SOLUTIONS

PHYSICS

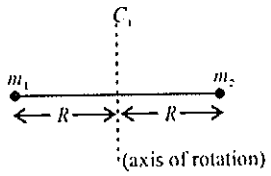
1. **(b)** : It is given that the amplitudes A_1 and A_2 are in the ratio $\frac{A_1}{A_2}=\frac{3}{5}$

$\therefore$ After superposition the maximum and minimum intensities will be in the ratio

$$\frac{I_{max}}{I_{min}}=\frac{(A_1+A_2)^2}{(A_1-A_2)^2}=\frac{(3+5)^2}{(3-5)^2}=\frac{8^2}{(-2)^2}=\frac{64}{4}=\frac{16}{1}$$

---

2. **(d)** :



Suppose the masses m_1 and m_2 are attached to the ends of a massless rod. C_1 is the axis of rotation which is at a distance R from each of the masses.

$\therefore$ the moment of inertia of the system,

$I = m_1R^2 + m_2R^2 = (m_1 + m_2)R^2$

Now if the distance between the masses is doubled, then the moment of inertia

$I' = m_1(2R)^2 + m_2(2R)^2 = (m_1 + m_2)4R^2$

Since the same torque is applied in both the cases,

$\tau = I\alpha = I'\alpha'$

$$\Rightarrow \alpha' = \frac{I\alpha}{I'} = \frac{(m_1+m_2)R^2\alpha}{(m_1+m_2)4R^2} = \frac{\alpha}{4}$$

---

3. **(a)** : Given that the force is inversely proportional to R

i.e. $F \propto \frac{1}{R}$

or $F = \frac{k}{R}$ ... (i)

or $mRw^2 = \frac{k}{R}$

or $w^2 = \frac{k}{mR^2}$

$\therefore$ $w^2 \propto \frac{1}{R^2}$

$\Rightarrow$ $w \propto \frac{1}{R}$

$\Rightarrow$ $\frac{2\pi}{T} \propto \frac{1}{R}$

$\Rightarrow$ $T \propto R$

---

4. **(b)** : As the earth's magnetic field is acting perpendicular to the coil and as here is no charge of magnetic flux through the coil, the current induced in the coil is zero.

---

5. **(b)** : Heat taken from source $Q_1 = 100$ cal

Heat left to sink $Q_2 = 80$ cal

$\therefore$ efficiency of the engine $\eta = 1-\frac{Q_2}{Q_1} = 1-\frac{80}{100}$

$= 20\%$

Temperature of the source $T_1 = 127°C = 400\,K$

Temperature of the sink $T_2 = ?$

We know that

$$\eta = 1-\frac{T_2}{T_1}$$

$$\Rightarrow 0.2 = 1-\frac{T_2}{400}$$

$$\Rightarrow \frac{T_2}{400} = 1-0.2 = 0.8$$

$$\Rightarrow T_2 = 320\,K = 47°C$$

---

6. **(b)** **7.** **(b)**

---

8. **(c)** : By definition

$$R = \rho\frac{l}{A}$$

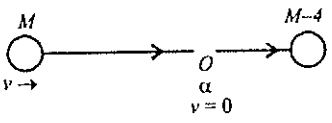
$$\Rightarrow \rho = \frac{RA}{l} = \frac{\frac{V}{I}A}{l} = \frac{VA}{Il}$$

$$\therefore [\rho] = \frac{[V][A]}{[I][l]}$$

$$= \frac{ML^2T^{-2}L^2}{IL} = [ML^3T^{-2}I^{-1}]$$

---

9. **(b)** :



Applying the principle of momentum conservation,

$Mv = (M-4)v'$ [$\because$ the speed of the α-particle is zero]

$\Rightarrow \quad v' = \frac{Mv}{M-4}$

10. (d) : Due to the current flowing in the wire, there is no change of magnetic flux linked with the wire and so there is no induced current.

11. (c) : The wire of length l is bent to from a circular loop, so $2\pi r = l$

$\Rightarrow r = \frac{l}{2\pi}$

The magnetic field at the centre of the loop is

$B = \frac{\mu_0 I}{2r} = \frac{\mu_0 I \times 2\pi}{2l}$

Now the same length of the wire is bent to from a double loop

$\therefore 2 \times 2\pi r' = l$

$\Rightarrow r' = \frac{l}{4\pi}$

And the magnetic field at the centre

$B' = \frac{\mu_0 I \times 2}{2 \times r'} = \frac{2\mu_0 I}{2 \times \frac{l}{4\pi}} = \frac{2 \times 4\pi\mu I}{2l}$

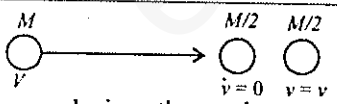
$\therefore \frac{B'}{B} = 4 \Rightarrow B' = 4B$

12. (c) : Let the resistance of the rod be R. If the rod is divided into two equal parts, then each part of the rod will have a resistance of $R/2$. Now these two parts of the rod are connected in parallel and a voltage V is applied across them. Hence the total power consumed is

$P' = \frac{V^2}{R/2} + \frac{V^2}{R/2} = 4\frac{V^2}{R} = 4P$ where

$P = \frac{V^2}{R}$ is the power consumed by the original rod when voltage V is applied across it.

13. (d) :



Before explosion, the total momentum of the system = MV

After explosion, the total momentum of the system

$= \frac{M}{2} \times 0 + \frac{M}{2} \times v = \frac{Mv}{2}$

From the principal of momentum conservation,

$MV = \frac{Mv}{2}$

$\Rightarrow \quad v = 2V$

14. (b) : Pressure and stress both have the dimensions of Force/area. Strain and angle are both dimensionsless. Energy and work have the same dimensions force × distance.

Tension and surface tension refer to two different physical quantities and their dimensions are different. Tension is a force and surface tension is force per unit length.

15. (c) : The solid sphere cools more quickly because the thermal conductivity of the solid sphere is more than that of the hollow sphere.

16. (c) : The satellite is moving at an attitude above the surface equal to the radius of the earth R.

$\therefore \quad \frac{mv_0^2}{2R} = G\frac{Mm}{4R^2}$

$\Rightarrow v_0 = \sqrt{\frac{GM}{2R}}$

Now if the satellite moves at an attitude equal to $R/2$ then,

$\frac{mv_0'^2}{3R/2} = G\frac{Mm}{9\times\left(R/2\right)^2}$

$\Rightarrow \quad v_0'^2 = \frac{2}{3}\cdot\frac{GM}{R}$

$\Rightarrow \quad v_0' = \frac{\sqrt{2}}{\sqrt{3}}\sqrt{\frac{GM}{R}} = \frac{\sqrt{2}}{\sqrt{3}}v_0\sqrt{2}$

$= \frac{\sqrt{4}}{\sqrt{3}}v_0 = \frac{2}{\sqrt{3}}v_0$

17. (d) : When the lift is at rest, the time period of the simple pendulum is $T = 2\pi\sqrt{\frac{l}{g}}$

Now, if the lift is moving up with an acceleration $\frac{g}{4}$ then the effective acceleration due to gravity

$g' = g + \frac{g}{4} = \frac{5g}{4}$

$\therefore$ Time period $T' = 2\pi\sqrt{\frac{l}{g'}}$

$= 2\pi\sqrt{\frac{l}{5g/4}}$

$= \frac{2}{\sqrt{5}} \times 2\pi\sqrt{\frac{l}{g}} = \frac{2}{\sqrt{5}}T$

18. (c) : We know that the heat flowing through a conductor is given by

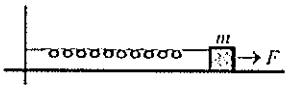
$\frac{Q}{t} = -KA\left(\frac{d\theta}{dx}\right)$

$\Rightarrow Q = -KA\left(\frac{d\theta}{dx}\right)t$

Where K = thermal conductivity of the material
A = area of cross-section
$\frac{d\theta}{dx}$ = temperature gradient
t = time

Now if we cut the rod into 4 pieces, A remains same K remains same, $\frac{d\theta}{dx}$ is said to be same, so for same time t, Q is going to be same as earlier.

19. (a) :



If we pull the mass m towards right by a distance x then the restoring force it experiences is

$$F = -kx$$

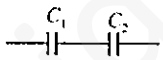
$$\Rightarrow \quad m\frac{d^2x}{dt^2} = -kx$$

$$\Rightarrow \frac{d^2x}{dt^2} + \frac{k}{m}x = 0 \Rightarrow \frac{d^2x}{dt^2} + \omega^2 x = 0$$

Where $\omega = \sqrt{\frac{x}{m}}$

$$\Rightarrow \quad \frac{2\pi}{T} = \sqrt{\frac{x}{m}}$$

$$\Rightarrow \quad n = \frac{1}{2\pi}\sqrt{\frac{x}{m}}$$



20. (b) : The given capacitor can be viewed as a series combination of two capacitors C_1 and C_2 where

$$C_1 = \frac{\varepsilon_0 K_1 A/2}{d}; \qquad C_2 = \frac{\varepsilon_0 K_2 A/2}{d}$$

where d is the separation between the plates,
$\therefore$ The effective capacitance

$$C = \frac{C_1 C_2}{C_1 + C_2}$$

$$= \frac{\frac{\varepsilon_0 K_1 A/2}{d} \times \frac{\varepsilon_0 K_2 A/2}{d}}{\frac{\varepsilon_0 K_1 A/2}{d} + \frac{\varepsilon_0 K_2 A/2}{d}} = \frac{\left(\frac{\varepsilon_0 A}{2d}\right)^2 K_1 K_2}{\left(\frac{\varepsilon_0 A}{2d}\right)(K_1 + K_2)}$$

$$= \frac{\varepsilon_0 A}{2d}\left(\frac{K_1 K_2}{K_1 + K_2}\right)$$

21. (b)

22. (d) : The charge on a proton = e. Hence when the proton is accelerated through a potential difference of 1V, its K.E. = 1eV.

23. (d) : Since both the metal spheres are connected to the same conducting wire, both of them will be having same charge on them. Let the charge on each of them be q.

Then, the electric field intensities are given by,

$$E_a = \frac{kq}{a^2}, \quad E_b = \frac{kq}{b^2}$$

$$\therefore \frac{E_a}{E_b} = \frac{b^2}{a^2}$$

24. (a) : The work fuction of a metal is an inherent property of the metal itself and it does not change with the frequency of the incident light.

25. (c) : Since white light is not monochromatic, so we obtain a central white bond instead of getting fringes or a diffraction pattern.

26. (a) : During elastic collision between two equal masses, the velocity of the two bodies get interchanged. So if one body is at rest, energy transfer will be maximum for $m_1 = m_2$.

27. (b)

28. (b) : For a pipe closed at one end, the frequencies are odd multiples of the fundamental frequencies.

29. (c) :

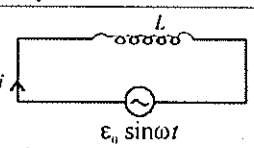


Figure shows a purely inductive circuit, in which a sinusoidal emf is applied. The induced emf across the inductor is $-L\frac{di}{dt}$ so that from Kirchhoffi's law,

$$\varepsilon_0 \sin\omega t - L\frac{di}{dt} = 0$$

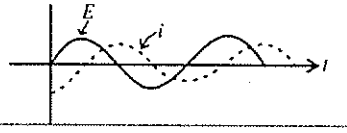
$$\Rightarrow \frac{di}{dt} = \frac{\varepsilon_0}{L}\sin\omega t$$

$$\text{or } i = -\frac{\varepsilon_0}{\omega L}\cos\omega t + C$$

The constant C can be shown to be zero from the fact that, the emf being sinusoidal, the current should also be so, and the average current over one time period has to be zero.

$$\therefore i = -\frac{\varepsilon_0}{\omega L}\cos\omega t \quad \text{or} \quad i = \frac{\varepsilon_0}{\omega L}\sin(\omega t - \pi/2)$$

which shows that the current lags behind the emf by a phase of $\pi/2$.



30. (b)

31. (b) : We know from Wien's displacement law that

$\lambda_m T = b$, where

λ_m = wavelength of light emitted with maximum intensity.

T = Temperature of the star

$\therefore$ From the colour (wavelength) of the emitted light, we can determine the temperature of the star.

32. (b) 33. (a)

34. (c) : The escape velocity is independent of the angle of projection. So, the escape velocity of the rocket remains same.

35. (d)

36. (b) : The heat produced in a wire due to current flow is given by

$$H = I^2Rt$$

$$\therefore \frac{\Delta H}{H} = \frac{2\Delta I}{I} + \frac{\Delta R}{R} + \frac{\Delta t}{t}$$

$$= 2 \times 0.02 + 0.01 + 0.01 = 0.06 = 6\%$$

37. (d) : Since the potential at each point of an equipotential surface is the same, the potential does not change while we move a unit positive charge from one point to another. Therefore work done in the process is zero.

38. (a) : Since the density of the electric lines of force at A is more than that at B, the electric field at A, $E_A > E_B$ (electric field at B).

39. (b) : Gauss's law tells that the total flux through an area enclosing a charge Q is $\frac{Q}{\varepsilon_0}$. Now as the cube is having six faces and as we can assume a symmetrical distribution of fluxes among its faces, the flux associated with one of its faces is $\frac{Q}{6\varepsilon_0}$.

40. (c) : The charge of flux through the metal wire

$$\Delta\phi = 8 \times 10^{-4} \text{ Wb}$$

Time taken $\Delta t = 0.4$ sec

$$\therefore \text{ Induced emf. } e = \frac{\Delta\phi}{\Delta t}$$

$$= \frac{8\times10^{-4}}{0.4}$$

$$= 20 \times 10^{-3} \text{ V}$$

41. (b) : The moment of inertia I of a solid sphere about the axis of rotation through the centre is $I = \frac{2}{5} MR^2$

$$\therefore \text{ Angular momentum } L = I\omega = \frac{2}{5} MR^2 \times \frac{2\pi}{T}$$

$$= \frac{4\pi MR^2}{5T} \text{ where } T = \text{time period of rotation.}$$

42. (b)

43. (d) : A constant pressure air-thermometer is based on the law

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

Here it is given that $V_1 = 47.5$

$V_2 = 67$

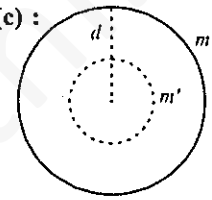
$T_1 = 0°C = 273$ K

$$\therefore \quad T_2 = 273 \times \frac{67}{47.5} = 385.07 \text{ K}$$

$$= 112°C$$

44. (b) : This is a case of a totally inelastic collision, in which linear momentum is conserved but the total mechanical energy is not conserved.

45. (c) :



At a depth d below the surface of the earth,

$$mg' = G\frac{M'm}{(R-d)^2}$$

$$M' = \frac{4}{3}\pi (R-d)^3\rho$$

$$\Rightarrow \quad g' = \frac{GM'}{(R-d)^2}$$

$$= \frac{4}{3} G\pi (R-d)\rho$$

If $d = \frac{R}{2}$ then

$$g' = \frac{4}{3} G\pi \rho = \frac{2\pi GR\rho}{3}$$

On the surface of the earth

$$g = \frac{Gm}{RV} = \frac{4}{3}\pi GR\rho$$

$$\therefore \quad g' = \frac{g}{2}$$

$\therefore$ The body weighed 250 N on the surface of the earth would weigh $\frac{1}{2} \times 250 = 125$ N, half way down towards the centre of the earth.

46. (b) : We know from Wien's displacement law,

$$\lambda_m T = \text{constant}$$

$$\therefore \quad \lambda_m T_1 = \lambda'_m T_2$$

$$\Rightarrow \quad \lambda'_m = \frac{\lambda_m T_1}{T_2} = \frac{\lambda_m \times 1000}{2000} = \frac{\lambda_m}{2}$$

47. (b) : $T_{½} = 20$ years

$N_0 = 10$ g

$N = 2.5$ g

$$N = N_0 e^{-\lambda t} \qquad \lambda = \frac{0.693}{T_{½}}$$

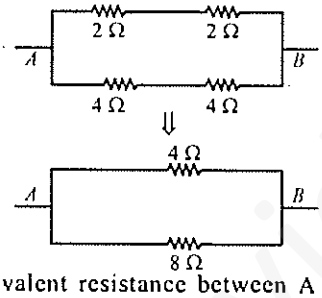
$$\Rightarrow \quad e^{-\lambda t} = \ln\left(\frac{N}{N_0}\right)$$

$$\Rightarrow \quad t = \frac{1}{\lambda} \ln\left(\frac{N_0}{N}\right) = \frac{T_{½}}{0.693} \times \ln\left(\frac{N_0}{N}\right)$$

$$= \frac{20}{0.693} \times \ln\left(\frac{10}{2.5}\right) = 40 \text{ years}$$

48. (a)

49. (b), (d) : The given circuit is a balanced Wheatstone bridge circuit. So, the resistance 7 Ω may be regulated. Therefore, we have the equivalent circuit as,



∴ The quivalent resistance between A and B is

$$R = \frac{4 \times 8}{4+8} = \frac{32}{12} = \frac{8}{3} \ \Omega$$

50. (b) : Frequency of source $n = 240$ Hz

Velocity of source $v_s = 20$ m/s

Velocity of observer $v_0 = 20$ m/s

Velocity of sound $v = 340$ m/s

Given both the source and the observer are moving towards each other. Hence the apparent frequency of the source is,

$$n' = n\left[\frac{v+v_0}{v-v_s}\right]$$

$$= 240 \times \left[\frac{340+20}{340-20}\right]$$

$$= 240 \times \frac{360}{320} = 270 \text{ Hz}$$

51. (a) : Since centripetal force is perpendicular to the displacement of the body, work done is zero as

$$W = \vec{F}.\vec{d} = Fd\cos\theta$$

52. (a)

53. (a) : As LASER is highly monochromatic and highly coherent, we can send a LASER beam to the moon, from where it comes back reflected without much loss of intensity. That's why the large distances can be measured accurately with the help of LASER.

54. (c) : In uniform circular motion, the force is always directed perpendicular to the displacement.

55. (a) : Because of the rotation of the earth, the value of acceleration due to gravity changes. Due to this rotation, the value of 'g' becomes minimum at the equator and maximum at the poles.

56. (c) : During reverse biasing, the depletion layer widens, and so there is more resistance for an electron or a hole to cross that layer to conduct current.

57. (d) 58. (a)

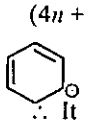
59. (c) : Kepler's laws are the general rules for all planetary motions. Hence artificial satellites showed also follow the same laws.

60. (c) : The third pin is used for grounding purposes so that it leaves the user safe while handling the appliance by making the extra charge on it get discharged.

CHEMISTRY

61. (b) : Aromaticity can be predicted by the use of Huckle's rule which says that $(4n + 2)$ π–electrons are required in delocalisation system to give it aromaticity.

$(4n + 2)$ π electrons means 2, 6, 10 .....π electrons.



Here total number of electrons available for delocalisation = 6

∴ It is expected to be aromatic.

62. (d) : Carbocation is more stable if it is bonded to electron relasing group which somewhat stabilise the carbocation. So more the number of electron releasing groups, more is the stability.

$\overset{+}{C}H_3 \quad CH_3 \rightarrow \overset{+}{C}H_2 \quad CH_3 \rightarrow \overset{+}{C}H \leftarrow CH_3 \quad CH_3 \rightarrow \overset{+}{\underset{CH_3}{\underset{|}{C}}} \leftarrow CH_3$

(least stable) (most stable)

63. (a) : CH_3 (methyl free radical) has planar structure with sp^2 hybridisation of 'C' atom. The odd electron is present in unhybridised $2p_z$ orbital.

$\overset{\oplus}{C}H_3$ (methyl carbonium ion) has also trigonal planar structure (sp^2).

$\overset{\ominus}{C}H_3$ (methyl carbanion ion) has tetrahedral structure (sp^3) and one of the hybrid orbital contains the lone pair of electrons.

64. (a) :

$$CH_3-CH_2-COOH \xrightarrow{P/Br_2} CH_3-\underset{\underset{Br}{|}}{CH}-COOH \xrightarrow[H^+]{\text{alc. KOH}}$$

$$CH_2 = CH - COOH + HBr$$

$P + Br_2$ is brominating agent that brominates the α-position. The product then undergo dehydrohalogenation in the pressure of alcoholic potassium hydroxides.

65. (a) : When $n = 5$, then $l = 0, 1, 2, 3, 4$.
Again when $l = 2$, then $m = -2, -1, 0, +1, +2$.
The 's' value can be $\pm 1/2$
Hence the arrangement, $n = 5$, $l = 2$, $m = 2$, $s = +1/2$ is possible for an electron.

66. (d) : Fluorine is a highly electronegative element, it withdraws electron from the neighbouring atoms. Therefore, more is the number of fluorine atoms attached, greater will be the acidity of the molecules. *e.g.* FCH_2COOH is more acidic than CH_3COOH. Therefore, correct order of acidity is :

$$CF_3COOH > CF_2HCOOH > FCH_2COOH > CH_3COOH$$

67. (a) : $HClO_4$ is the strongest acid among HClO, $HClO_2$, $HClO_3$ and $HClO_4$ as more the number of oxygen atoms attached, more is the acidity of the molecule order of acidity is :

$$HClO < HClO_2 < HClO_3 < HClO_4$$

So the conjugate base order will be just the reverse:

$$ClO^- > ClO_2^- > ClO_3^- > ClO_4^-$$

68. (a) : Smaller sized and highly charged metal atoms have higher hydration energy. In the alkaline earth metal, the hydration energy for the compact and charged ions is greater than the large sized charged ions. Therefore, order of hydration energy in this group is $Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

69. (b) : Carbon, oxygen and nitrogen atoms do not have any d-orbital available. Therefore, in CO_2^{2-}, NO_2^- and NO_3^-, there is no possibility of p_π–d_π type of bonding.

In PO_4^{3-} phosphorus atom have vacant d-orbital available which is used to form p_π–d_π type of bonding with p-orbital of oxygen atom.

70. (c) : Feasibility of reaction is determined by free energy change value (ΔG). ΔG is given by gibbs – Helmhots equation :

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

Reaction is feasible if ΔG value is negative. Therefore, if ΔH is negative and $T\Delta S$ is positive then the ΔG will always be feasible.

71. (c) : $C + O_2 \rightarrow CO_2$; $\Delta H^\circ = -a$ kJ
$2CO + O_2 \rightarrow 2CO_2$; $\Delta H^\circ = -b$ kJ
Formation of CO can be written as :

$$C + \frac{1}{2}O_2 \rightarrow CO \; ; \; \Delta H^\circ = ?$$

Adding equation : $C + O_2 \rightarrow CO_2$; $\Delta H^\circ = -a$ kJ

$$CO_2 \rightarrow CO + \frac{1}{2}O_2 \; ; \; \Delta H^\circ = \frac{b}{2} \text{ kJ}$$

We get $\Delta H^\circ_f(CO) = \frac{b}{2} - a = \frac{b-2a}{2}$

72. (a) : The bond strength H-X decreases from HF to HI. Thus HF is the most stable and hence weakest acid while is least stable and most acidic. In aqueous solutions, HF is only slightly ionised but HCl, HBr and HI are almost completely ionised. As basicity is the reverse of acidity. Therefore, HF is the most basic of all H-X.

73. (d) : 'Ba' reacts with water giving soluble hydroxide (Baryata) solution. While Mg and Sr forms insoluble hydroxides and Br_2 forms a reddish brown solution with water.

74. (d) : As the temperature increases, the dissociation of water in solution increases. Hence the H^+ ion conc. increases and pH of the solution decreases with increase in temperature.

75. (d) : Boron carbide is written as B_4C. It is produced by reducing B_2O_3 with C at 1600° C. Fibres of B_4C have an enormous tensile strength and are used to make bullet-proof clothing.

76. (c) : Electronic configuration for chromium is :
$_{24}Cr \rightarrow 1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^5\,4s^1$

After ionisation of $4s$ electron the next electron which will be ionised is from $3d$ orbital. As $3d^5$ electronic configuration, therefore is stable. Hence, the second ionisation of Cr will require much greater ionisation energy than the expected one.

77. (b) : In O_2, the bond order = 2
In O_2^{+2}, the bond order = 2.5
In O_2^-, the bond order = 1.5
In O_2^{-2}, the bond order = 1
As the bond order in O_2^{+2} is highest, so its internuclear distance is smallest.

78. (c) : For a salt of weak acid and weak base, its

$$pH = 7 + \frac{1}{2}pK_a - \frac{1}{2}pK_b$$

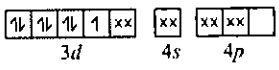
$$= 7 + \frac{1}{2} \times 3.8 - \frac{1}{2} \times 4.8 = 6.5$$

79. (a) : Ionic azides are usually much more stable e.g. KN_3, NaN_3 and Mg_3N_2 than the covalent azides. Covalent azides are used as detonators and explosives *e.g.* $Ba(N_3)_2$.

80. (b) : Electronic configuration of Co :

Co (Z = 27) : $4s^2\ 3d^7$

Co^{2+} : $3d^7$

$[CoCl_4]$: 

Therefore, hybridisation is dsp^2 and structure is square planar.

81. (b) : Basicity in nitrogen compounds is attributed to the availability of lone pair of electrons. The order of availability of e^- pair on N-atom is :

$NH_3 > NH_2NH_2 > HN_3 > NH_2OH$.

Therefore, same is the order of basicity of these compounds.

82. (b) : Electron osmosis – when electro phoresis of dispersed particles in a colloidal system is presented by some smitable means, it is observed that the dispersion medium it self begins to move in an electric field. This phenomenon is called as electro-osmosis.

83. (a) : Hydrogen fluoride is an associated molecule and can be represented by H_2F_2. This is due to the fact that strong Hydrogen bonding exist between the molecules. (as F is highly electronegative element)

$H_2F_2 + KF \rightarrow KHF_2 + HF$

84. (b) : The nitration of benzene takes places in three steps, *i.e.*

(i) Generation of electrophile (NO_2^+)

(ii) Attack of an electrophile to benzene ring forming the carbocation

(iii) Loss of proton from carbocation giving nitrobenzene.

The attack of electrophile to benzene ring giving a carbocation is the slowest and rate determining step.

85. (a) : CCl_4 is non-inflammable due to strong C—Cl bonds in it. Therefore it is inert to fire and used as a fire-extinguisher under the name of pyrene.

86. (b) : Concentration of NH_4OH solution = 0.1 N

Concentration of OH^- ions in solution,

$$[OH^-] = 20\% \text{ of } 0.1\text{ N} = \frac{20}{100} \times 0.1$$
$$= 0.02\text{ N}$$

$$\Rightarrow \quad pOH = -\log[OH^-] = -\log(0.02)$$
$$= 2 - 0.301$$
$$\Rightarrow \quad pH = 14 - pOH = 12.30$$

87. (a) : carnallite is ore of potassium and its formula is KCl. $MgCl_2.6H_2O$.

88. (a) : Standard Electrode potential for Gold is

$$Au^{3+} + 3e^- \rightleftharpoons Au,$$

is 1.50 volt. therefore, gold get easily reduced. So to electroplate gold on the spoon, spoon should be made cathode as reduction takes place on cathode.

89. (d) : Bond order of the molecules :

$O_2 : KK(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_x)^2(\pi 2p_y)^2(\pi 2p_z)^2 (\pi^* 2p_y)^2(\pi 2p_z)^1$

Bond order of $O_2^- = \frac{1}{2}(8-5) = 1.5$

$He_2^+ : (\sigma\ 1s)^2(\sigma^*\ 1s)^1$

Bond order of $He_2^+ = \frac{1}{2}(2-1) = 0.5$

$C_2 : Kk(\sigma\ 2s)^2(\sigma^*\ 2s)^2(\sigma 2p_x)^2(\pi 2p_y)^1(\pi 2p_z)^1$

Bond order $= \frac{1}{2}(6-2) = 2.0$

$NO : Kk(\sigma 2s)^2(\sigma^*\ 2s)^2(\sigma 2p_x)^2(\pi^2 p_y)^2(\pi^2 p_z)^2(\sigma^* 2p_x)^1$

Bond order $= \frac{1}{2}(8-3) = 2.5$

90. (a) : NaCl type structure is also called face centred cubic lattice. Here the radius ratio (r_c/r_a) ranges from 0.414 to 0.732.

$$\text{radius ratio} = \frac{r_c}{r_a} = \frac{\text{radius of cation}}{\text{radius of anion}}$$

$$\Rightarrow \quad \text{radius of anion } (B^-) = \frac{\text{radius of } A^+}{\text{radius ratio}}$$
$$= \frac{100}{0.414} \text{ to } \frac{100}{0.732}$$
$$= 241.5 \text{ to } 136.6.$$

91. (a) : Freundlich gave an empirical relationship between the quantity of gas adsorbed by unit mass of solid adsorbent and concentration at a particular temperature.

$$\log x/m = \log K + \frac{1}{n}\log C$$

x = mass of gas adsorbed, m = mass of adsorbent

C = concentration, k, n = constants.

92. (c) : Crystalline solids are anisotropic therefore their physical properties *e.g.* electrical conductivity, thermal conductivity, refractive index are the different in different directions. But amorphous solids, liquids

and gases are isotropic (*i.e.* same physical properties in all directions).

93. (a) : Charge = current × time

Charge, Q = 1A × 60 sec

= 60 coulumb

Now,

96500 C charge is carried by 6.023×10^{23} electron

$\Rightarrow$ 60 C charge $= \frac{6.023 \times 10^{23}}{96500} \times 60$ electrons

$= 3.74 \times 10^{20}$ electrons

94. (c) : $K_p = K_c (RT)^{\Delta n}$

Δn = change in number of moles

If Δn = positive then K_p will be greater than K_c.

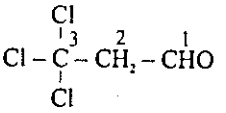
$PCl_3 + Cl_2 \rightarrow PCl_5$, $\Delta n = 1-2 = -1$; $K_p < K_c$

$H_2 + I_2 \rightarrow 2HI$, $\Delta n = 0$; $K_p = K_c$

$2SO_3 \rightarrow O_2 + 2SO_2$, $\Delta n = 1$; $K_p > K_c$

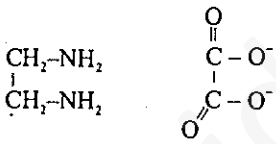
$N_2 + 3H_2 \rightarrow 2NH_3$; $\Delta n = -2$; $K_p < K_c$

95. (c) :



Therefore IUPAC name is 3,3,3 – trichloropropanal.

96. (a) : Bidentate ligands are those ligand which can coordinate to metal atom by two donor atoms. *e.g.*



97. (a) : $Al^{3+} + 3e^- \rightarrow Al$

Therefore, number of electrons required to deposite 1 gm equivelent of aluminium is three mole.

98. (b) : Reversible reactions are those reaction in which there is equilibrium established at every infinitesimal step. But the rate of forward and rate of backward reaction can be influenced (or speed up) by the use of catalyst.

99. (a) : Molecular weight of NH_4OH = 35

Now,

35 g of NH_4OH is needed to prepare 1 M solution in 1 litre

$\Rightarrow$ 35 g NH_4OH is 1 L solution $\equiv$ 1 molar solution

$\Rightarrow 2.5 \times 35$ g NH_4OH is 1 L solution $\equiv$ 2.5 molar solution

$\Rightarrow \frac{2.5 \times 35}{10}$ g NH_4OH is 100 L solution $\equiv$ 2.5 molar solution

$\Rightarrow$ 8.75 g NH_4OH was dissolved.

$NH_3 + H_2O \rightarrow NH_4OH$

For 35 g NH_4OH, NH_3 needed = 22.4 L at S.T.P

$\Rightarrow$ for 8.75 g NH_4OH, NH_3 needed $= \frac{22.4}{35} \times 8.75$ L

$= 5.6$ L

100. (a) : The equilibrium constant is not affected by changing the volume of the whole reaction flask.

101. (d) : Fe (Z = 26) ; Atomic weight = 55.85

Co (Z = 27) ; Atomic weight = 58.93

Ni (Z = 28) ; Atomic weight = 58.69

The correct order of Atomic weights is

CO > Ni > Fe

102. (c) : $NaClO_4 \rightarrow Na^+ + ClO_4^-$

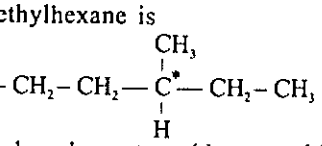
$NaClO_3 \rightarrow Na^+ + ClO_3^-$

$NaClO_2 \rightarrow Na^+ + ClO_2^-$

$NaClO \rightarrow Na^+ + ClO^-$

In aqueous solution, these compounds decompose into ions. ClO_4^- will most easily abstract proton from water molecules. So it will be most acidic.

103. (a) : 3–methylhexane is



C* = chiral carbon atom (due to which the compound is optieally active).

104. (d) : pH = – log[H^+]

$\Rightarrow$ pH = 2 $\Rightarrow$ [H^+] for pH = 2 = 10^{-2}

pH = 6 $\Rightarrow$ [H^+] for pH = 6 = 10^{-6}

$\Rightarrow \frac{10^{-2}}{10^{-6}} = 10^4 = 10{,}000$

105. (b) : Relative lowering of vapour pressure is given by :

$$\frac{P^0 - P}{P^0} = \frac{w/m}{w/m + W/M}$$

Where, P^0 = Vapour pressure of pure solvent

P = Vapour pressure of solution

w = mass of slute

m = molecular mass of solute

W = mass of solvent

M = molecular mass of solvent.

For dilute solution

$\Rightarrow \frac{121.8 - 120.2}{121.8} = \frac{15/m}{250/78} \Rightarrow m = 356.265$

106. (d) : BCl_3 : $\underset{2s}{\boxed{1\times}}\ \underset{2p}{\boxed{1\times}\boxed{1\times}\boxed{\ }}$ (Central Borm atom)

No lone pair of electron is available in BCl_3.

NCl_3 : $\underset{2s}{\boxed{\uparrow\downarrow}}\ \underset{2p}{\boxed{1\times}\boxed{1\times}\boxed{1\times}}$ (Central N-atom)

One lone pair of electron is available on N-atoms, it occupies a corner in the tetrahedral arrangement. Therefore, NCl_3 appears pyramidal in shape.

107. (a) : $Na_2[CuCl_4]$

Oxidation state of copper = + 2

Electronic configuration of $Cu^{2+} \Rightarrow 3d^9$

As there is no d–d transition possible, the molecule is not coloured.

108. (c) : Organic compound → Comp. + AgCl

0.189 g 0.287 g

$$\text{Percentage of chlorine in AgCl} = \frac{35.5}{143.35} \times 100 = 24.76\%$$

$$\text{Weight of chlorine in 0.287 g AgCl} = \frac{24.76}{100} \times 0.287 = .07106 \text{ g}$$

$$\text{Percentage of chlorine in 0.189 g} = \frac{.07106}{0.189} \times 100 = 37.598\%$$

109. (c) : All the alcohols are water soluble as alcohol molecules forms extensive hydrogen bonding with the water molecules.

110. (c) : The ground state electronic configuration of neon atom (Z = 10) is :

$1s^2, 2s^2, 2p^6$

Therefore first excited state of Neon will be :

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

111. (a) : Dissociation consant for :

$$HA \rightleftharpoons H^+ + A^-$$

Can be given as :

$$K_s = \frac{[H^+][A^-]}{[HA]}$$

Therefore, we can say that dissociation constant is a measure of its ability to furnish protons in the solution.

112. (a) : *p*-nitrophenol has higher boiling point than *o*-nitrophenol, because intermolecular hydrogen bonding present in *p*-nitrophenol is responsible for it. But intramolecular hydrogen bonding in *o*-nitrophenol does not effect boiling point.

113. (c) : Due to the presence of hydroxyl group (–OH), there is extensive hydrogen bonding between the ethanol molecules (C_2H_5OH). But there is no such Hydrogen bonding in Dimethyl ether (due to absence of –OH group). So boiling point of Dimethyl ether is much lower than ethanol.

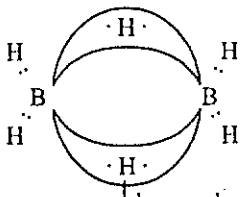
114. (a) : $CHCl_3$ and CH_3—OH are miscible due to intermolecular van der Waal's force of attraction. However CH_3OH is polar and $CHCl_3$ is non-polar.

115. (a) : Oxygen is the most electronegative element after fluorine. Therefore, in the componds between oxygen and fluorine, oxygen is found to show positive oxidation state.

e.g. OF_2 : Oxygen difluoride.

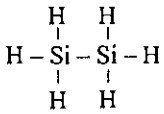
Oxidation state of oxygen here is +2.

116. (d) : B_2H_6 is an electron deficient compound. B_2H_6 contain some unusual bonds which are called as 2-electron, 3-centre bonds.



↓banana bonds

Si_2H_6 is called disilane.



117. (a) : A nuclear reaction in which two lighter nuclei are fused together to form a heavier nuclei is called nuclear fusion. In such a process, more stable nuclei come into existence binding energy per nucleon increases. Fusion reactions are highly exothermic because of loss of mass during fusion. *e.g.*

$${}_1^2H + {}_1^2H \rightarrow {}_2^4He + 24.9 \text{ MeV}$$

118. (a) : Heavy water is used as a moderator in nuclear reactors to absorb high speed neutrons. So that they slow down the rate of nuclear reaction.

119. (d) : Electronic configuration of Berylium and Boron is given as :

Be (Z = 4) : $1s^2, 2s^2$

Be (Z = 5) : $1s^2, 2s^2, 2p^1$

Ionisatin potential of Be is greater than that of Boron as first electron released from Be is from *s*-orbital while it is from *p*-orbital in Boron.

120. (a) : The large sized sulphate anion (SO_4^{2-}) is stabilised better by a large sized cation. So the stability of sulphates down the group increases so the lattice energy is more in $BaSO_4$ than in Na_2SO_4.

BIOLOGY

121. (c) : A muscle fibre would contract only when it receives stimulation of certain intensity called threshold stimulus. Response of a muscle fibre to a stimulus is not proportionate to its intensity. It is absent when the intensity is subliminal. Muscle fibre contracts to the maximum whether the stimulus has threshold value or supra–liminal value.

122. (b) : Cell cycle is a series of cyclic changes through which a cell passes during its growth and divisions. In the cell cycle, the resting stage or interphase can be divided into three periods.

Periods of Interphase	*Function*
G_1/post-mitotic gap phase	RNA and proteins synthesiszed
S/Synthetic phase	DNA is formed from purines and pyrimidines. The DNA content of nucleus would be doubled.
G_2/Pre mitotic gap phase	Synthesis of RNA and protein continues, but DNA synthesis stops

123. (a) : Barrbody is also known as sex chromatin, X chromatin. Barr body is partially inactivated and development of this facultative heterochromatin occurs in one of the two X chromosomes in interphase nuclei. Any of the two X–chromosomes can become heterochromatic.

124. (b) : Respiratory centre controls the rate of respiration. Respiratory centre is located in medulla oblongata and pons. It has the following components (i) inspiratory area – connected to inspiratory muscles, (ii) Pneumotaxic area, (iii) Expiratory area, (iv) chemosensitive area. Chemoreceptors located on carotid and aortic bodies are sensitive to oxygen deficiency in arterial blood. They send information to respiratory centre.

125. (b) : Cocaine is a natural alkaloid obtained from leaves of *Erthyroxylon coca*. Its chemical formula is $C_{17}H_{21}NO_4$. It is a powerful CNS stimulant. It causes lack of sleep and loss of appetite.

126. (c) : According to Petersons Mark and Recapture Method, the population (P) is given by

$$P = m(r + u)/r$$

where m = number of marked fishes

r = number of marked fishes recaptured

u = number of unmarked fishes captured.

$P = m(r + u)/r$ $\quad m = 80$

$= \frac{80(40+60)}{40}$ $\quad r = 40$

$= 200$ $\quad u = (100 - 40)$

$= 60$

127. (c) : In the primordial hot soup, simple organic molecules reacted amongst themselves to form heavier and larger molecules. When temperature of the earth cooled down to 1000°C or even lower a variety of simple hydrocarbons are formed. First, small chain compounds of C, H and O were formed from hydroxy derivatives. Some of the nucleotides came to have more phosphates and functioned as energy suppliers. Nucleotides underwent polymerization to form nucleic acids, DNA and RNA. Later enzymes and coenzymes came into existence.

128. (a) : Jamming of wooden frames during rains is caused by swelling of wood due to imbibition. (The absorption of water by the solid particles of a substance without forming a solution is called imbibition).

129. (b) : Plastids are semiautonomous cell organelles. They take part in storage and synthesis of organic compounds. Mitochondria are called the power houses of the cell as they are the centres of Krebs cycle or respiration liberating the maximum amount of energy. Ribosomes are submicroscopic polypeptide manufacturing naked granular nucleoprotein cell organelles.

Plasmids are defined as autonomous elements, whose genomes exist in the cell as the extrachromosomal unit. These are the chromosomal element found in bacteria. Plasmids are used as cloning vectors, due to their increased yield potential.

130. (c) : In Fabaceae stamens have diadelphous arrangement i.e. (9) + 1. In total these are 10 in number.

131. (d) : Test cross is a cross to know the genotype of the individual. The individual is crossed with recessive parent. The dihybrid test cross ratio is 1:1:1:1.

The characters under consideration is tall white and dwarf black.

Gametes of TtWw = TW, Tw, tW, tw

Gametes of ttww = tw

♂/♀	tw	tw	tw	tw
TW	TtWw	TtWw	TtWw	TtWw
Tw	Ttww	Ttww	Ttww	Ttww
tW	ttWw	ttWw	ttWw	ttWw
tw	ttww	ttww	ttww	ttww

Thus the ratio of TtWw : Ttww : ttWw : ttww : is 1 : 1 : 1 : 1

132. (a) : Porous wood possesses abundant vessels. Due to the presence of vessels, the hardwoods are also called porous wood.

133. (b) : For human RBC, 0.9% salt solution is isotonic. Hence a medium of 1.5 % salt solution would be hypertonic i.e. more concentrated. Hence the RBC will shrink due to exosmosis.

134. (b) : A simple reflex action is a nerve mediated spontaneous automatic and involuntary response to a stimulus acting on a specific receptor without consulting the will of the animal. Conditioned reflexes are those reflex actions that are not present at birth but develop later in life through learning, habit, experience or regular association of an indifferent stimulus with unconditioned stimulus.

135. (b) : Duck billed platypus is an egg laying mammal. It is a monotreme.

136. (a) : In RNA, thymine is replaced by uracil.

137. (a) : Pulmonary veins carry oxygenated blood from the lungs to the left atrium of the heart. Hepatic portal vein forms the hepatic portal system. It enters liver and breaks into capillaries. The renal artery branches out from the dorsal aorta and supplies blood to the kidney.

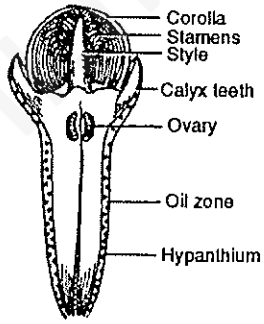
138. (b) : Some evolution occurs by random fluctuations in gene frequency called genetic drift. Such fluctuations are more likely to occur in a small population. Given frequency in small population changes by chance.

139. (d) : Organophosphates (Malathion) kills insects by inhibiting enzyme cholinesterase. It is carbamates. They are the organic esters of the carbonic acid. In their structure, they are quite similar to acetylcholine and, therefore have strong affinity for the enzyme *acetylcholinesterase*, and inhibits its activity.

140. (d) : Biosphere is the living mantle or biologically inhabited part of earth along with its abiotic or physiochemical component. Biosphere consists of three interacting subdivisions – atmosphere, lithosphere and hydrosphere. Atmosphere is the transparent gaseous mantle surrounding the earth. Lithosphere is the outer solid crust of earth. Hydrosphere is liquid mantle of earth.

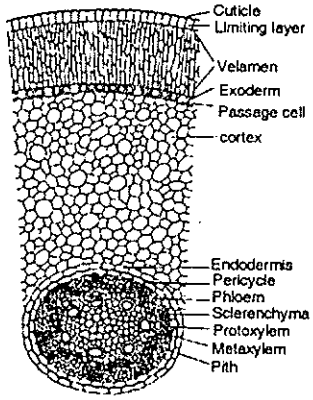
141. (c) : In photorespiration uptake of oxygen and evolution of carbondioxide are light dependent. RuBP carboxylase act as RuBP oxygenase. It occurs in chloroplast and require the help of peroxisomes and mitochondria.

142. (a) : Cloves are unopened floral buds of *Syzygium aromaticum*.



Diagrammatic longitudinal section through a clove flower bud

143. (a) : Velamen is a dead spongy tissue present in epiphytic roots (hygroscopic roots). With the help of velamen, these roots are able to absorb water from moist atmosphere, dew and rain.



Detailed structure of a portion of T.S. of orchid root

144. (d) : Hydroponics is soilless cultivation of plants by placing the roots in the nutrient solution. Goerick (1940) used the term hydroponics to refer the growth of plants in water and sand culture.

145. (b) : Commercial coir is obtained from the fibrous husk (mesocarp) of fruits of coconut palm. The fibre is valued for its lightness, elasticity, exceedingly high resistance to mechanical wear and dampness.

146. (b) : Vernalization is a process of shortening of the juvenile or vegetative phase and hastening

flowering by a previous cold treatment. The term vernalization was coined by Lysenko (1928).

147. (b) : Viruses have the strong reproductive capacity within the host body, thus when viral disease occurs, several copies of that virus are produced in the body and cure by taking medicines is almost impossible. Only, body's own immunity can destroy them. Viruses cause a number of infectious human diseases like common cold, yellow fever, rabies, cancer, AIDS etc.

148. (a) : Tadpoles can be made to grow in size by injecting thyroxine hormone. The process by which tadpole grows in size and becomes adult is known as metamorphosis. The amphibian metamorphosis is under neuroendocrine control.

Thyroxine–Releasing–factor or TRF secreted by Hypothalamus
↓
Anterior Pituitary become stimulated and produce TSH
↓
Thyroid produces T_4 and T_3 hormones
↓
Metamorphosis of the tadpole starts

149. (a) : Pituitary is found in sella turcica. It is a depression in sphenoid bone of cranial cavity.

150. (d) : Crustaceans are mostly marine but a few live in freshwater or moist places. Body consists of cephalothorax and abdomen. Each body segment bears a pair of biramous appendages. Respiration occurs through body surface or gills. Excretion occurs through green glands. They bear two pairs of antennae.

151. (a) : Chloromycetin or chloramphenicol is obtained from *Streptomyces venezuelae* and *S. lavendulae*.

Maximum number of antibiotics are produced by mycelial bacteria known as actinomycetes.

152. (c) : Mutualism is an obligatory positive interspecific interaction strongly beneficial to both species. The unicellular photosynthetic plants, called *Zoochlorellae* live symbiotically in the outer tissues of coelenterates. Algae are photosynthetic and produce oxygen and nitrogenous compounds beneficial to hosts and in exchange they obtain materials like carbon dioxide and nitrogenous wastes released by metabolism of host animals. The relationship between hermit crab and sea anemone is an example of commensalism.

153. (b) : In respiration, from 180 gm of glucose 264 gm CO_2 + 108 gm H_2O + 686 Kcal energy is formed.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 686$ Kcal

Atomic weight of C = 12, H = 1, O = 16

$C_6H_{12}O_6 = (12 \times 6 + 12 \times 1 + 16 \times 6)$
$= 180$ gm

$6CO_2 = 6\,(12 + 16 \times 2)$
$= 264$ gm

$6H_2O = 6\,(2 \times 1 + 16)$
$= 108$ gm

$\therefore$ From 1 molecule or 180 gm of glucose, through respiration, 264 gm CO_2, 108 gm H_2O and 686 Kcal energy are formed.

154. (c) : Cytoplasmic inheritance or non chromosomal (extranuclear) inheritance is the passage of traits from parents to offspring through structures present inside cytoplasm of contributing gametes. The genes controlling cytoplasmic inheritance are called plasma genes or extra nuclear genes. These occur in plastids, mitochondria, plasmids. Cytoplasmic inheritance is usually uniparental. It is also called maternal inheritance as zygote receives its cytoplasm from ovum.

155. (a) : Water always moves from the area of high water potential to the area of low water potential i.e., from less negative potential to more negative potential.

156. (a) : Stomata are meant for gaseous exchange but are also the main source of transpiration. In majority of plants stomata open in the presence of light and close in darkness.

157. (b) : 10 pairs of cranial nerves are present in anamniotes (fishes and amphibians) and 12 pairs occur in amniotes (reptiles, birds and mammals). In anamniotes the cranial nerves are – Olfactory, Optic, Occulomotor, Trochlear, Trigeminal, Abducens, Facial, Auditory, Glossopharyngeal and Vagus. In amniotes two more cranial nerves, Spinal accessory and Hypoglossal nerves are present in addition to the above ten.

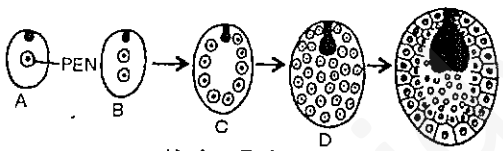
158. (c) : In arthropods like prawn, the blood is colourless and contains WBCs only. The blue respiratory pigment, haemocyanin is present in the

blood of molluscs. The RBCs of mammals contain the red pigment haemoglobin which carries oxygen.

159. **(a)** : *Escherichia coli* is the non-pathogenic bacteria of colon. It is the motile or non-motile organism which lives in the intestine of humans as the part of normal flora. One of the characterisitcs of *Escherichia coli* is the production of bacteriocins (colicins), a specific type of metabolite which is not only lethal to the organism of the same species but also to related organisms.

Balantidium coli results in inflammation of alimentary tract. *Entamoeba coli* causes amoebic dysentery. *Enterobius vermicularis* infection is known as oxyuriasis or enterobiosis.

160. **(b)** : In Nuclear endosperm the primary endosperm nucleus divides repeatedly without wall formation produce a large number of free nuclei. It is most common type of endosperm. It is named so because it contains free nuclei in the beginning.



Nuclear Endosperm

161. **(c)** : Cell wall is two layered and wavy in Gram (-) bacteria. The wall contains peptidoglycan in the inner layer. The outer layer has lipopolysaccharides, proteins and phospholipids.

162. **(c)** : Nematocysts are the stinging cells and are the organs of offence and defence of coelenterates, Nematocyst contains a poisonous proteinaceous fluid hypnotoxin along tube which injects the fluid into the victim. Nematocysts are activated in response to chemicals secreted by prey. They explode after coming in contact with the prey.

163. **(b)** : Phytochrome is an amorphous photoreceptor chromoprotein. It exists in two interconvertible forms i.e., P_r and P_{fr}.

$$P_r \text{ (inactive)} \underset{\text{far red (in dark)}}{\overset{\text{Red light}}{\rightleftharpoons}} P_{fr} \text{ (active)}$$

164. (d) : Blackmann formulated the principle of limiting factors. He studied the effect of CO_2 concentration, light intensity and temperature on the rate of photosynthesis.

165. **(b)** : Graafian follicle develops under influence of FSH of anterior pituitary. Its follicular cells secrete estrogen. Rising level of estrogen decreases production of FSH, and stimulates secretion of LH. The two cause mature graafian follicle to release the ovum.

166. (c) : *Calvin et al* while working on *Chlorella* found that carbon dioxide fixes during dark phase of photosynthesis. 6 molecules of CO_2 combines with 6 RuBP and after a chain of reaction form one molecule of glucose (six calvin cycle are required for the production of one glucose molecule).

167. **(a)**

168 **(b)** : In prokaryotes meiosis is absent due to absence of gamete formation. But there occurs genetic recombination through following three processes :

Transduction, Tranformation and conjugation (for more details please refer solution no. 157 of AIIMS 2000).

170. **(a)**

171. **(b)** : The opening and closing of stomata is a function of turgor changes in guard cells. In light malic acid produce in guard cells, which dissociates into hydrogen and malate ions, resulting in intake of K^+ ions through H^+–K^+ ion exchange. There is increase in concentration of K^+ and malate ions in guard cells, endosmosis of water into guard cells resulting in increased turgor pressure which results in stomatal opening.

Stomata are chiefly concerned with gaseous exchange during photosynthesis and respiration and water loss through transpiration.

172. **(a)** : Cheetah is the most successful among quadrapedal animals. Because of its specially developed forelimbs and bodyshape, it acquires the power of fastest running over the ground. During running, it uses its powerful forelimbs to push itself forward.

173. **(a)** : Wounds heal slowly due to vitamin deficiency. The best eharaeterized function of vitamin C is the synthesis of collagen connective tissue protein at the level of hydroxylation of prolyl and lysyl residues of procollagen. Thus vitamin C is important for tissue healing. Patients with peptic ulcers will heal faster on vitamin C than those with extra vitamin C.

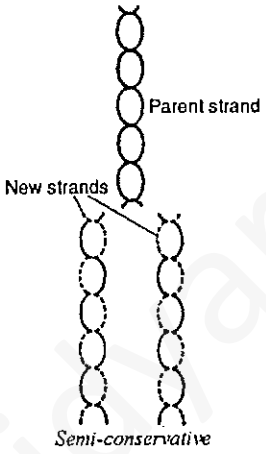
174 **(c)** : A plant girdled upto bast will show the sign of degradation because of the non transportation of the solute which occurs through phloem (bast). Water transportation will case if the xylem portion is girdled.

Girdled bast
↓ stop
Solute translocation
↓ results
death of root
↓ hence
death of plant

175 **(c)** : Phenylketonuria is the inborn error in metabolism. This disease is associated with metabolic breakdown of phenylalanine. The disease occurs due to accumulation of phenylpyruvic acid and causes mental disorders.

176. **(d)** : Salamander is a semiterrestrial lizard like tailed carnivorous and nocturnal amphibian. Sphenodon is a burrowing, carnivorous and nocturnal reptile. It is regarded as a living fossil.

177. **(d)** : Watson and Crick suggested that replication of DNA is semiconservative. Semiconservative nature of DNA replication was proved by Messelson and Stahl by using heavy isotope of nitrogen (15N).

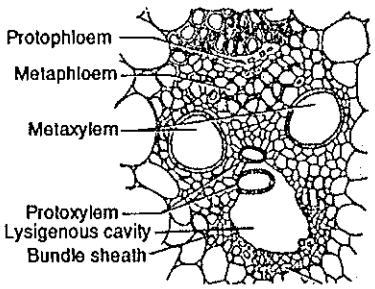


Semi-conservative

DNA polymerase III establishes phosphodiester linkages between the adjacent deoxyribonucleoside phosphate in presence of ATP/GTP, TPP and Mg^{2+}. It produces a new strand of DNA. DNA polymerase binds nucleotides in 5'–3' direction.

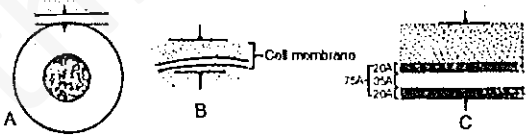
178. **(c)** : *t*RNA is synthesized in the nucleus as a DNA template. Only 0.025% of DNA codes for *t*RNA. *t*RNA is an exception to other cellular RNAs in that a part of its ribonucleotide sequence (–CCA) is added after it comes off the DNA template *t*RNA is formed from only a small part of DNA molecule. Therefore, it does not show any obvious base relationship to DNA.

179 **(d)** : Monocot stem bear collateral closed vascular bundle. In monocot stem cambium is absent and such vasular bundle is called closed type.



Monocot stem.

180. **(a)** : All cells are bounded by a thin membrane called the plasmalemma. This membrane is not seen under light microscope as separate layer. It has no cell cement and thus it is very thin. It has structural proteins, enzymes and carrier proteins.



The cell membrane : (A) Light microscope view. (B) and (C) Electron microscope views.

GENERAL KNOWLEDGE

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

❖ ❖ ❖