SOLUTIONS

PHYSICS

1. **(b)** : In an unbiased *PN* junction diode current flow due to minority charge carriers (electron in the *P*-region and holes in the *N*-region).

2. **(c)** : If $\frac{dI}{dt}$ is the rate of change of current through inductor L of any instant, then induced emf in the inductor of the same instant is

$$=\left(-\frac{L\,dI}{dt}\right)$$

To maintain the flow of current in the circuit applied voltage must be equal and opposite to the induced voltage.

$$\therefore \quad V=-\left(-L\frac{dI}{dt}\right).$$

Given, $V = V_0 \sin\omega t$ ...(i)

$$\therefore \quad V_0 \sin\omega t = \frac{L\,dI}{dt}$$

$$\frac{dI}{dt}=\frac{V_0}{L}\sin\omega t$$

$$\text{or} \quad I=\frac{-V_0}{L}\frac{\cos\omega t}{\omega} \qquad ...(ii)$$

Instantaneous power,

$$\because \quad P = V I$$

$$=(V_0\sin\omega t)\left(-\frac{V_0\cos\omega t}{L\omega}\right) \quad \text{(Using (i) \& (ii))}$$

$$=\frac{-V_0^2\sin 2\omega t}{2L\omega}$$

3. **(c)** : The resultant intensity is given by

$$I_R = I_1 + I_2 + 2\sqrt{I_1 I_2}\ \cos\phi$$

For constructive interference, $\cos\phi = 1$

$$\therefore \quad I_R = I_1 + I_2 + 2\sqrt{I_1 I_2}$$

$$\text{or} \quad I_R = 4I \qquad (\text{Given } I_1 = I_2 = I)$$

4. **(b)** : Let L is the distance between a real object and its real image formed by a convex lens, then as

$$L = (|u| + |v|)$$

$$=(\sqrt{u}-\sqrt{v})^2 + 2\sqrt{uv} \qquad ...(i)$$

L will be minimum, when

$$(\sqrt{u}-\sqrt{v})^2 = 0$$

i.e., $u = v$

Putting, $u = -u$ and $v = +u$ in lens formula,

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{F}$$

$$\frac{1}{u}-\frac{1}{-u}=\frac{1}{F}$$

$$u = 2F$$

$$\therefore \quad (L)_{\min} = 2\sqrt{2F\times 2F} = 4F \qquad \text{(Using (i))}$$

5. **(a)** : The fringe width is given by

$$\beta=\frac{\lambda D}{d}$$

Here D is the separation between screen and slits and d is the separation between slits.

6. **(c)** : Here, $T_{1/2} = 8$ years

$t = 32$ years

Using, $N = N_0\left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$

$$\left(\frac{N}{N_0}\right)=\left(\frac{1}{2}\right)^{\frac{32}{8}}$$

$$=\left(\frac{1}{2}\right)^4$$

$$\left(\frac{N}{N_0}\right)=\frac{1}{16}$$

7. **(c)** : In the circuit, the zener diode is used as power regular therefore,

$$P = VI$$

$$= 12 \times 0.05 = 0.6 \text{ W.}$$

8. **(c)** : The relation between kinetic energy, threshold frequency and frequency of photon is given as

$$\frac{1}{2}mv^2 = (h\upsilon - h\upsilon_0)$$

$$= h\,(1\times 10^{14} - 5\times 10^{13})$$

$$k = h\,(5\times 10^{13})$$

$$= 6.67\times 10^{-34}\times 5\times 10^{13}$$

$$= 3.3\times 10^{-20}\ \text{J.}$$

9. **(a)** : The phase angle

$$0 = \tan^{-1}\left(\frac{X_C - X_L}{R}\right)$$

$= \tan^{-1}\left(\frac{8-5}{4}\right)$

$\theta = \tan^{-1}\left(\frac{3}{4}\right)$

Therefore, the current leads the voltage by $\tan^{-1}\left(\frac{3}{4}\right)$.

10. **(a)** : Here, $m = 100\ g = 10^{-1}\ kg$, $l = 1\ m$, $I = 5\ A$
For a wire balanced midway air by a magnetic field is
$mg = IlB$.
or $B = \frac{mg}{Il}$
$= \frac{10^{-1} \times 10}{5 \times 1}$
$B = 0.2\ T$.

11. **(a)** : Heat supplied to a system is in the form of energy.
$\therefore$ Dimensional formula is = $[M\ L^2\ T^{-2}]$.

12. **(d)** : The magnetic field at any point inside the toroid is zero.

13. **(d)**

14. **(a)**

15. **(b)** : Magnetic dipole moment of electron in an atom is given as
$M = \frac{n\,eh}{4\pi m} = n\mu_B$
where, n = number of orbit
μ_B = Bohr Magneton
For minimum dipole moment, $n = 1$
$\therefore \quad M = \frac{eh}{4\pi m}$

16. **(a)**

17. **(a)** : Total energy of an electron in hydrogen atom above 0 eV leads to continuation of energy states.

18. **(c)** : Two parallel current carrying wires in the same direction attract each other whereas two parallel current carrying wires in the opposite direction repel each other.

19. **(b)** : Let a particle of mass m is thrown vertically upwards with velocity v. Let its velocity be v' at a height $3R$ from the surface of the earth.
According to the conservation of energy,

$$\frac{1}{2}mv^2 - \frac{GMm}{R} = \frac{1}{2}mv'^2 - \frac{GMm}{(R+3R)}$$

$$v^2 - \frac{2GM}{R} = v'^2 - \frac{2GM}{4R}$$

$$v^2 - v'^2 = \frac{-2GM}{4R} + \frac{2GM}{R} = \frac{6}{4}\frac{GM}{R}$$

$$v'^2 = v^2 - \frac{6}{4}\frac{GM}{R}$$

$$v' = \sqrt{(11.2)^2 - \frac{3}{2}gR} \quad \left(\because g = \frac{GM}{R^2}\right)$$

$$= \sqrt{(11.2)^2 - \frac{3}{2} \times \frac{9.8 \times 6400}{1000}}$$

$$= \sqrt{(11.2)^2 - (94.08)}$$

$$= 5.6\ km\ s^{-1}$$

20. **(d)** : The Gamma decay due to instability of nucleus is excess energy of nucleus.

21. **(c)** : de broglie wavelength,
$\lambda = \frac{h}{\sqrt{2mk}}$
or $k = \frac{h^2}{2m\lambda^2}$
$= \frac{(6.67 \times 10^{-34})^2}{2 \times 9.1 \times 10^{-31} \times (1 \times 10^{-9})^2} = 1.5\ eV.$

22. **(c)** : Terminal velocity
$V_t \propto D^2$.

23. **(a)** : Electric field due to a long charged wire is given as
$E = \frac{\lambda}{2\pi \epsilon_0 r}$
where, λ = linear charge density.
r = distance from the wire.
$\therefore \quad E \propto \frac{1}{r}$

24. **(a)** : Mass (m) = 2 kg; initial radius of the path (r_1) = 0.8 m; initial angular velocity (ω_1) = 44 rad/sec and final radius of the path (r_2) = 1 m.
Moment of inertia, $I_1 = mr_1^2 = 2 \times (0.8)^2$
$= 1.28\ kg\ m^2$ and $I_2 = mr_2^2 = 2 \times (1)^2 = 2\ kg\ m^2$
Therefore from the law of conservation of angular momentum $I_1\omega_1 = I_2\omega_2$
or $\omega_2 = \frac{I_1 \times \omega_1}{I_2} = \frac{1.28 \times 44}{2}$
$\omega_2 = 28.16$ rad/sec

25. (b)

26. (a) : Since, $\vec{v} = v_0 \hat{i}$

$$\vec{E} = E_0 \hat{j}$$

The electron is moving in x-direction perpendicular to the electric field which is in y-direction.

Thus, the path of electron moving perpendicular to field will be a parabola.

27. (b) : Effective acceleration due to gravity due to rotation earth is given as

$g' = g - R\omega^2\cos^2\phi$

$\therefore$ Change in acceleration, $dg = R\omega^2\cos^2\phi$

$\therefore$ $dg \propto \cos^2\phi$

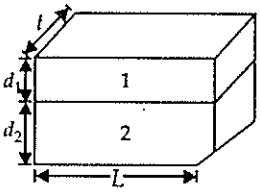
28. (c) : Let t be the width and L be the length of each conductor.

Effective thermal resistance, $R_p = \dfrac{R_1R_2}{R_1 + R_2}$

$\because$ $R = \dfrac{L}{KA}$

where k = thermal conductivity

$$\frac{L}{AK_{eq}} = \frac{\frac{L}{K_1A_1}\frac{L}{K_2A_2}}{\frac{L}{K_1A_1} + \frac{L}{K_2A_2}}$$



$$\Rightarrow \frac{1}{K_{eq}(A_1 + A_2)} = \frac{1}{K_2A_2 + K_1A_1}$$

$$\Rightarrow K_{eq} = \frac{K_1A_1 + K_2A_2}{A_1A_2}$$

$$= \frac{K_1d_1t + K_2d_2t}{d_1t + d_2t} = \frac{K_1d_1 + K_2d_2}{d_1 + d_2}$$

29. (a) : It is a balanced Wheatstone bridge. Hence no current flows through resistance of arm BD and the resistance of arm BD is ineffective.

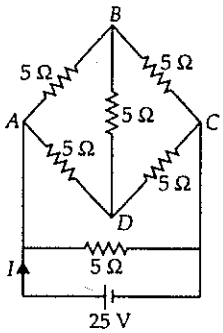
$\therefore$ $\dfrac{R_{AB}}{R_{BC}} = \dfrac{R_{AD}}{R_{DC}}$

$\Rightarrow$ $\dfrac{5\,\Omega}{5\,\Omega} = \dfrac{5\,\Omega}{5\,\Omega}$

Resistance of arm $ABC = 5\,\Omega + 5\,\Omega = 10\,\Omega$

Resistance of arm $ADC = 5\,\Omega + 5\,\Omega = 10\,\Omega$

The effective resistance between A and C is



$$\frac{1}{R_{AC}} = \frac{1}{10} + \frac{1}{10} \text{ or } R_{AC} = 5\,\Omega$$

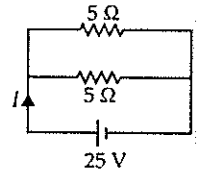
Now the equivalent circuit becomes

$\therefore$ The equivalent resistance of the circuit

$$\frac{1}{R} = \frac{1}{5} + \frac{1}{5} \text{ or } R = 2.5\,\Omega$$

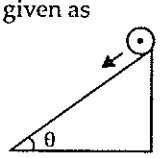
Current in the circuit,

$$I = \frac{V}{R} = \frac{25}{2.5} = 10\text{ A}$$



30. (c) : Let the inclination of the inclined plane be θ. Acceleration of a rolling body is given as

$$a = \frac{g\sin\theta}{(1 + K^2/R^2)}$$



Here, K is radius of gyration.

For circular disc

$$I = \frac{1}{2}MR^2 \quad \therefore \quad \frac{K^2}{R^2} = \frac{1}{2}$$

$$\therefore \quad a = \frac{2}{3}g\sin\theta \qquad \text{...(i)}$$

For solid cylinder

$$I = \frac{1}{2}MR^2 \quad \therefore \quad \frac{K^2}{R^2} = \frac{1}{2}$$

$$\therefore \quad a = \frac{2}{3}g\sin\theta \qquad \text{...(ii)}$$

For solid sphere

$$I = \frac{2}{5}MR^2 \quad \therefore \quad \frac{K^2}{R^2} = \frac{2}{5}$$

$$\therefore \quad a = \frac{5}{7}g\sin\theta \qquad \text{...(iii)}$$

For hollow cylinder

$$I = MR^2 \quad \therefore \quad \frac{K^2}{R^2} = 1$$

$$\therefore \quad a = \frac{1}{2}g\sin\theta \qquad \text{...(iv)}$$

Hence, from (i), (ii), (iii) and (iv) we conclude that the solid sphere will reach the bottom with maximum acceleration.

31. (d) : Here, $P = 100$ W, $t = 10$ min $= 60$ s

Heat developed in time t

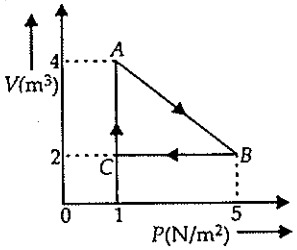
$H = P \times t = (100\text{ W})(60\text{ s}) = 6000$ J

32. (c) : A polyatomic gas has 3 translational, 3 rotational degrees of freedom and a certain number (f) of vibrational modes. Hence, the degree of freedom for polyatomic gas is ≥ 6.

33. (b)

34. (b)

35. (b) :



Process $B \rightarrow C$ occurs at constant volume

Hence, $W_{BC} = 0$

Process $C \rightarrow A$ occurs at constant process.

Hence the work done in the process is

$W_{CA} = P\Delta V = (1)(V_A - V_C) = (1)(4-2) = 2$ J

For a cyclic process, $\Delta U = 0$

According to the first law of thermodynamics

$\Delta Q = \Delta W + \Delta U$

$\Delta Q = \Delta W$

$= W_{AB} + W_{BC} + W_{CA}$

$5 = W_{AB} + 0 + 2$ or $W_{AB} = 3$ J

36. (b) : For an isothermal process, the slope is $-\frac{P}{V}$.

37. (a) : The frequency order for given electromagnetic waves is as follows.

$\upsilon_{\gamma\text{-rays}} > \upsilon_{\text{X-Rays}} > \upsilon_{UV}$

$B > A > C$

38. (a) : Here, $I_B = 5\ \mu A = 5 \times 10^{-6}$ A

$\beta = 100$

$R_L = 10\ k\Omega = 10 \times 10^3\ \Omega$

As $\beta = \frac{I_C}{I_B}$

or $I_C = (100)(5 \times 10^{-6}\ A) = 5 \times 10^{-4}$ A

The voltage across collector emitter is

$V_{CE} = R_L I_C = (10 \times 10^3\ \Omega)(5 \times 10^{-4}\ A) = 5$ V

39. (b) : After a long time the capacitor has become fully charged, the entire battery voltage 60 V appears across the capacitor.

40. (d) : Emission of α-particle decreases the mass number and the atomic number by 4 and 2 respectively. Emission of β-particle increases the atomic number by 1 while the mass number remains unchanged.

After the emission of the one α-particle and two β-particles

Decreases in mass number = 4 – 0 = 4

Decreases in atomic number = 2 – 2 = 0

∴ The resulting the nucleus is ${}^{m-4}_{n}X$.

i.e. the isotope of the given nucleus.

41. (a) : Maximum air flow due to convection does not occur at the north pole but it occurs at 30° N pole because there is a maximum temperature difference between equator and 30°N at poles.

42. (c) : Lenses have different refractive index for different wavelengths of light. The refractive index decreases with increasing wavelength. So red light will bend least and violet the most. This will result is slight dispersion which will be seen as chromatic aberration.

43. (d) : If a material is in contact with another material, the surface energy depends on the interaction of molecules of the materials. If the molecules of the materials attract each other, surface energy is reduced and when they repel each other, the surface energy is increased. Thus the surface energy depends on both the materials, so both the assertion and reason are false.

44. (b)

45. (a) : Animate object do not obey Newton's second law, so it can accelerate in the absence of external force.

46. (a) : Magnetic field due to a circular loop carrying current I is given as

$$B = \frac{\mu_0}{4\pi}\frac{2\pi I r^2}{(r^2 + x^2)^{3/2}}$$

where, r = radius of loop

x = distance from centre of loop

For large distances, $(x >> r)$,

$$\therefore \quad B = \frac{\mu_0}{4\pi}\frac{2IA}{x^3} = \frac{\mu_0}{4\pi}\frac{2M}{x^3}$$

where $M = IA$ = magnetic dipole moment of current loop which is equal to the magnetic field due to magnetic dipole.

Thus, the current loop can be considered as a magnetic dipole.

47. (b)

48. (b)

49. (b) : In telescope to have a large magnifying power, focal length of objective lens is kept large. To increase the magnifying power and resolving power, aperture of the objective lens is made large.

50. **(a)** : We know that $E = -\frac{13.6}{n^2}$ eV

It shows that total energy of electron in a stationary orbit in a hydrogen atom is negative, which means the electron is bound to the nuclear and is not free to leave it.

51. **(c)** : According to law of equipartition of energy, in thermal equilibrium, at temperature T, each degree of freedom of translational, rotational and vibrational motion contributes an average energy equal to $\frac{1}{2}k_BT$. The vibrational motion has two types of energy associated with the vibrations along the length of the molecule-kinetic energy and potential energy. Thus, it contributes two degrees of freedom. Thus vibrational energy $= 2 \times \frac{1}{2}k_BT = k_BT$.

52. **(b)** : Superconductor is both a perfect diamagnetic substance as well as a perfect conductor.

53. **(b)** : Electrostatic field is a conservative field which means work done by an electrostatic field in moving a charge from one point to another depends only on the initial and the final positions and is independent at the path taken to go from one point to the another.

54. **(a)** : Cyclotron is used to accelerate charged particles to high energies. It uses both electric and magnetic fields together to increase the energy of the charged particle.

55. **(a)**

56. **(b)** : Electromagnetic waves are those waves in which there are sinusoidal variation of electric and magnetic field vectors at right angles to each other as well as at right angles to the direction of wave propagation. They are self-sustaining oscillations of electric and magnetic fields in free space or vacuum.

57. **(b)** : Gauss's theorem is based on inverse square dependence of electric field on distance.

58. **(b)**

59. **(a)**

60. **(b)**

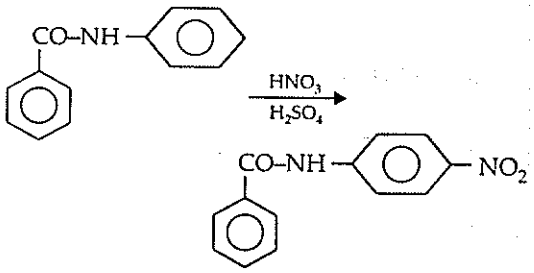
CHEMISTRY

61. **(b)** : Following the conservation of energy principle,

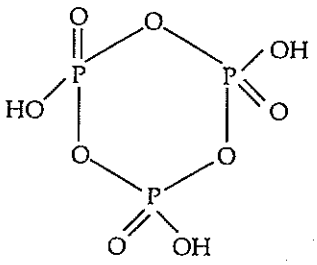
$$\text{Kinetic energy } \left(\frac{1}{2}m_e v^2\right) = h(\upsilon - \upsilon_0)$$
$$= (6.626 \times 10^{-34}\ \text{J s})(1 \times 10^{14}\ \text{s}^{-1} - 5 \times 10^{13}\ \text{s}^{-1})$$
$$= (6.626 \times 10^{-34}\ \text{J s})(5 \times 10^{13}\ \text{s}^{-1})$$
$$= 3.313 \times 10^{-20}\ \text{J}$$

62. **(b)** : The ring attached to the nitrogen atom in benzanilide is strongly activated towards electrophilic substitution reaction.

$\therefore$ Nitration occurs at *p*-position to the ring attached to 'N' atom.



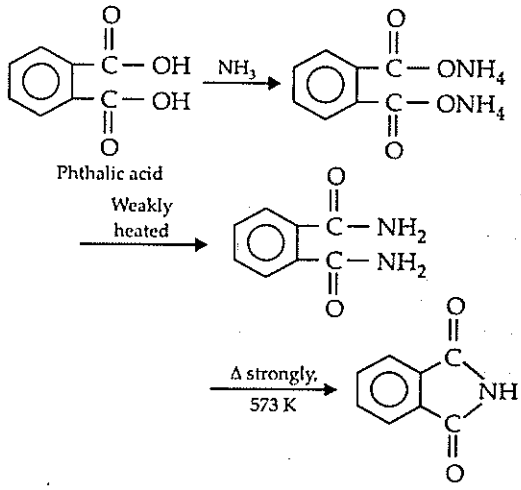
63. **(b)** :



$(HPO_3)_3$

64. **(a)**

65. **(d)**



66. **(a)** : *bcc* has eight atoms at corners and each is shared by 8 unit cells so that the contribution of each atom at corner is $\frac{1}{8}$.

67. **(c)** : Greater are the intermolecular forces of attraction, higher is the critical temperature.

68. **(c)** : Dissociation energy of methane = 360 kJ mol^{-1}

$\therefore$ Bond energy of C — H bond $= \frac{360}{4} = 90$ kJ

Bond energy of ethane,

1(C — C) + 6 (C — H) = 620 kJ/mol

(C — C) + 6 × 90 = 620

(C — C) + 540 = 620

C — C = 620 – 540

C — C = 80 kJ mol^{-1}.

Bond dissociation of C — C bond = 80 kJ mol^{-1}.

69. **(c)** : Silicon is hydrophobic.

70. **(d)** : $mvr = \frac{nh}{2\pi}$

71. **(d)** : Copper (I) compounds are unstable in aqueous solution and undergo disproportionation.

$2Cu^{+} \rightarrow Cu^{2+} + Cu$

The greater stability of $Cu^{2+}_{(aq.)}$ than $Cu^{+}_{(aq.)}$ is due to much more $-ve$ $\Delta_{hyd}H$ of $Cu^{2+}_{(aq.)}$ than $Cu^{+}_{(aq.)}$, which more than compensates for the second ionisation enthalpy of Cu.

72. **(a)** : Rate $= \frac{\text{concentration}}{\text{time}} = \frac{\text{mol L}^{-1}}{\text{s}}$

$= \text{mol L}^{-1}\text{ s}^{-1}$

The units of rate constant for the reaction of the order = (mol L^{-1})$^{1-n}$ s^{-1}

here, $n = \frac{3}{2}$

$\therefore$ Unit of rate constant = (mol L^{-1})$^{1-3/2}$ s^{-1}

= (mol L^{-1})$^{-1/2}$ s^{-1}

= mol$^{-1/2}$ L$^{1/2}$ s^{-1}

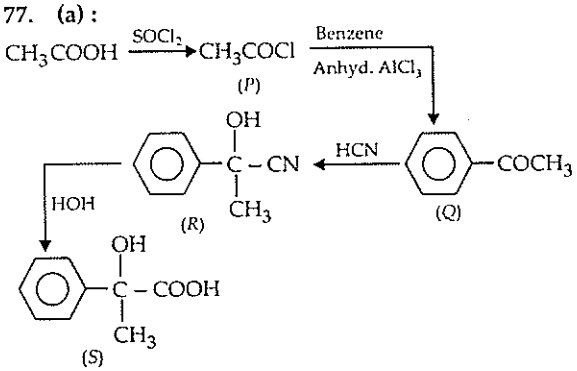
73. **(b)** : Nitrogen is more electronegative and smaller in size than phosphorus. Therefore, the lone pair is concentrated on a small region and has maximum electron density. So, NH_3 is more basic than PH_3.

74. **(b)** : Silicon belongs to group 14, it is doped with a group 13 element like B which contains only three valence electrons. The place where the fourth valence e^{-} is missing is called electron hole. Under the electric field, e^{-} holes moves toward the negatively charged plate, which implies that e^{-} holes are positively charged, thus it is a *p*-type semiconductor.

75. **(b)** : NH_4Cl solution is acidic, its pH < 7. $NaNO_3$ solution is neutral, its pH = 7. CH_3COOK and Na_2CO_3 solutions are basic their pH > 7. But Na_2CO_3 solution is more basic, its pH > pH of CH_3COOK solution.

76. **(c)** : Carbon monoxide combines with haemoglobin of blood to form a complex called carboxy-haemoglobin. Formation of this complex makes the haemoglobin incapable of oxygen transport. Due to which there will be oxygen deficiency in the blood.

77. **(a)** :



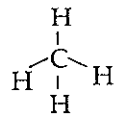
78. **(d)** : Chiral compound contains one or more 'chiral' carbon atom(s). Chiral carbon atoms are usually bonded to four different atoms or group of atoms.

$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$ (Hexane)

(Achiral)

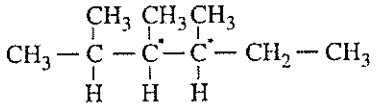
$CH_3 - CH_2 - CH_2 - CH_3$ (*n*-Butane)

(Achiral)



(Methane)

(Achiral)



(Chiral)

(2, 3, 4-Trimethylhexane.)

79. **(b)** : $E^{\circ}_{cell} = E^{\circ}_{right} - E^{\circ}_{left}$

$E^{\circ}_{cell} = 0 - (0 - 0.76) = 0.76$ V

80. (c) : $\Delta_{n_g} = n_p - n_r = 1 - \frac{3}{2}$

$\Delta_{n_g} = \frac{-1}{2}$. Hence $K_p = K_c(RT)^{-1/2}$

$\frac{K_p}{K_c} = \frac{1}{(RT)^{1/2}} = \frac{1}{\sqrt{RT}}$

81. (d) : For a n^{th} order reaction,

$t_{1/2} \propto \frac{1}{[a]^{n-1}}$

where n = order of reaction

$t_{1/2} \propto \frac{1}{[a]^{3-1}}$ $[\because n = 3]$

$t_{1/2} \propto \frac{1}{[a]^2}$

82. (c) : In the body-centred cubic unit cell,

$a\sqrt{3} = 4r$

$r = \frac{a\sqrt{3}}{4} = \frac{400\sqrt{3}}{4} = 100\sqrt{3}$ pm

83. (a)

84. (a) : In acidic solution, manganese (VI) becomes unstable and undergo disproportionation to form manganese (VII) and manganese (IV)

$\overset{VI}{5MnO_3} + 2H^+ \longrightarrow \overset{IV}{3MnO_2} + \overset{VII}{2MnO_4^-} + H_2O$

85. (a) : $Cr^{2+} = 3d^4$, No. of unpaired electrons (n) = 4

Magnetic moment $= \sqrt{n(n+2)}$ BM

$= \sqrt{4(4+2)} = \sqrt{24} = 4.89$ BM

$Fe^{2+} = 3d^6$, No. of unpaired electrons (n) = 4

Magnetic moment $= \sqrt{4(4+2)}$ BM

$= \sqrt{24} = 4.89$ BM

$Mn^{2+} = 3d^5$, No. of unpaired electrons (n) = 5

Magnetic moment $= \sqrt{5(5+2)}$ BM

$= \sqrt{35} = 5.91$ BM

$Co^{2+} = 3d^7$, No. of unpaired electrons (n) = 3

Magnetic moment $= \sqrt{3(3+2)}$ BM

$= \sqrt{15} = 3.87$ BM

$Ni^{2+} = 3d^8$, No. of unpaired electrons (n) = 2

Magnetic moment $= \sqrt{2(2+2)}$ BM

$= \sqrt{8} = 2.82$ BM

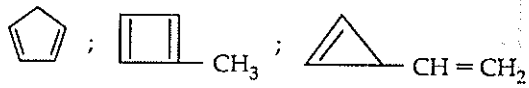
86. (b) : (1) and (4) compounds are *meso*-compounds, they possesses a plane of symmetry and is consequently optically inactive and superimposes on its mirror image (*i.e.*, they are identical).

87. (c)

88. (c) : The difference in atomic radius is maximum between Na and K.

89. (d) : BF_3 has zero dipole moment.

90. (b) : Isomers of C_5H_6 :



91. (b):

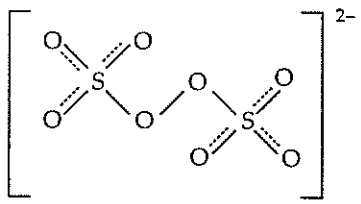
	N_2O_4	$\rightleftharpoons$	$2NO_2$
Initially	1		0
At equilibrium	$1-\alpha$		2α

N_2O_4 is 50% dissociated, so $\alpha = \frac{1}{2}$

$K_p = \frac{p^2_{NO_2}}{p_{N_2O_4}} = \frac{\left(2 \times \frac{1}{2}\right)^2}{\left(1 - \frac{1}{2}\right)} = 2$ atm

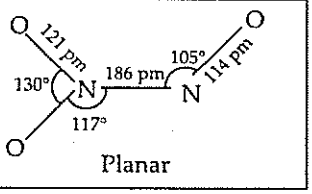
92. (d) : Larger the value of pK_a, smaller will be its acidity. Out of the four groups, –COOH, $-NO_2$ and –CN are e^- withdrawing which makes benzoic acid more acidic whereas $-OCH_3$ is e^- donating which reduces the acidity (makes H^+ less easily available). pK_a value increases if $-OCH_3$ is present at *para*-position of benzoic acid.

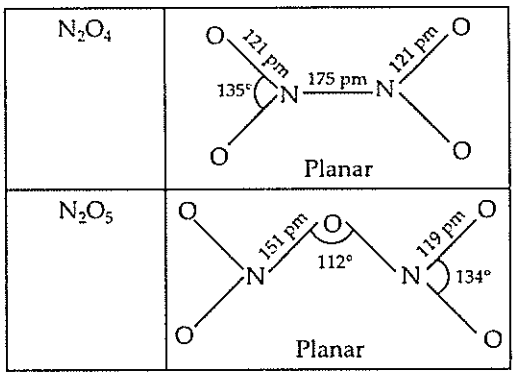
93. (c) : The structure of peroxodisulfate anion is:



It has a O–O bridge.

94. (a) : N—N bond length is minimum in N_2O.

Compound	Structure
N_2O	N —(113 pm)— N —(119 pm)— O Linear
N_2O_3	 Planar



95. **(c)** : Nylon 6, 6 and dacron are the examples of condensation polymers.

Condensation polymers are formed by condensation of two or more bifunctional monomers with the elimination of simple molecules like H_2O, NH_3, alcohol, etc.

Dacron is formed from ethylene glycol and terephthalic acid with the removal of H_2O.

Nylon 6, 6 is formed from hexamethylenediamine and adipic acid with the removal of H_2O.

$[n\ HOCH_2CH_2OH] + n\ [HOOC-C_6H_4-COOH]$

Ethylene glycol — Terephthalic acid

$\rightarrow +OCH_2CH_2-O-C(=O)-C_6H_4-C(=O)+_n + n\ H_2O$

Dacron

$n\ H_2N-(CH_2)_6-NH_2 +$

Hexamethylenediamine

$n\ HO-C(=O)-(CH_2)_4-C(=O)-OH$

Adipic acid

$\rightarrow +NH-(CH_2)_6-NH-C(=O)-(CH_2)_4-C(=O)+_n$

Nylon – 6, 6

96. **(b)** :

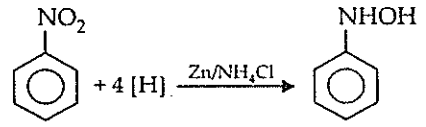
$CH_3CH_2CH=CH_2 \xrightarrow[H_3O^+]{Hg(OAc)_2}$

But-1-ene

$H_3C-CH_2-CH(OH)-CH_3$

Butan-2-ol

97. **(b)** :



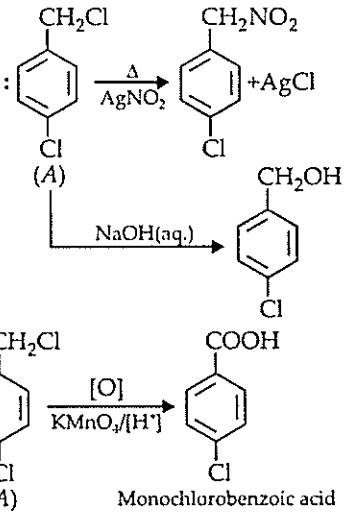
Nitrobenzene — Phenyl hydroxylamine

In neutral medium, nitrobenzene reduces to phenyl hydroxylamine.

98. **(c)** : $MgSO_4$ is readily soluble in water. The solubility of the sulphates of alkaline earth metals decrease with increase in size of the central metal ion. The greater hydration enthalpies of Mg^{2+} ions overcome the lattice enthalpy factor and therefore $MgSO_4$ is more soluble in water.

99. **(a)** : $PhCH_2Cl \xrightarrow{aq.\ NaCN} PhCH_2CN \xrightarrow[\text{Cat. hydrogenation}]{H_2,\ Pd} PhCH_2CH_2NH_2$ (U)

100. **(a)** :



101. **(c)** : For first order reaction,

$Rate_1 = k[A_1]$

According to question,

$[A_2] = [2A_1]$

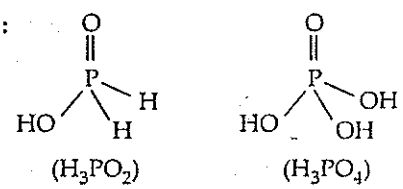
$\therefore\ Rate_2 = k[2A_1]$

$\Rightarrow\ Rate_2 = 2\ Rate_1$

For a given reaction, rate constant is constant and independent of the concentration of reactant.

102. **(d)** : Sodium acetate on Kolbe's electrolysis gives ethane. It is formed at anode.

103. **(b)** :



(H_3PO_2) (H_3PO_4)

Oxoacids of phosphorus which contain P — H bond act as reducing agents and reduce metal salts to free metals. Thus, H_3PO_2 act as reducing agent while H_3PO_4 does not.

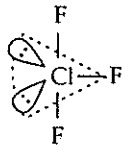
104. **(c)** : In diamond, C-atoms are sp^3 hybridized while in graphite, they are sp^2 hybridized.

105. **(b)** : Bohr model does not explain the spectra of multi-electron atoms.

106. **(d)** : $\overset{1}{CH_2}(Cl) - \overset{2}{CH_2}(Cl)$

Since it has no chiral carbon, it is optically inactive. Meso compounds are optically inactive.

107. **(c)** :

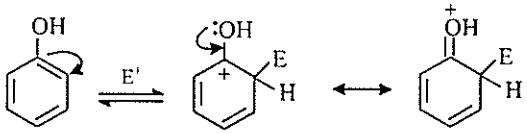


ClF_3 (T-shape)

The lone pairs are at equatorial position (120° angle).

108. **(c)** : Oxygen has two unpaired electrons. So it is paramagnetic.

109. **(b)** : –OH group shows +*M* effect and is an activating group, moreover the arenium ion of phenolic substitution is more stable.



110. **(c)** : S is more electronegative than Se.

111. **(b)** : Fluorine has higher standard electrode potential (reduction potential) than iodine.

112. **(a)** : The element which can reduce itself acts as an oxidising agent.

113. **(a)** : All species like He^+, Li^{2+}, Be^{3+} having one electron are expected to have similar spectrum as that of hydrogen.

114. **(c)** : Cl_2 is an oxidising agent. It bleaches the articles permanently by oxidation in presence of moisture.

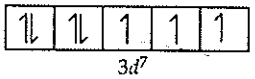
115. **(a)** : Due to lanthanide contraction, the size of Lu^{3+} is increased and therefore $Lu(OH)_3$ shows more covalent character (Large cation, more is covalent character - Fajan's rule). Thus $La(OH)_3$ is more ionic and thus more basic.

116. **(a)**

117. **(a)** : Fe^+ : [Ar] $3d^6\,4s^1$

When the weak field ligand H_2O and strong field ligand NO attack, the configuration changes as follows:

Fe^+ : [Ar] $3d^7\,4s^0$



$3d^7$

∴ Fe^+ has 3 unpaired electrons.

118. **(a)** : This is according to Henry's law which states that the solubility of a gas in given volume of a liquid at a particular temperature is directly proportional to the pressure of gas above the liquid. $m \propto p$, $m = kp$ where k = Henry's constant.

119. **(a)** : $HC\equiv C^-$ has 50% *s*-character and $H_2C=CH^-$ has 33% *s*-character. Stability of carbanions increases with an increase in the *s*-character at the carbanion. So $HC\equiv C^-$ is more stable than $H_2C=CH^-$.

120. **(c)** : In pressure cooker, water boils above 100°C. When the lid of cooker is opened, pressure is lowered so that boiling point decreases and water boils again.

BIOLOGY

121. **(b)** : In frog three types of respiration occurs to suit its amphibious mode of life. These are cutaneous, buccopharyngeal and pulmonary respiration. Cutaneous respiration occurs through the thin, moist, highly vascular and naked skin. It takes place in water as well as on land. Buccopharyngeal respiration occurs on land *via* thin, vascular, moist lining of buccopharyngeal cavity. Pulmonary respiration takes place when the frog is outside the water. It occurs by lungs of adult frog.

122. **(b)** : Fasciculated root is a type of adventitious root. In this case, roots are swollen which occur in clusters from lower nodes of stems, e.g., *Asparagus*, *Dahlia*, etc.

123. **(d)** : The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. Inner cell mass looks like a small knob at one pole which gives rise to the embryo and is called the embryonal knob. The trophoblast does not take part in the formation of the embryo proper. It remains external to the

embryo and gives rise to the extraembryonic membranes, namely, chorion and amnion, for the protection and nourishment of the embryo. The trophoblast cells in contact with the embryonal knob are known as cells of Rauber.

124. **(d)** : The given figure shows population growth curve, in which A is carrying capacity, B is exponential growth curve and C is logistic growth curve.

125. **(b)** : Deuteromycetes are commonly known as imperfect fungi because only the asexual or vegetative stages of these fungi are known. The deuteromycetes reproduce only by asexual spores known as conidia. The mycelium is septate and branched. Some members are saprophytes or parasites while a large number of them are decomposers of litter and help in mineral cycling. Some examples are *Alternaria, Colletotrichum* and *Trichoderma*.

126. **(d)** : Abscisic acid acts as a general plant growth inhibitor and an inhibitor of plant metabolism. ABA inhibits seed germination. ABA stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses. Therefore, it is also called the stress hormone.

127. **(c)** : Parturition is induced from the fully developed foetus and the placenta. Parturition involves foetal ejection reflex which are mild contractions of the placenta. This reflex triggers release of oxytocin from the maternal pituitary which acts on the uterine muscles and causes stronger uterine contractions and that further stimulates secretion of oxytocin. This stimulatory reflex between uterine muscle contraction and oxytocin secretion continues resulting in stronger contractions and eventually leading into expulsion of the baby out of the uterus.

128. **(d)**

129. **(b)** : Sodium-potassium pump (Na^+–K^+) is a membrane transport protein that exchanges sodium ions (Na^+) for potassium ions (K^+). It transports 3 Na^+ outwards for 2K^+ into the cell, thus maintaining the differential concentrations of each ion across the plasma membrane. The process requires energy in the form of ATP, being a form of active transport.

130. **(c)**

131. **(d)** : Photorespiration is the light dependent process of oxygenation of ribulose biphosphate (RuBP) and release of carbon dioxide by the photosynthetic organs of a plant. Normally photosynthetic organs do the reverse in the light, i.e., uptake of CO_2 and release of O_2. At high temperature, RuBP carboxylase functions as oxygenase and instead of fixing carbon dioxide (C_3 cycle), oxidises ribulose 1, 5-biphosphate to produce a 3-carbon phosphoglyceric acid and a 2-carbon phosphoglycolate.

Photorespiration does not produce energy or reducing power. Rather, it consumes energy. Further, it undoes the work of photosynthesis. There is 25% loss of fixed CO_2. Therefore, photorespiration is a highly wasteful process. This happens only in case of C3 plants. C4 plants have overcome the problem of photorespiration.

132. **(c)** : Phase contrast microscope was developed by Zernicke (1935, Nobel Prize 1953) to observe living cells and the events occurring in them (e.g., Spindle formation, movement of chromosomes, endocytosis, exocytosis). It is similar to optical microscope except that it has an annular diaphragm in the condenser and a transparent phase plate at the back focal plane of objective. The microscope converts differences in refractive indices into differences in brightness.

133. **(d)** : A - Basilar membrane
B - Scala media
C - Reissner's membrane
D - Tectorial membrane

134. **(c)** : The net gain from complete oxidation of a glucose molecule in aerobic respiration is 36 ATP molecules. 10 molecules of $NADH_2$ (2 from Glycolysis + 8 from Krebs' cycle) yield = 10 × 3 = 30 ATP, 2 molecules of $FADH_2$ yield = 2 × 2 = 4 ATP and glycolysis also yields 2 ATP. Therefore, total release of ATP per hexose will be = 30 + 4 + 2 = 36 ATP.

135. **(a)**

136. **(c)**

137. **(c)** : A - Photosystem I (PS I)
B - Photosystem II (PS II)
C - e– acceptor
D - LHC(Light Harvesting Complex).

138. **(a)** : Muscle contraction is brought about by sliding of the actin filaments over myosin

filaments. When a muscle fibril contracts, its A band remains constant and I band shortens. H zone also disappears as the actin filaments of both sides in each sarcomere may overlap each other at M line.

139. (c) : When an impulse arrives at the synaptic knob of the axon, it depolarizes the presynaptic membrane and increases its permeability to calcium ions (Ca^{2+}). Ca^{2+} ions from the synaptic cleft pass into the synaptic knob via voltage-gated channels. Sudden rise in the cytosolic concentration of Ca^{2+}, causes the release of a chemical, called neurotransmitter substance, from small synaptic vesicles present there into the synaptic cleft by exocytosis through the presynaptic membrane.

140. (b) : Cattle ranching refers to practice of raising grazing livestock such as cattle or sheep for meat and wool, etc. The area of landscape meant primarily for cattle ranching is called a ranch. The practice has lead to accelerated deforestation and contributed to increased methane gas concentration in atmosphere. Whatever cattle eat; is subjected to the action of methanogens (bacteria) harbouring the stomach (rumen) of cattle. The action of these bacteria on food material produces methane gas which is released through cattle fart into the earth's atmosphere where it absorbs heat just like carbon dioxide, contributing to global warming.

141. (b) : The C_4 plants are adapted to dry tropical regions and have greater productivity of biomass. They have special type of leaf anatomy known as Kranz anatomy. In this type of anatomy the bundle sheath cells form several layers around the vascular bundles; they are characterized by having a large number of chloroplasts, thick walls impervious to gaseous exchange and no intercellular spaces.

142. (a) : Colchicine is an alkaloid derived from the autumn crocus, *Colchicum autumnale*. It inhibits spindle formation in cells during mitosis so that chromosomes cannot separate during anaphase, thus inducing multiple sets of chromosomes. It does not affect cytokinesis.

143. (b) : The adrenal medulla secretes two hormones called adrenaline or epinephrine and noradrenaline or norepinephrine. These are commonly called as catecholamines. These are rapidly secreted in response to stress of any kind and during emergency situations and are called emergency hormones or hormones of fight or flight. These hormones increase alertness, pupillary dilation, piloerection (raising of hairs), sweating, etc. Both the hormones increase the heart beat, the strength of heart contraction and the rate of respiration. Catecholamines also stimulate the breakdown of glycogen, lipids and proteins.

144. (b) : The structure in option (b) is of a basophil. Basophils are granular WBCs and are the least (0.5– 1 per cent) of the total WBCs. They secrete histamine, serotonin, heparin, etc. and are involved in inflammatory reactions.

145. (a)

146. (b) : Bohr's effect is the phenomenon whereby the affinity of the respiratory pigment i.e., haemoglobin in the blood for oxygen is reduced when the level of carbon dioxide is increased. An increase in carbon dioxide concentration makes the blood more acidic which results in decrease in the efficiency of the uptake of oxygen by haemoglobin molecules. This facilitates gaseous exchange, because more oxygen is released in the tissues where the amount of carbon dioxide is rising due to metabolic activity. In its reverse, more oxygen is taken up at the lungs where the amount of carbon dioxide is low.

147. (d) : Bacteria like *Rhizobium* and *Frankia* live free as aerobes in the soil but are unable to fix nitrogen. They develop the ability to fix nitrogen only as a symbiont when they become anaerobic. They are unable to fix nitrogen by themselves. Roots of a legume secrete chemical attractants. Bacteria collect over the root hairs and form an infection thread enclosing the bacteria. Infection thread grows alongwith multiplication of bacteria. Bacteria stop dividing and form irregular polyhedral structures called bacteroids. In an infected cell bacteriods occur in groups surrounded by host membrane. The host cell develops a pinkish pigment called leghaemoglobin (Lb). It is oxygen scavenger and is related to blood pigment haemoglobin. It protects nitrogen fixing enzyme nitrogenase from oxygen.

148. (b)

149. **(d)** : Segmentation occurs in three highly organized phyla-annelida (earthworm), arthropoda (*Periplaneta*) and chordates. The body is often divided both externally and internally into a number of segments (metameres) *e.g.*, annelids. Segmentation is mostly external in arthropods and mainly internal in man and other chordates.

150. **(a)**

151. **(a)** : G_0 phase is the stage of inactivation of cell cycle due to non-availability of mitogens and energy rich compounds. The cells in this phase remain metabolically active and usually grow in size assuming particular shape (cell differentiation). Cell enters G_0 phase from a cell cycle checkpoint in the G_1 phase. G_1 phase checkpoint (restriction point) takes the key decision whether the cell should divide, delay division or enter resting stage. Cells then remain in G_0 phase until there is a reason for them to divide. Several biocatalysts can help a cell in G_0 phase to proceed through cell division when required.

152. **(a)** : The "beads-on-a-string" structure is seen in electron microscope of isolated metaphase chromosomes. The chromonema form the gene bearing portions of the chromosome. Basically chromonema is made up of nucleosome chains. Nucleosome chain gives a beads on string appearance under electron microscope. Nucleosome is the fundamental packaging unit in eukaryotic chromosomes.

153. **(b)** : RNAi is a regulatory mechanism for an estimated 30% of all protein-coding genes(in mammals). It helps to protect cells against certain viruses by targeting viral RNA for destruction. It helps to silence potentially disruptive transposons in the genome by destroying RNA copies arising from transposon replication. RNAi is a precise and efficient tool for knockout of specific genes when studying gene function in experimental organisms. It also has potential for new forms of targeted gene therapy.

154. **(c)** : Alkaloids - Morphine, Codeine
Pigments- Carotenoids, Anthocyanin
Drugs- Vinblastin, Curcumin.

155. **(c)** : Four main types of commercial tea are generally recognized in the trade. These are black tea (China, India, Sri Lanka), green tea (China, Japan and Taiwan), oolong tea (Taiwan) and brick tea (China). Dust or fannings are left over small part of tea leaves, which are also widely used.

156. **(c)** : The cardiac cycle consists of one heart beat or one cycle of contraction and relaxation of the cardiac muscle. The contraction phase is called the systole while the relaxation phase is called the diastole.

157. **(c)** : The given floral diagram is of liliaceae family. This family is a characteristic representative of monocot plants. Most plants of this family are good ornamentals, source of medicine, vegetables and colchicine.

158. **(c)** : Particulate matter mainly includes dust, soot particles, volatile hydrocarbons, some sulphate and metallic residues emitted into the air by sources such as factories, power plants, vehicles, etc. PM is usually divided into different classes based on size ranging from total suspended matter (TSP) to PM-10 (particles with diameter of 10 μ or less) to PM-2.5 (particles with diameter of 2.5 μ or less). Smallest particles pose highest human health risk. Larger particles ($\leq$ 10 μ) can easily be expelled from lungs through mucus but finer particles ($\leq$ 2.5 μ) penetrate deep in lungs and can cause severe lung damage including lung cancer.

159. **(c)** : Pebrine or pepper disease is caused by protozoan *Nosema bombycis*. The parasite infects eggs and is therefore, transmitted to next generation. It kills caterpillars.

160. **(b)** : Homopolysaccharides or homoglycans are those complex carbohydrates which are formed by polymerization of only one type of monosaccharide monomers. For example, starch, glycogen, inulin, cellulose, chitin, etc.
Agar, pectin, hyaluronic acid, heparin, etc., are heteropolysaccharides.

161. **(b)** : Hot spots are areas with high density of biodiversity or megadiversity which are also the most threatened ones. Ecologically hot spots are determined by four factors.
(i) Number of species/species diversity.
(ii) Degree of endemism
(iii) Degree of threat to habitat due to its degradation and fragmentation.
(iv) Degree of exploitation.

Myers (1988) initially identified 12 hot spots. Today the number of hotspots identified by ecologists is 34 covering an area less than 2% of land surface with about 20% of human population living there.

162. **(b)** : When the offsprings are produced by self fertilization or breeding between closely related parents it is called inbreeding. Inbreeding results in increase in homozygosity. The most revealing impact of inbreeding is the loss of vigour and physiological efficiency of the organisms characterized by reduction in size. A number of lethal and defective characters appear in the population which has undergone inbreeding (selfing). This loss of fitness in the progenies or decline in character expression with decreased heterozygosity arising from self mating is known as inbreeding depression or inbreeding decline. Continued inbreeding reduces fertility and even productivity. But the inbreeding progeny with lethal and harmful recessive genes being homozygous express these traits which otherwise remain hidden in heterozygous individuals. Natural selection works upon these individuals and eliminate them. Gradually, such genes get eliminated from the population.

163. **(a)** : For aquatic organism salt concentration (measured as salinity in parts per thousand) is a major factor for their survival. Salinity of different aquatic habitats varies greatly. It is less than 5 per thousand parts, in inland waters, 30–35 per thousand parts in the sea and more than 100 per thousand parts in some hypersaline lagoons. Many fresh water animals cannot live for long in sea water and vice versa because of the osmotic problems they would face due to the change in relative tonicity of the surrounding water with cytoplasm. It may result into endosmosis or exosmosis according to the conditions. The tolerance of organisms to the salinity range varies. Some organisms are tolerant of a wide range of salinities and are called euryhaline e.g. salmon, while some can tolerate only a narrow range of salinity i.e., stenohaline e.g., shark.

164. **(c)** : In non-myelinated nerve fibres, the ionic changes are repeated over the membrane all along the length of the fibre. So, the action potential flows all along the membrane over the entire length of the fibre. But in myelinated fibres, the ionic changes and the consequent depolarisation can take place only at the nodes of Ranvier free from myelin sheath, because the myelin sheath between the nodes insulates the fibre and prevents its depolarisation. So, the action potential in effect jumps from one node to the next.This is called saltatory conduction of nerve impulses. Because of this, nerve impulses do not have to run all along the myelinated nerve fibre. This is why nerve impulses are conducted far more rapidly in myelinated fibres than in the non - myelinated ones.

165. **(c)** : Frogs are able to change the colour of their skins to match with that of the surroundings. It makes them hard to be noticed by enemies. This is a type of protective colouration known as camouflage not mimicry. Changes in colour are possible by dispersion or concentration of special amoeboid pigment cells in their skin.

166. **(a)** : Simple goitre or endemic goitre is the enlargement of thyroid gland accompanied with cretinism or myxoedema. It occurs in case of hyposecretion of thyroxine. To compensate for lower secretion of thyroxine from cells, thyroid gland enlarges to accommodate more secretory cells. It is caused due to dietary deficiency of iodine. To form normal quantities of thyroxine about 1 mg/week of ingested iodine is required in the form of iodides.

167. **(b)** : Sickle cell anaemia is an autosomal hereditary disorder in which the erythrocytes become sickle shaped. The disorder or disease is caused by the formation of an abnormal haemoglobin called haemoglobin–s denoted as Hbs. Thus, the genotype of an individual homozygous for sickle cell anaemia is written as HbsHbs.

168. **(d)** : Manganese (Mn) is a micronutrient. Excess of it in soil can cause manganese toxicity characterized by brown spots surrounded by chlorotic veins. It occurs due to (i) reduction in uptake of iron and magnesium (ii) inhibition of binding of magnesium to specific enzymes (iii) inhibition of calcium translocation into shoot apex. Therefore excess of manganese (Mn) causes deficiency of iron (Fe), magnesium (Mg) and calcium (Ca).

Hence the toxicity symptoms of Mn are actually combined deficiency symptoms of Fe, Mg and Ca.

169. (a) : Females having 45 chromosomes (2A + X0) are affected with Turner's syndrome. Individuals having Turner's syndrome have female sexual differentiation but ovaries are rudimentary. Other associated phenotypes of this condition are short stature, webbed-neck, broad chest, lack of secondary sexual characteristics and sterility. Thus, any imbalance in the copies of the sex chromosomes may disrupt the genetic information necessary for normal sexual development.

170. (d) : In proximal convoluted tubule (PCT) about 65% of the glomerular filtrate is reabsorbed normally. Here most of the solutes are reabsorbed making the filtrate isotonic to blood plasma. HCO–3 is not absorbed in PCT.

171. (b) : Classification involves hierarchy of steps, in which each step represents a rank or category, called taxonomic category or taxon. All taxa together constitute a taxonomic hierarchy as follows:

Species → Genus → Family → Order → Class → Phylum or division → Kingdom.

Most common characters among individual members are found in taxon species. Common characters decrease from species to kingdom and members of a kingdom have least number of common characters. Similarly, complexity of classification decreases from species to kingdom.

172. (c) : There are two types of food chains: grazing food chain and detritus food chain. Detritus food chains are those which start from the dead bodies of animals or fallen leaves etc. In terrestrial ecosystems, detritus food chain is the major conduit of energy flow, while in aquatic ecosystems, grazing food chain is the major conduit of energy flow. As the detritus food chains depend upon the dead organic matter hence, these are not directly dependent upon solar energy.

173. (c) : *Wuchereria* (*W.bancrofti* & *W.malayi*), the filarial worms cause a slowly developing chronic inflammation of the organs in which they live for many years, usually the lymphatic vessels of the lower limbs, and the disease is called filariasis. The pathogen spread from one human being to another through mosquitoes like Culex and to a less extent by *Anopheles* and *Aedes*. The parasite resides in lymph vessels, connective tissues and mesentery. It is manifestated by lymphoedema accompanied by thickening of subcutaneous tissues and skin so that there is permanent swelling mostly of feet, legs, thighs, scrotal sacs, breast etc. In Culex and other mosquitoes females are blood sucking while males suck juices of flowers and fruits. Female Culex carries filarial worm from one person to another. It prefers to breed in dirty water near human habitation.

174. (b) : Retrovirus is an RNA-containing virus that converts its RNA into DNA by means of the enzyme reverse transcriptase. This enables it to become integrated into its host's DNA. Some retroviruses can cause cancer in animals they contain oncogenes (cancer-causing genes), which are activated when the virus enters its host cell and starts to replicate. The special properties of retroviruses make them useful as vectors for inserting genetic material into eukaryotic cells. The best-known retrovirus is HIV, responsible for AIDS in humans.

175. (a) : Leydig's cells or interstitial cells of testes are large, polygonal cells that lie in the connective tissue present between the seminiferous tubules. They secrete androgens, the male sex hormones e.g., testosterone into the blood. Androgens control male sexual characteristics including facial and pubic hairs.

176. (a) : During strenuous exercise, the muscle does not get sufficient oxygen to meet its energy needs immediately. So, it contracts anaerobically and accumulates lactic acid. During recovery, the oxygen consumption of the muscle far exceeds than that in the resting state. The extra oxygen consumed during recovery is called oxygen debt of the muscle.

177. (c) : Being insoluble in water, fats and oils form large immiscible droplets in aqueous media but the enzymes which hydrolyse fats and oils (called lipases) are insoluble in fats and soluble in water. Therefore, lipases can act only on the water adjoining surfaces of fat droplets. Evidently, the larger the surface area of fat droplets, the greater is the action of the lipase on them. We know that the smaller the size of a droplet, the larger is its surface area relative to its mass. Thus lipases can digest fat in significant amounts only when large fat droplets are broken into tiny droplets to form a fine emulsion. This is the reason why emulsification is so necessary for the digestion

of fats. Enzyme amylase, on the other hand, is a starch - hydrolysing enzyme which has no role in fat digestion.

178. **(b)** : Bilirubin is a yellow pigment which arises from the catabolism of red pigment haemoglobin of old and worn out RBCs. The pale yellow colour of blood plasma is largely due to the presence of bilirubin. It has to be excreted into the bile and from there it is excreted out of the body along with the faecal matter. If, all of the bilirubin can not be excreted from the body then the skin and mucous membranes assume a yellowish hue, giving rise to the condition called jaundice.

179. **(a)** : No taste sensation is evoked when distilled water is put on human tongue because man does not possess taste buds for tasting water. The taste buds present on the tongue send nerve impulses to the brain which actually preceives the taste sensation. Some mammals such as rhesus monkeys, pigs, cats and dogs possess some taste buds which send nerve impulses to the brain when distilled water is applied on them. It seems, therefore, that water may stimulate these taste buds to evoke taste sensation in these animals.

180. **(d)** : It is not oxytocin, but the hormone vasopressin (also known as antidiuretic hormone, ADH) because it reduces the volume of urine by increasing the reabsorption of water from the urine in the distal convoluted tubules, collecting tubules and collecting ducts in the kidney. It does so by rendering the walls of those tubules permeable to water. Failure of secretion of vasopressin leads to a reduced renal reabsorption of water and a consequent elimination of a large volume of very dilute (hypotonic) urine.

Oxytocin is another hormone released by the posterior lobe of pituitary gland. Oxytocin contracts the mammary glands, smooth muscles of uterus. Uterine contractions, stimulated by oxytocin at the end of pregnancy, help in the child-birth or parturition, hence also called birth hormone. The oxytocin - induced contractions of the mammary gland muscles help in the flow of stored milk from the mammary glands, hence also called milk ejection hormone.

GENERAL KNOWLEDGE

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

Chapterwise Index - '13

Physics • Chemistry • Biology

Use the index for topicwise analysis of AIIMS paper and refer to these questions when you are practising MCQs chapterwise.

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