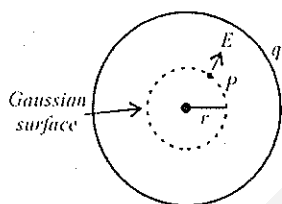


# SOLUTIONS

## PHYSICS

1. (a) : Let us consider a charged hollow sphere with charge  $q$ . The charge  $q$  is on the surface of the sphere. We have to calculate the electric field at an interior point  $P$



distance  $r$  from the centre. If we imagine a Gaussian spherical surface through the point  $P$  and concentric with the given shell, we can use the Gauss theorem,

$E \times 4\pi r^2 = \frac{q'}{\epsilon_0}$  where  $q'$  is the charge enclosed by this Gaussian surface = 0

$$\therefore E = 0$$

2. (b) : On an artificial satellite orbiting the earth the acceleration is given by  $\frac{GM}{R^2}$  towards the centre of the earth. Now for a body of mass  $m$  on the satellite the gravitational force due to earth is  $\frac{GMm}{R^2}$  towards the centre of the earth. Let the reaction force on the surface of the satellite be  $N$ , then

$$\frac{GMm}{R^2} - N = m\left(\frac{GM}{R^2}\right)$$

$$\Rightarrow N = 0$$

That is on the satellite there is a state of weightlessness or  $g = 0$

$\therefore$  The time period of the simple pendulum,

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

3. (c) : The chromatic aberration formed by a convex lens is considered positive and that by a concave lens is considered negative, as they have got exactly opposite characteristics. So the chromatic aberration formed by one lens can be nullified by the suitable use of the second lens.

4. (a)    5. (d)    6. (d)

7. (a) : For very small drops, the potential energy

due to gravity is insignificant as compared to that due to surface tension. Therefore the shape of the liquid drop is determined by the surface tension.

8. (b) : Due to the rotation of the earth, the acceleration due to gravity for earth changes and at the equator, its value is given by  $g' = g - \omega^2 R$

And at poles,  $g' = g$

$\therefore$  The value of acceleration due to gravity is minimum at the equator.

9. (b) : Negative sign reverses the direction. Since magnitude of the number is 2, therefore magnitude of the vector is doubled.

10. (b) : The law of conservation of linear momentum states that in absence of an external force, the linear momentum of a body remains constant. And Newton's first law states that until and unless an external force is applied a body in a state of rest will tend to be in a state of rest and body in motion will tend to keep on moving without a change of speed and direction. In other words if a body is in a state of rest then its momentum is zero and the first law tells that the body tries to preserve its zero momentum. And when in motion (momentum ' $mv$ '), the body tries to preserve its momentum  $mv$  again. Which is the law of conservation of momentum.

11. (d) :  $\vec{P} + \vec{Q}$  and  $\vec{P} - \vec{Q}$  are diagonals of a parallelogram whose sides are  $\vec{P}$  and  $\vec{Q}$ . Thus the angle between them may be between  $0^\circ$  and  $180^\circ$ .

12. (b)

13. (a) : Pyrometer can measure temperature from  $800^\circ\text{C}$  to  $6000^\circ\text{C}$ . Therefore temperature of the sun is measured by pyrometer.

14. (b) : Objective of large aperture is used in a telescope, so that it may collect sufficient light and form a bright image.

15. (a) : The magnetic flux through a surface is given by

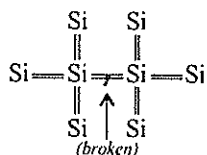
$$\phi = \vec{B} \cdot \vec{A} = BA \cos \theta$$

Now since the magnetic field  $\vec{B}$  is parallel to the surface, so the magnetic flux in a direction perpendicular to the surface will be  $\phi = BA \cos 90^\circ = 0$

16. (d) : The electrical resistance of a semiconductor decreases with the rise in temperature. Therefore at absolute zero temperature, a semiconductor becomes an insulator.

17. (c) : In a choke coil, we use a low resistance and a high inductance to reduce the current in an a.c. circuit. We use a high inductance in place of a high resistance because the inductance does not consume power, so we don't lose any energy in the form of heat.

18. (c) : In the case of an intrinsic semiconductor (say Si) where each Si is having 4 outermost electrons, its crystal structure consists of making 4 covalent bonds with 4 neighbouring Si atoms. Each bond consists of two electrons.



Now if one of the bonds get broken due to some reason (collisions or high temperature) then one electron gets freed and it will be having sufficient energy to cross the band gap and be ready for conduction. So in intrinsic semiconductors, current flows due to breakage of crystal bonds.

19. (c) : Given : E.M.F. of the battery ( $E$ ) = 10 volts; Internal resistance ( $r$ ) = 3  $\Omega$  and current ( $I$ ) = 0.5 A.

We know that current ( $I$ ) =  $\frac{E}{R+r}$  or  $0.5 = \frac{10}{R+3}$  or

$$0.5R + 1.5 = 10 \text{ or } 0.5R = 8.5 \text{ or } R = \frac{8.5}{0.5} = 17 \Omega$$

20. (b) : Given : Initial radius of the bubble =  $r$ ; Final radius of the bubble =  $2r$  and initial pressure at the surface ( $P_1$ ) = column of water height  $H$ . When radius of a bubble becomes double, its volume ( $V_2$ ) becomes 8 times. Also from the Boyle's law,  $P_1V_1 = P_2V_2$  or

$$P_2 = \frac{P_1V_1}{V_2} = \frac{H \times 8V}{V} = 8H. \text{ Therefore depth of the lake} \\ = 8H - H = 7H.$$

21. (c) : If a star is moving towards the earth (i.e. observer), the frequency of its radiation will increase or the wavelength will decrease. Therefore the spectrum lines will shift towards blue end of the spectrum.

22. (a) : Viscous force ( $F$ ) =  $\eta A \times \frac{dv}{dx} \propto A$  (where  $A$  is the area of the plates).

23. (a)

24. (c) : The heat given to the melting solid is used in displacing the molecules from their original position and making their order irregular. It increases the average distance between the molecules.

25. (b) : Since the angle of inclination  $\theta = 60^\circ$

$$\therefore n = \frac{360^\circ}{60^\circ} = 6 \text{ which is even}$$

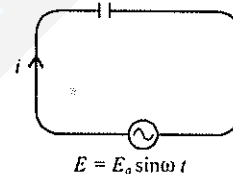
$\therefore$  no. of images formed for any position of the object in between the mirrors =  $6 - 1 = 5$

$$(n) = \frac{360^\circ}{\theta} - 1 \Rightarrow \frac{360^\circ}{60} - 1 \Rightarrow 6 - 1 \Rightarrow 5$$

26. (c) : In a purely capacitive circuit, where there is no resistance, the current  $i$  flowing through it deposits a charge  $dq$  on the capacitor in time that is

$$dq = idt$$

$$\Rightarrow i = \frac{dq}{dt}$$



Now using Kirchoff's law, if total charge deposited on the capacitor is  $q$  then

$$\frac{q}{C} = E_0 \sin \omega t$$

$$\Rightarrow q = CE_0 \sin \omega t$$

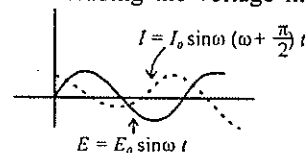
$$\Rightarrow i = \frac{dq}{dt} = CE_0 \omega \cos \omega t = i_0 \cos \omega t \text{ where}$$

$$i_0 = \frac{E_0}{\left(\frac{1}{C\omega}\right)} = \text{peak current}$$

$$\therefore i = i_0 \cos \omega t = i_0 \sin \left(\omega + \frac{\pi}{2}\right) t$$

and  $E = E_0 \sin \omega t$

Hence current is leading the voltage in phase by  $\frac{\pi}{2}$



27. (a) : Given : Distance between two charges =  $d$  and dielectric constant ( $k$ ) = 2. Force between two charged spheres ( $F$ ) =  $\frac{1}{4\pi\epsilon_0} \times \frac{q_1q_2}{r^2}$ , where  $\epsilon_0$  is

permittivity of free space. and force for a medium with dielectric constant  $k$ ,

$$F' = \frac{1}{k} \times \frac{1}{4\pi\epsilon_0} \times \frac{q_1 q_2}{r^2} = \frac{F}{k} = \frac{F}{2}.$$

28. (c)

29. (d) : Given : Initial radius of wire ( $r_1$ ) =  $r$ ; Initial resistance =  $R$  and final radius of wire ( $r_2$ ) =  $0.5r$ . Let  $L_1$  and  $A_1$  be the length and cross-sectional area of original wire and  $L_2$ ,  $A_2$  be the values for the stretched wire.

$$\text{Therefore, } L_1 \times \pi r_1^2 = L_2 \times \pi r_2^2 \quad \text{or}$$

$$L_1 r^2 = L_2 \times (0.5r)^2 \quad \text{or} \quad \frac{L_1}{L_2} = \frac{1}{4} \quad \text{and} \quad \frac{A_1}{A_2} = \frac{\pi(r)^2}{\pi(0.5r)^2} = 4.$$

$$\text{Resistance } (R) = \rho \frac{L}{A} \propto \frac{L}{A} \quad \text{or}$$

$$\frac{R_1}{R_2} = \frac{L_1}{L_2} \times \frac{A_2}{A_1} = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16} \quad \text{or} \quad R_2 = 16 R_1$$

30. (a) : Thermal resistivity =

$$\frac{1}{\text{Thermal conductivity}} = \frac{1}{4} = 0.25$$

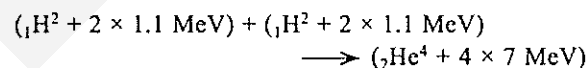
31. (d)

32. (a) : Wavelength ( $\lambda$ ) =  $\frac{hc}{eV} \propto \frac{1}{V}$ . Therefore if voltage is increased then wavelength is decreased.

33. (b) : Plate resistance ( $r_p$ ) =  $\frac{\delta V}{\delta I}$  (where  $\delta V$  is the change in voltage and  $\delta I$  is the change in current. At saturation, current  $\delta I = 0$ . Therefore at saturation

$$(r_p) = \frac{\delta V}{0} = \infty.$$

34. (c) : Given : binding energy per nucleon of deuteron ( ${}_1\text{H}^2$ ) = 1.1 MeV and binding energy per nucleon of helium  ${}_2\text{He}^4$  = 7 MeV. Total binding energy of two deuteron atoms ( ${}_1\text{H}^2$ ) ( $1p + 1n$ ) =  $2(2 \times 1.1) = 4.4$  MeV and total binding energy of helium atom ( ${}_2\text{He}^4$ ) ( $2p + 2n$ ) =  $4 \times 7 = 28$  MeV. Therefore energy released on forming helium nucleus from two deuterons =  $28 - 4.4 = 23.6$  MeV. The reaction taking place is schematically represented as



35. (c)

36. (c) : Mass is the matter contained in a body. It remains constant irrespective of the place where the

body is taken. Therefore mass of the body on the moon surface is  $M$ .

37. (b) : Given : Inductance of the coil ( $L$ ) = 5 H and rate of change of current  $\left(\frac{dI}{dt}\right) = 2 \text{ A/sec}$ . The induced e.m.f. =  $-L\left(\frac{dI}{dt}\right) = -5 \times 2 = -10 \text{ V}$ .

38. (a)

39. (a) : Given : Stress on the wire =  $S$  and Young's modulus of the material =  $Y$ . Energy stored per unit volume =  $\frac{1}{2} \times \text{Stress} \times \text{Strain}$

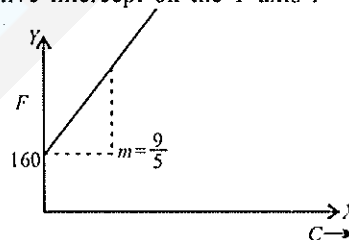
$$= \frac{1}{2} \times S \times \frac{\text{Stress}}{Y} = \frac{1}{2} \times S \times \frac{S}{Y} = \frac{S^2}{2Y}$$

40. (b) : We know that

$$\frac{C}{100} = \frac{F - 32}{180}$$

$$\Rightarrow F = \frac{9}{5}C + 160, \text{ which gives us a straight line}$$

with positive intercept on the  $Y$  axis :



41. (a) : Planck's constant ( $h$ ) =

$$\frac{\text{Energy in each photon}}{\text{Frequency of radiation}} = \frac{[E]}{[\nu]} = \frac{[ML^2T^{-2}]}{[T^{-1}]} = [ML^2T^{-1}].$$

42. (c) : We know from the lens maker's formula the focal length,

$$\frac{1}{f} = \left(\frac{\mu_2 - \mu_1}{\mu_1}\right) \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Now for the lens to behave like a glass plate its focal length will be infinity ( $f = \infty$ )

$$\therefore \mu_2 - \mu_1 = 0 \Rightarrow \mu_2 = \mu_1$$

That is, the refractive index of the medium should be equal to the refractive index of glass.

43. (d) : Given : Radius of the first orbit ( $r_1$ ) =  $r_0$ .

Radius of  $n$ th orbit ( $r_n$ ) =  $\frac{\epsilon_0 h^2}{\pi m Z e^2} \times n^2 \propto n^2$  or

$$\frac{r_0}{r_3} = \left(\frac{n_1}{n_3}\right)^2 = \left(\frac{1}{3}\right)^2 = \frac{1}{9} \quad \text{or} \quad r_3 = 9r_0. \dots (\text{where } r_3 = \text{radius of the third orbit})$$

44. (d)

45. (a) : Given : Mass of the molecule =  $m$ ; Initial velocity of the molecule =  $v$ . Initial momentum =  $mv$  and final momentum =  $-mv$  (minus sign due to motion in the opposite direction). Therefore change in linear momentum of the molecule = Final momentum - Initial momentum =  $-mv - mv = -2mv$

$\therefore$  The magnitude of change of linear momentum =  $2mv$

46. (b) : Given Initial angular momentum ( $J_1$ ) =  $J$ ; final angular momentum ( $J_2$ ) =  $4J$  and time ( $t$ ) =  $4$  sec. Torque = Rate of change of angular momentum

$$= \frac{J_2 - J_1}{t} = \frac{4J - J}{4} = \frac{3}{4}J.$$

47. (a) : Since the charge is moving in a circle or along an equipotential surface, therefore work done will be zero.

48. (b) : Extension of spring =  $x$ , tension on spring =  $T$  and spring constant =  $k$ . Now extension of spring

$x = \frac{T}{k}$  and energy stored by the spring

$$E = \frac{1}{2} \times kx^2 = \frac{1}{2} \times k \times \left(\frac{T}{k}\right)^2 = \frac{1}{2} \times k \times \frac{T^2}{k^2} = \frac{T^2}{2k}.$$

49. (a) : Given : Initial temperature ( $T_1$ ) =  $7^\circ\text{C} = 280\text{K}$ ; Final temperature ( $T_2$ ) =  $287^\circ\text{C} = 560\text{K}$ . The Stefan's law states that radiated energy  $E \propto T^4$

$$\text{or } \frac{E_1}{E_2} = \left(\frac{T_1}{T_2}\right)^4 = \left(\frac{280}{560}\right)^4 = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$$

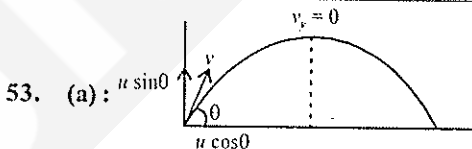
or  $E_2 = 16 E_1$ .

50. (d) : Acceleration due to gravity at a depth  $h$  from the earth's surface

$$g' = g\left(1 - \frac{h}{R}\right) = g\left(1 - \frac{R}{R}\right) = g(1-1) = 0.$$

51. (a) : In an insulator, the valance band is completely filled and the conduction band is completely empty. There is no charge carriers at all in the conduction band. Moreover as the energy gap  $E_g \gg KT$ , where  $T$  is the room temperature, so no electron can jump from the valance band to the conduction band at low temperatures and even at higher temperatures.

52. (c)



At the topmost point vertical component of velocity = 0

Let time taken to reach the topmost point =  $T$ , then

$$v_y = 0 = u \sin \theta - gT$$

$$\Rightarrow T = \frac{u \sin \theta}{g}$$

$$\therefore \text{Total time of flight} = 2T = \frac{2u \sin \theta}{g}$$

$$\therefore \text{Range, } R = u \cos \theta \times \frac{2u \sin \theta}{g} = \frac{u^2 \sin^2 \theta}{g}$$

$\therefore$  For  $R$  to be maximum,  $\sin^2 \theta = 1$

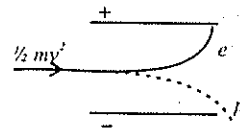
$$\Rightarrow 2\theta = 90^\circ \Rightarrow \theta = 45^\circ$$

54. (b) : Sound waves are longitudinal in nature and light waves are transverse in character. Moreover light wave is electromagnetic in nature. That's why light waves do not need a material medium for its propagation.

55. (a)

56. (a) : In both the cases of the cycle and the car, it is the centripetal acceleration towards the centre which provides the necessary frictional force in a turning so that there is no skidding. In the case of the cyclist, as the centre of gravity of the system (cycle + cyclist) goes through the cyclist, the whole system leans towards the centre of the arc. But in case of the car, the centre of gravity does not pass through a person sitting in the car. That's why due to inertia, that person leans outwards.

57. (c) : As both the electron and the proton enters the electric field with equal energies, the electron will finally traverse a more curved path than the proton as the electron is lighter than the proton, because of which the acceleration of the electron will be much more than that of the proton.



58. (d) : If the ice cap of the poles melts, ice will flow towards the equator, and will increase the moment of inertia of the earth thereby decreasing its frequency of rotation. Due to decrease of the frequency of rotation, the day length increases.

59. (a) : The energy gap between the valance and the conduction band is very small, so by raising the temperature we can get more electrons flipping from valance to conduction band thereby increasing the carriers of electricity in the semiconductors. That's why in semiconductors we have negative temperature coefficient of resistance and so the resistance decreases with temperature.

60. (a) : As the free falling body has an acceleration

equal to 'g', the effective acceleration due to gravity for the pendulum is  $g_{eff} = 0$

$$\therefore \text{Time period } T = 2\pi \sqrt{\frac{l}{g_{eff}}} = \infty.$$

## CHEMISTRY

61. (d) : According to Heisenberg's uncertainty principle,

$$\Delta x \times \Delta v = \frac{h}{4\pi}$$

$\Delta x$  = uncertainty in position

$\Delta v$  = uncertainty in velocity

$h$  = Planck's constant ( $6.63 \times 10^{-34}$  Js)

62. (d) :  $\text{CH}_3\text{COOH} \xrightarrow{\text{NaOH/CaO}} \text{CH}_4 + \text{Na}_2\text{CO}_3$

When sodium salt of carboxylic acids are heated with (NaOH + CaO), alkane is obtained with one less carbon atom than the acid, and the process is called decarboxylation.

63. (d) : Magnalium : 95% Al, 5% Mg. It is used in the construction of airships, balance and pistons of motor engine.

Duralumin : 95% Al, 4% Cu, 0.5% Mg, 0.5% Mn. It is used in aeroplanes and automobile parts.

64. (b) : If Principle quantum number ( $n$ ) is 2,  
orbitals possible =  $2s, 2p_x, 2p_y, 2p_z$   
total = 4 (i.e.  $n^2 = 4$ )

If  $n = 3$ ,

Orbitals possible, one  $s$ , three  $p$ -orbitals and five  $d$ -orbitals total = 9 (i.e.  $n^2 = 9$ )

65. (d) :  $\text{pH} = -\log [\text{H}^+]$

$$\Rightarrow 2 = -\log [\text{H}^+]_1, \text{ and } 6 = -\log [\text{H}^+]_2$$

$$\Rightarrow \frac{\log [\text{H}^+]_1}{\log [\text{H}^+]_2} = \frac{10^{-2}}{10^{-6}} = 10^4 = 10,000$$

Therefore, acidity is more in  $\text{pH}=2$  than  $\text{pH}=6$  by an order of 10,000.

66. (b) : As,  $\frac{P^0 - P}{P^0} = \frac{w}{m}$

$P^0$  = vap. pressure of pure component

$P$  = vap. pressure in solution

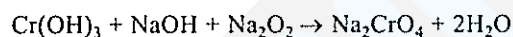
$w$  = mass of solute,  $m$  = mol. wt. of solute

$W$  = mass of solvent,  $M$  = mol. wt. of solvent

$$\Rightarrow \frac{121.8 - 120.2}{121.8} = \frac{15}{250}$$

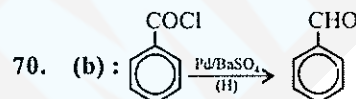
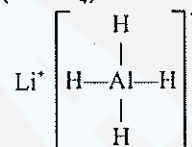
$$\Rightarrow m = 356.7 \text{ g}$$

67. (c) : Yellow colour is due to the formation of  $\text{CrO}_4^{2-}$  ion.



68. (a) : According to Bronsted theory, acid is a substance that can release protons while base are those that accept protons.

69. (c) : Lithium aluminium hydride is a strong reducing agent. ( $\text{LiAlH}_4$ )



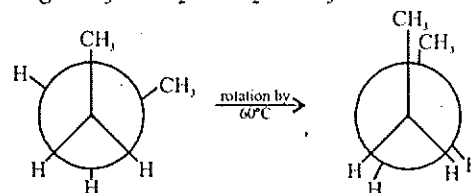
This reaction is called Rosenmund reaction.

71. (c) :  $\text{H}_2\text{S}$  is the group reagent for II and IV group of basic radicals (cations). So with  $\text{COCl}_2$  (no metal here), no metallic sulphide will be produced.

72. (d) : As there is no lone pair on boron in  $\text{BCl}_3$ , therefore no repulsion takes place. But there is a lone pair on nitrogen in  $\text{NCl}_3$ . Therefore repulsion takes place. Thus  $\text{BCl}_3$  is planar molecule but  $\text{NCl}_3$  is pyramidal molecule.

73. (a) : Conformers are obtained by rotating molecules around  $\sigma$ -bonds between C-atoms.

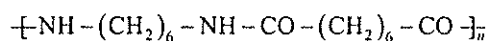
e.g.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$



Gauche conformer

Eclipsed conformer

74. (d) : Nylon-66 is prepared from monomers, adipic acid and hexamethylene diamine by condensation process.



Nylon-66

75. (a) :  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow 2\text{HI}(\text{g})$

$\Delta n$  = no. of product species - no. of reactant species

$$= 2 - (1 + 1) = 0$$

As  $\Delta H = \Delta E + \Delta n RT$

$$\Rightarrow \Delta H = \Delta E + 0 \times RT \Rightarrow \Delta H = \Delta E$$

76. (a): 1 carat = 200 mg  
0.5 carat = 100 mg  
1 mole of C-atoms weight = 12 g  
 $\Rightarrow$  12 g of carbon =  $6.023 \times 10^{23}$  C-atoms  
 $\Rightarrow$  100 g of carbon =  $\frac{6.023 \times 10^{23} \times 100}{12 \times 1000}$   
 $= 5.02 \times 10^{21}$

77. (b):  $\text{Na}_2[\text{CdCl}_4]$

Cd :  $4d^{10} 5s^2$

$\text{Cd}^{2+}$  :  $4d^{10}$

As there is no scope for  $d-d$  transition in  $\text{Cd}^{2+}$  ion, therefore, it does not exhibit any colour.

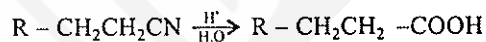
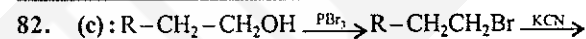
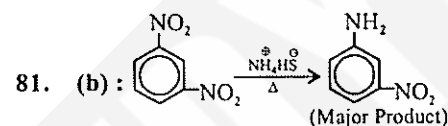
78. (b): Potash alum is  $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ . It is used for disinfectant purposes.

79. (b): Aromatic compounds are characterised by their unusual stability, delocalisation of  $\pi$ -electrons in a planar ring. They undergo substitution reactions more favourably than addition reaction these properties are not present in cyclohexane.

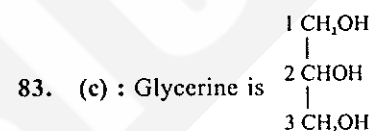
80. (c): Given : Mass of the compound = 0.189 g and mass of AgCl = 0.287 g. Equivalent weight of chlorine is 35.5 and equivalent weight of AgCl is 143.5. Therefore percentage of chlorine

$$= \frac{35.5}{143.5} \times \frac{\text{Mass of AgCl formed}}{\text{Mass of substance taken}}$$

$$= \frac{35.5}{143.5} \times \frac{0.2870}{0.1890} = 0.3757 = 37.57\%$$



This is called upgradation reaction.



1 and 3 C-atoms are primary.  
2 is secondary C-atom.

84. (a):  $Q = It$

$$= 5 \times 200 = 1000 \text{ coulombs}$$

Charge carried by 1 electron =  $1.6 \times 10^{-19} \text{C}$ .

$$\Rightarrow \text{No. of electrons for } 1000 \text{ C} = \frac{1000}{1.6 \times 10^{-19}}$$

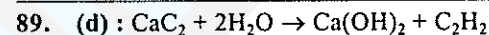
$$= 6.241 \times 10^{21}$$

85. (c): All the alcohols are water soluble due to the formation of extensive Hydrogen bonding between water molecules and alcohol molecules. Lower alcohols are highly soluble in water and their solubility decreases with an increase in the molecular weight.

86. (d): Steam distillation is employed as there is a large difference between boiling points of ortho and para-nitrophenols. This is due to the presence of intra molecular H-bonding in the case of o-nitrophenol (so low b.p.) and intermolecular H-bonding in p-nitrophenol (so high b.p.)

87. (a): Radioactive substances usually emit  $\alpha$ -rays ( ${}^4_2\text{He}$  numbers),  $\beta$ -ray (electrons) or  $\gamma$ -rays or sometimes positrons ( ${}^0_1\beta$ ).

88. (c): Copper and zinc are the components of brass.



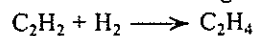
mol. wt.  $\rightarrow$  64 g

$$\Rightarrow 64 \text{ g CaC}_2 \equiv 26 \text{ g C}_2\text{H}_2$$

$$\Rightarrow 64100 \text{ g CaC}_2 \equiv \frac{26}{64} \times 64100 \text{ g C}_2\text{H}_2$$

$$\equiv 26040.625 \text{ g C}_2\text{H}_2$$

$$\equiv 26.04 \text{ Kg C}_2\text{H}_2$$

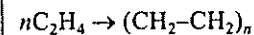


Mol. wt. 26 g 28 g

$$\Rightarrow 26 \text{ g C}_2\text{H}_2 \equiv 28 \text{ g C}_2\text{H}_4$$

$$\Rightarrow 26.04 \text{ Kg C}_2\text{H}_2 \equiv \frac{28}{26} \times 26.04 \text{ Kg C}_2\text{H}_4$$

$$\equiv 28.04 \text{ Kg C}_2\text{H}_4$$



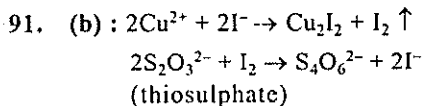
Therefore, amount of polythene obtained is 28.04Kg.

90. (a): According to Charles' and Boyle's Law,

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

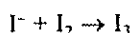
$$\Rightarrow \frac{620 \times 300}{300} = \frac{640 \times V_2}{320}$$

$$\Rightarrow V_2 = 310 \text{ cc}$$

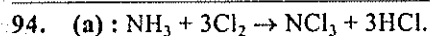


Iodometric titration involves the evolution of iodine immediately before adding thiosulphate solution.

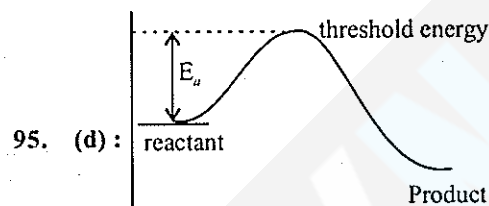
92. (a) :  $\text{I}^-$  ion can act as Lewis base *i.e.* it can donate electron pair to some species *e.g.*  $\text{I}_2$ . The electron donor species are termed as Lewis base.



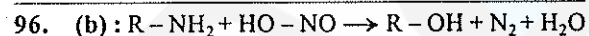
93. (c) : Enthalpy change ( $\Delta H$ ) is a state function so it does not depend on the path taken by the reaction, It depend only on the difference of final and initial values of enthalpy change.



$\text{NCl}_3$  is an explosive material.



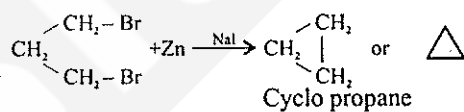
$E_a$  = Activation energy



Nitrous  
acid

97. (a) :  $\text{BaCl}_2(0.5\text{M}) + \text{H}_2\text{SO}_4(1\text{M}) \rightarrow \text{BaSO}_4 \downarrow + 2\text{HCl}$   
 As  $\text{Ba}^{2+}$  ion concentration is only 0.5M, therefore only 0.5M of  $\text{BaSO}_4$  can be precipitated.

98. (c) :  $\alpha, \omega$ -Dihalides when treated with sodium or zinc form cyclo-alkanes. Reaction is called Freund reaction.



99. (d) : Charge = Current  $\times$  time  
 $= 9.95 \times 10 \times 60$   
 $= 5970 \text{ C}$

$\therefore$  5970 C deposits 3 g of metal

$\Rightarrow$  96500 C will deposit  $= \frac{3}{5970} \times 96500 \text{ g metal}$   
 $= 48.49 \text{ g metal}$

Therefore equivalent weight is 48.49 g

100. (d) : Potassium dichromate :  $\text{K}_2\text{Cr}_2\text{O}_7$

Let the Oxidation state of Cr be  $x$

$$\Rightarrow 2 \times (+1) + 2x + 7 \times (-2) = 0$$

$$\Rightarrow x = +6.$$

101. (a) : compressibility factor is defined as :

$$Z = \frac{PV}{(PV)_{ideal}} = \frac{PV}{nRT}$$

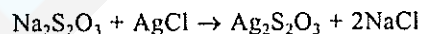
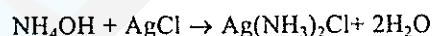
for non ideal gases,  $Z \neq 1$

for ideal gases,  $Z = 1$

102. (b) : Molality is not effected by temperature as molality is not involved with volume (volume changes with temperature).

$$\text{Molality} = \frac{\text{moles of solute}}{\text{Weight of solvent (Kg)}}$$

103. (c) :  $\text{NaNO}_3 + \text{AgCl} \rightarrow \text{AgNO}_3 + \text{NaCl}$



104. (d) : Cl, OH and  $\text{NH}_2$  groups are all o/p directing while COOH group is a strong *m*-directing agent (due to its electron withdrawing effect).

105. (a) : de Broglie proposed the relation :

$$\lambda = \frac{h}{mv}$$

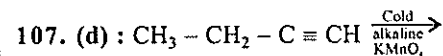
$\lambda$  = wavelength

$mv$  = momentum of particle.

106. (d) : Equilibrium constant

$$\frac{[\text{C}_2\text{H}_6]}{[\text{C}_2\text{H}_4][\text{H}_2]} = \frac{\text{mole.litre}^{-1}}{(\text{mole.litre}^{-1}) \cdot (\text{mole.litre}^{-1})}$$

$$= \frac{1}{\text{mole.litre}^{-1}} = \frac{\text{litre}}{\text{mole}}$$

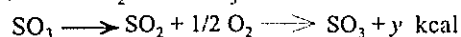
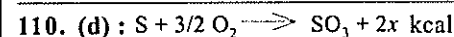


108. (c) : Neon :  $1s^2, 2s^2, 2p^6$

Excited state of Neon can be represented as :

$$1s^2, 2s^2, 2p^5, 3s^1$$

109. (b) : Visible spectrum ranges from 4000Å to 7000Å.

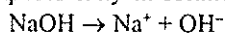


$\therefore$  Heat of formation of  $\text{SO}_2$  in equal to  $2x - y \text{ kcal}$ .

111. (d) : The bond angle of  $\text{PBr}_3$  is lesser than  $\text{PH}_3$ , but the bond angle of  $\text{NBr}_3$  is greater than  $\text{NH}_3$ .

Size of Br is larger than hydrogen.

112. (a) : NaOH is a strong electrolyte and decomposes fully in solution into its ions.



Due to high availability of  $\text{OH}^-$  ions, both strong acids  $\text{HNO}_3$  and  $\text{HCl}$  are neutralised with equal ease. So equal heat of neutralisation for both.

113. (b) : Gibbs free energy ( $\Delta G$ ) is given by :

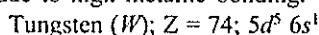
$$\Delta G = \Delta H - T\Delta S$$

In chemical systems, the reaction moves in a direction in which there is decrease in free energy *i.e.*  $\Delta G = -ve$ .

Also, decrease in free energy is a measure of the maximum useful work that can be obtained from a reaction. But the reaction can be exothermic or endothermic *e.g.* water evaporation is endothermic but it is a spontaneous process (*i.e.*  $\Delta G = -ve$ )

114. (b) : Liquid ammonia is used in refrigeration on account of its large heat of evaporation.

115. (c) : Tungsten is a transition element and is very hard due to high metallic bonding.

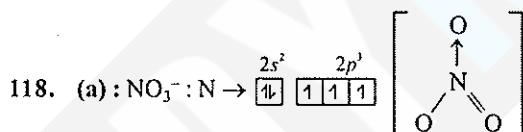


116. (a) : Hydrogen ( $Z = 1$ );  $1s^1$

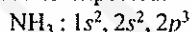
This single electron can be expected to go in higher energy levels and when de-excited it gives out different spectral lines *e.g.* Balmer, Paschen, etc.

117. (d) : Be ( $Z = 4$ );  $1s^2, 2s^2$   
B ( $Z = 5$ );  $1s^2, 2s^2, 2p^1$

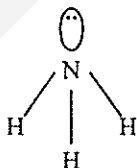
Ionisation potential of Be is greater than that of B as first electron released from Be is from  $s$ -orbital while it is from  $p$ -orbital in B.



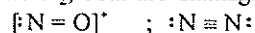
Hybridisation is  $sp^2$  here and therefore planar structure is expected.



Hybridisation is  $sp^3$ , therefore tetrahedral structure is expected but there is pyramidal structure as lone pair of electron occupies one of the corners of tetrahedron.



119. (b) : Due to the absence of unpaired electron in  $\text{NO}^+$  and  $\text{N}_2$ , both are diamagnetic



$$\text{total no. of } e^- \text{ in } \text{NO} = 6 + 8 = 14$$

$$\text{total no. of } e^- \text{ in } \text{N}_2 = 7 + 7 = 14$$

Therefore, both are isoelectronic.

120. (a) : The large sized sulphate anion ( $\text{SO}_4^{2-}$ ) is stabilised better by a large sized cation. So the stability of sulphates down the group, increases. In other words lattice energy is more down the group.

## BIOLOGY

121. (a) : NO is physiologically ubiquitous as a potent vasodilator. It is produced and recycled in the respiratory tract to regulate the air way. NO has much higher affinity for haemoglobin than  $\text{CO}_2$  and  $\text{O}_2$ . It has no direct reaction with  $\text{O}_2$ . Thus it does not impede  $\text{O}_2$  transport.

122. (d) : Eugenics is the study of improvement of human race by controlled selective breeding between individuals with desirable characteristics.

Eugenics is the study of environmental conditions that contribute to the improvement of intellect and other traits in the human genetic engineering. Obstetrics is the science connected with care of women before, during and after childbirth.

123. (a) : As a result of nucleic acid digestion, nitrogenous organic bases-purines (adenine and guanine) and pyrimidines (cytosine, thymine and uracil) are absorbed from intestine into the blood. Most of these are excreted out. In man, purines are changed to uric acid for excretion.

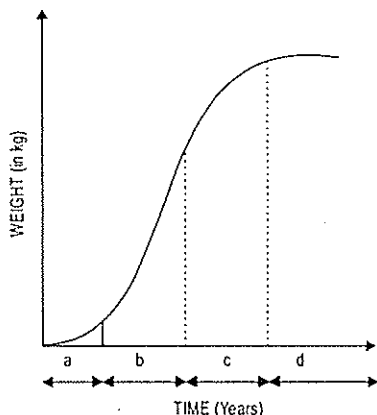
124. (b) : Positron Emission Tomographic Scanning (PET) is computerised imaging technique. It gives quantitative information on the metabolic and physiological process of tissue and organs.

125. (c) : Phenylketonuria and Alkaptonuria both are inborn errors (congenital) of metabolism. Phenylketonuria is due to accumulation of phenylpyruvic acid and causes mental disorders. Alkaptonuria is the lack of ability to breakdown homogentisic acid into acetoacetic acid. Due to accumulation of homogentisic acid, the urine of patients suffering from this disease turns black as soon as it comes in contact with air.

126. (d)

127. (c) Growth curve is the graphic representation of the total growth against time. If total growth (of





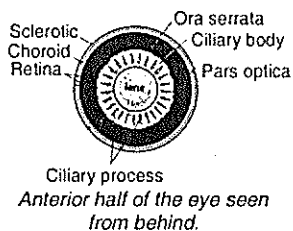
A typical sigmoid growth curve for higher animals including man. (a) Lag phase; (b) log phase; (c) phase of diminishing growth; (d) steady phase.

an organism or population) against time is drawn an S - shaped or sigmoid curve is obtained. It consists of four parts - lag phase, log phase (exponential phase), phase of diminishing growth and stationary phase (steady growth for organs or organisms of indefinite growth). Growth is slow in the lag phase, rapid during log or exponential phase, slow again during the phase of diminishing growth.

128. (d) : Prolactin is a lactogenic hormone produced by the anterior lobe of pituitary gland. It stimulates milk production in cow.

129. (c) Diphtheria is an acute infectious disease caused by *Corynebacterium diphtheriae* and its toxin. It primarily affect the membrane of the nose, throat or larynx and marked by formation of a gray - white pseudomembrane, with fever, pain and in the laryngeal form, aphonia and respiratory obstruction. Tuberculosis is caused by *Mycobacterium tuberculae* and marked by formation of tubercles and causes necrosis in tissue of any organ. Tetanus is an acute, often fatal disease marked by tonic muscular spasm and hyper-reflexia, resulting in lockjaw, generalized muscle spasm, opisthotonus and seizures. It is caused by the neurotoxin. Pertussis is whooping cough.

130. (b) : Ora serrata is a part of third wall of retina of eye. It is composed of neural tissue containing the receptor cells. The posterior part of the retina which ends at the ciliary body along an irregular line is termed as *ora serrata*.



131. (c) : Colour - blindness is a sex linked disease which is linked to X - chromosome. Cretinism is arrested physical and mental development with dystrophy of bones and soft tissues, due to congenital lack of thyroid secretion. Night - blindness is caused by deficiency of vitamin A. Anaemia is caused due to iron deficiency.

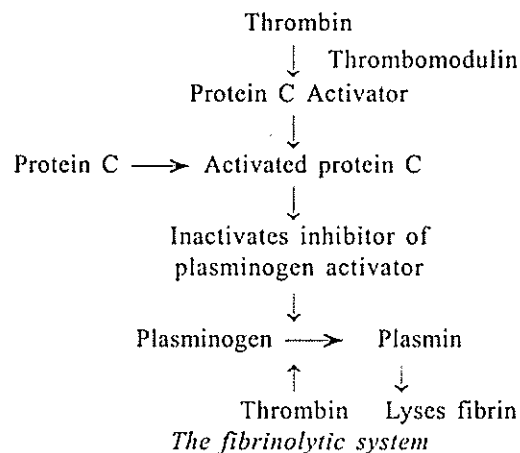
132. (b) : Chloragogen cells (yellow cells) of earthworm are star-shaped, small sized cells storing food. They also help in excretion. Thus it is analogous to liver of higher vertebrates.

133. (c) : Colostrum is maternal milk of mammal formed during the first few days after the birth. It is particularly rich in proteins, including antibodies.

134. (c) Klinefelter's syndrome is characterized by trisomy (XXY). These are male individuals, who are phenotypically fairly normal but have a very low sperm count and, are therefore sterile. As the syndrome has two X chromosomes, one barr body is seen in this case.

135. (d) : The preparation of sperm before penetration of ovum is called capacitation. During this time coating substances of the sperm, especially acrosome is removed and the sperm becomes ready to receive the signal from ovulated egg. After this penetration occurs.

136. (b) : Plasmin is the proteolytic enzyme found in plasma which can digest many proteins through the process of hydrolysis. Plasmin (also known as fibrinolysin) is the active component of fibrinolytic system. This enzyme lyses fibrin and fibrinogen degrading products. Plasmin is formed by its active precursor plasminogen.



137. (b)

138. (b) : Juvenile hormone is secreted by corpora allata, a retrocerebral complex present in insect brain. Chemically it is an unsaponifiable, nonsteroidic lipid. This hormone regulates morphogenesis and so promotes metamorphosis, *i.e.* development of the larva into adult through pupal stage.

139. (b) : Flight feathers of wings of birds are termed as pinions or remiges of quills wing. They are present at the base of quill or flight feathers.

140. (c) : Metamorphosis in frog is regulated by thyroid activity. During metamorphosis changes occur in heart, lung and intestine, but the nervous system remains the same after metamorphosis. It undergoes least changes however, brain acquires its normal shape and size during metamorphosis.

141. (b) : 1.34 ml of oxygen is present in one gram of haemoglobin *i.e.* each gram of haemoglobin can combine maximally with 1.34 ml of O<sub>2</sub>; normally, there are 12–15 gm haemoglobin per dl of blood.

142. (c) : Otoconium are minute particles, composed chiefly of calcium carbonate, found in otolithic membrane on surface of maculae of inner ear.

143. (c) : Any persistent fear of a specific stimulus or object or situation is called phobia. Fear due to pain is called algophobia. Pathophobia is phobia or fear of contracting sexually transmitted disease. Myophobia is a paradigm created from the misuse of fitness language that translates into a fear of muscle. Haematophobia is fear of blood.

144. (c) : Antiserum contains antibodies. The term antiserum is applied to materials prepared in animals. Antiserum is a serum containing antibodies with affinity for a specific antigenic determinant to which they bind. They may result in cross-reactivity within recipient.

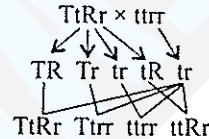
145. (b) : *Psychiatry* is the branch of medicine dealing with the study, treatment and prevention of mental illness. *Neurology* is that branch of medical science which deals with the nervous system, both normal and in disease. *Neuropsychiatry* is the combined specialities of neurology and psychiatry. *Psychology* is the science dealing with the mind and mental processes, especially in relation to human and animal behaviour.

146. (c) : Several theories have been put forward to explain the mechanism of translocation of organic

nutrients through the phloem. The best one is known as mass flow hypothesis which was proposed by Munch.

147. (a) : In cabbage plant, the stem is so short that the great mass of thick overlapping leaves tend to form a head. The older leaves surround the younger smaller, more tender leaves and the cabbage resembles a huge bud. In cauliflower a short erect stem is produced with an undeveloped inflorescence. The whole inflorescence forms a large head of abortive flowers on thick hypertrophied branches. The onion bulb consists of edible fleshy leaf bases. Agave provides "Sisal Hemp".

148. (a) : It is an example of test cross. Test cross is a cross to know whether an individual is homozygous or heterozygous for the dominant character. When double heterozygote (for eg. TtRr) crossed with double recessive (ttrr), the ratio will be 1:1:1:1.



149. (a) : The upper surface of leaf blade or lamina of "Sundew" bears a number (100 - 200) of club-shaped hair or tentacles. Their tips are swollen, glandular and reddish. The glandular heads of the tentacles secrete a thick sticky juice which shines in the sun like dew drops. An insect which happens to touch the head of the tentacle is stuck by its juice. *Aldrovanda* bears whorls of specialised leaves with broad-winged petioles, two lobed winged lamina bearing curved marginal teeth, a number of sensitive trigger hair and colourless digestive glands. The upper surface of each lamina lobe in *Dionaea* contains 3 sensitive spines and a number of red coloured digestive glands.

150 (a) : Unfavourable reiteration of soil by addition or removal of substances and factors which decrease soil productivity, quality of plants and ground water is called soil pollution. It is of two main types : negative and positive. Negative soil pollution includes over use of soil and erosion. Fertile land is also being converted into barren areas by unplanned urbanisation, building of roads, houses or industrial complex. Rubbish, empty cans, garbage, broken furniture, empty bottles, building material, sludge, ash, etc. are all dumped outside the town on vacant lands which not only become barren but also make the nearby lands so.

Positive pollution is a pollution caused by (i) pesticides, herbicides and fumigants (ii) chemical fertilizers and (iii) air pollutants washed down from atmosphere through rain. Excessive use of chemical fertilizers causes soil deterioration through the decrease in natural bacterial population and destruction of crumb structure. The salt content of the soil is also bound to increase with continuous use of fertilizers. Addition of industrial wastes come under positive pollution.

151. (d) : Perisperm is persisting nucellus in the seeds.

152. (b) : Chaparral is a broad - leaved evergreen shrub forest of hard and thick - leaved small trees and shrubs which usually contain resin but are resistant to fires. Both plants and animals are adapted to long droughts. Steppes are grasslands of Eurasia. Temperate deciduous forest has dominant climax vegetation consisting of broad - leaved hardwood trees like Oak, Elm, Maple, Birch, Beech, Hickory, Magnolias, etc. Tropical deciduous forest is dominated by trees, e.g. *Dalbergia*, *Bombax*, *Butea*, *Shorea*, etc.

153. (a) : The primitive atmosphere contained gases like  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{N}$ ,  $\text{H}_2$ , etc. Water vapour and metallic carbides reacted to form the first organic compound, methane ( $\text{CH}_4$ ). It is suggested that simple one celled organisms somewhat similar to today's cyanobacteria (blue green algae) were present on earth about 3600 million years ago. With the addition of oxygen into the atmosphere, methane and ammonia began to disappear as they got oxidised forming  $\text{CO}_2$  and  $\text{N}_2$  respectively. The reaction of oxidation of  $\text{CH}_4$  is.



154. (d) : The genes involved in quantitative inheritance is called polygenic gene or polygenes. Quantitative inheritance is a type of inheritance controlled by one or more genes in which the dominant allele expressing a part or unit of the trait, the full trait being shown only when all the dominant alleles are present. The gene having a multiple phenotypic effect because of its ability to control expression of a number of characters is called pleiotropic gene.

155. (c) : *Gambusia* feeds on the larva of *Anopheles* mosquitoes. *Anopheles* is the carrier of malarial parasite, *Plasmodium*. Thus, *Gambusia*, is used to control *Anopheles* population and hence, malaria.

156. (b) : Plants that utilize primarily RuBP to fix  $\text{CO}_2$  which results in the formation of the three - carbon

compound (3 - PGA), are called  $\text{C}_3$  plants. Hatch and Slack proposed a new pathway of  $\text{CO}_2$  fixation via the carboxylation of Phosphoenol Pyruvate (PEP). Because the products are four carbon compounds (oxaloacetic, malic and aspartic acids), plants exhibiting this pathway are referred as  $\text{C}_4$  plants. Ribulose diphosphate is the first acceptor of  $\text{CO}_2$  in  $\text{C}_3$  plants and phosphoenol pyruvate is the first acceptor of  $\text{CO}_2$  in  $\text{C}_4$  plants. In  $\text{C}_3$  plants fixation of one molecule of  $\text{CO}_2$  uses 3 ATP and 2 NADPH, whereas in  $\text{C}_4$  plants fixation of one molecule of  $\text{CO}_2$  uses 5 ATP and 2 NADPH.

157. (c) : In xerophytic plants, stems are flattened (e.g. *Opuntia*, *Muhlenbeckia*) or cylindrical (e.g. *Euphorbia royleana*, *E. tirucalli*). Green stems of unlimited growth in such plants have taken over the function of photosynthesis. True leaves are caducous. Formation of phylloclades helps the plant to grow in dry habitats because transpiration is little from the stem.

158. (c) : Biosphere or living mantle is the habitable part of earth and its atmosphere which is composed of both biotic and abiotic components. Biosphere has three subdivisions:-

(i) *Lithosphere* - It is the solid or dry crust of the earth that forms the continents and other land masses.

(ii) *Hydrosphere* - It is the liquid mantle of the earth present in oceans, seas, lakes, ponds, rivers, ground etc.

(iii) *Atmosphere* - It is the gaseous mantle that envelops the biosphere and overlies both lithosphere as well as hydrosphere.

159. (a), (d) : The red and blue biliproteins, called phycoerythrins and phycocyanins, respectively, are found in algae. They both are called phycobilins. The phycobilins are active in the transfer of light energy to chlorophyll for utilization in the process of photosynthesis. The phycocyanins and phycoerythrins effectively absorb light over range of wavelengths that cannot be absorbed by chlorophyll. Thus, they prevent chlorophyll from long and direct illumination and also from its photo oxidation.

160. (b) : In the sporophyte of *Dryopteris*, the sporangia are usually grouped together in sori. In sporangia each spore mother cell finally undergoes the reduction division (meiosis) to form four haploid

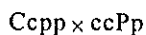
spores. Spores under favourable conditions germinate to gametophyte (prothallus). Prothallus is haploid.

161. (b) : When fossil fuels are burnt, S and N are oxidized and there is a build - up in the atmospheric CO<sub>2</sub> and the oxides of S and N, which lead to acid - base interaction. The acidity of the rain water is mainly caused by H<sub>2</sub>SO<sub>4</sub> and NHO<sub>3</sub>.

162. (b) : Autoradiography is the study of fate of labelled precursors and intermediate metabolites by knowing the movement of radioactivity with the help of photographic films and emulsions at short intervals. Tritiated hydrogen (<sup>3</sup>H) and carbon - labelled (<sup>14</sup>C) compounds of thymidine, uridine and amino acids are used to study synthesis of DNA, RNA and proteins respectively. Cellular fractionation is rupturing cells, separation and suspension of cell constituents. Phase contrast microscope is useful in observing components of living cells and their processes. Tissue culture is a technique of growing cells, tissue and other structures on artificial medium under controlled aseptic conditions inside special containers.

163. (c) : The common wheat is hexaploid with  $2n = 42$  and is derived from three diploid species : (i) AA = *Triticum aegilopoides* ( $2n = 14$ ), (ii) BB = *Aegilops spelloides* ( $2n = 14$ ), (iii) DD = *Aegilops squarrosa*. The hexaploid wheat therefore, is designated as AABBDD, the tetraploid ( $2n = 28$ ) as AABB and diploid ( $2n = 14$ ) as DD.

164. (a) : It is as dihybrid cross.



The genotype of colourless flowers will be ccpp.

We know that  $CcPp \times ccPp$

Male gametes are Cpcp

Female gametes are cPcp

Hence, ratio =

1(colour) : 3 (white)

i.e. 25% coloured flower.

	Cp	cp
cP	CcPp colour	cPcp white
cp	Cpcp white	cpcp white

165. (b)

166. (b) : A species may include sexually as well as apomictically (asexually) reproducing individuals. Fragmentation is vegetative means of reproduction in lower plants. Self - fertilization is the case in which fusion occurs between male and female gametes from same individual.

167. (d) : After M - phase (mitotic phase) a cell may either enter interphase or G<sub>0</sub> phase. G<sub>0</sub> phase is the

stage when cell cycle is arrested. Therefore, further divisions stop.

168. (b) : The gene which inhibits or suppresses the expression of a nonallelic gene is known as epistatic gene. Epistasis reduces the number of phenotypes appearing in the F<sub>2</sub> generation of dihybrid cross. Thus instead of normal 9:3:3:1 dihybrid ratio, epistasis may result in a ratio of 9:3:4 (recessive epistasis), 12:3:1 (dominant epistasis), 13:3 (dominant recessive epistasis) or 9:7 (double recessive epistasis) etc.

169. (d) : All characters of options (a, b and c) are similar to family solanaceae. Gynoecium of Solanaceae is obliquely placed. Ovary becomes 2 - celled or sometimes 4 - celled owing to the development of a false septum. Ovary is superior.

170. (c) : Phytoalexins are non - specific fungitoxic substances, generally phenolic in nature, synthesized *de novo* or in greatly increased concentration by plants in response to infection by fungi. Phytotron is building in which plants can be grown on a large scale in a range of rigidly controlled conditions of light, temperature of air and soil, humidity and composition of air, water and nutrient content of soil etc. Phytotoxins are toxic substances produced by plants, e.g. Azadirachtin, Rotenones, Aflatoxin, etc. Phytol is a hydrocarbon.

171. (d) : Absorbed alcohol is carried directly to the liver, where it becomes the preferred fuel. Use of moderate amounts of alcohol does not cause liver damage, provided adequate nutrition is maintained. The liver becomes enlarged, yellow, greasy and firm. Hepatocytes are distended by large fat globules which push the hepatocyte nucleus against the cell membrane. Accumulation of fat in the liver of the alcoholic person results from the combination of impaired fatty acid oxidation, increased uptake and esterification of fatty acids to form triglycerides (fats) and diminished lipoprotein biosynthesis and secretion, it means there is increase in the fat synthesis in the liver.

172. (d) : Ovaries secrete steroid hormones or female sex hormones like estrogen and progesterone which are mainly responsible for the controlling of total menstrual cycle. Ovariectomy means total removal of ovary from the body. Thus no hormones would be secreted from ovary and menstrual cycle may be stopped.

173. (b) : Cold blooded animals have no fat layer. The skin of cold-blooded animal is devoid of any fat

layer because temperature regulation-the important function of fat layer, is not necessary here. But fat bodies are present in front of each testis. They are reserves of nourishment and cold-blooded animals may use them in hibernation.

174. (b) : In morula stage, the cells divide without any increase in size and becomes a solid mass of cells. Zona pellucida remains undivided till cleavage is complete. After damage it breaks down and morula formation starts.

175. (a) : The ascending limb of Henle's loop is impermeable to water so no water is reabsorbed with solutes (it is known as diluting segment). Due to which nephric filtrate become hypotonic in ascending limb. On the other side, descending limb is not permeable to  $\text{Na}^+$  and other solutes. But it is very permeable to water, making more water absorption from the solution, thus, the filtrate becomes hypertonic to plasma.

176. (b) : There are no stomata in the epidermal layer of the leaves of submerged water plant. If at all present, they are nonfunctional. The leaf epidermis either lacks cuticle or it is feebly developed, thus permitting easy absorption of salts dissolved in water and gaseous exchange. Similarly the thin cuticle and epidermis of submerged organs presumably allow free passage of dissolved organs and  $\text{CO}_2$ , there is evidence that all epidermal cells are not equally permeable to dissolved salts.

177. (a) : Cutinization involves the transformation of cellulose or pectic substances of the primary or secondary wall into cutin, which forms a continuous layer, called the cuticle. It generally forms the skin or outermost covering of the stem, leaves and some fruits. It is impermeable to water and pathogens.

178. (b) : There are three codons UAA, UAG and UGA which are designated as termination codons. UAA (also known as ochre), UAG (also known as amber) and UGA (also known as opal) are three codons which whenever present in mRNA, would bring about termination of polypeptide chain which would then be released from ribosome. *m*-RNA has a "termination codon" region which consists of UAA, UAG or UGA.

179. (d) : Plasmids are small, circular, double-stranded, self-replicating additional or extra chromosomal DNA elements which are commonly found in bacteria (prokaryote).

180. (d) The plants where the usual sexual reproduction has been completely replaced by a type of asexual reproduction are called apomictic, and

phenomenon is apomixis. Apomixis offers the possibility of indefinite multiplication of specially favourable biotypes without any variation due to segregation or recombination.

### GENERAL KNOWLEDGE

181. (b)

182. (b) : There are seven tombs built by Quatab Shahi near the Golkunda fort, which are situated in Hyderabad.

183. (c)

184. (a) : Hippocrates (460-370 B.C) was a Greek-physician, dedicated to the cause of medical science. He is known as the father of medicine. Rules of conduct for doctors are based on Hippocratic Oath.

185. (a)

186. (d) : Comets are the long tails stars. Halley's comet is the most famous comet which is seen after every 76 years. Last time, it was seen in 1986. Therefore it will be seen next in 2062.

187. (b)

188. (a) : Deep-Blue is a computerized chess system having very high speed and very large memory. Recently this system defeated the world champion of chess.

189. (a)

190. (d) : As Dachigam Sanctuary in Kashmir is popular for hangul or Kashmir stag.

191. (b)

192. (a) : Saeed Anwar, a left handed opening batsman of Pakistan, who scored 194 runs against India in Chennai in May 1997. He has the highest score in a one day cricket match.

193. (c)

194. (d) : Olympic Games were not played in the years 1916, 1940 and 1944 due to world-war.

195. (a)

196. (b) : The first and the ninth Asian Games were held in March 1951 (New Delhi) and in 1982 (New Delhi) respectively.

197. (c)

198. (d) : The Principality of Liechtenstein is situated between Switzerland and Austria.

199. (d)

200. (d) : 'Future Shock' is a science fiction which was written by Alwyn Toffler.

