

SOLUTIONS

PHYSICS

1. (c) : As the interior of the sun is at a very high temperature (of the order of 8000 K), nuclear fusion is the highly possible reaction taking place inside the sun to produce energy.

2. (d) : Suppose S_1 and S_2 are the slits at a distance d from each other. Distance of screen be D . Let P be a point where there is a bright fringe. A glass plate is placed in the path of the ray from S_1 to P . We know that the path difference between the rays

$$\text{in absence of glass plate is } \Delta x = S_2P - S_1P = \frac{dy}{D}$$

In presence of the glass plate, the optical path length of the ray from S_1 to P will be different. The total optical path length for this ray is given by

$$S_1P - t + \mu t \\ = S_1P + (\mu - 1)t$$

Where μ is the refractive index of the glass plate and t is its thickness.

Hence the new path difference is given by

$$\Delta x' = S_2P - [S_1P + (\mu - 1)t] \\ = \Delta x - (\mu - 1)t$$

$$= \frac{dy}{D} - (\mu - 1)t$$

For a bright fringe, $\Delta x' = n\lambda$

and $y = y_n =$ distance of the bright fringe from the central fringe

$$\therefore \frac{dy_n}{D} - (\mu - 1)t = n\lambda$$

$$\Rightarrow y_n = \frac{D}{d} [(\mu - 1)t + n\lambda]$$

$$\therefore y_{n+1} - y_n = \omega = \frac{D\lambda}{d}$$

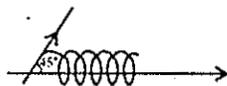
Hence the fringe width remains constant.

3. (d) : When a charged particle enters a magnetic field, the particle experiences a Lorentz force given

by $\vec{F} = q(\vec{v} \times \vec{B})$, which act in

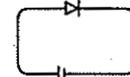
a direction perpendicular to both \vec{v} and \vec{B} . Now since the initial velocity of the particle

makes an angle 45° with the magnetic field, it will be having a velocity component parallel to \vec{B} and another



component perpendicular to \vec{B} . The parallel component of velocity is going to experience no force, so it will remain the same but as the perpendicular component will experience a constant force in the normal plane, hence the particle will finally move in a helical path.

4. (a) : Diode is a device which allows to pass a current only when it is forward biased. That's why if



we use one alternating voltage (Forward bias of diode) source instead of a battery, during the negative cycles the diode will be reverse biased and will not allow the current to flow. Hence it can be used as a rectifier.

5. (d) : N-type semiconductors are those formed by doping the intrinsic semiconductor with an element which has got more outer most shell electrons than the parent intrinsic semiconductor. When this sort of an element is used for doping, we get more free electrons in the semiconductor and so the majority charge carriers is electrons.

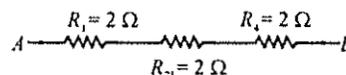
6. (b) 7. (c)

8. (c) : The stationary or standing wave is a superposition of two waves of equal amplitude and frequency moving in opposite direction to each other and so there is no movement of the particles of the medium. That's why there is no transfer of energy in the case of standing waves.

9. (b) : A choke will has got high inductance and low resistance. Since an inductor is a non-resistive device, it does not consume any power in the form of heat like a resistance. That's why we use a low resistance and a high inductance in a choke to save power.

10. (b) : Since the resistances R_2 and R_3 are in parallel, their equivalent resistance will be $R_{23} = \frac{4 \times 4}{2 \times 4} = 2 \Omega$

Now the equivalent circuit will be



There are three resistances in series. Therefore the equivalent resistance will be $R_{AB} = 2 + 2 + 2 = 6 \Omega$.

11. (d)

12. (a) : To reduce the plate current to zero V_p should be reduced to zero. Hence for $I_p = 0$.

$$\Delta V_p = 0 - 300 \\ = -300 \text{ V}$$

We know that amplification factor,

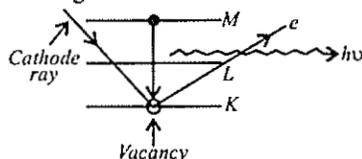
$$\mu = \left(\frac{\Delta V_p}{\Delta V_G} \right)_{\Delta I_p = \text{constant}}$$

$$\therefore \Delta V_G = \frac{\Delta V_p}{\mu} \\ = \frac{-300}{20} \\ = -15$$

 \therefore Required Grid voltage is -15 V .

13. (d)

14. (c) : When fast cathode rays strike a metal surface with high melting point, the cathode rays might transfer its K.E. to an electron in an inner shell, which eventually might come out of the metal surface. Due to the vacancy created in an inner orbit, some outer orbit electron might jump down to fill up the gap thereby emitting some electromagnetic radiation known as x-rays.

15. (c) : We know that the radius of the n^{th} orbit of a hydrogen like atom/ion is given by

$$r_n = n^2 a_0 \text{ where}$$

 $a_0 = \text{Bohr radius} = \text{radius of the ground state of the hydrogen atom}$

$$\therefore r_n \propto n^2$$

16. (d)

17. (d) : We know that

$$1 \text{ e} = 1.6 \times 10^{-19} \text{ C}$$

$$\Rightarrow 1 \text{ C} = \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18} \text{ electrons}$$

18. (c) : We know that the critical angle for water and glass are given by,

$$\sin C_w = \frac{1}{\mu_w} \Rightarrow C_w = \sin^{-1} \left(\frac{1}{\mu_w} \right)$$

$$\sin C_g = \frac{1}{\mu_g} \Rightarrow C_g = \sin^{-1} \left(\frac{1}{\mu_g} \right)$$

$$\text{since } \mu_w < \mu_g$$

$$\Rightarrow \frac{1}{\mu_w} > \frac{1}{\mu_g}$$

$$\Rightarrow \sin^{-1} \left(\frac{1}{\mu_w} \right) > \sin^{-1} \left(\frac{1}{\mu_g} \right)$$

$$\therefore C_w > C_g$$

19. (a) 20. (c) 21. (b)

22. (b) : If A is the area of the coil, there are N turns in the coil, ω being the angular velocity of the armature, then the flux through each turn in time t is given by

$$\phi = BA \cos \omega t$$

Using Faraday's Law, the emf induced in each turn of the coil is

$$-\frac{d\phi}{dt} = BA\omega \sin \omega t$$

The total induced emf in the coil

$$\varepsilon = NBA\omega \sin \omega t$$

Now if we double ω , ε will be doubled.23. (b) : In a step-down transformer, the voltage in the secondary is less than the voltage in the primary circuit. That is $\varepsilon_2 < \varepsilon_1$. Since we know for an ideal transformer

$$\varepsilon_2 i_2 = \varepsilon_1 i_1$$

$$\Rightarrow i_2 = \frac{\varepsilon_1}{\varepsilon_2} i_1$$

$$\Rightarrow i_2 > i_1$$

 \therefore The current in the secondary increases.24. (a) : The idea behind a transformer is to supply the power generated by a power plant to the users without much loss of energy. Since the power plants are normally situated far away from the users, it needs to carry the power for several hundred kilometers through transmission lines. But in so doing, a lot of energy is wasted in the form of joule heating $i^2 R t$. So in this situation we use a transformer to step-up the voltage, so that the current decreases, thereby decreasing the joule heating also. And finally we use a step-down transformer to reduce the voltage and increase the current, so that the power transferred remains the same.

25. (b) : Since both the block of metal and the block of wood feel equally cold or hot, their temperatures must be equal to the temperature of the body. Otherwise there will be heat flow between the body and either of the blocks. And as the thermal conductivity of the metal is more than that of the wood, it would either

feel more hot or more cold than that the block of wood.

26. (d) : Interference is a characteristic of all wave motion, any sort of wave can show interference phenomenon.

27. (a) : On a clear atmosphere, the scattering centres are mainly the air molecules whose dimension is of the order of the wavelength of light. We know that amount of scattering is proportional to $\frac{1}{\lambda^4}$. Hence red light is the least scattered and more scattering occurs towards the blue end of the spectrum. And on a clear day, as light (blue end) is scattered uniformly, the sky appears blue.

28. (a) : Given :

- Number of turns in the primary $N_1 = 500$
- Number of turns in the secondary $N_2 = 5000$
- Input voltage $V_1 = 20V$
- Output voltage $V_2 = ?$

We know that

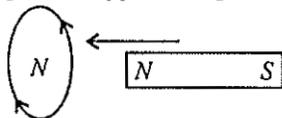
$$|V_2| = \frac{N_2}{N_1} V_1$$

$$= \frac{5000}{500} \times 20 = 200 \text{ V}$$

As in a transformer the output frequency of the ac supply remains the same as that of the input supply, the frequency of the output current will be 50 Hz.

29. (b)

30. (c) : When the north pole of a magnet is brought near a metallic ring, the induced current produced in the ring will be such that it opposes the growth of current in the ring. That's why by Lenz's law, there must be a magnetic north pole created in the ring so that it can repel the approaching north pole.



Now the direction of the current will be clockwise if we view it from behind the ring and it will be anticlockwise if we view it from above.

31. (a) : We know that the frequency of a mechanical wave created in a string is given by

$$v = \frac{1}{2\pi} \sqrt{\frac{T}{m}}$$

∴ To double the vibrations, tension T has to be raised by a factor of 4.

32. (a) : We know that the K.E of one mole of a gas molecules at a temperature T is given by $K = \frac{3}{2} KT$

Now, $T_1 = 27^\circ\text{C} = 300 \text{ K}$

$K_1 = 6.21 \times 10^{-21} \text{ J}$

$T_2 = 227^\circ\text{C} = 500 \text{ K}$

$K_2 = ?$

We have, $\frac{K_1}{K_2} = \frac{T_1}{T_2} \Rightarrow K_2 = \frac{T_2}{T_1} \times K_1 = \frac{500}{300} \times 6.21 \times 10^{-21}$
 $= 10.35 \times 10^{-21} \text{ J}$

33. (d) : Adiabatic processes are those in which there is no transfer of energy between the system and the surrounding. Therefore the total heat of the system remains conserved in an adiabatic process.

34. (d) : We know that while a cyclist moving with a speed v takes a sharp turn on a circular track of radius r , the coefficient of friction is given by

$$\mu = \tan\theta = \frac{v^2}{rg}$$

Here $v = 4.9 \text{ m/s}$

$r = 4 \text{ m}$

and $g = 9.8 \text{ m/s}^2$

∴ $\mu = \frac{4.9 \times 4.9}{4 \times 9.8} = 0.61$

35. (c) : The angular velocity $\omega = 3.5 \text{ rad/sec}$
 maximum acceleration $a_{\text{max}} = 7.5 \text{ m/s}^2$

We know for a SHM, the displacement

$x = A \sin\omega t$

∴ $v = \frac{dx}{dt} = A\omega \cos\omega t$

∴ $a = \frac{dv}{dt} = -A\omega^2 \sin\omega t$

∴ Maximum acceleration

$|a_{\text{max}}| = A\omega^2$

Now $A\omega^2 = 7.5$

⇒ $A = \frac{7.5}{\omega^2}$
 $= \frac{7.5}{(3.5)^2} = 0.6$

∴ Amplitude = 0.6

36. (c) :

Here $m_1 = m$

$m_2 = 2m$

$v_1 = v$

$v_2 = 0$

Let the speed of the system after collision = v
 Using the principle of conservation of linear momentum

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v'$$

$$\Rightarrow v' = \frac{mv + 2m \times 0}{m + 2m} = \frac{mv}{3m} = \frac{v}{3}$$

37. (b)

38. (d) : Let the initial velocity of the body = u And final velocity at the initial point be v . Now the potential energy of the body at the point of projection is the same in both the upward and the downward journey. Since the total energy of the system has to be conserved, the kinetic energies at that point must also be the same in both the journeys

$$\therefore \frac{1}{2} m v^2 = \frac{1}{2} m u^2 \Rightarrow v = u$$

39. (d) : $\vec{P}\vec{Q} = PQ$
 $\Rightarrow PQ \cos\theta = PQ$
 $\Rightarrow \cos\theta = 1$
 $\Rightarrow \theta = 0^\circ$

40. (b)

41. (d) : Torque is defined as

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$\therefore \text{Dimensions of torque } [\tau] = [r] \times [F]$$

$$= [L] \times [MLT^{-2}]$$

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

Similarly for work and energy the dimensions are same as that of torque i.e. $[ML^2T^{-2}]$

Now for viscosity, we know that

$$F = 6\pi\eta r v$$

$$\Rightarrow \eta = \frac{F}{6\pi r v}$$

$$\therefore [\eta] = \frac{[F]}{[r][v]} = \frac{[MLT^{-2}]}{[L][LT^{-1}]}$$

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

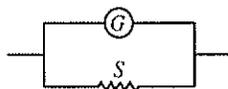
\therefore The given dimensions are related to the coefficient of viscosity.

42. (d) : The resistance of the galvanometer $G = 50 \Omega$ The current required for a full scale deflection $I_{FS} = 100 \mu A$

$$\therefore \text{The voltage applied across the galvanometer}$$

$$E = 50 \times 100 \times 10^{-6}$$

$$= 5 \times 10^{-3} V = 5 \text{ mV}$$



Now to convert this galvanometer into an ammeter we need to put a shunt S in parallel with the galvanometer. The total resistance will be determined

by the maximum current read by the ammeter which is 10 A

$$\therefore R = \frac{E}{I} = \frac{5 \times 10^{-3}}{10} = 5 \times 10^{-4} \Omega$$

We can find S from the relation

$$\frac{1}{R} = \frac{1}{S} + \frac{1}{G}$$

$$\Rightarrow \frac{1}{S} = \frac{1}{R} - \frac{1}{G} = \frac{1}{5 \times 10^{-4}} - \frac{1}{50}$$

$$= \frac{10^5}{50} - \frac{1}{50} \approx \frac{10^5}{50}$$

$$\therefore S = \frac{50}{10^5} = 5 \times 10^{-4} \Omega$$

43. (d) : As the platform is executing SHM, its time period will be minimum when it has the maximum acceleration. We know that in SHM, the maximum acceleration is given by

$$a_{\max} = \omega^2 A$$

Now if the body is not to be detached from the platform, a_{\max} should be less than the acceleration due to gravity.

In the limiting case,

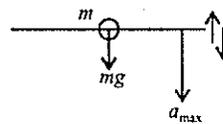
$$a_{\max} = g$$

$$\Rightarrow \omega^2 A = g$$

$$\Rightarrow \frac{4\pi^2 A}{T^2} = g$$

$$\Rightarrow T = 2\pi \sqrt{\frac{A}{g}} = 2\pi \times \sqrt{\frac{3.92 \times 10^{-4}}{9.8}}$$

$$\therefore T_{\min} = 0.1256 \text{ sec.}$$



44. (d)

45. (d) : The restoring force in a SHM is given by

$$F = -Kx \Rightarrow \text{if } x \text{ is maximum } F \text{ is also maximum.}$$

Hence the restoring force is maximum at the extreme positions. In SHM the total energy of the particle always remains constant and the restoring force as the name suggests, always acts towards a fixed point.

We know that the displacement of a particle in SHM is given by $y = A \sin \omega t$

$$\Rightarrow v = \frac{dy}{dt} = A\omega \cos \omega t$$

$$\therefore a = \frac{dv}{dt} = -A\omega^2 \sin \omega t$$

$$\therefore \frac{a^2}{A^2 \omega^4} + \frac{v^2}{A^2 \omega^2} = 1 \Rightarrow a^2 = \omega^2 [A^2 \omega^2 - v^2]$$

From this expression, it is clear that if v is maximum a is minimum and if v is minimum, a is maximum. As in the equilibrium position, the velocity is maximum,

the acceleration is going to be minimum. Hence expression (d) is incorrect.

46. (d) : We know that the minimum length of the air column in a resonance tube corresponds to the fundamental mode of vibrations. Hence by ignoring end correction,

$$l = \frac{\lambda}{4}$$

$$\Rightarrow \lambda = 4l = 4 \times 20 = 80 \text{ cm} = 0.8 \text{ m}$$

$$\text{Resonant frequency } \nu = 450 \text{ Hz}$$

$$\therefore \text{Speed of sound } v = \nu \lambda = 450 \times 0.8 = 360 \text{ m/s}$$

47. (b) : We know that the work done is product of the force and the displacement caused by the force on the body along the direction of the force. But here as the weight of the body is not causing any displacement, work done is zero.

48. (d)

49. (c) : The moment of inertia of a disc of radius R about an axis perpendicular to the disc and passing through the centre is given by

$$I = \frac{1}{2} MR^2$$

$$= \frac{1}{2} \times 0.4 \times 1^2 = 0.2 \text{ Kg m}^2$$

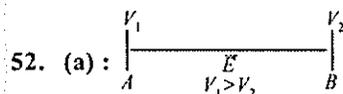
50. (c) : The escape velocity of a body projected from the earth's surface is independent of the angle of projection. Hence the escape velocity of the body projected at an angle 50° will also be 11.2 km/s

51. (b) : Let us consider two spherical shells of radii r_1 and r_2 which are possessing the same positive charge Q . Therefore the potential on the surface of each conductor will be

$$V_1 = \frac{KQ}{r_1}$$

$$V_2 = \frac{KQ}{r_2}$$

Since $r_1 \neq r_2$, $V_1 \neq V_2$ and consequently there will be a potential difference between the two conductors.



Suppose A and B are two regions having potentials V_1 and V_2 such that $V_1 > V_2$. So the electric field will be set up from A to B (i.e. from higher potential to lower potential). Now since the electron has got a negative charge, the force experienced by the electron

will be in a direction opposite to the direction of the electric field. Hence the electrons move from a region of lower potential to a region of higher potential due to their negative charges.

53. (c) : At as high a temperature as 6000 K , the sun acts like a perfect blackbody emitting complete radiation. That's why the radiation coming from the sun's surface follows Stefan's law which states that the energy radiated per unit area per unit time varies as the fourth power of absolute temperature, i.e.

$$E = \sigma T^4$$

54. (b) : The second postulate of special theory of relativity states that no material particle can cross the speed of light in vacuum. Cerenkov radiation occurs when some particles move through a transparent medium such as water with a speed more than the speed of light in the medium. So the existence of Cerenkov radiation tells us that the speed of light in a transparent medium can be crossed by a material particle in some circumstances. But this does not violate the second postulate of special theory of relativity as it deals with the speed in vacuum.

55. (c) : Einstein's photoelectric equation states that

$$h\nu = h\nu_0 + KE_{\max}$$

$$\Rightarrow KE_{\max} = h\nu - h\nu_0 = h\nu - W$$

Where $W = h\nu_0 =$ work function of the material

Therefore we see that the maximum kinetic energy of the emitted photoelectrons depends directly on the frequency of the incident radiations. It does not depend upon the intensity of the light used.

56. (b) : The atmospheric pressure is due to the force exerted by the atmosphere on the region below it. But a hydrogen filled balloon rises up in the atmosphere due to density difference only. As the density of hydrogen gas is less than that of air, the hydrogen filled balloon rises up in the air. But as we know that density of air also keeps on decreasing as we move up, so there will be a point up in the atmosphere where the rising balloon will find that its density is same as that of the surrounding atmosphere. As there is no density difference between the balloon and the atmosphere, the balloon will stop rising.

57. (c) : Induced current (emf) in a coil is directly proportional to the rate of change of magnetic flux linked with the coil. If there is no change in the flux, there is no induced current also.

58. (d) : We know that the Rydberg constant is given

by $R = \frac{13.6\text{eV}}{hc}$, which is independent of the mass number of an element.

The electron does not have a reduced mass. It is defined only for a system of masses.

59. (a) : On a rainy day, due to wetness of the surface, the coefficient of friction becomes lowered which might very easily lead to skidding of a bus or car. That's why it is difficult to run a bus or a car with high speed on a rainy day.

60. (c) : Isotopes have same number of electrons and protons but different neutron number. That's why the mass number of isotopes are different and can be separated by using a mass spectrometer.

CHEMISTRY

61. (c) : $C_{\text{excited state}} = 2s^1 2p_x^1 p_y^1 p_z^1$
 $O_{\text{ground state}} = 2s^2 2p_x^2 p_y^1 p_z^1$

In the formation of CO_2 molecule, hybridization of orbitals of carbon occurs only to a limited extent involving only one s and one p orbital and gives rise to sp hybridization.

62. (d) : According to Charles' law,

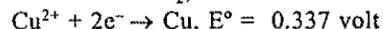
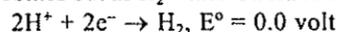
$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

\Rightarrow putting the given values :

$$\frac{300 \text{ ml}}{300 \text{ K}} = \frac{V_2}{280} \Rightarrow V_2 = 280 \text{ ml}$$

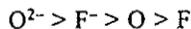
63. (b) : Ammonium sulphate and sodium sulphate readily hydrolysed in water. Calcium sulphate is sparingly soluble.

64. (a) : As Cu is below hydrogen in the Electrochemical series. Hydrogen is oxidised at anode and comes out as H_2 while Cu is reduced at the cathode.

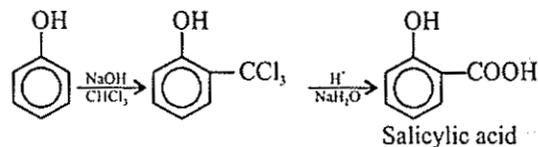
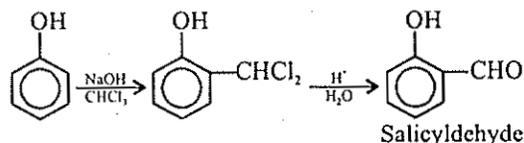


65. (d) : We know that anion is always larger than the corresponding atom therefore $\text{F}^- > \text{F}$ and $\text{O}^{2-} > \text{O}$.

Also, in a period, size of the atom decreases from left to right due to greater force of attraction exerted correct order is :



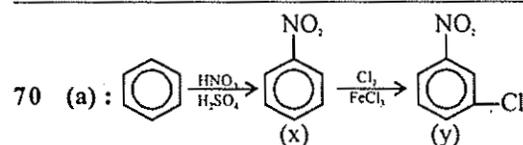
66. (d) : The given reaction is Reimer-Tiemann reaction.



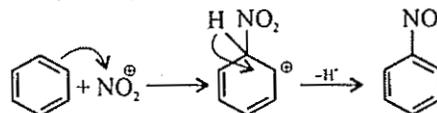
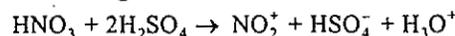
67. (c) : Alkali metals have lower ionisation potential than alkaline earth metals due to the extra nuclear charge in alkaline earth metals (which pulls e^- inwards). Also, Mg has got lower ionisation potential than Be as electron to be removed from Mg is present in one shell outwards than in Be.

68. (d) : A system is said to be in colloidal state if particles of one or more components have the size range 10^{-6} to 10^{-9} m. In other words, the colloidal solution is a heterogeneous dispersion of solute particles of size ranging between 10^{-6} to 10^{-9} m into a solvent. Particles are visible only with an ultramicroscope.

69. (a) : In the alkaline earth metal group the lower metals have high heat of hydration than the larger ones due to the fact heat of hydration is higher for small sized highly charged cations. So solubility of sulphate of these metals decrease down the group.

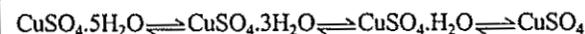


($\text{HNO}_3 + \text{H}_2\text{SO}_4$) reagent is the agent for nitration in aromatic rings.



NO_2 group is a meta directing group so chlorine atom goes to meta position of the ring.

71. (d) :



Blue Pale blue Bluish white White

So interaction of water in a liquid with copper sulphate will produce blue colour so water can be detected.

72. (b) : Isotones are the nucleus that have same number of neutrons in them.

$${}_{16}\text{S}^{32} : \text{number of neutrons} = 32 - 16 = 16$$

$${}_{15}\text{P}^{31} : \text{number of neutrons} = 31 - 15 = 16$$

73. (a) : He is a noble gas. Weak van der waal's forces operate between the gaseous molecules of Helium. In NH_3 , H_2O and HCl , there is strong Hydrogen bonding between the molecules.

74. (a) : Potassium and Sodium are metals so have mobile electrons. In graphite, each of the C-atom is covalently bonded to three other C-atoms so one valence electron is available for electrical and thermal conduction there is no mobile electron present in diamond as each C-atom is bonded to four other C-atoms by covalent bond.

75. (c) : Mn shows highest oxidation state of +7. i.e. KMnO_4

Mn ($Z = 25$) : $4s^1 3d^5$ (ground state)

Mn (excited) : $1 1 1 1 1 1 1$

76. (d) : The given reaction is :



Molecular mass of H_3PO_4 is 98. As there is only one electron change involved therefore, equivalent weight of H_3PO_4 in this reaction is, $\frac{98}{1} = 98$

77. (d) : Vinegar is 6-10% aqueous solution of acetic acid. It is obtained by fermentation of liquors containing ethyl alcohol.

78. (d) : Colligative properties are those properties that depend only on the number of particles (ions, atoms, molecules) present in the solution e.g. elevation in boiling point, depression in freezing point, osmotic pressure etc.

79. (b) : As $Q = It$

$$\Rightarrow \text{Total charge carried} = 2 \times 30 \times 60 = 3600 \text{ C}$$

Now,

$$\begin{aligned} 96500 \text{ C of charge deposits } 35.5 \text{ g chlorine} \\ \Rightarrow 3600 \text{ C of charge will deposit} \\ = \frac{35.5}{96500} \times 3600 \\ = 1.32 \text{ g} \end{aligned}$$

80. (c) : Moles of oxygen, $n_{\text{O}_2} = \frac{4}{32} = 0.125 \text{ mol}$

$$\text{Moes of Hydrogen, } n_{\text{H}_2} = \frac{2}{2} = 1.00 \text{ mol}$$

Temperature = 273 K, volume = 1 Litre

$$\Rightarrow \text{Total pressure} = \frac{(n_{\text{O}_2} + n_{\text{H}_2}) \times RT}{V}$$

$$\begin{aligned} &= \frac{1.125 \times 0.0821 \times 273}{1} \\ &= 25.215 \text{ atm.} \end{aligned}$$

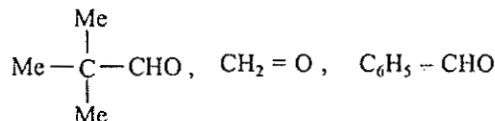
81. (b) : We know that

$$\begin{aligned} \text{specific conductance} &= \text{cell constant} \times \text{conductance} \\ \Rightarrow \text{Cell constant} &= \text{Resistance} \times \text{specific conductance} \\ &= 0.0212 \times 55 \\ &= 1.166 \text{ cm}^{-1} \end{aligned}$$

82. (a) : Isotopes are nuclei that have same atomic number but different atomic mass.

$$\begin{aligned} \therefore \text{Atomic number of the isotope} &= 12 \\ \Rightarrow \text{Number of electrons and protons} &= 12 \\ \text{Number of neutrons} &= \text{At. mass} - \text{Atomic no.} \\ &= 26 - 12 = 14 \end{aligned}$$

83. (c) : Cannizaro reaction is given by those aldehydes and ketones which do not contain any α -hydrogens



No α -hydrogen atom is present.

84. (d) : For first order reaction,
rate = rate constant \times concentration of reactant
 \therefore Initial rate = rate constant \times Initial concentration
 $= 3 \times 10^{-6} \times 0.10 = 3 \times 10^{-7} \text{ M s}^{-1}$

85. (a) : On heating Ammonium nitrate,
 $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + 2\text{H}_2\text{O}$
Nitrous oxide is evolved.

86. (a) : Average life = half life \times 1.44
 $= 1580 \times 1.44$
 $= 2275.2$
 $= 2.275 \times 10^3 \text{ years.}$

87. (d) : Empirical formula of compound is CH_2O
Empirical mass = 12 + 2 + 16 = 30
Molecular weight of compound = 180
As, $n = \frac{\text{molecular mass}}{\text{empirical mass}} = \frac{180}{30} = 6$
Therefore, Molecular formula of compound is $(\text{CH}_2\text{O})_6 = \text{C}_6\text{H}_{12}\text{O}_6$

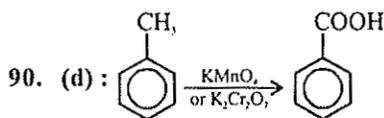
88. (b) : Principle quantum number (n) represents the name, size and energy of the shell of the electron.
 $n = 1, 2, 3, 4 \dots\dots$

Azimuthal quantum number (l) describes the spatial distribution of electron cloud and angular momentum.

Magnetic quantum number (m) describes the possible orientations of orbitals.

89. (a) : Molecular formula for monosaccharide (e.g. glucose, fructose) is given by : $C_6H_{12}O_6$. Therefore, molecular formula for the disaccharides is $C_{12}H_{22}O_{11}$.

As $2C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$



Both $KMnO_4$ and $K_2Cr_2O_7$ are strong oxidising agents therefore can oxidise any alkyl benzene to benzoic acid.

91. (b) : In body centred cubic crystals,

$$\begin{aligned} \text{radius} &= \frac{\sqrt{3}}{4} \times \text{edge length} \\ &= \frac{\sqrt{3}}{4} \times 4.29 \times 10^{-8} \text{ cm} \\ &= 1.8576 \times 10^{-8} \text{ cm} \end{aligned}$$

92. (a) : Beilstein's test : A small quantity of organic compound is taken on the flattened end of Cu wire and introduced in the flame. A green or blue colour indicates halogens.

93. (d) : N ($Z = 7$) : $\uparrow\downarrow$ $\uparrow\downarrow$ $\uparrow\downarrow$ \uparrow \uparrow \uparrow

Due to the presence of three unpaired electrons, N atom will be paramagnetic in nature.

94. (c) : Molecular weight of $C_{60}H_{122} = 60 \times 12 + 1 \times 122 = 842$

\therefore Weight of 1 mole of $C_{60}H_{122}$ molecules = 842 g
or Weight of 6.023×10^{23} molecules = 842 g

\Rightarrow Weight of 1 molecule of $C_{60}H_{122} = \frac{842}{6.023 \times 10^{23}} \text{ g} = 1.4 \times 10^{-21} \text{ g}$

95. (b) : Nitrogen is more electronegative than the phosphorus atom. In NH_3 , nitrogen attracts the bonded pair of electron between N and H atoms towards it, and this effect is more in NH_3 than in PH_3 . Due to this effect, the lone pair of electrons in NH_3 can participate more than that of PH_3 .

96. (a) : $CuSO_4 + 2KCN \rightarrow Cu(CN)_2 + K_2SO_4$

$2Cu(CN)_2 \rightarrow Cu_2(CN)_2 + (CN)_2$

$Cu_2(CN)_2 + 6KCN \rightarrow 2K_3Cu(CN)_4$

$2CuSO_4 + 10KCN \rightarrow 2K_3Cu(CN)_4 + 2K_2SO_4 + (CN)_2$

97. (a) : The root mean square velocity is defined as the square of different velocities possessed by molecules of a gas at a given temperature.

$$V_{rms} = \sqrt{\frac{3kT}{m}} \Rightarrow V_{rms} \propto \frac{1}{\sqrt{m}}$$

m = mass of gas molecules

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

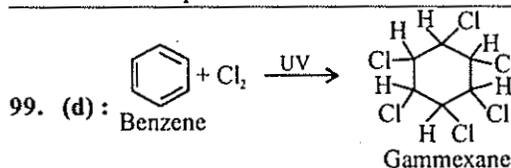
$$\Rightarrow V_{rms} \propto \frac{1}{\sqrt{\text{density}}}$$

$$\Rightarrow \frac{V_{rms}(O_2)}{V_{rms}(H_2)} = \sqrt{\frac{\text{density of } H_2}{\text{density of } O_2}}$$

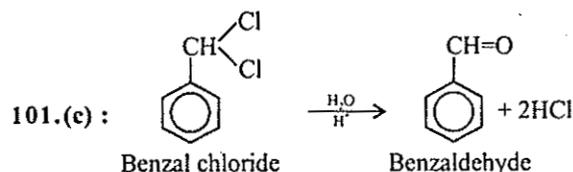
$$= \sqrt{\frac{1}{16}} = \frac{1}{4}$$

98. (d) : According to law of conservation of mass in all chemical changes the total mass of the system remains constant or in a chemical reaction, mass is neither created nor destroyed. This law was proposed by Lavoisier and tested by Landolt.

But in (b) and (c), mass of reactants is not equal to the mass of products.

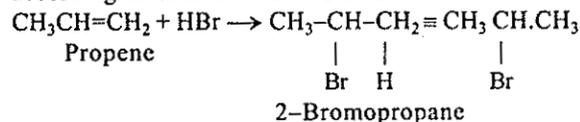


100. (d) : More the number of oxygen atoms attached to the central atom, more is the electron withdrawal effect towards oxygen atom, which in turn makes central atom electron deficient so the hydrogen attached becomes more and more acidic with increasing number of oxygen atoms.



102. (a) : Brass is an alloy of Cu and Zn. Bronze is an alloy of Cu and Sn. German-silver is an alloy of Cu, Zn and Ni.

103. (b) : HBr adds on the double bond of propene according to Markownikoff's rule.



104. (b) : In the alkaline earth metal group, down the group as the size increases the ability to lose electrons i.e. ionic character increases. The smaller metal require

more ionisation potential for cation formation.

105. (d) : NO_2 group is the electron withdrawing group due to which electron density in the ring decreases. Therefore meta positions are preferred over ortho / para positions.

106. (d) : Every substance is associated with a definite amount of energy which depends upon its chemical nature as well as on its temperature, pressure and volume. This energy is called as internal energy and it includes translational, rotational and vibrational energy of the molecule.

107. (a) : According to Dulong Petit's law :
 Atomic weight \times specific heat = 6.4

$$\text{Atomic weight} = \frac{6.4}{0.16} = 40$$

108. (a) : Relative lowering of vapour pressure is given by :

$$\frac{P^0 - P_s}{P^0} = X_A; X_A = \text{mole fraction of solute}$$

P^0 = vapour pressure of pure solvent

P_s = vapour pressure of solution

$$\Rightarrow \frac{39.08/78}{39.08/78 + 2.175/M_A} \Rightarrow M_A = 69.60$$

109. (b) : Dipole moment in the molecule depends upon the charge and the distance between the charges.

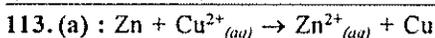
As oxygen is more electronegative than nitrogen, iodine or sulphur, it will have greater dipole moment.

110. (d) : OsO_4 , Let oxidation state of Os be x .

$$x + 4 \times (-2) = 0 \Rightarrow x = +8$$

111. (b) : Xenon belongs to noble gases which are considered to be very unreactive. In xenon atom, the ionisation potential of Xe to lose one electron was found to be nearly equivalent that of $\text{O}_2 \rightarrow \text{O}_2^+ + e^-$. Also, due to the presence of empty $5d$ -orbitals, electrons can be excited and higher valency of xenon can be produced. e.g. XeF_2 , XeF_4 , XeF_6 etc.

112. (d) : Identification of cathode and anode is done by using ammeter. The liberated electrons at the anode after oxidation flow to the cathode side of cell. So the 'positive electricity' flow from cathode to the anode.



$$E^{\circ}_{\text{Cu}^{2+}/\text{Cu}} = 0.34\text{V}, \quad E^{\circ}_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$$

The above values show that zinc will release electrons and copper will like to get reduced.

114. (a) : H_2SO_4 when react with NaBr and NaI, give out Br_2 and I_2 as concentrated H_2SO_4 is a strong oxidising agent.

115. (a) : When mercury is exposed to ozone it get superficially oxidised and loses its meniscus and sticks to the glass.

116. (b) : Bond order

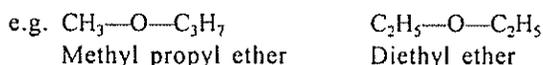
$$= \frac{1}{2} \left[\text{No. of bonding orbital electrons} - \text{No. of antibonding orbital electrons} \right]. \text{ The bond}$$

order zero indicates that the bond does not exist.

117. (a) : The linear triatomic molecules of the type B-A-B e.g. CO_2 have no dipole moment, not because the individual C=O bonds are non-polar but because the two bond moments (polarity) cancel each other. Therefore, geometry of molecules can be predicted by the value of dipole moment.

118. (b) : Lower aldehydes and ketones are soluble in water due to polar effect of $>\text{C}=\text{O}$ which makes hydrogen bonds with water molecules. As the size of the aldehydes and ketones increases the hydrophobic part i.e., alkyl chain increases which weakens the H-bond formations with H_2O molecules and decreases the solubility.

119. (c) : Metamers differ in nature of alkyl groups attached to the same functional group.



120. (a) : Equivalent conductance is defined as the conducting power of all the ions produced by one equivalent in a given solution. Therefore, at higher concentrations, degree of dissociation of electrolyte is less. Degree of dissociation can be increased by dilution.

BIOLOGY

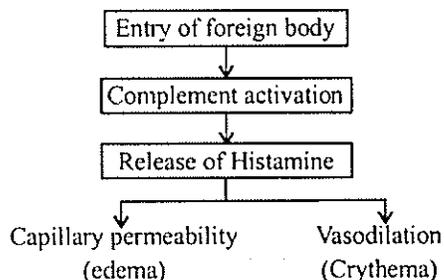
121. (d) : In vertebrate heart, the walls of ventricle are thicker than the walls of auricle. Wall of left ventricle is three times thicker than that of right ventricle. This is so because it receive a large amount of oxygenated blood from lungs and pumps that with great force to all visceral organs and parts of body through aorta.

122. (b) : Thyroid glands play a key role in metamorphosis of frog's tadpole. Metamorphosis is profound changes of form during development from larva to adult animal. The process of metamorphosis is

essentially under hormonal control. Hormones from the hypothalamus (e.g. TSH or thyroid stimulating hormone) and the thyroid gland regulate the process of metamorphosis. Thyroxine hormone affects the tissues directly, causing the degeneration and necrosis of some cells and stimulating the growth and differentiation of others.

123. (a) : Weberian ossicles are found in fishes. The chewing construction with the rotating skull renders a single Weberian ossicle connecting the sound receiving swimming bladder and internal ear. This is a series of four or five modified vertebrae connecting the swimbladder and the inner ear.

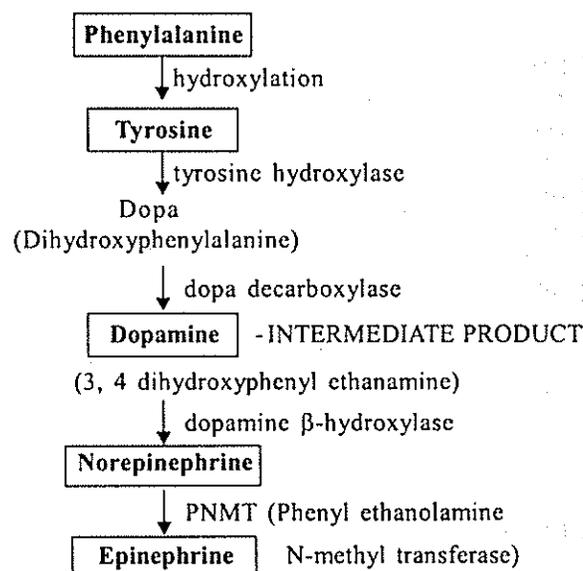
124. (a) : Inflammatory response, in allergy is caused by histamines. The presence of foreign body such as bacteria within the body provokes a protective inflammatory response. Histamine increases the capillary permeability.



125. (a) : Turner's syndrome is characterised by the monosomy of XO type. These are immature sterile females with webbed neck. Klinefelter's syndrome is characterised by trisomy (XXY). These are male individuals, who are phenotypically fairly normal but have a fairly low sperm count and therefore sterile. Down's syndrome is caused due to the presence of extra chromosome 21 (in trisomy 21) i.e. The patients suffering from Down's syndrome is called mongolian idiot.

126. (d) : If a person is injured, he should be given blood. The blood group O should be given without checking the patients own blood group. Blood group O has anti A and anti B antibodies in serum but no antigens. Due to the absence of antigens, O blood group can be recognised as the universal donor.

127. (c) : Epinephrine is the derivative of amino acid. Epinephrine is formed by the hydroxylation and decarboxylation of the amino acids phenylalanine and tyrosine.



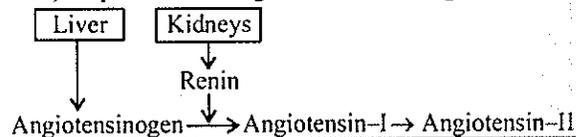
Biosynthetic pathway of Epinephrine

Progesterone, estrogen and prostaglandin can be derived from cholesterol and fatty acid respectively.

128. (b) : Liver in our body stores vitamin A. The fat soluble vitamin A may be stored in large amounts and this gives them the potential to cause toxicity if consumed in high amounts. Retinol or vitamin A is synthesized by the liver and thus it is stored by the liver.

129. (a) : Cumulus covers ovum. Within the mature follicle, the ovum is surrounded by a group of granulosa cells known as cumulus (cumuloophorus). The follicular epithelial cells are known as granulosa cells.

130. (d) : The function of renin is degradation of angiotensinogen. When the blood pressure falls the hormone renin secreted by juxtaglomerular cells of kidney plays an important role in reabsorption of sodium. Renin on reaching the blood, changes angiotensinogen (inactive compound released from liver) of plasma into angiotensin II via angiotensin I



131. (d) : Trained dog salivates when you ring a bell is the example of conditioned reflex. It is also called acquired reflexes. It is not inborn, but acquired and dependent on past experience, training and learning i.e. adopted during the course of lifetime.

132. (a) : The heartbeat increases at the time of interview due to secretion of adrenaline. Adrenaline is a stress hormone. At the time of interview, the candidate suffers from anxiety or tension, this leads to the extra production and secretion of adrenaline.

133. (d) : Heparin prevents blood coagulation in the blood vessels. It is a product of most cells. It is an anticoagulant, blocking conversion of prothrombin to thrombin. Haemoglobin is the blood pigment necessary for oxygen transport. Plasma is the component of blood. Thrombin is the product of blood clotting.

134. (a) : Conn's disease is caused by the over secretion of aldosterone.

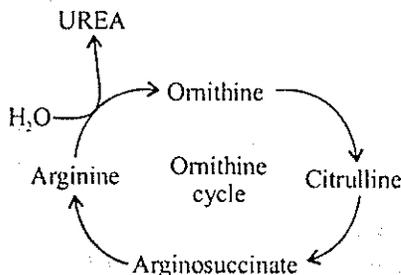
It is a disease of the adrenal glands involving excess production of a hormone, aldosterone. It is a cause of high blood pressure. Other symptoms may occur because high aldosterone levels in the blood act on the kidney.

135. (c) : The extra embryonic membranes of mammalian embryo are derived from trophoblast. After the cleavage of the zygote, blastocyst is formed. Then, trophoblast, the epithelial layer surrounding the blastocyst is formed. This trophoblast cells are destined to form most of the extra embryonic membrane in mammals.

136. (a) : Ageing is associated both with calcium deficiency, due to low dietary intake and decreased intestinal absorption, and with vitamin D deficiency, secondary to depletion of body stores resulting from inadequate exposure to sunlight.

The consequences of calcium deficiency might thus include not only osteoporosis, but also arteriosclerosis and hypertension due to the increase of calcium in the vascular wall, amyotrophic lateral sclerosis and senile dementia due to calcium deposition in the central nervous system, and a decrease in cellular function, because of blunting of the difference in extracellular-intracellular calcium, leading to diabetes mellitus, immune deficiency and other disorders.

137. (c) : The end-product of ornithine cycle is urea.

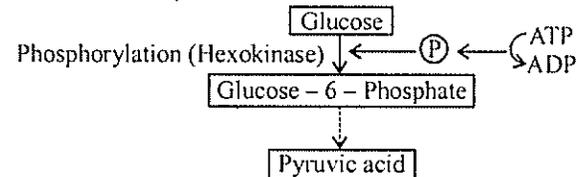


Most of the NH₄⁺ formed by deamination of amino acids in the liver is converted to urea, and the urea is excreted in the urine. The synthesis of urea via ornithine cycle involves conversion of the amino acid ornithine to citrulline and then to arginine, following which urea is split off and ornithine is regenerated.

138. (a) : Wings of pigeon, mosquito and bat show divergent evolution. It is the evolutionary process resulting in dissimilarity in structural features of organisms that occupy similar habitat.

Atavism is the regaining of same structures after a certain gap of few generations.

139. (d) : First step of utilization of glucose in metabolism is glucose - 6 - phosphate. It is the first step of glycolysis. According to the Embden Meyerhof -Parnas scheme, the conversation would be like.



140. (b) : Otorhinolaryngology is the study of ENT that means ear, nose and throat.

141. (c) : If one strand of DNA has the nitrogenous base sequence ATGCTTGA, the sequence in the complementary strand will be



As A binds, with T and G binds with C we get the result TACGAACT.

142. (a) : When certain proviruses turn into virulent viruses thereby causing lysis of host cell, they may carry with them segments of host's DNA. If such virus particles carrying a segment of DNA from one host infects another host which is different than the first one, the latter may inherit some of the properties of the properties of the former host due to transfer of DNA segment through infecting phase. This phenomenon of transfer of genetic material from one bacterial strain to another through the agency of virus is called transduction. In conjugation, genetic material is transferred through a conjugation tube, when two strains come in contact. In transformation, genetic material is released from one strain and a part may be acquired from another strain, which thus gets transformed without coming in contact with the other strain.

143. (a) : Endonucleases are very specific and cut DNA at very specific nucleotide sequences. They are popularly called restriction enzymes, because their action is restricted to only very specific sequences which exhibit a two-fold symmetry as follows :

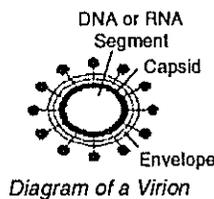
AAG	CTT
TTC	GAA

144. (d) : Bacterial cell wall is the outer rigid covering of the cell which provides shape and protection to the protoplasm. Bacterial wall contains peptidoglycan and diaminopimelic acid. Peptidoglycan consists of two linked molecules, acetyl glucosamine and acetyl muramic acid.

145. (a) & (b) : The plant body of bryophytes lacks the true roots, stem or leaves. It grows prostrate on the ground and is attached to the substratum by delicate, unbranched, unicellular hair like organs called the rhizoids. The bryophytes like the thallophytes lack the vascular tissue (xylem and phloem) characteristic of the higher plants. All bryophytes exhibit alternation of generation but it is always of heterologous type (i.e. sporophytes and gametophytes are of different types). Gametophytes of bryophyte are green, leafy individual and due to presence of chlorophyll they are autotrophic in nature. The sporophyte is dependent for its nutrient wholly or partially on the gametophyte plant to which it is attached organically throughout its life.

146. (a)

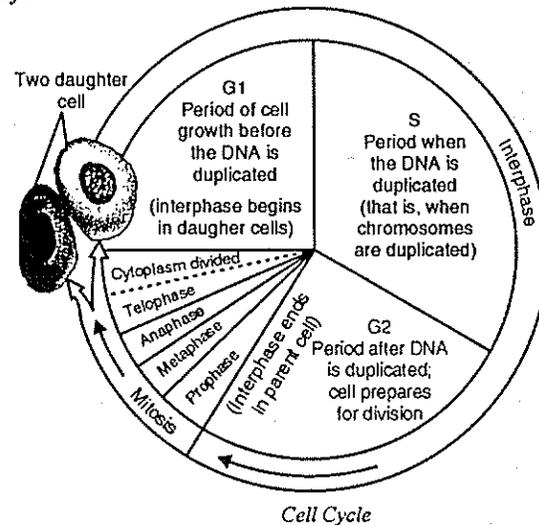
147. (d) : The mature virus particle (Singular unit virion) consists of an outer, inert, non-genetic protein coat or shell which surrounds and protects the genetic material or nucleic acid forming the core. The protein coat is called capsid. The capsid is made up of numerous small subunits called the capsomeres.



148. (d) : Middle lamella is a thin, amorphous and cementing layer between two adjacent cells. Lomasomes are plasmalemma foldings found in fungal cells below the wall. Lysosomes are small vesicles which are bounded by a single membrane and contain hydrolytic enzymes. Microsomes are particles isolated from cytoplasm for biochemical study by mechanically centrifuging the result.

149. (c) : Cell cycle consists of two states, a long non-dividing growing I-phase and a short dividing M-phase. I-phase (interphase) is divisible into three stages, G_1 , S

and G_2 . Therefore, there are following stages in cell cycle



- (i) G_1 - phase - first growth phase or post mitotic gap phase.
- (ii) S - phase - synthetic phase
- (iii) G_2 - phase - second growth phase or pre-mitotic gap phase
- (iv) M- phase (mitotic phase)

150. (a) : Sporogony of malarial parasites occur in stomach wall of mosquito. It is an asexual multiplication phase. The nucleus of the oocyst divides and followed by cytoplasmic division, several sporozoites are formed. This is the infective stage, when a mosquito bites a man, thousands of sporozoites enter into the blood of the man.

151. (a) : In spermatogenesis, the acrosome of sperm is formed by golgi complex. Acrosome is a part of sperm head. This acrosome is formed by a special granule secreted by golgi body. The acrosome contains all the enzymes present in golgi complex.

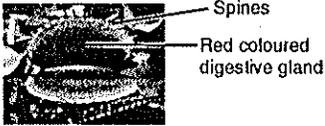
152. (a) : Paired spermathecae occur in 6, 7, 8, 9 segments of *Pheretima*. These are four pairs of small flask shaped structures. Their function is to receive and store sperms from another worm during copulation.

153. (a) : Kidney of adult reptiles are metanephric. Metanephric kidney is of double origin. Metanephric are the functional kidneys of adult amniotes and they have achieved the separation of urinary function from the genital function.

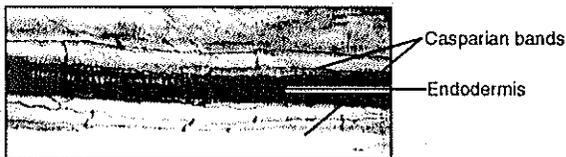
154. (c) : Amebiasis is caused by *Entamoeba histolytica*. It is a protozoa, under class Rhizopoda,

order Amoebida. *Taenia solium* causes Cestodiasis, Cysticercosis. *Wuchereria bancrofti* causes Filariasis, *Ascaris lumbricoides* causes Ascariasis.

155. (c) : Secondary phloem is made up of the same type of cells as are found in the primary phloem (metaphloem) - sieve tubes, companion cells tubes become non functional by development of a pad of wall material over the sieve phloem fibres and phloem parenchyma. The sieve plates. It generally happens at the end of a growing season. Such a nonfunctional phloem may get crushed during the next growing season due to the expanding cylinder of newly formed secondary xylem and phloem.

156. (a) : *Dionaea* is an American herb that possesses a rosette of long-petioled leaves. The upper surface of each lamina lobe contains 3 sensitive spines and a number of red-coloured digestive glands. If an insect happens to touch a sensitive spine twice  *Dionaea* showing two lobes of lamina in quick succession, the two lobes of the lamina fold rapidly. Bending of sensitive spines after coming in contact with an insect is thigmonastic. Opening and closing of flowers in response to light and darkness is called photonasty. Seismonasty is shown by *Mimosa*. A response to temperature changes is termed as thermonasty

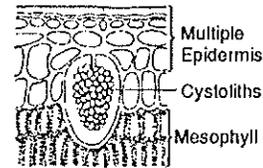
157. (b) : Endodermis is a single layer of compactly arranged cells which are generally parenchymatous, but have distinct wall characteristics. Caspary (1865-



66) recognised a band of the wall material in the radial and transverse walls of endodermis. This particular wall material is chemically different from the rest of the wall. It is known as *casparyan strip or band*. It is believed to be made of suberin.

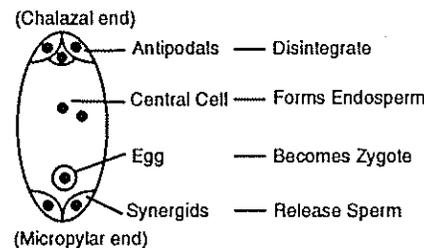
158. (d) : Calcium carbonate crystals have been reported from within the cells of Banyan leaf (*Ficus benghalensis*) and some members of the families *Acanthaceae*, *cucurbitaceae*, *Urticaceae*, etc. In the leaf of Banyan they have been seen to occur in grape-like clusters hanging from a stalk that is attached to the cell wall. The name cystolith is given to such a cluster.

Some cells contain star-shaped aggregation of crystals of calcium oxalate, which are known as *sphaeraphides*. Raphide is needle-shaped crystals of calcium oxalate occurring in bundles in certain plant cells. Otolith is granule of calcium carbonate in *Epidermis* in *Ficus* showing cystoliths vertebrate inner ear.



159. (d) : In anemophilous flowers, stigma is hairy, feathery or branched to catch the wind-borne pollen grains.

160. (a) : The female gametophyte, also called embryo sac, is mostly a 7-celled and eight nucleated structure. The micropylar end of the central cell is occupied by the egg apparatus, comprising an egg cell and two



Angiospermic Embryo sac

synergids, and at its chalazal end three antipodal cells are present. Cells of the egg apparatus and the antipodal cells are uninucleate and haploid whereas the central cell is binucleate or diploid.

161. (b) : High-energy phosphate bonds are universally symbolized by the symbol ~ and high energy phosphate groups as ~ P. ATP can be designated as A-R~P~P~P. ADP as A-R-P~P. In other words, the ADP-ATP system is carrier of phosphoryl ($-PO_2^{2-}$) groups from high energy phosphate compounds.

162. (d) : Endoplasmic reticulum functions as cytoskeleton or intracellular and ultrastructural skeletal framework by providing mechanical support to colloidal cytoplasmic matrix. Proteins and enzymes synthesised by ribosomes enter the channels of rough endoplasmic reticulum both for intracellular use as well as extracellular transport.

163. (b) : The secondary meristems are usually lateral. They give rise to secondary tissues that constitute secondary growth. The common examples are vascular cambium of the root (derived from conjunctive parenchyma), interfascicular vascular cambium, cork

cambium, wound cambium and accessory cambia. The apical meristems are present at the tips of stem, root and their branches. Intercalary meristems are meristematic regions which are derived from the apical meristems and which have been separated from them by the formation of permanent tissues in between. Xylem and phloem are complex permanent tissues.

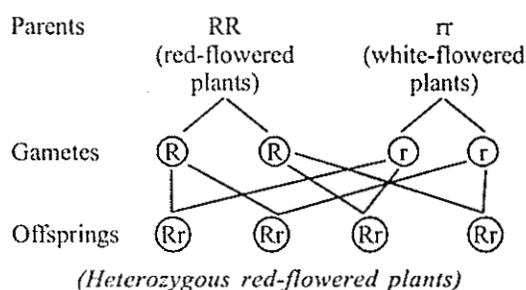
164. (c) : Growing of alternate crops in the similar seasons on the same piece of land is called crop rotation. Crop rotation is helpful in improvement of soil fertility because of the following reasons.

- (i) It decreases the chances of soil borne diseases because the pathogens are unable to find the same host next year.
- (ii) It avoids deficiency of minerals from one level because the roots of different crops penetrate to different depths in the soil.
- (iii) Crop rotation maintains the nitrogen fertility of the soil when legume crop is rotated with others.
- (iv) It increases soil porosity because of the penetration of roots of different crops to various depths.

165. (b) : Decomposers are saprotrophic micro organisms which feed on dead bodies of organisms and organic wastes of living organisms. They are also called detritivores. They bring mineralisation (the digested form of organic matter is partly absorbed by micro organisms for their own assimilation. The remaining adds raw materials and minerals back into the substratum. The phenomenon is called mineralisation).

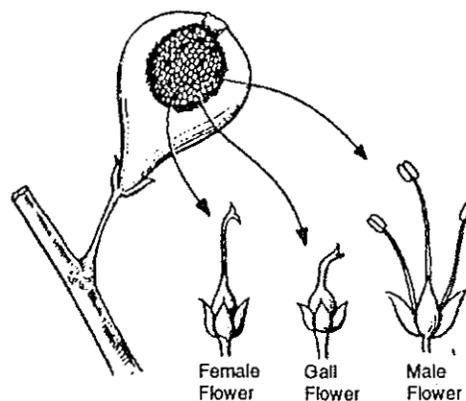
166. (a) : Obligate parasites can grow only upon suitable living host tissues. The best examples of obligate parasites are the downy and powdery mildews.

167. (d) : The red colour of flower dominates upon white colour of flower. In the present varieties both parents are of pure variety, therefore, the offsprings will be all red flowered as shown below :



168. (d) : Nitrous acid deaminates with decreasing frequency, the bases G, C and A in DNA and with equal frequencies in RNA. HNO_2 deaminates adenine (A) to hypoxanthine (H) : Cytosine (C) to uracil (U) and guanine (G) to xanthine (X). It pairs with C; U pairs with A and X pairs with C.

169. (d) : When the fleshy receptacle forms a hollow cavity with an apical opening guarded by scales, and the flowers are borne on the inner wall of the cavity,



Hypanthodium inflorescence (Ficus)

the inflorescence is a hypanthodium, as in *Ficus* (e.g. banyan, fig, peepul, etc.). Here the female flowers develop at the base of the cavity and the male flowers higher up towards the apical pore.

170. (d) : Abscisic acid induces dormancy of buds towards the approach of winter. Seed dormancy is mainly caused by abscisic acid. Because of its action in inducing dormancy, abscisic acid or ABA is also named as dormin.

171. (c) : To detect some mineral elements of a plant, the plant is subjected to high temperature (about 600°C) and then its ash content is analyzed. In the ash, only the mineral elements are present, all of the organic compounds have been decomposed and passed off in the form of gases. The primary elements (carbon, hydrogen and oxygen) are therefore given off as CO_2 , water vapour and oxygen. We cannot accurately detect the element nitrogen with this method since some of it is given off in the form of ammonium or nitrogen gas. The method of growing plants in aqueous nutrient solutions as employed by Sacks and Knob is used experimentally and commercially today and is known as hydroponic culture.

172. (a) : Some enzymes depend for activity only on their structure as proteins, while others require in

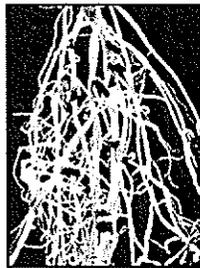
addition nonprotein structures, or cofactor for activity. The cofactor may be either a metal ion or a complex organic molecule called a coenzyme usually function as intermediary carriers of electrons or of specific atoms or functional groups that are transferred in the overall enzymatic reaction.

173. (b) : Mineral matter occurs in the form of particles in soil. The particles are irregular in outline and enclose spaces for circulation of air and water. Depending upon their size, mineral particles of the soil are called sand, silt and clay. Clay particles are chemically active. Water and chemical nutrients are abundant. Soil is the source of a number of essential elements to the plants. They are called plant nutrients or essential mineral elements.

174. (b) : Wax is often secreted in the form of grains, plates or rods on the surface of cuticle. It forms characteristic *glaucous*, "bloom" on the surface of leaves and fruits. Oil and resins are often abundantly developed *e.g.* *Pinus* suberin prevents evaporation of water from inner tissues of plants.

175. (a) : In the majority of plants stomata open in the presence of light and close in darkness. A strong light further increases transpiration probably due to its heating effect. Because most of the transpiration occurs through stomata, the rate of transpiration falls down appreciably in the darkness.

176. (a) : The symbiotic relationship between legumes and *Rhizobium* seems to be species-specific. The accumulation of soil bacteria in the vicinity of plant roots occur especially roots of legume plants. This accumulation probably



Root nodules showing association of *Rhizobium* with root of leguminous plant

occurs because plant roots excrete certain growth factors into the soil. Then the bacteria either penetrate the relatively soft root hair tip or invade damaged or broken root hairs and progress in an infection thread through the cortex tissue to the immediate area of the endodermis and pericycle. Cell divisions commence in the endodermis and pericycle area and the nodule grows rapidly and pushes its way to the surface of the root.

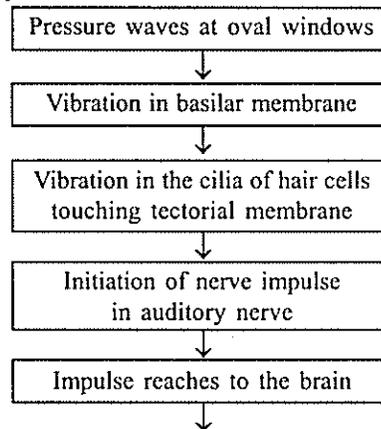
177. (a) : It is the co-ordinated process by which stimulus passes to the brain via sense organs or sensory receptors. These receptors are transducers that convert various form of energy in the environment into

action potentials in neurons. The form of energy converted by the receptors include, mechanical, thermal, electromagnetic and chemical energy. Information about the internal and external environment reaches to the sensory receptors which in turn after getting adequate stimulus, transfer it to the brain through nerve impulses. Then the brain gives response for the stimulus.

178. (c) : The purine and pyrimidine bases pair only in certain combinations. Adenine pairs with thymine (A:T) and guanine with cytosine (G:C). Adenine and thymine are joined by two hydrogen bonds through atoms attached to positions 6' and 1'. Cytosine and guanine are joined by three hydrogen bonds through positions 6', 1' and 2'.

179. (b) : Cartilage and bone are rigid connective tissues because in cartilage, protein is the matrix and in bone calcium is the matrix both of which are solid structures. On the other hand blood is the connective tissue. Where plasma is the matrix which is mainly the liquid component having some blood cells in it.

180. (a) : Hair cells on the basilar membrane is responsible for hearing. In the cochlear duct of the internal ear, the basilar papilla forms a basilar membrane with hair cells constituting an organ of corti, the fibres are embedded in a tectorial membrane lying above the organ of Corti which is sensitive to vibrations of high frequency. The mechanism is as follow



GENERAL KNOWLEDGE

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|----------|----------|----------|----------|----------|
| 181. (b) | 182. (c) | 183. (c) | 184. (d) | 185. (a) |
| 186. (d) | 187. (d) | 188. (b) | 189. (d) | 190. (a) |
| 191. (b) | 192. (d) | 193. (d) | 194. (d) | 195. (b) |
| 196. (d) | 197. (d) | 198. (b) | 199. (d) | 200. (c) |

