\qquad \lambda_2 = 51$ cm $= 0.51$ m

$\therefore \quad v =$ speed of sound

$$= \dfrac{12 \times 0.50 \times 0.51}{(0.51 - 0.50)}$$

$$= \dfrac{12 \times 0.50 \times 0.51}{0.01} = 306 \text{ m/s}$$

Thus, speed of sound is 306 m/s.

19. According to Coulomb's law, force between two charges is directly proportional to product of charges and inversely proportional to square of distance between them. Thus,

$$F = \dfrac{1}{4\pi\varepsilon_0} \dfrac{q_1 q_2}{r^2} \qquad \text{...(i)}$$

Here, $\dfrac{1}{4\pi\varepsilon_0} =$ proportionality constant.

If a dielectric medium of constant K is placed between them, then new force between them,

$$F' = \dfrac{1}{4\pi\varepsilon_0 K} \cdot \dfrac{q_1 q_2}{r^2} \qquad \text{...(ii)}$$

Dividing Eq. (ii) by Eq. (i), we have

$$\dfrac{F'}{F} = \dfrac{1}{K}$$

or $\qquad F' = \dfrac{F}{K}$

Thus, new force decreases K times.

20. The electron has negative charge. When an electron is bringing towards another electron, then due to same negative charge repulsive force is produced between them. So, to bring them closer a work is done against this repulsive force. This work is stored in the form of electrostatic potential energy. Thus, electrostatic potential energy of system increases.

Alternative : Electrostatic potential energy of system of two electrons

$$U = \dfrac{1}{4\pi\varepsilon_0} \dfrac{(-e)(-e)}{r} = \dfrac{1}{4\pi\varepsilon_0} \dfrac{e^2}{r}$$

Thus, as r decreases, potential energy U increases.

21. The capacitance of a parallel plate capacitor with dielectric (oil) between its plates is.

$$C = \dfrac{K\varepsilon_0 A}{d} \qquad \text{...(i)}$$

where $\varepsilon_0 =$ electric permittivity of free space

$\qquad K =$ dielectric constant

$\qquad A =$ area of each plate of capacitor

$\qquad d =$ distance between two plates

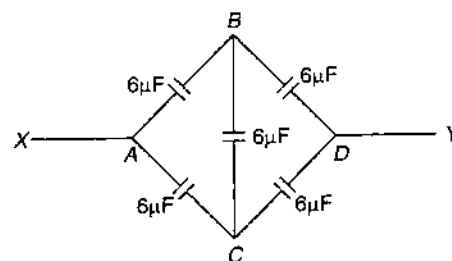When dielectric (oil) is removed, so capacitance

$$C_0 = \dfrac{\varepsilon_0 A}{d} \qquad \text{...(ii)}$$
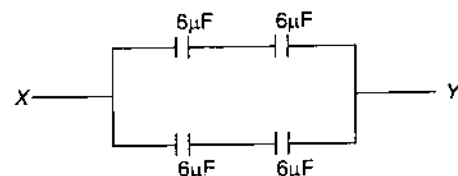
Comparing Eqs. (i) and (ii), we get

$$C = KC_0$$

$\Rightarrow \qquad C_0 = \dfrac{C}{K} = \dfrac{C}{2} \ (K = 2)$

22. The given circuit can be redrawn as

It is a balanced Wheatstone's bridge $\left(\text{as} \dfrac{C_{AB}}{C_{BD}} = \dfrac{C_{AC}}{C_{CD}} = \dfrac{6}{6}\right)$.

So, potential of B and C are equal and 20 μF capacitor is ineffective. The simplified circuit is shown as :

Capacitors of 6 μF and 6 μF in upper arms are in series order, so

$$C' = \dfrac{6 \times 6}{6 + 6} = \dfrac{36}{12} = 3 \,\mu\text{F}$$

Similarly, 6 μF and 6 μF in lower arms are in series order, so

$$C'' = \dfrac{6 \times 6}{6 + 6} = 3 \,\mu\text{F}$$

Now, C' and C'' are in parallel order, hence

$$C = C' + C'' = 3 + 3 = 6\,\mu F$$

23. In the given circuit resistances R_B and R_C are in series order, so their effective resistance,

$$R' = R_B + R_C = 6 + 6 = 12\,\Omega$$

Now R_A and R' are in parallel order, hence net resistance of the circuit

$$R = \frac{R' \times R_A}{R' + R_A} = \frac{12 \times 3}{12 + 3} = \frac{36}{15}\,\Omega$$

The current flowing in the circuit

$$I = \frac{V}{R} = 4.8 \times \frac{15}{36} = 2\,A$$

24. In discharge tube, the current is due to flow of positive ions and electrons. Moreover secondary emission of electrons is also possible. So, V–I curve is non-linear, hence its resistance is non-ohmic.

25. Let unknown resistance be X.

$$P = 20\,\Omega \qquad\qquad Q = 8\,\Omega$$
$$\mid\!\leftarrow\!\text{—— 20 cm ——}\!\rightarrow\!\mid\!\leftarrow\!\text{ (100 – 20) cm }\!\rightarrow\!\mid$$
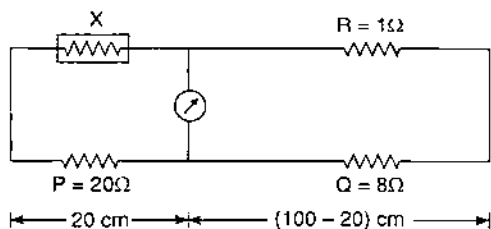
Then condition of Wheatstone's bridge gives,

$$\frac{X}{R} = \frac{20\,r}{80\,r}$$

Hence, unknown resistance is

$$X = \frac{20}{80} \times R = \frac{1}{4} \times 1 \qquad (\because R = 1\,\Omega)$$
$$= 0.25\,\Omega$$

26. $\quad$ Potential gradient $= \dfrac{\text{Potential applied}}{\text{Length of wire}}$

$$\therefore \qquad\qquad k = \frac{V}{L}$$

Given, $V = 2$ V, $L = 4$ m

$$\therefore \qquad k = \frac{2}{4} = 0.5\,V/m$$

27. When white light is incident on a soap bubble it is partly reflected from upper surface and partly reflected from lower surface. These two reflected beams superpose to cause interference. The colours which satisfy the condition of maxima are visible in reflected light. So, colours of soap bubbles are caused due to interference.

28. Key Idea : *The radius of curvature of plane surface of plano-convex lens is ∞ (infinite).*
Lens maker's formula for focal length of lens is,

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \qquad\qquad ...(i)$$

We know that for plano-convex lens, the radius of curvature of plane surface is infinite, i.e., $R_2 = \infty$.
Given, $R_1 = 60$ cm, $\mu = 1.6$
Substituting the given values in Eq. (i), we get

$$\frac{1}{f} = (1.6 - 1)\left(\frac{1}{60} - \frac{1}{\infty}\right) = 0.6 \times \frac{1}{60}$$
$$\therefore \qquad f = \frac{60}{0.6} = 100\,cm$$

29. The refractive index of material of prism (from Snell's law) is

$$\mu = \frac{\sin i}{\sin r}$$

Here, $\quad i = \dfrac{A + \delta_m}{2}$ and $r = \dfrac{A}{2}$

where A is the angle of prism and δ_m the angle of minimum deviation.

Hence, $\mu = \dfrac{\sin\left(\dfrac{A + \delta_m}{2}\right)}{\sin \dfrac{A}{2}}$

Given, $\mu = \sqrt{3}$, $\qquad\qquad A = 60°$ (for prism)

Thus, $\sqrt{3} = \dfrac{\sin\left(\dfrac{60 + \delta_m}{2}\right)}{\sin 30°}$

or $\quad \sin\left(\dfrac{60 + \delta_m}{2}\right) = \dfrac{1}{2} \times \sqrt{3}$

or $\quad \sin\left(\dfrac{60 + \delta_m}{2}\right) = \sin 60°$

or $\quad \dfrac{60 + \delta_m}{2} = 60$

or $\quad\quad \delta_m = 2 \times 60 - 60 = 60°$

30. The relation between velocity of light (c), frequency (ν) and wavelength (λ) is.

$$c = \nu\lambda$$

Thus, wavelength $\lambda = \dfrac{c}{\nu}$

Given, $c = 3 \times 10^8$ m/s, $\nu = 100$ Hz

$$\therefore \qquad \lambda = \frac{3 \times 10^8}{100} = 3 \times 10^6\,m$$

NOTE : If light undergoes any medium other than air or vacuum, its frequency does not change.

31. The maximum wavelength above which no photoelectron can emit from metal surface is called cut-off wavelength and is given by

$$\text{work function} = \frac{hc}{\text{cut-off wavelength}}$$

or cut-off wavelength $= \dfrac{hc}{\text{work function}}$

∴ $\qquad\qquad \lambda_0 = \dfrac{hc}{W}$ ...(i)

Given, $\qquad h = 6.6 \times 10^{-34}$ J-s

$$c = 3 \times 10^8 \text{ m/s}$$

$$W = 4.125 \text{ eV} = 4.125 \times 1.6 \times 10^{-19} \text{ J}$$

Substituting the given values in Eq. (i), we get

$$\lambda_0 = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{4.125 \times 1.6 \times 10^{-19}} \text{ Å}$$

$$= 3 \times 10^{-7} \text{ m} = 3000 \text{ Å}$$

32. According to Einstein's theory of photoelectric effect a single incident photon ejects a single electron. Therefore, when intensity increases, the number of incident photons increases, so number of ejected electrons increases, hence, photocurrent increases.

Now, maximum energy of electron $= \dfrac{1}{2} mv_{max}^2$

and $\quad \dfrac{1}{2} mv_{max}^2 = eV_0$, where V_0 is stoping potential

Thus, the maximum kinetic energy of the electrons does not depend upon the intensity of the incident rays, because the stopping is not affected by the increase of the intensity of rays. Hence, options (c) and (d) are wrong.

33. According to Ampere's circuital law

$$B(2\pi r) = \mu_0 \times 0$$

or $\qquad\qquad B = 0$

So, inside a hollow metallic (copper) pipe carrying current, the magnetic field is zero.

But for external points, the whole current behaves as if it were concentrated at the axis only, so outside

$$B_0 = \frac{\mu_0 i}{2\pi r}$$

Thus, the magnetic field is produced outside the pipe only.

34. For external points the current carrying wire

concentrated at the axis, so magnetic field at far points from axis $B = \dfrac{\mu_0 i}{2\pi r}$ remains unaffected if diameter of wire is changed.

35. At the centre of circular coil carrying current, the magnetic field is,

$$B = \frac{\mu_0 Ni}{2r}$$

where $N =$ number of turns in the coil

$i =$ current flowing

$r =$ radius of the coil

Given, $N = 1000$, $i = 0.1$ A, $r = 0.1$ m

Substituting the values, we have

$$B = \frac{4\pi \times 10^{-7} \times 1000 \times 0.1}{2 \times 0.1}$$

$$= 2\pi \times 10^{-4} = 6.28 \times 10^{-4} \text{ tesla}$$

NOTE : Tesla is the unit of B in SI system. In the same system the unit of B is also Wb/m^2. In the CGS system, its unit is gauss.

Thus, $\quad 1 \text{ Wb/m}^2 = 1 \text{ tesla} = 10^4 \text{ gauss}$

36. When diamagnetic substances are placed in magnetic field of a strong magnet then it is feebly magnetised in the opposite direction of field or it is repelled by strong magnet.

NOTE : The property 'Diamagnetism' is found in those materials whose atoms or molecules have even number of electrons. Thus, net magnetic moment of atom of diamagnetic substance is zero.

37. When a bar magnet is placed in an external magnetic field $\vec{B}$, a magnetic torque $\vec{\tau}$ acts on it, which is given by $\vec{\tau} = \vec{M} \times \vec{B}$

38. Key Idea : *Terminal voltage across the cell decreases due to voltage drop across internal resistance.*

The current flowing in the circuit is,

$$i = \frac{E}{R + r}$$

Given, $\qquad E = 2$ V, $R = 3.9\,\Omega$, $\quad r = 0.1\,\Omega$

So, $\qquad i = \dfrac{2}{3.9 + 0.1} = \dfrac{2}{4.0} = 0.5$ A

The voltage drop across internal resistance,

$$V' = ir = 0.5 \times 0.1$$

$$= 0.05 \text{ V}$$

Thus, terminal voltage across cell is,

$$V = E - ir = E - V'$$

$$= 2 - 0.05 = 1.95 \text{ V}$$

39. A stationary charge produces electric field only; a uniformly moving charge produces localised electromagnetic field.

An accelerated charge produces electromagnetic radiations. The reason is that due to accelerated charges, magnetic field is produced around accelerating charges. As the velocity of charge changes, the magnetic field produced due to it also changes with time. This varying magnetic field produces the electric field. The electric field so produced also changes with time. These two varying fields are mutually perpendicular and also perpendicular to the direction of propagation of wave and both the fields are in same phase and of same frequency. The frequency of these fields is same as the frequency of oscillations of the charged particle. The wave associated with these oscillations is called the electromagnetic wave.

40. Initially there is no DC current in inductive circuit and maximum DC current in capacitive circuit. Hence, the current is zero in A_2 and maximum in A_1.

41. When pentavalent impurity is added to silicon then n-type semiconductor is formed. Out of given options only phosphorus (P) is pentavalent, so it should be doped to silicon to make it n-type semiconductor.

42. Key Idea : *Holes in a junction diode are produced due to thermal agitation of electrons in valence band.*

In a junction diode, when electron jumps to conduction band from valence band due to thermal agitation or any other circumstances, then a vacancy is created in valence band which has positive charge equal to charge of electron in magnitude. This is called a hole.

Thus, holes in junction diode are due to missing electrons.

Note : The density of electrons in the conduction band of p-type is proportional to the Boltzmann factor.

43. When a piece of p-type material is in contact with n-type material, then to bring Fermi level in a line, electrons in conduction band on n-type side travel across the junction and leave the positively ionised impurity atoms unneutralized. Consequently, there is a positively charged region adjacent to the junction in n-type material . On p-type side, the electrons which have traversed the boundary recombine with positive holes in the valence band. Near to the junction on p-type side, there is a layer of unneutralised negatively ionised trivalent impurity which forms a negatively charged region. This region around the junction is called charge depletion region or space charge region.

44. Alpha particle is a positive particle. An alpha particle has 3.2×10^{-19}C charge twice the negative charge of an electron. The mass of a α-particle is 6.645×10^{-27} kg which is equal to mass of helium nucleus. When two electrons are emitted by a helium atom, a nucleus of helium remains which has charge equal to that of two electrons. Actually alpha (α) particle is a nucleus of helium. Hence, it is also called as doubly-ionised helium atom.

45. Since in forward biasing, negative of the battery is connected to n-type side, energy of the electrons in n-type region increases by an amount eV where V is the voltage (forward) applied by the battery. Due to this increase in energy on n-type side, more electrons cross the junction easily and potential barrier is reduced to $e(V_B - V)$. Thus, depletion layer of p-n junction diode decreases.

46. When a proton is accelerated through 1V, its kinetic energy
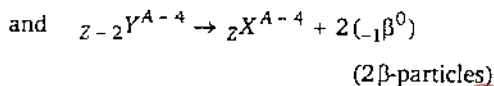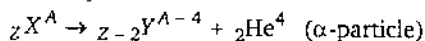
$$K = qV$$

For a proton, $q = e = 1.6 \times 10^{-19}$ C

and $V = 1$ volt

Thus, $K = (1.6 \times 10^{-19} \times 1)J = 1$ eV

(as 1 eV $= = 1.6 \times 10^{-19}$ J)

47. Semiconductors doped with acceptor atoms are called p-type semiconductors. The p stands for positive to imply that the holes introduced into the valence band, which behave like positive charge carriers, greatly out number the electrons in the conduction band. In p-type semiconductors, holes are the majority carriers and electrons are the minority carriers.

48. Key Idea : *In every type of emission whether it is α-decay or β-decay, the mass number and atomic number of resultant nucleus depend on the decay which is being done.*

The α-particle can be represented as $_2He^4$ and β-particle as $_{-1}\beta^0$. So, after emission of one α-particle the mass number of resultant nucleus decreases by 4 unit and atomic number by 2 unit. Similarly after emission of one β-particle the atomic number increase by 1 unit keeping its mass number same. So, according to reaction (assuming $_ZX^A$ the initial nucleus)

$$_ZX^A \rightarrow _{Z-2}Y^{A-4} + _2He^4 \quad (\alpha\text{-particle})$$

and $\quad _{Z-2}Y^{A-4} \rightarrow _ZX^{A-4} + 2(_{-1}\beta^0)$

(2 β-particles)

So, by one α and two β-emissions the atomic number remains unchanged. While mass number decreases by 4.

49. The distance between any two nearest neighbours (atoms) in body centered lattice is $\frac{\sqrt{3}}{2}a$, where a is lattice parameter.
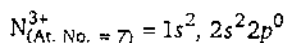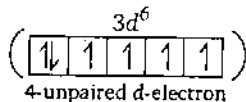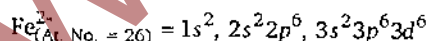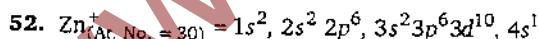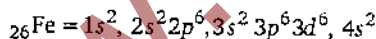
We have given

$$\frac{\sqrt{3}}{2}a = 3.7$$

$$\therefore \quad a = \frac{3.7 \times 2}{\sqrt{3}} = \frac{3.7 \times 2}{1.73} = 4.3 \text{ Å}$$

50. Output of upper AND gate $= \bar{A}B$
Output of lower AND gate $= A\bar{B}$
Thus, output of OR gate $= \bar{A}B + A\bar{B}$
This is Boolean expression for XOR gate.

NOTE : XOR operation employed in XOR gate is called mod-2 addition and rules of addition are
$0 \oplus 0 = 0; \quad 0 \oplus 1 = 1; \quad 1 \oplus 0 = 1; \quad 1 \oplus 1 = 0$

Chemistry

51. Firstly the electrons are filled in increasing order of energy as per Aufbau's principle and then rearrange the sub-shells in increasing order as :

$$_{26}Fe = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^6, 4s^2$$

52. $Zn^+_{(At. No. = 30)} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}, 4s^1$

$Fe^{2+}_{(At. No. = 26)} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^6$

$$\overbrace{\boxed{\uparrow\downarrow | \uparrow | \uparrow | \uparrow | \uparrow}}^{3d^6}$$
4-unpaired d-electron

$N^{3+}_{(At. No. = 7)} = 1s^2, 2s^2 2p^0$

$Cu^+_{(At. No. = 29)} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^{10}$
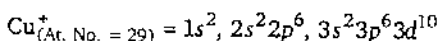
So, maximum number of unpaired electrons are present in Fe^{2+}.

53. Oxidation state of Fe in Fe_3O_4 is :

$\overset{x}{Fe_3} \overset{-2}{O_4}$

$3x + (-2 \times 4) = 0$

$3x = +8$

$x = +\frac{8}{3}$

54. $w = 0.15\,g, \quad W = 15\,g, \quad \Delta T_b = 0.216°C,$
$K_b = 2.16, \quad m = ?$

$$m = \frac{1000 \times K_b}{\Delta T_b} \times \frac{w}{W}$$

$$= \frac{1000 \times 2.16 \times 0.15}{0.216 \times 15} = 100$$

55. Equivalent wt. of dibasic acid $= \frac{\text{Mol. wt.}}{2}$

$$= \frac{200}{2} = 100$$

Strength = 0.1 N, $\quad m = ?, V = 100$ mL
then,

$$m = \frac{EVN}{1000} = \frac{100 \times 100 \times 0.1}{1000} = 1g$$

56. As the temperature is constant. Boyle's law is applicable–

$$P_1V_1 = P_2V_2$$

$V_1 = 380$ mL, $\quad P_1 = 730$ mm, $\quad V_2 = ?,$
$P_2 = 760$ mm

$$730 \times 380 = 760 \times V_2$$

$$V_2 = \frac{730 \times 380}{760}$$

$$= 365 \text{ mL}$$

57. $T_{1/2}$ of nth order reaction $\propto \frac{1}{a^{n-1}}$.

where $a \rightarrow$ initial concentration of reactant

$\quad n \rightarrow$ order of reaction

$$T_{1/2} \propto \frac{1}{a^{n-1}} \qquad (n=1)$$

$$T_{1/2} \propto \frac{1}{a^{1-1}}$$

or $\qquad T_{1/2} \propto \frac{1}{a^0}$

So, for a first order reaction half-life is independent on initial concentration of reactants.

58. According to Heisenberg uncertainty principle :

$$\Delta p \times \Delta x \geq \frac{h}{4\pi}$$

$$1 \times 10^{-5} \times \Delta x = \frac{6.62 \times 10^{-34}}{4 \times \frac{22}{7}}$$

$$\Delta x = \frac{6.62 \times 10^{-34} \times 7}{1 \times 10^{-5} \times 4 \times 22} = 5.265 \times 10^{-30} \text{ m}$$

$$\approx 5.27 \times 10^{-30} \text{ m}$$

59. Sommerfeld modified Bohr's theory. According to him electrons move in elliptical orbits in addition to circular orbits.

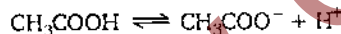**60.** $p = \frac{h}{\lambda}$ (de-Broglie equation)

$$\lambda = \frac{h}{mv} \qquad (\because p = mv)$$

$$\lambda = \frac{6.63 \times 10^{-34} \text{ kg m}^2/\text{s}}{10^{-3} \text{ kg} \times 100 \text{ m/s}} = 6.63 \times 10^{-33} \text{ m}$$

61. $[H^+]$ in monobasic acid

$= $ molarity $\times$ degree of ionisation

$$= 0.1 \times \frac{2}{100} = 2 \times 10^{-3} \text{ M}$$

$$[OH^-] = \frac{K_w}{[H^+]} = \frac{1 \times 10^{-14}}{2 \times 10^{-3}} = 5 \times 10^{-12} \text{ M}$$

62. Weak acid forms strong conjugate base. In HNO_3, HCl, H_2SO_4 and CH_3COOH, CH_3COOH is weak acid so its conjugate base is strongest.

$$\underset{\text{(conjugate base)}}{CH_3COOH \rightleftharpoons CH_3COO^- + H^+}$$

63. K_s (sp. conductivity) $= \frac{1}{R} \times \frac{l}{a}$

$\frac{l}{a} = $ cell constant of cell

So, $0.012 \text{ ohm}^{-1} \text{ cm}^{-1} = \frac{1}{55 \text{ ohm}} \times \frac{l}{a}$

$\frac{l}{a}$ (cell constant) $= 55 \times 0.012 = 0.66 \text{ cm}^{-1}$

64. Acidic nature of oxides decreases down a group. So, N_2O_5 is most acidic.
Another reason of acidic strength of N_2O_5 is that the electronegativity of N is maximum in the given Vth group elements. As we know that by increasing the electronegative character, acidic nature increases.

65. H_2O_2 shows non-planar structure. It has a half opened book like structure in which the two O—H groups lie on the two pages of the book.
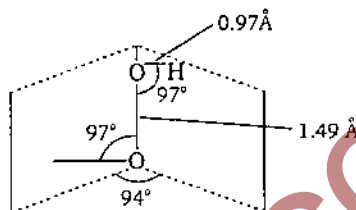
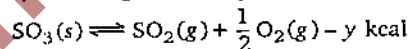**66.** Mass of gas cannot be determined by weighing a container in which it is enclosed. So, it is a wrong statement.

67. For endothermic, reactions standard heat of reaction (ΔH) is positive because in these total energy of reactant is lower than product. i.e.,
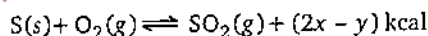
$$E_R < E_P$$

So, $\quad \Delta H = E_P - E_R = + \text{ ve}$

68. (i) $S(s) + \frac{3}{2} O_2(g) \rightleftharpoons SO_3(g) + 2x \text{ kcal}$

(ii) By inverting second equation

$$SO_3(s) \rightleftharpoons SO_2(g) + \frac{1}{2} O_2(g) - y \text{ kcal}$$

on addition

$$S(s) + O_2(g) \rightleftharpoons SO_2(g) + (2x - y) \text{ kcal}$$

Hence, heat of formation of SO_2 is $(2x - y)$ kcal.

69. The electron affinity decreases from $Cl \rightarrow Br \rightarrow I$ i.e., on moving down the group. However, electron affinity of fluorine is unexpected low. It cannot be explained by any simple mechanism. It is probably due to small size of the atom. The addition of an extra electron produces high electron charge density in a relatively compact $2p$ sub-shell resulting in strong electron-electron repulsion. The repulsive forces between electrons imply low electron affinity. So, the correct order of electron affinity for halogens is :

$$I < Br < F < Cl$$

70. In *ortho* and *para* nitrophenol, *ortho* nitrophenol has intramolecular H-bonding. So, it has lower boiling point. Whereas *para* nitrophenol has intermolecular H-bonding. So, it has higher boiling point. Due to difference in boiling points *ortho* and *para* nitrophenol can be separated from each other by **distillation**.

71. $$_{16}S^{35} \xrightarrow{-\beta}$$
(Mass = 34.96903 amu)

$$_{17}Cl^{35}$$
(Mass = 34.96885 amu)
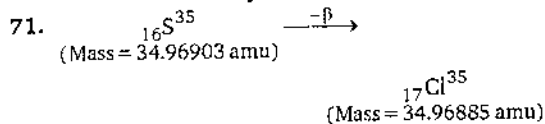
Mass defect = $(34.96903 - 34.96885)$ amu
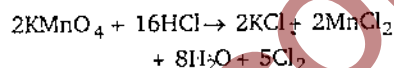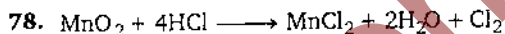= 0.00018 amu

Energy = 0.00018×931 MeV = 0.16758 MeV

72. Each boron atom in diborane (B_2H_6) is sp^3. In the structure of diborane four H-atoms, two on the left and two on the right, known as **terminal hydrogens**, are in different environments from the other two hydrogen atoms which are known as **bridging atoms**. The two boron atoms and the four terminal hydrogen atoms lie in the same plane while the two boron atoms and the two bridging hydrogen atoms, one above and the other below, lie in a plane perpendicular to this plane
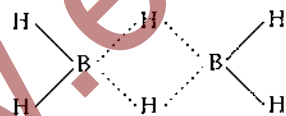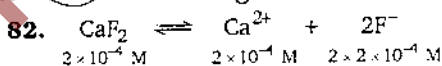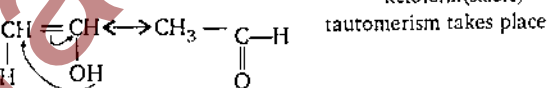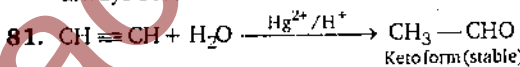

Structure of diborane molecule

73. Purification of aluminium by electrolyte refining is known as **Hoope's process**. By this process 99.9% pure aluminium metal is obtained. The cell used for this process consist of three layers. In this cell pure Al acts as cathode and anode is made up of impure Al.

74. Bell metal is an alloy of copper and tin.
Cu = 80% and Sn = 20%.
It is used for making bells, utensils etc.

75. Diamond does not show electrical conductivity due to the absence of free electrons. All carbon atoms are bonded tetra hedrally to four other C atoms. Sodium and potassium are metallic conductors while graphite is a non metallic conductor.

76. White phosphorus has low ignition temperature. So, it is most reactive.

77. Cassiterite is an ore of Sn, its chemical composition is SnO_2. It is also known as tin stone.

78. $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$
$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2$
$\qquad\qquad\qquad + 8H_2O + 5Cl_2$

79. In lead pencil graphite and clay is present so the per cent of lead is zero.

80. Oxidation state of Fe in $Fe(CO)_5$ is zero because CO is neutral ligand and it shows zero oxidation state.
In metal carbonyls, oxidation state of metal is always zero.

81. $CH \equiv CH + H_2O \xrightarrow{Hg^{2+}/H^+} CH_3 - CHO$
Keto form (stable)
tautomerism takes place

82. $CaF_2 \rightleftharpoons Ca^{2+} + 2F^-$
2×10^{-4} M $\quad 2 \times 10^{-4}$ M $\quad 2 \times 2 \times 10^{-4}$ M

K_{sp} of $CaF_2 = [Ca^{2+}][F^-]^2$
$\qquad = [2 \times 10^{-4}][4 \times 10^{-4}]^2$
$\qquad = 32 \times 10^{-12}$ $(mol/L)^2$

83. According to Raoult's law :
$$\frac{p_0 - p_s}{p_0} = \frac{w \times M}{m \times W}$$
$$\frac{640 - 600}{640} = \frac{2.175 \times 78}{m \times 39.08}$$
(M for $C_6H_6 = 78$)
$$m = \frac{2.175 \times 78 \times 640}{40 \times 39.08}$$
$$= 69.45 \approx = 69.4$$

84. Weight of NH_3 = 4.25 g
Number of moles of NH_3
$$= \frac{Wt.}{Mol. \ wt.} = \frac{4.25}{17} = 0.25$$

Number of molecules in 0.25 mole of NH_3
$$= 0.25 \times 6.023 \times 10^{23}$$

So, number of atoms = $4 \times 0.25 \times 6.023 \times 10^{23}$
$$= 6.0 \times 10^{23}$$

85. By mean of emission of an α-particle the atomic number is decreased by two unit while mass number is decreased by four unit, but in case of emission of one, β-particle the atomic number is increased by one unit while mass number is not effected

$$_{92}X^{232} \xrightarrow[- 3\beta]{- 3\alpha \ and} {}_{89}Y^{220}$$
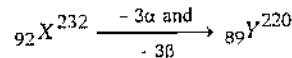
So, 3α and 3β particles are ejected.

86. Radioactive decay is first order reaction.

So, $\lambda = \dfrac{0.693}{T_{1/2}}$

$\therefore \quad T_{1/2} = \dfrac{0.693}{2.31 \times 10^{-4}}$ year

$= 0.3 \times 10^4 = \mathbf{3 \times 10^3 \ year}$

87. $C_2H_5 \boxed{Cl + Na} \ OC_2H_5 \longrightarrow$

$\qquad C_2H_5 — O — C_2H_5 + NaCl$

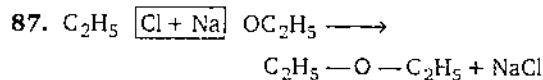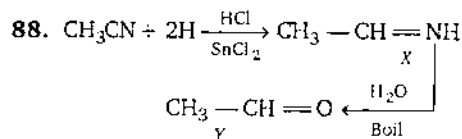It is Williamson's synthesis.

88. $CH_3CN + 2H \xrightarrow[SnCl_2]{HCl} CH_3 — CH = \underset{X}{NH}$

$\underset{Y}{CH_3 — CH = O} \xleftarrow[Boil]{H_2O}$

So, Y is acetaldehyde.

89. Table for empirical formula.

Element	%	At. wt.	Rel. Number	Ratio
C	40.00	12	$\dfrac{40}{12} = 3.33$	$\dfrac{3.33}{3.33} = 1$
H	13.33	1	$\dfrac{13.13}{1} = 13.33$	$\dfrac{13.33}{3.33} = 4$
N	46.67	14	$\dfrac{46.67}{14} = 3.33$	$\dfrac{3.33}{3.33} = 1$

Hence, empirical formula $= CH_4N$

90. Friedel-Craft's alkylation : When benzene reacts with alkyl halide in presence of anhy. $AlCl_3$, toluene is obtained. It is called Friedel-Craft's alkylation.

$C_6H_6 + CH_3Cl \xrightarrow{Anhyd. \ AlCl_3} \underset{Toluene}{C_6H_5CH_3} + HCl$
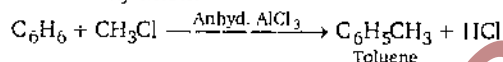
91. Phenyl isocyanide is formed by carbylamine reaction.

$C_6H_5NH_2 + CHCl_3 + 3KOH \rightarrow \underset{Phenyl \ isocyanide}{C_6H_5NC} + 3KCl$
$\underset{(alc.)}{}$

$+ 3H_2O$
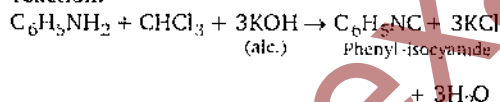
92. Decomposition of organic compounds in the presence of oxygen is generally called as decay. The remaining three reactions takes place in presence of bacteria.

93. Fructose is the sweetest sugar and is highly soluble in water.

94. Aldol condensation in aldehydes is due to presence of α-hydrogen atoms. In these aldehydes HCHO does not have α-hydrogen atom. So, HCHO does not give aldol condensation reaction.

95. Gammexane is benzene hexachloride

or $\underset{BHC}{C_6H_6Cl_6}$
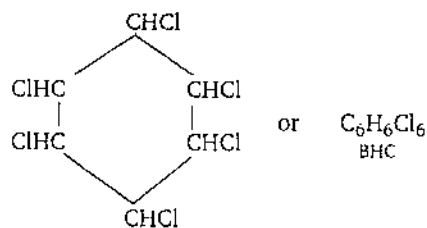
96. Amides can be converted into amines by Hofmann-Bromamide reaction. The reaction is :

$R — CONH_2 + Br_2(l) + 4KOH \longrightarrow R — NH_2$

$\qquad + 2KBr + K_2CO_3 + 2H_2O$
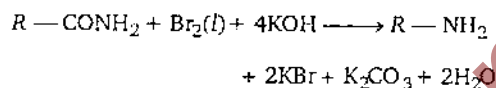
97. Only acetic acid reacts with $NaHCO_3$ to give sodium salt and CO_2, because $NaHCO_3$ is a base and it reacts with acid only.

This is one of the distinguishing test of carboxylic acids.

$R — COOH + NaHCO_3 \rightarrow R — COONa + CO_2 + H_2O$
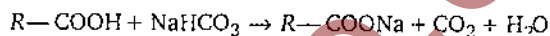
98. —Cl is able to deactivate the benzene nucleus but show o/p-directive influence while —OH and —CH_3 activate the benzene nucleus (order —OH > —CH_3) so, they show electrophilic substitution easily on o/p position in comparison to benzene.

Order of electrophilic substitution

Thus phenol will be most easily attacked by an electrophile. Order of electrophilic substitution
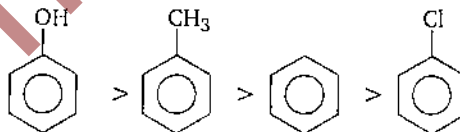
99. Terylene is a condensation polymer of ethylene glycol and terephthalic acid.

(i) Condensation
—————————→
(ii) Polymerisation

Terylene
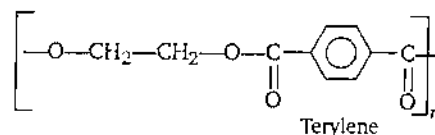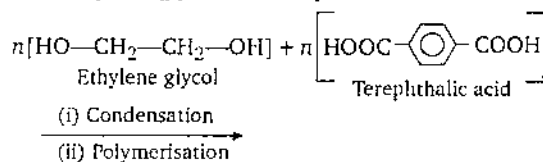
100. Polyisoprene is the natural rubber which is the polymer of isoprene.

$$n\left[CH_2 = CH - \underset{\underset{CH_3}{|}}{C} = CH_2\right] \xrightarrow{\text{Polymerisation}} \left[CH_2 - CH = \underset{\underset{CH_3}{|}}{C} - CH_2\right]_n$$

Isopropene

Polyisopropene
(Natural rubber)

Biology

101. A large proportion of soil water is present between the soil particles and is held against the gravitational force. It is called capillary water, which is readily available to the plants.

102. Clinging roots are modified adventitious roots meant for providing mechanical support. These arise from the axils of leaves or nodes of the stem and pierce the substratum plant to facilitate fixation e. g., orchids, ivy.

103. DDT is a non-degradable pesticide. As it passes through food chain, its concentration rises at each successive level in the food chain. Naturally it would be highest in top carnivores.

104. LH (Luteinizing hormone), secreted by anterior pituitary, stimulates the corpus luteum to secrete the hormone progesterone.

105. Normally, the breathing process (inspiration and expiration) is controlled involuntarily by a breathing centre located in the **medulla oblongata**. The ventral portion of the breathing centre (inspiratory centre) increases the rate and depth of inspiration while the dorsal and lateral portions of the centre (expiratory centre) inhibit inspiration and stimulate expiration.
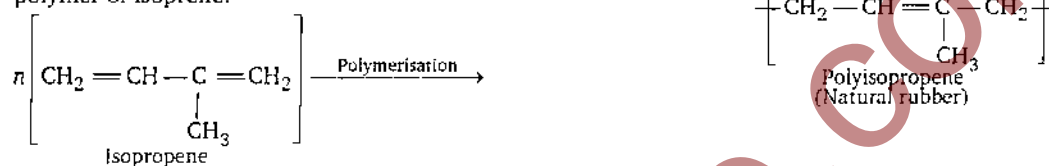
106. The term 'aquaculture' refers to systematic method of cultivation of aquatic organisms to obtain maximum yield of best quality. It include 'pisciculture' (fish farming)-both inland and marine.

107. During protein synthesis, smaller subunits of ribosomes attach to m-RNA. The ribosomes provide space as well as enzyme for the synthesis of proteins. Therefore, these are known as protein factories or workbenches of protein.

Mitochondria are involved in energy production i. e., ATP. Centrosomes are involved in the formation of astral rays during cell division in animals (absent in plants). The main function of Golgi complex is secretion.

108. Mutation is a sudden heritable change in genes structure of an organism. The term genetic mutation covers somatic mutation as well as germinal mutation (occurring during reproduction).

109. Skin colour in human beings is believed to be controlled by at least three pairs of genes Aa, Bb and Cc located in different chromosomes and inherited separately.

Phenylketonuria is a recessive human genetic disorder. It happens due to absence of enzyme which converts the amino acid phenyl alanine to tyrosine.

110. Ligaments are made up of inelastic white fibrous tissue and connect bones at joints.

111. The middle piece of human sperm contains mitochondria which are coiled around an axial

filament called mitochondrial spiral. These provide energy for the movement of sperm.

Human sperm
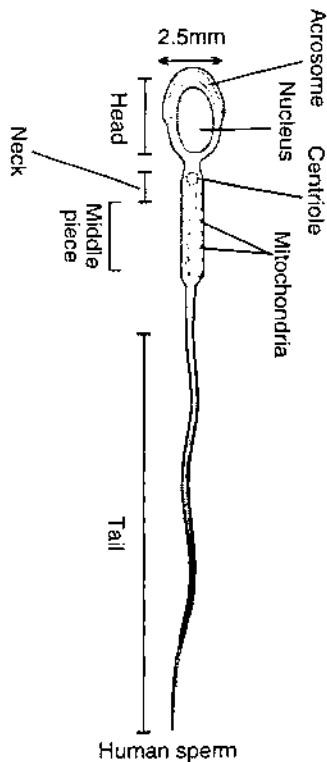
112. Algae and bryophytes do not possess vascular tissues. Pteridophytes and gymnosperms do have vascular tissues. However, gymnosperms bear seeds while pteridophytes do not bear seeds.

113. Cell wall is not/does not have a membrane. The mitochondria and nucleus are surrounded by double-membraned envelope.

Spherosomes are single membrane bound, spherical structures in plant cell cytoplasm. These are apparently centres of lipid synthesis and accumulation.

114. Medulla of brain has two regions affecting heart rate (i) cardiac inhibitory centre, (ii) cardiac accelerator centre. Sensory nerves originating from the accelerator centre run parallel to the spinal cord and enter the sino-atrial node. Stimulation by these nerves, which are part of sympathetic nervous system cause an increase in heart beat.

115. George Bentham and J.D. Hooker jointly published three volumes of Genera Plantarum. A book by the same title was published by A.C. de Jussieu also much earlier (1789).

Hutchinson proposed the phylogenetic system of classification. He wrote the book "Families of flowering plants".

116. The regulator gene codes for a repressor protein which either binds to the operator itself (as in lac operon) blocking its activity or requires the presence of end product for binding to the operator. In any case, it represses the activity of operator.

117. The endodermal cells of roots develop a band of suberin which runs round the cell, and is called casparian strip.
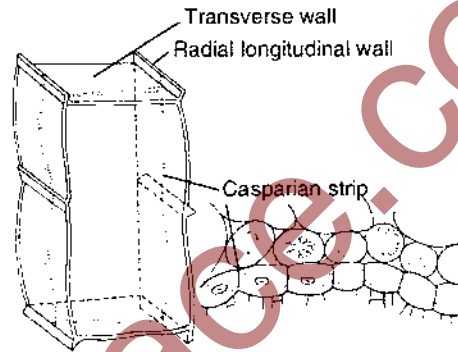
The diagram of an endodermal cell showing casparian strip

118. Some fish are larvivorous i. e., feed upon larvae. These include *Gambusia, Labester, Oryzias, Telapia.*

119. *Nepenthes* (pitcher plant), *Dionaea* (also called Venus fly trap), Bladderwort *(Utricularia)* and *Drosera* (sundew plant) are insectivorous plants. *Rafflesia* is a total root parasite. *Viscum* (mistletoe) is a partial stem parasite.

120. In natural system of classification, all important characters of plants are taken into consideration. In an artificial system, plants are classified on the basis of one or a few convenient characters.

Phylogenetic system was proposed by Bessey. Engler and Prantl, Hutchinson, Cronquist, Takhtajan etc.

Carolus Linnaeus (1707-1778) proposed artificial system of classification.

121. A myeloma is a type of cancer associated with abnormal production of irregular antibodies. It occurs in antibody-producing cells that have lost their normal control. Clones of the hybrid cell resulting from artificial fusion of a normal antibody producing B cell with myeloma cell are called hybridomas.

122. The antherozoids of *Funaria* are spirally coiled and bear two equal flagella at anterior end.

Antherozoid of *Funaria*
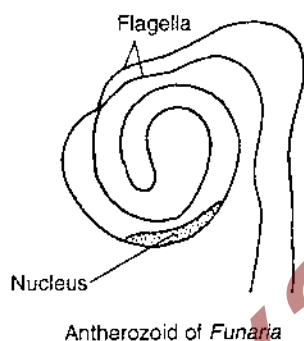
123. In a DNA molecule, the purine adenine in either chain is associated with the pyrimidine thymidine in the other.
Similarly, purine guanine in either chain is associated with pyrimidine cytosine in the other.

124. Methyl isocyanate gas, used as raw material for synthesising carbaryl, caused Bhopal gas tragedy in 1984.

125. An average person not doing hard work requires about 3200 kcal per day as compared to 3,500-5000 kcal required by a person doing hard physical work.

126. Industrial melanism refers to the occurrence, of dark (melanic) forms (of insects) in regions with high industrial pollution—where surfaces on which the insects rest are darkened by soot and where atmospheric SO_2 level are high enough to prevent the growth of lichens. The mutant dark forms of insects would not be easily seen and avoid being preyed; thus the population of dark forms of insects would increase-natural selection being in their favour as compared to lighter forms which would be easily sighted and eaten.

127. Colourblindness is sex-linked recessive character carried by X chromosome. Since males have only one X chromosome (XY), presence of gene for colour blindness on X chromosome (X) would cause colour blindness while in woman both chromosomes should have the gene for colour blindness to appear. X^cX woman would be carriers for the disease.
A cross between XY (normal man) and colour blind woman (X^cX^c) would produce all colour blind son and carrier daughter.
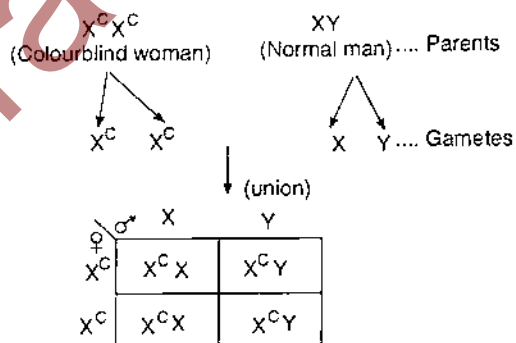
Result of this cross is :
1. Colourblind sons.
2. Carrier daughters.

128. **Landsteiner** and **Weiner** (1940) discovered Rh antigens in the rhesus monkey.
Now it is found in most human beings. Humans with this factor are said to be Rh^+ (positive) and humans without this factor are said to be Rh^- (negative).
The problem due to Rh incompatibility arises when the blood of Rh^+ person and Rh^- women mixes up during pregnancy or through blood transfusion.

129. Immunity is described as 'active immunity' when an organism's own body manufactures its own antibodies. It may be natural (developing when organism is exposed to an infectious agent) or artificial (achieved by injecting small amount of antigen callled vaccine into the body of the individual).

130. Haemophilia is also a sex-linked recessive disease (like colour blindness).

None of the children would suffer from haemophilia, though girls would be carriers of the disease.

X^hY XX
(Haemophilic man)   (Normal woman) .... (Parents)

X^h Y   X X .... Gametes

Fertilization

♂ \ ♀	X	X
X^h	X^hX (Carrier)	X^hX (Carrier)
Y	XY	XY

Results—All daughters are carrier while all sons are normal.

131. Beri-beri is caused by the deficiency of vitamin B_1 (thiamine).

Vitamin K is also known as antihaemorrhagic factor. The main sources of vitamin K are green leafy vegetables such as cauliflower, cabbage, spinach etc. It is also found in animal sources like egg yolk, liver etc. Vitamin K is essential for blood clotting and deficiency of it causes **haemorrhage**.

132. Hepatic portal vein receives many small veins from different regions of the digestive tract (including intestine) and carries digestion products like glucose and amino acids from alimentary canal to the liver.

Hepatic portal circulation of human

133. Sponges possess an extensive system of interconnected cavities called canal system which typically consists of incurrent canals, radial canals, excurrent canals and spongocoel. The system is useful for nutrition, respiration and excretion.

134. Both cholecystokinin and duocrinin are hormones secreted by the intestine. Former stimulates the gall bladder to release bile and pancreas to release enzyme mixture while the, the latter regulates the release of mucus from Brunner's glands.

135. Contraceptive pills for women contain female sex hormones estrogen and progesterone. These prevent development of eggs and ovulation by inhibiting secretion of FSH. Some pills contain progesterone only-in such cases, ovulation may occur but cervical mucus is thickened preventing the entry of sperm.

136. Offsprings with genotypes Tt (heterozygous tall) and tt (homozygous dwarf) are produced in the ratio of 1 : 1.

It can be shown diagrammatically as

Tt   tt   (Parents)

T   t   t   t   (Gametes)

Fertilization

	t	t
T	Tt	Tt
t	tt	tt

Results—Ratio of genotype is 1 : 1.
Ratio of phenotype is 1 : 1.

137. The tropical rain forests are most diverse and highly dense with maximum productivity (approx. 12000 kcal/m^2/yr).

138. Besides catalase, the glyoxysomes contain enzymes for the glyoxylate cycle through which fats are converted into carbohydrates.

Microsomes are product of homogenization of ER.

Liposomes are artificially produced lipid bilayers, 25 nm or more in diameter. Golgy body is a dynamic eukaryotic organalles, consisted of cisternae, vesicles and tubules.

139. In photosynthetic bacteria, small particles of 60 μm diameter, called chromatophores, are present. These are attached to the inner surface of cell membrane, have no limiting membrane and possess bacteriochlorophyll.

    Plastids are of three types, on the basis of their colour.

    (a) **Chromoplasts**—Coloured plastids except green, give different type of colour appearance to different parts of the plant.

    (b) **Chloroplasts**—Green plastids take part in the process of photosynthesis.

    (c) **Leucoplasts**—Colourless plastids, mainly function as store house of various types of food.

140. Though many liverworts are dichotomously branched, some of the leafy liverworts are not. However, *Marchantia* is a liverwort which is dichotomously branched.

141. Aril is a fleshy covering on the seed, arising as an upgrowth of the funicle or base of the ovule. It is the aril of litchi which we do eat.

142. To apply Koch's postulates, we have to culture the suspected causal organism *in vitro*. *Mycobacterium leprae* cannot be cultured *in vitro*. Hence, Koch's postulates are not applicable to leprosy because its incubtion period is 2-5 years.

    Cholera is caused by *Vibrio cholerae*.

    TB is caused by *Mycobacterium tuberculosis*.

    Diphtheria is caused by *Mycobacterium diphtheriae*.

143. Nondegradable chemicals enter the food chain, and their concentration goes up as it moves up in the food chain. This phenomenon is called biomagnification. Naturally in an aquatic food chain, Phytoplankton → Zooplankton → Fishes →Birds, it would be highest in fishes.

144. Axis vertebra possesses a peg-like structure called the odontoid process which projects forward from the centrum. It fits into the cavity of the atlas below the ligament so that it is separated from the neural canal. Such an arrangement gives a **pivot joint** which allows head to shake (rotate from one side to the other).

145. Until recently, forests covered one third of the land surface.

146. Metamorphosis (meta= change : morphe : form) is the process by which an animal undergoes a comparatively rapid change from larval to adult form.

    Regeneration is regrowth of the part of body which has been removed due to injury or other causes. Growth is an increase in dry mass of an organism.

    Ageing is progressive deterioration in activity of cells, tissues, organs etc.

147. Frederick Griffith (1928) found that 'something' passed from heat-killed encapsulated forms of *Pneumococcus* to live non-capsulated forms which caused them to develop capsules and become virulent. Avery *et. al.*, (1944) found this transforming agent (hence. genetic material) to be DNA.

148. Main physiological effects of ABA (Abscisic acid) are as follows :

    a. It brings about seed dormancy, bud dormancy etc.

    b. It brings about senescence of leaves.

    c. It accelerates abscission of leaves, fruits.

    d. ABA acts a growth inhibitor.

    e . It promotes the closing of stomata.

149. **Watson** and **Crick** studied the structure of DNA in 1953. DNA is a double helical structure made up of two polynucleotide chains running antiparallel and joined by hydrogen bonds.

    Most of the amount of DNA is found in nucleus while some amounts of DNA are found in mitochondria and chloroplast.

150. Bryophytes are non vascular cryptogams, their main plant body is gametophytic (haploid) which is a thalloid structure. It contains chlorophyll for the process of photosynthesis. Thalloid plant body bear archegonia as female sex organs.

151. A major component (20–50%) of the eukaryotic genome consists of DNA which does not code for any protein. This portion consists of certain base sequences which are repeated many times (hence called repetitive DNA). DNA of prokaryotes does not contain histones-nor it is single stranded.

152. In C_3 plants, CO_2 molecules are accepted by RuBP (formerly known as RuDP) to produce a 6-C compound which breaks down into 3-phosphoglyceric acid (3-C compound).

    $$RuBP + CO_2 + H_2O \xrightarrow{\text{RuBP Carboxylase}}$$

    6-C Compound
    Enzyme RuBP carboxylase (Rubisco) is a most abundantly found protein in the world because this enzyme present in all plants containing chlorophyll.

153. Antibodies are glycoproteins and are secreted by mature vertebrate plasma cells which are modified form of B cells.

    These selectively bind to epitopes of antigens and clumping them (agglutination) prior to phagocytic engulfment.

154. Poikilothermy (cold bloodedness) is a condition of any animal whose body temperature fluctuates considerably with that of its environment. Homeothermy, on the other hand, is the quality of maintaining a constant body temperature.

155. 'Humulin' is first genetically engineered human insulin. It was launched on 5th July, 1983 by an American firm, Eli Lilly.

156. The gonadotropic hormones (FSH and ICSH =LH) are secreted by anterior lobe of the pituitary (adenohypophysis).

    Gonadotropic hormone (GTH) or gonado-tropins controls the function of gonads (ovary in females and testes in males).

157. Vagus nerve has five branches :

    (a) Superior laryngeal nerve

    (b) Recurrent laryngeal nerve

    (c) Cardiac nerve

    (d) Pneumogastric nerve

    (e) Depresser nerve

158. Haemoglobin is a proteinaceous respiratory pigment made up of a protein called globin with iron [Fe^{2+}] containing porphyrin as prosthetic group. It binds oxygen reversibly.

159. Just after ovulation, LH hormone (secreted by anterior lobe of pituitary gland) stimulates remaining ovarian follicles to develop corpus luteum.

    The corpus luteum plays an important role in the preparation of the endometrium for the implantation of the fertilized egg by secreting estrogens and progesterone.

160. The concentration of Na^+ in plasma is 0.32% followed by K^+(.02%) and magnesium (.0025%).

    The mineral ions like Na^+ and others present in the blood plasma play an essential role in the maintenance of osmotic pressure of the blood.

161. **Silicosis** is caused by inhalation of dust containing free silica or silicon dioxide especially by workers engaged in mining, pottery, ceramic industry, sand blasting, building and construction industries.

    Fluorosis is caused due to deficiency of fluoride.

    Leprosy is caused by *Mycobacterium lepri*.

    Pneumonicosis is caused by *Diplococcus pneumoni*.

162. Homologous organs are those organs which are originally and anatomically similar but functionally different.

    The forelimbs of vertebrates are built on same pentadactyl plan, though they may have different functions *e.g.*, In birds these are modified for flying.

163. Pollutants formed by the chemical interaction of primary pollutants with atmospheric gas and moisture, often catalysed by sunlight are called secondary pollutants. PAN (Peroxyacetyl Nitrate) is one such substance.

164. *Anabaena* (in *Azolla*) is the main source of algal biofertiliser in South and South East Asia especially for paddy.

165. The nervous tissue is made up of nerve cells called neurons.

Structure of a neuron
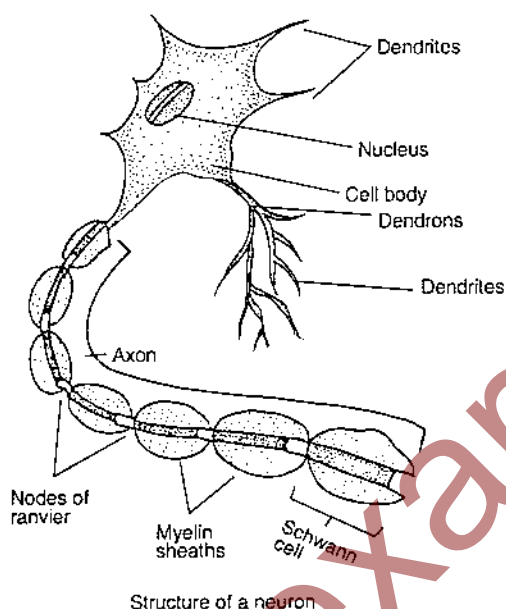
Each neuron has a cell body or cyton and two kinds of cell processes :

(i) dendrons—come out from cyton

(ii) axon-an elongated nerve fibre.

166. Folic acid (folacin) and pantothenic acid (vitamin B_3) belong to vitamin B complex alongwith thiamine, riboflavin, pyridoxine, niacin, biotin and cyanocobalamin.

Deficiency of vitamin C (ascorbic acid) leads to disease **scurvy**.

Deficiency of vitamin K (phylloquinone) causes haemorrhage.

Deficiency of vitamin A (retinol) causes xerophthalamia, night blindness, keratomalacia, retarded growth etc.

167. Destruction of habitats deprives wild life of their best places where they could flourish, indiscriminate killing of wild animals has greatly reduced their population, and pollution adversely affects their life cycles.

168. There are three types of members present in a bee-hive. One is queen (fertile female), a few hundred are drones (fertile male) and rest are workers (sterile female). Later are smaller than both queen and drone.

Due to their hard life, the worker bees live only for two to four months (8-16 weeks).

Honey bee *(Apis indica)* is a social insect. It lives in a colony in **bee-hive**.

169. The end to end position of the axon of one neuron and the dendrites of another neuron is called the **synapse**.

Most neurons do not actually touch other neurons with which they communicate, instead there is a minute space, separating these two called the **synaptic cleft**.

170. Growth of lichens is inhibited by air pollution. Hence, atmospheric pollution causes decrease in their populations.

Lichens are the symbiotic association between algae and fungi. In this fungi absorb water and minerals from the soil which is utilized by algae in the process of photosynthesis. In exchange of this fungi take prepared material from algae.

171. Bryophytes are a group of thalloid, non vascular, cryptogams which have gametophytic (haploid) phase as dominant phase. They bear diploid sporophytic phase (diploid phase), which takes food from gametophytic phase, thus behaves as parasite on gametophyte.

172. As per **10 per cent law,** only 10% of the energy fixed at one trophic level is passed to next trophic level. For example, when plants are eaten by animals, only 10% of the energy of the food is fixed into animal flesh, rest is lost through respiration.

173. Rate of photosynthesis is maximum in **red light**, average in blue light and minimum in green light.

174. Plasmids are extrachromosomal double stranded, circular DNA molecules, present in the cytoplasm of a bacterial cell.

Replication in plasmid is initiated by plasmid genes while other stages of replication are controlled by bacterial genes.

175. Seismonastic movements are nastic movements of turgor in response to stimulus of shock (like touch/mechanical/electrical/thermal/chemical shock). On touching *Mimosa pudica,* its leaves droop down and the stimulus travels at the speed of 1 cm/sec.

176. Increase in CO_2. CFCs. SO_2 and other substances has disturbed the balance between the amount of energy received and that reflected back into the space. This leads to rise in global temperature.

177. Plasmids are used as vectors in genetic engineering.

178. The first field trials of a herbicide-resistant transgenic tobacco were conducted in USA in 1986.

179. Atherosclerosis involves thickening of inner walls of arteries which prevents the dilation of arteries.

180. The contraction of the heart depends on a small cluster of specialized muscle cells which are embedded in the upper wall of the right atrium. This cluster of cells, called the **sinoatrial node** (SA node). It automatically and rhythmically sends out impulses that initiate each heart beat.

181. Endosperm in gymnosperms develops before fertilisation and is, hence, haploid.
In angiosperms, the endosperm is formed after fertilization and it is a triploid structure which is formed due to union of a second male nuclei and a diploid secondary nucleus.

182. *Rafflesia,* a **total root parasite,** produces largest flowers in the world.

183. DDT is non-degradable; and accumulates in the tissues-13-31 ppm in body fat of Indians.

184. 'AUG' acts as start signal for initiation of polypeptide chain.

185. Secretin is a polypeptide hormone secreted by the mucosa of duodenum and jejunum.

It holds two functions : (a) It stimulates sodium bicarbonate from the pancreas which neutralizes the acid in the chyme so that it will not damage the wall of the small intestine. (b) It increases the rate of bile secretion in the liver.

186. Brunner's glands are convoluted and branched glands find only in duodenum and located in submucosa.

187. In 1952, poisoning in Japan resulted in 'Minimata disease' due to eating of fish trapped from mercury-polluted Minimata bay.

188. In hybridization, two or more plants of unlike genotype are crossed together to get offsprings with new desirable combinations of characters, as a result of genetic recombination.

189. *Azolla* leaves harbour *Anabaena* colonies which fix atmospheric nitrogen. The nitrogen rich *Azolla* is used as biofertiliser.

190. Diabetes mellitus occurs due to deficiency of hormone insulin which is secreted by **Islets of Langerhans** of pancreas. It is a peptide hormone.

191. The white fibres form cords called tendons which connect muscles with the bones.

192. Oxytocin causes contraction of the smooth muscles of myometrium forcing the foetus out of the uterus. Oxytocin is also involved in ejection of milk, but not lactation (actual production of milk). For milk to be produced, prolactin must be present.

193. The animals which excrete urea are called ureotelic animals. These include amphibians, mammals, many other categories of animals as aquatic or semiaquatic reptiles like turtles and alligators.

194. Forelimbs of birds are modified into wings.

195. Epistasis is an interaction between two genes in which one of them hide the phenotypic expression of the other. The first example of epistasis was observed in 1918 by geneticist **R.A. Emerson** who worked with particular varieties of corn.

196. In *Rhizopus*, the central nonsporiferous region of sporangium is called columella.

197. Parietal placentation occurs in bicarpellary to polycarpellary syncarpous pistils in which the ovary is unilocular. The placentae are formed
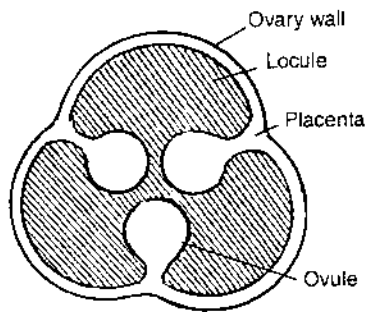
Parietal placentation

along the fused margins of the carpels from where the ovules arise.

198. Persons having blood group 'O' have no antigen but have both antibodies a, b in their plasma.

199. During aerobic respiration, 38 ATP molecules are gained. If specifically aerobic respiration in eukaryote is asked, then the answer would be 36 ATP because 2 ATP molecules are utilised in transporting 2 NADH molecules produced in glycolysis to the mitochondrion.

200. In prokaryotes, the nucleoid consists of double stranded circular molecule of DNA without histone proteins.

❑