

## R ANSWER KEY & SOLUTION KEY FINAL ROUND - 03 (PCB) Dt.05.04.2024

### PHYSICS

#### SECTION - A (35 Questions)

01. (1) When a stone tied with string is rotated in horizontal circle, then centripetal force is required which is given as

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

$$\therefore F \propto v^2, F \propto \frac{1}{r}$$

From above, it is clear that when stone is rotated with greater speed, then greater force (centripetal force) is required.

Again, when stone is rotated in a circle of smaller radius, greater force is required.

So, statement I and II are correct but III is incorrect

02. (2) From the principle of dimensional homogeneity [F] = [at]

$$\therefore [a] \left[ \frac{F}{t} \right] = \left[ \frac{MLT^{-2}}{T} \right] = [MLT^{-3}]$$

Similarly [F] = [bt<sup>2</sup>]

$$\therefore [b] \left[ \frac{F}{t^2} \right] = \left[ \frac{MLT^{-2}}{T^2} \right] = [MLT^{-4}]$$

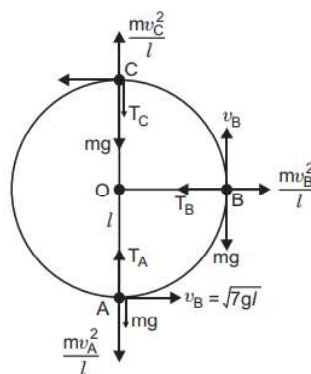
03. (2)  $F = \frac{-dU}{dx} = -(\text{Slope})$

04. (2) Tension at lowest point A

$$T_A - mg = \frac{mv_A^2}{l}$$

$$T_A = mg + \frac{m(\sqrt{7gl})^2}{l}$$

$$T_A = 8mg$$



05. (3) For circular disc,  $I = \frac{1}{2}MR^2$

$$\therefore I_A = \frac{1}{2}M_A R_A^2 = \frac{1}{2}(\pi R_A^2 t_A) d R_A^2 = \frac{1}{2} \pi t d r^3$$

$$\text{and } I_B = \frac{1}{2} \pi \left( \frac{t}{4} \right) d (4r)^3 = \frac{1}{2} \pi d (16r^3)$$

$$\therefore I_A < I_B$$

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

Hence, the correct answer is option (2).

07. (3)

A. Static friction is the frictional force between the surfaces of two objects when they are not in motion with respect to each other. Due to this reason, static friction has the highest value of frictional force and hence  $\mu$  is highest.

B. rolling friction takes place when one body rolls over the surface of another body due to which the value of friction is less in case of rolling friction and hence  $\mu$  is lowest.

C. Kinetic friction takes place when one body slides over the surface of the another body. Value of friction is moderate and lie in between the friction value of rolling and static friction and hence  $\mu$  is moderate.

Hence,  $A \rightarrow 1, B \rightarrow 3$  and  $C \rightarrow 2$

08. (4)  $V_D = \frac{m_C}{\rho_W} + \frac{m_B}{\rho_W}$  and  $V_g = \frac{m_C}{\rho_C} + \frac{m_B}{\rho_W}$

Since,  $\rho_C > \rho_W, V_g < V_D$

Hence,  $l$  and  $h$  both decrease.

Hence, the correct answer is option (4)

09. (1) Stoke's law:  $6\pi r\eta v = \frac{4}{3}\pi r^3(\rho - \sigma)g$

$\therefore v \propto r^2.$

As  $M$  is given,  $\rho = \frac{M}{\frac{4}{3}\pi r^3}$

But as  $r^3$  increases,  $M$  also increases and  $\rho$  is constant

$\therefore v$ , the terminal velocity  $\propto r^2.$

Hence, the correct answer is option (1).

10. (1) By Newton's law of cooling,

$$\frac{dH}{dt} = K \left( \frac{\theta_1 + \theta_2}{2} - \theta_0 \right)$$

where,  $\theta_0$  is temperature of surroundings and

$\frac{\theta_1 + \theta_2}{2}$  is the temperature of body.

Hence,  $t_3 > t_2 > t_1.$

11. (3)  $PV = nRT = \frac{M}{M_0} RT$

$$P = \frac{M}{V} \frac{RT}{M_0} = d \frac{RT}{M_0}$$

$$2P = d' \frac{R(T/3)}{M_0}$$

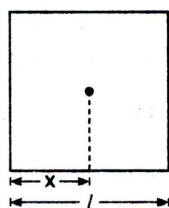
$$2d \frac{RT}{M_0} = \frac{d'R(T/3)}{M_0} \Rightarrow \therefore d' = 6d.$$

12. (4)  $\frac{x}{\mu} + \frac{(l-x)}{\mu} = 3 + 5$

$$\Rightarrow \frac{l}{\mu} = 8$$

$$\Rightarrow l = 8 \times \frac{3}{2}$$

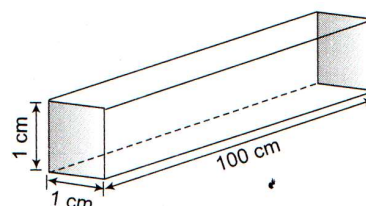
$$\Rightarrow \therefore l = 12cm.$$



13. (3) The electric field lines, are directed away from positively charged source and directed toward negatively charged source. In electric field force are directly proportional to the electric field strength hence, higher the electric field strength greater the force and vice-versa. The space between the electric field lines is increasing, from left to right so strength of electric field decreases with the increase in the space between electric field lines. Then the force on charges also decreases from left to right. Thus, the force on charge  $-q$  is greater than force on charge  $+q$  in turn dipole will experience a force towards left.

14. (3)

15. (2) Length  $l = 1 \text{ cm} = 10^{-2} \text{ m}$



Area of cross-section  $A = 1 \text{ cm} \times 100 \text{ cm} = 100 \text{ cm}^2 = 10^{-2} \text{ m}^2$

Resistance  $R = 3 \times 10^{-7} \times \frac{10^{-2}}{10^{-2}} = 3 \times 10^{-7} \Omega$

16. (4)  $e = \frac{d\phi}{dt}$

$$e = \frac{dNBA}{dt} \Rightarrow e = \frac{NAdB}{dt}$$

$$44 = N \times \frac{\pi}{4} \times (.02)^2 \times \frac{3000}{3}$$

$N = 140$

17. (2) In the given situation, motional e.m.f.

$$e = B l v$$

Induced current,  $i = \frac{e}{r} = \frac{B l v}{r}$

Force on conductor

$$F = B i l = B \left( \frac{B l v}{r} \right) l = \frac{B^2 l^2 v}{r}$$

Power dissipated = power required to push the conductor

$$= F \times v = \frac{B^2 l^2 v}{r} \times v = \frac{B^2 l^2 v^2}{r}$$

18. (4)  $P = V_{\text{rms}} I_{\text{rms}} \cos \phi = \frac{40}{\sqrt{2}} \left( \frac{5}{\sqrt{2}} \right) \cos \frac{\pi}{3} = 50 \text{ W}$

19. (2)  $W = hv - \frac{1}{2}mv^2$

$h\nu =$  energy of incident photon

$$= \frac{12400}{1240} eV = 10eV$$

$$\therefore W = 10 - 8 = 2eV$$

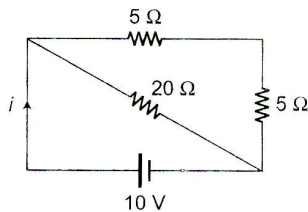
So,  $\lambda_o =$  Threshold wavelength

$$= \frac{12400}{2eV} = 6200 \text{ \AA}$$

20. (4)  $\therefore B = \frac{\mu_0 I}{2r}$  and  $I = \frac{e}{T}$

$$B = \frac{\mu_0 e}{2rT} [r \propto n^2, T \propto n^3]; B \propto \frac{1}{n^5}$$

21. (3)  $D_1$  is in reverse bias,  $D_2, D_3$  in forward bias.



$$R_{eq} = \frac{10 \times 20}{10 + 20} = \frac{20}{3}$$

$$i = \frac{10}{20/3} = 1.5 \text{ A}$$

22. (2)  $n_i^2 = n_e n_h$

$$(1.5 \times 10^{16})^2 = n_e (4.5 \times 10^{22})$$

$$n_e = 0.5 \times 10^{10} = 5 \times 10^9$$

$$n_h = 4.5 \times 10^{22}$$

$$n_h > n_e \text{ (p-type)}$$

23. (4) Let  $\rho_1, \rho_2$  be the density of bob and liquid respectively. When simple pendulum is oscillating in air, then

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

When bob of pendulum is in liquid, the period of

$$\text{oscillation is } 3T = 2\pi \sqrt{\frac{l}{g(1 - \rho_2 / \rho_1)}}$$

$$\text{or } \frac{1}{3} = \sqrt{1 - \rho_2 / \rho_1} \quad \text{or } 1 - \frac{\rho_2}{\rho_1} = \frac{1}{9}$$

$$\text{or } \frac{\rho_2}{\rho_1} = 1 - \frac{1}{9} = \frac{8}{9} \quad \text{or } \therefore \frac{\rho_1}{\rho_2} = \frac{9}{8}$$

24. (3) The given equation of wave,

$$y = A \sin(kx - \omega t + \phi)$$

At  $x = 0, t = 0, y = 0$  and slope is negative

$$\Rightarrow \phi = \pi$$

25. (4) In this case  $|m| = \frac{f_o}{f_e} = 5$

$$\therefore f_o = 5f_e$$

$$\text{Length of telescope} = f_o + f_e = 36$$

$$\therefore 5f_e + f_e = 36$$

$$6f_e = 36 \quad \therefore f_e = 6 \text{ cm}$$

$$\text{As } f_o + f_e = 36$$

$$f_o + 6 = 36$$

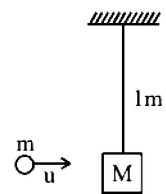
$$f_o = 36 - 6 = 30 \text{ cm.}$$

26. (2)  $mu = (M + m)V$

$$10^{-2} \times 2 \times 10^2 \cong 1 \times V$$

$$V \cong 2 \text{ m/s}$$

$$h = \frac{V^2}{2g} = 0.2 \text{ m.}$$



27. (2) Breaking stress remains same.

28. (1) Here,  $LFP = 20^\circ\text{C}$ ,  $UFP = 150^\circ\text{C}$ ,  $C = 60^\circ$ ,  $x = ?$

$$\text{From } \frac{C}{100} = \frac{x - LFP}{UFP - LFP} = \frac{x - 20}{150 - 20}$$

$$\Rightarrow \frac{60}{100} = \frac{x - 20}{130}$$

$$\Rightarrow x - 20 = \frac{130 \times 60}{100} = 78; x = 78 + 20 = 98^\circ\text{C.}$$

29. (4)

30. (2)

31. (3) Work done,  $W = \int P dt$

$$\text{or } \frac{1}{2} mv^2 = \int P dt = \int_0^2 \left( \frac{3t^2}{2} \right) dt = 4 \text{ J}$$

$$v^2 = \frac{2 \times 4}{m} = \frac{2 \times 4}{2} = 4$$

$$\Rightarrow v = 2 \text{ ms}^{-1}$$

32. (3)  $N$  vernier scale divisions are equivalent to  $(N - 1)$  Main scale division

$$\Rightarrow 1 \text{ V.S.D. is equivalent to } \frac{(N - 1)}{N} \text{ M.S.D.}$$

Now Least count =  $1 \text{ M.S.D.} - 1 \text{ V.S.D.}$

$$= 1 \text{ M.S.D.} - \frac{N-1}{N} \text{ M.S.D.}$$

$$= \frac{1}{N} \text{ M.S.D.}$$

$$= \frac{1}{N} \text{ mm} = \frac{1}{10 N} \text{ cm}$$

33. (1) Let  $q$  and  $q'$  be the charges on spheres of radii  $R$  and  $2R$  respectively.

$$\text{Given } q + q' = Q \quad \dots(i)$$

Surface charge densities are

$$\sigma = \frac{q}{4\pi R^2} \text{ and } \sigma' = \frac{q'}{4\pi(2R)^2}$$

$$\text{Given } \sigma = \sigma'$$

$$\therefore \frac{q}{4\pi R^2} = \frac{q'}{4\pi(2R)^2} \text{ or } , q' = 4q$$

$$\text{From eq. (i), } q' = Q - q \text{ or, } 4q = Q - q$$

$$\text{or, } Q = 5q \quad \dots(ii)$$

$$\therefore q' = Q - q = Q - \frac{Q}{5} = \frac{4Q}{5}$$

34. (2) Projectile has same range for  $\theta$  and  $90^\circ - \theta$

Hence when  $\theta = 40^\circ$ ,  $90^\circ - \theta = 50^\circ$

35. (2)  $\vec{v} = \hat{i} + 2\hat{j}$

$$\Rightarrow x = t \quad \dots(i)$$

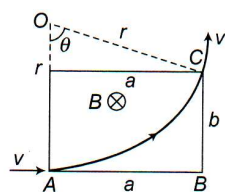
$$y = 2t - \frac{1}{2}(10t^2) \quad \dots(ii)$$

**SECTION - B (Attempt Any 10 Questions)**

36. (2)  $I_D = \epsilon_0 \frac{d\phi_E}{dt} = \epsilon_0 \frac{EA}{t} = \epsilon_0 \left(\frac{V}{d}\right) \cdot \frac{A}{t}$

$$= \frac{8.85 \times 10^{-12} \times 400 \times 60 \times 10^{-4}}{2 \times 10^{-3} \times 10^{-6}} = 1.062 \times 10^{-2} \text{ amp}$$

37. (1) Let speed of the particle be  $v$  (speed will remain constant)



$$r = AO = CO = \frac{mv}{qB}; \text{ Also}$$

$$\frac{a}{r} = \sin \theta, \frac{r-b}{r} = \cos \theta$$

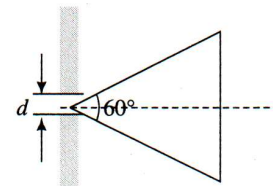
Solving the above equations, we get

$$v = \frac{qB(a^2 + b^2)}{2mb}$$

38. (2) Due to decreasing current along AB, magnetic flux linked with loop is decreasing. To oppose this decreases, current induced in the loop must be anticlockwise.

39. (2) In case of single slit diffraction of  $d \sin 30^\circ = \lambda$

$$d \times \frac{1}{2} = \lambda \text{ or } \lambda = \frac{d}{2} \Rightarrow \lambda = \frac{10^{-6}}{2} \text{ m}$$



$$\text{We know Young's fringe width } \beta = \frac{D\lambda}{d'}$$

where  $d'$  = separation between two slits.

Substituting the corresponding values

$$10^{-2} = \frac{50 \times 10^{-2} \times 10^{-6}}{2 d'} = \frac{25 \times 10^{-8}}{d'}$$

$$\text{We get } d' = 25 \mu\text{m}$$

40. (2) (A) → (1); (B) → (1); (C) → (2); (D) → (2)

If  $V$  is the potential applied across the capacitor

then p.d. across each capacitor will be  $\frac{V}{2}$ . When

(A) dielectric is inserted in capacitor B, then

$$(B) V_1 + V_2 = V$$

$$(C) \text{ and } CV_1 = kCV_2$$

(D) On solving above equations, we get

$$V_1 = \left(\frac{kV}{k+1}\right) \text{ and } V_2 = \left(\frac{V}{k+1}\right)$$

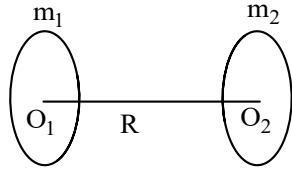
Clearly potential of A increases and that of B decreases. Initial charges on the capacitors are:

$$q_1 = \frac{CV}{2}, q_2 = \frac{CV}{2}$$

charges:  $q_1 = CV_1 = \frac{kCV}{k+1}$  and  $q_2 = \frac{CV}{k+1}$ .

Charge on capacitor A will increase, and on B will decrease.

41. (4) The situation is as shown in the figure.



Gravitational potential at the centre of the first ring (i.e., at  $O_1$ ) is

$$V_1 = -\frac{Gm_1}{R} - \frac{Gm_2}{\sqrt{R^2 + R^2}} = -\frac{Gm_1}{R} - \frac{Gm_2}{\sqrt{2}R}$$

Gravitational potential at the centre of the second ring (i.e., at  $O_2$ ) is

$$V_2 = -\frac{Gm_2}{R} - \frac{Gm_1}{\sqrt{R^2 + R^2}} = -\frac{Gm_2}{R} - \frac{Gm_1}{\sqrt{2}R}$$

Work done in moving a mass  $m$  from  $O_1$  to  $O_2$  is

$$\begin{aligned} W &= m(V_2 - V_1) \\ &= m \left[ -\frac{Gm_2}{R} - \frac{Gm_1}{\sqrt{2}R} - \left( -\frac{Gm_1}{R} - \frac{Gm_2}{\sqrt{2}R} \right) \right] \\ &= m \left[ -\frac{Gm_2}{R} - \frac{Gm_1}{\sqrt{2}R} + \frac{Gm_1}{R} + \frac{Gm_2}{\sqrt{2}R} \right] \\ &= \frac{Gm}{R} \left[ \frac{-\sqrt{2}m_2 - m_1 + \sqrt{2}m_1 + m_2}{\sqrt{2}} \right] \\ &= \frac{Gm}{\sqrt{2}R} \left[ \sqrt{2}(m_1 - m_2) - (m_1 - m_2) \right] \\ &= \frac{Gm(m_1 - m_2)}{\sqrt{2}R} \left[ \sqrt{2} - 1 \right] \end{aligned}$$

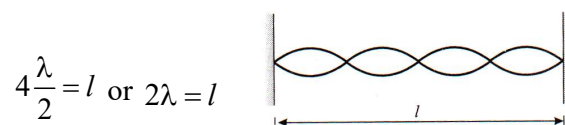
As we don't know whether  $m_1 > m_2$  or  $m_2 > m_1$

$\Rightarrow$  we can't say

42. (2)  $P_2 = 0.8 P_1 = 0.8 (4 \text{ kW}) = 3.2 \text{ kW}$

$$I_2 = \frac{P_2}{V_2} = \frac{3.2 \times 10^3}{240} = 13.33 \text{ A}$$

43. (2) In case of 4th harmonic



$$4 \frac{\lambda}{2} = l \text{ or } 2\lambda = l$$

From equation  $\frac{2\pi}{\lambda} = 0.157$

$$\Rightarrow \lambda = \frac{2\pi}{0.157} = 40 \text{ m}$$

Hence,  $l = 2\lambda = 80 \text{ m}$

44. (2) In the given SHM, at time  $t=0$ , the particle is passing from mean position. So displacement of SHM at time  $t$  is

$$y = A \sin \omega t$$

$$\text{Velocity, } V = \frac{dy}{dt} = A\omega \cos \omega t$$

K.E. of particle,

$$K = \frac{1}{2} m V^2 = \frac{1}{2} m \omega^2 A^2 \cos^2 \omega t$$

Hence, the variation between KE v/s time is of the type as shown in option (2).

45. (1) In magnetic field speed is constant so  $\lambda$  will remain constant.

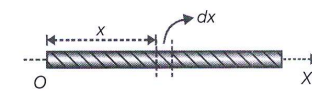
$$46. (3) R = \frac{V - I_g R_g}{I_g} = \left( \frac{V - V_g}{I_g} \right)$$

$$R = \frac{V}{I_g} - R_g$$

$$\frac{50}{2 \times 10^{-3}} - 50 = 25000 - 50 = 24950$$

47. (2) Linear density of the rod varies with distance

$$\frac{dm}{dx} = \lambda \text{ [Given]} \therefore dm = \lambda dx$$



$$\text{Position of centre of mass } x_{CM} = \frac{\int dm \times x}{\int dm}$$

$$\frac{\int_0^l (\lambda dx) \times x}{\int_0^l \lambda dx} = \frac{\int_0^l (2+x) \times x dx}{\int_0^l (2+x) dx} = \frac{\left[ x^2 + \frac{x^3}{3} \right]_0^l}{\left[ 2x + \frac{x^2}{2} \right]_0^l}$$

$$= \frac{9+9}{6+\frac{9}{2}} = \frac{36}{21} = \frac{12}{7} \text{ m.}$$

48. (2)  $d \sin \theta = n\lambda$

$$\therefore \lambda = \frac{d \sin \theta}{n} = 10^{-4} \times \frac{1}{40} \times \frac{1}{n}$$

$$\therefore \lambda = \frac{2.5 \times 10^{-6}}{n} = \frac{2500 \times 10^{-9}}{n} = \frac{2500}{n} \text{ nm}$$

Putting  $n = 1$ ,  $\lambda_1 = 2500 \text{ nm}$

$$n = 2, \lambda_2 = 1250 \text{ nm}$$

$$n = 3, \lambda_3 = 833 \text{ nm}$$

$$n = 4, \lambda_4 = 625 \text{ nm}$$

$$n = 5, \lambda_5 = 500 \text{ nm}$$

$$n = 6, \lambda_6 = 357 \text{ nm}$$

49. (1) Distance of closest approach

$$r_0 = \frac{Ze(2e)}{4\pi\epsilon_0 \left(\frac{1}{2}mv^2\right)}$$

Energy,  $E = 5 \times 10^6 \times 1.6 \times 10^{-19} \text{ J}$

$$\therefore r_0 = \frac{9 \times 10^9 \times (92 \times 1.6 \times 10^{-19})(2 \times 1.6 \times 10^{-19})}{5 \times 10^6 \times 1.6 \times 10^{-19}}$$

$$\Rightarrow r = 5.2 \times 10^{-14} \text{ m} = 5.3 \times 10^{-12} \text{ cm.}$$

50. (3)  $n = 2$ ,  $\Delta Q_{cyclic} = -1200 \text{ J}$

$AB$  : isobaric process

$$\Delta W_{AB} = \Delta T = nR(T_B - T_A)$$

$$= 2 \times 8.3 (500 - 300) = 3320 \text{ J}$$

$CA$  : isochoric process

$$\Delta W_{CA} = 0$$

$$\Delta W_{cyclic} = \Delta W_{AB} + \Delta W_{BC} + \Delta W_{CA} = \Delta Q_{cyclic}$$

$$3320 + \Delta W_{BC} + 0 = -1200$$

$$\Delta W_{BC} = -4520 \text{ J.}$$

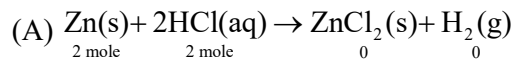
## CHEMISTRY

### SECTION - A (35 Questions)

51. (1)  $\text{LiAlH}_4$  reduces both  $\text{—}\overset{\text{O}}{\parallel}\text{C—H}$ ,  $\text{—}\overset{\text{O}}{\parallel}\text{C—}$  and acid ester to alcohol  $\text{NaBH}_4$  reduces  $\text{—}\overset{\text{O}}{\parallel}\text{C—H}$ ,  $\text{—}\overset{\text{O}}{\parallel}\text{C—}$  without affecting  $\text{C}=\text{C}/\text{C}\equiv\text{C}$

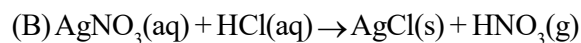
52. (4) Not more than four hydrogen atoms can be substituted by methyl groups in the molecule of  $\text{B}_2\text{H}_6$ . The bridge hydrogen atoms are not to be substituted.

53. (1)



$$2-1 \quad 2-2 \quad 1 \text{ mole} \quad 1 \text{ mole}$$

$$= 1 \text{ mole} = 0$$



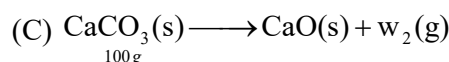
$$170\text{g} \quad 18.25\text{g} \quad 0 \quad 0$$

$$n = 1 \text{ mole} \quad 0.5 \text{ moles}$$

$$\text{ER} \quad \text{LR}$$

$$1 - 0.5 \quad 0.5 - 0.5 \quad 0.5 \quad 0.5$$

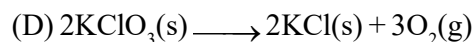
$$= 0.5 \text{ moles} \quad = 0 \text{ moles}$$



$$n = 1 \text{ mole} \quad 0 \quad 0$$

$$1 - 1 \quad 1 \text{ mole} \quad 1 \text{ mole}$$

$$= 0$$

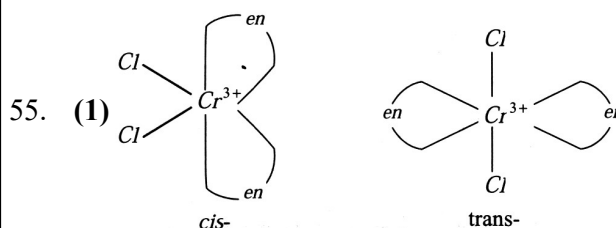


$$\frac{2}{3} \text{ moles} \quad 0 \quad 0$$

$$\frac{2}{3} - \frac{2}{3} \quad \frac{2}{3} \text{ moles} \quad 1 \text{ mole}$$

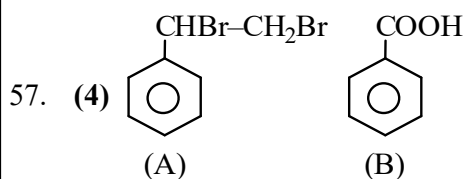
$$= 0 \text{ mole}$$

54. (2)  $c > b > a$



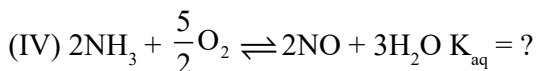
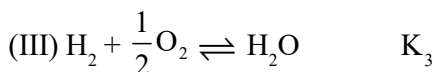
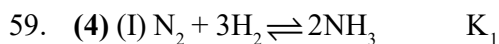
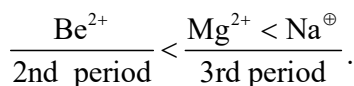
It contains  $\text{Cl}^-$  and ethylene diamine as ligands.

56. (3) A, D

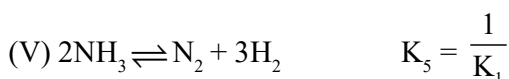


58. (1)  $\text{Be}^{2+}$  ion is of 2<sup>nd</sup> period, whereas  $\text{Mg}^{2+}$  and  $\text{Na}^+$  ions are of 3<sup>rd</sup> period. Size of 3<sup>rd</sup> period ions is

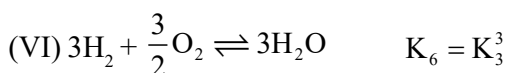
greater than that of 2<sup>nd</sup> period. Moreover, more positive charge have lesser size. Therefore, order of sizes is



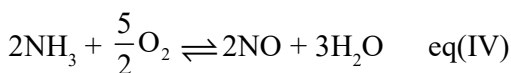
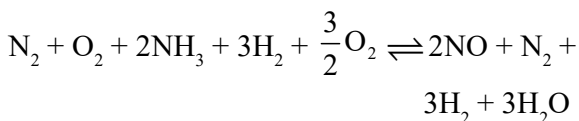
eq(V) = -eq(I)



(VI) = 3eq(I)



eq(II) + eq(V) + eq(VI) is



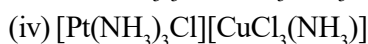
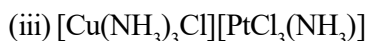
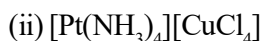
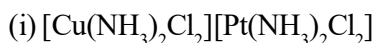
eq(IV) = eq(II) + eq(V) + eq(VI)

$$\Rightarrow K_4 = K_2 \times K_5 \times K_6 = K_2 \times \frac{1}{K_1} \times K_3^3$$

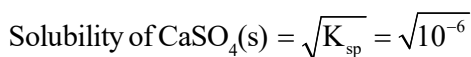
$$K_4 = \frac{K_2 K_3^3}{K_1}$$

60. (3) Electrophilic substitution takes place activated ring

61. (4) Four coordinate isomers are possible.



62. (2) Solubility of  $\text{BaSO}_4(\text{s}) = \sqrt{K_{\text{sp}}} = \sqrt{10^{-11}}$   
 $= 3.16 \times 10^{-6} \text{ mol/L}$



$$= 1.0 \times 10^{-3} \text{ mol/L}$$

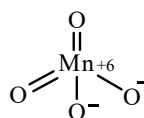
$$\text{Solubility of } \text{Ag}_2\text{SO}_4 = \sqrt[3]{\frac{K_{\text{sp}}}{4}}$$

$$(\because \text{Ag}_2\text{SO}_4, 4\text{s}^3 = K_{\text{sp}})$$

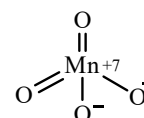
$$= \sqrt[3]{\frac{10^{-5}}{4}} = 1 \times 10^{-2} \text{ mol/L}$$

63. (4) Both silica gel and alumina are used as adsorbents in adsorption chromatography.

64. (3) Manganate Permanganate



Paramagnetic,  
green in colour,  
Tetrahedral &  
contains  
 $\pi\pi$ - $d\pi$  bond



Diamagnetic,  
purple in colour,  
Tetrahedral &  
contains  
 $\pi\pi$ - $d\pi$  bond

Manganate ion is paramagnetic while permanganate ion is diamagnetic.

65. (3)  $W = -P\Delta V = -10^5(1 \times 10^{-2} - 1 \times 10^{-3}) = -900 \text{ J}$

66. (4) III > I > IV > II

67. (3) In acidic medium,  $\text{MnO}_4^- \longrightarrow \text{Mn}^{2+}$  Change in O.N. of Mn = 5.

$\therefore$  Eq. wt. of  $\text{KMnO}_4$

$$= \frac{\text{Mol. wt.}}{5} = \frac{39 + 55 + 64}{5} = \frac{158}{5} = 31.6.$$

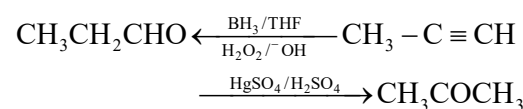
68. (1) (i)-(b), (ii)-(d), (iii)-(a), (iv)-(e), (v)-(c)

69. (3) Balmer series

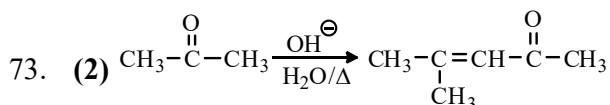
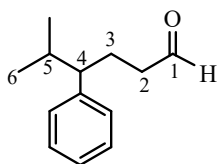
70. (2) As,  $E \propto \frac{1}{\lambda}$  so  $\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1}$

$$\frac{2.5}{5} = \frac{\lambda_2}{\lambda_1} \text{ or } \lambda_1 = 2\lambda_2$$

71. (2)



72. (4) The compound is an aldehyde containing longest chain of 6 C-atoms and side chains.



74. (1) In case of  $d_{z^2}$ ,  $d_{x^2-y^2}$ ,  $e^-$  density is along with the axes while in  $d_{xy}$ ,  $d_{yz}$ ,  $d_{xz}$  it is in between two axis at  $45^\circ$ .

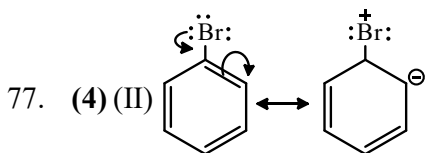
75. (2) [Bond angle for  $\text{AB}_x$  molecule]

$$\propto \frac{1}{\text{EN of atom B}}$$

EN of Cl < F. So, bond angle of  $\text{NH}_3 > \text{NF}_3$ . Hence I is correct. EN of H < F. So, bond angle of  $\text{NH}_3 > \text{NF}_3$ . Hence, III is also correct. Thus, decreasing order of bond angle is :

$\text{NH}_3 > \text{NCl}_3 > \text{NF}_3$ . Since EN of H < Cl.

76. (2) Catalyst brings the equilibrium faster by decreasing the activation energy for both forward and backward reaction.

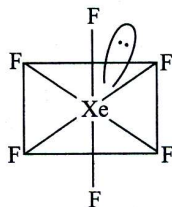


C-X bond is stabilised by resonance.

(III)  $3^\circ$ -alkyl halide undergoes elimination.

78. (4)  $\text{AB}_6 \text{E}$  type ( $:\text{XeF}_6$ ) have  $sp^3d^3$  hybridisation with  $\text{P}_{6h}$  geometry and it should have pentagonal pyramid shape.

But this case is an exception in which it has distorted octahedral structure.



79. (3) If assertion is true but reason is false

80. (1) Alkyl group is +I showing group. In general, it increases the electron density over nitrogen, thus, increase the availability of lone pair for donation. But in case of tertiary amines, in aqueous solution, the over crowding of three bulkier alkyl group result

in increased strain, which decreases the availability of lone pairs for donation and thus result in decreased basicity. Hence, in aqueous solution,  $3^\circ$  amines are less basic as compared to  $2^\circ$  amine.

81. (4) Some interhalogens are solids and are not volatile.

82. (3)  $\text{Conductivity} = \frac{1}{R} \times \frac{l}{A}$

83. (2) Acid which can form more stable conjugate base is more basic

84. (2) Only bonding  $\sigma$  MO's have zero nodal plane.

85. (1) Atomic mass

$$= \frac{10 \times 19 + 81 \times 11}{100} = \frac{190 + 891}{100} = \frac{1081}{100} = 10.81$$

### SECTION - B (Attempt Any 10 Questions)

86. (4)  $[\text{Co}(\text{CN})_6]^{3-}$  (Tetrahedral)

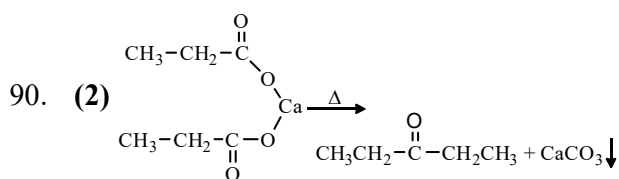
O.N. of Co = +3

$\text{Co}^{+3} = 4s^0 3d^6$ ,  $\text{CN}^-$  is strong field ligand so hybridisation is  $d^2sp^3$  and has no unpaired electrons.

87. (2)  $\lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34} \text{ Js}}{0.01 \text{ kg} \times 100 \text{ ms}^{-1}} = 6.626 \times 10^{-34} \text{ m}$

88. (4) Aromatic aldehyde does not reduced by Fehling's reagent

89. (2) Lattice energy of the carbonates of group 2 elements decreases down the group ( $\downarrow$ ), due to decrease in charge density of cations.



91. (2) As total time,  $T = n \times t_{1/2}$

$$\therefore 48 = n \times 12 \quad \text{or} \quad n = 4$$

Now from equation,  $\left[\frac{A}{A_0}\right] = \left(\frac{1}{2}\right)^n$

$$\Rightarrow \left(\frac{A}{10}\right) = \left(\frac{1}{2}\right)^4 \quad \Rightarrow \left(\frac{A}{10}\right) = \frac{1}{16}$$

$$\therefore [A] = \frac{10}{16} = 0.625$$



92. (2) Alkyl halide (RX) should be 2° or 3° while alkoxide (RO<sup>-</sup>Na<sup>+</sup>) should be 1°
93. (1) Na<sub>2</sub>O, MgO, Al<sub>2</sub>O<sub>3</sub>, CuO
94. (3) Equal to  $\frac{\text{Normal molecular mass}}{\text{Observed molecular mass}}$
95. (1) Starch is a polymer of  $\alpha$ -glucose
96. (3) In group 15 hydrides, the basic character decreases on going down the group due to decrease in the availability of the lone pair of electrons because of the increase in size of elements from N to Bi. Thus, correct order of basicity is NH<sub>3</sub> > PH<sub>3</sub> > AsH<sub>3</sub> > SbH<sub>3</sub>.
97. (2)  $\frac{1}{2}\text{H}_2 + \frac{1}{2}\text{Cl}_2 \rightarrow \text{HCl}$

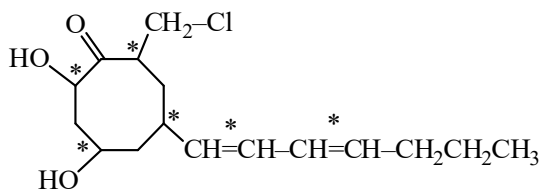
$$\Delta H_{\text{HCl}} = \Sigma \text{B.E. of reactant}$$

$$-\Sigma \text{B.E. of products}$$

$$-90 = \frac{1}{2} \times 430 + \frac{1}{2} \times 240 - \text{B.E. of HCl}$$

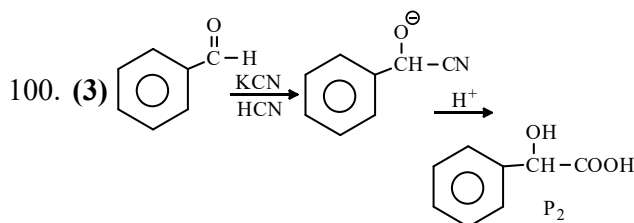
$$\therefore \text{B.E. of HCl} = 215 + 120 + 90 = 425 \text{ kJ mol}^{-1}$$

98. (4)



$$\text{Total isomer} = 2^6 = 64$$

99. (2)  $\text{NO}_3^- \xrightarrow{+e^- \times 1 = +7e^-} \overset{-2}{\text{N}_2\text{H}_4}$



## BOTANY

### Section - A (35 Questions)

101. (2) (NCERT XII, Pg 90, Para 4,5)

102. (3) (NCERT XII, Pg 80, Concept- Law of independent assortment)
103. (3) (11<sup>th</sup> NCERT PK Conceptual)
104. (2) (NCERT 12<sup>th</sup>, Page no- 23, 2<sup>nd</sup> paragraph, Line no- 22, 23)
105. (3) [NCERT XI, page no. 248, Point no.- 15.4.3.1, page no. 249, Point no. 15.4.3.2 and page no. 250, Point 15.4.3.5]
106. (1) (11<sup>th</sup> Para 8.1,8.2, Page no. 125,126)
107. (4) (NCERT 11<sup>th</sup>, page no- 9, Last paragraph, Line no- 30, 31, 32)
108. (3) (NCERT XII, Pg 89, 5.8.2 Mendelian Disorders)
109. (3) (NCERT XI; Sub-topic 5.5.1.3 and 5.9.3)
110. (1) (NCERT XI Page No. 76; Sub-topic 5.6. conceptual)
111. (4) (NCERT XI Page No.79; Sub-topic 5.9.1)
112. (1) (NCERT 11<sup>th</sup>, Page no- 19, 3<sup>rd</sup> paragraph, Concept based)
113. (1) NCERT Page no- 34, Figure- 2.13(b)
114. (4) (NCERT XI Pg. No. 211, 13.5, 213, 13.6.3)
115. (3) (NCERT XI Pg. No. 218 table above 13.8)
116. (3) (11<sup>th</sup> Para 10.2.4,10.2.1, Page no. 166,164)
117. (1) (NCERT XII, Pg 92, last Para )
118. (4) (NCERT 12<sup>th</sup>, page no- 34, 1<sup>st</sup> paragraph, Line no-3 and 4)
119. (4) (11<sup>th</sup> Para 10.2.4, Page no. 166)
120. (2) [NCERT class XI, Page no. 91, Point 6.3.2]
121. (4) (11<sup>th</sup> NCERT Page no.36 and 37)
122. (2) NCERT Page no- 24, Paragraph- 2.3.4, Line no- 29,30
123. (3) NCERT page no-20, Paragraph- 2.2.1, Line no- 30
124. (3) (11<sup>th</sup> Para 8.3, Page no. 126 )
125. (4) (11<sup>th</sup> Para 8.5.2, Page no.132 )
126. (1) [NCERT class XI, Page no. 93, Point 6.3.5]
127. (3) (NCERT XII, Pg 82, Para 3, line 2; Pg 83, Para 2, line 7;Pg 88, Para 3, line 1; Pg 91, Para 2, line 6; Pg 94, Para 1, line 2; )
128. (4) (NCERT XII, Pg 120, Para 1, Line 1)
129. (2) (NCERT XII, Pg 83, Concept- Linkage)
130. (1) [NCERT XI, Page 250, point 15.4.3.4]
131. (3) (NCERT XI Pg.234, 145)
132. (4) (NCERT XI Pg.228, 14.2)
133. (1) (11<sup>th</sup> NCERT old ,page no.35 last para)
134. (1) (12<sup>th</sup> NCERT Page no.248-249 conceptual)
135. (2) (NCERT XII, Pg 81, Para 3, Line 8)

### SECTION - B (Attempt Any 10 Questions)

136. (1) (NCERT XII, Pg 85, Para 2, Line 8)  
 137. (4) (NCERT XI Pg. No. 208, 2<sup>nd</sup> paragraph)  
 138. (3) (NCERT XI Page No.71; Sub-topic 5.3.3)  
 139. (1) (11<sup>th</sup> NCERT PK ,CONCEPTUAL)  
 140. (2) (NCERT XII, Pg 118, Goals of HGP- Point vi.)  
 141. (1) [NCERT class XI, Page no. 86, Point 6.1.2.1, Page no. 94, Line number- 06-09, Page no. 91 (Line no.- 05-08), Page no. 93- Point- 6.3.5]  
 142. (2) (NCERT XI Pg.232, 14.3)  
 143. (4) ( 12<sup>th</sup> NCERT Conceptual)  
 144. (4) (NCERT XII, Pg 116, Para 3, line 3)  
 145. (3) (NCERT XII, Hardy Weinberg Concept.)  
 146. (2) (11<sup>th</sup> Para 8.5.3.2, Page no.133, 134 )  
 147. (3) (NCERT 11<sup>th</sup>, Page no- 23, 2<sup>nd</sup> paragraph, Line no- 26, 27, 28, 29)  
 148. (2) (NCERT 11<sup>th</sup>, Page no- 10, 1<sup>st</sup> paragraph, Line no- 9)  
 (NCERT 11<sup>th</sup>, Page no- 11, Table-1.1)  
 149. (1) (NCERT 12<sup>th</sup>, Page no- 35, Figure- 2.14 (b))  
 150. (3) (11<sup>th</sup> Para10.4.1, Page no. 168)

## ZOOLOGY

### Section - A (35 Questions)

151. (3) [NCERT P. No.318 1<sup>st</sup> three lines ]  
 152. (1) [NCERT P.No.208, Pest resistant Plants]  
 153. (2) [NCERT P.No.208, 2<sup>nd</sup> para]  
 154. (3) [NCERT P.No.212, 3<sup>rd</sup> para]  
 155. (4) (NCERT 12<sup>th</sup>, p.no. 62, para3, line7)  
 156. (3) (NCERT P.No. 149)  
 157. (1) (NCERT XI Page No. 337, 2nd paragraph)  
 158. (3) (NCERT XI Page No. 297, 2nd paragraph of 19.5)  
 159. (3) (12<sup>th</sup> NCERT,Page no.236 to 238)  
 160. (1) (NCERT 12<sup>th</sup>. p.no.51, para 1, line5)  
 161. (4) (12<sup>th</sup> Para10.2.3 , Page no.183 )  
 162. (3) (NCERT based - applied)  
 163. (1) (NCERT12<sup>th</sup>, p.no.60, para1, line7)  
 164. (3) (NCERT11<sup>th</sup> page no 114, para 3, line 8)  
 165. (3) (NCERT 11<sup>th</sup> page116, para4, line3)  
 166. (4) (NCERT P.No. 158 - Drug & Alcohol abuse)  
 167. (3) (NCERT Pg.274)  
 168. (4) (NCERT 12<sup>th</sup>, Page no- 135, 3<sup>rd</sup> paragraph, Line no- 1 and 2)  
 169. (4) (NCERT 12<sup>th</sup>, Page no- 129, Last paragraph, Concept based)

170. (3) (NCERT 12<sup>th</sup>, Page no- 142, Summary)  
 171. (3) (NCERT P.No. 282 - Circulatory pathway)  
 172. (1) NCERT 11<sup>th</sup>, Page no-159, Paragraph- 9.12.6, Line no-1-6  
 173. (4) NCERT 11<sup>th</sup>, Page no-,159 Paragraph- 9.12.6, Line no-16,17  
 174. (1) (12<sup>th</sup> Para10.2.3, 10.5, Page no.183, 187)  
 175. (4) (NCERT Pa. No.155)  
 176. (3) (NCERT Conceptual)  
 (NCERT XI Page No. 334, Last line of 1st paragraph)  
 (NCERT XI Page No. 338, 2nd paragraph)  
 177. (4) (NCERT XI Page No. 56; Class-chondrichthyes)  
 178. (4) [NCERT Practical Syllabus P.No.128, Point iii]  
 179. (4) [NCERT P. No.312 2<sup>nd</sup> para 2<sup>nd</sup> Line ]  
 180. (3) ( 12<sup>th</sup> NCERT page no.261,15.1.2 1<sup>st</sup> para)  
 181. (3) (12<sup>th</sup> NCERT Page no.266 to 267)  
 182. (3) [NCERT P. No.308 Last Para]  
 183. (4) [NCERT P. No.317 Last 3<sup>rd</sup> Line]  
 184. (2) (NCERT XI Page No. 59, Class - mammalia)  
 185. (3) (NCERT XI Page No. 58; 4.2.11.5)

### SECTION - B (Attempt Any 10 Questions)

186. (3) (12<sup>th</sup> NCERT Page no.232. table no.13.1)  
 187. (2) (NCERT 12<sup>th</sup>. p.no.45, para 1)  
 188. (2) (NCERT 12<sup>th</sup>, page 59, para 2)  
 189. (2) (NCERT Pg.285)  
 190. (2) (12<sup>th</sup> Para 10.6 /Page no.188)  
 191. (4) (NCERT XI Page No. 295, 1st paragraph)  
 192. (3) [NCERT P. No.312 Disorders 1<sup>st</sup> Line]  
 193. (3) [NCERT P. No.321 Midbrain 2<sup>nd</sup> Line]  
 194. (2) [NCERT P.No.203 last para , P-204 1<sup>st</sup> para,]  
 195. (2) (NCERT 11<sup>th</sup> page 102, 7.1.2 Connective Tissue)  
 196. (3) (NCERT 12<sup>th</sup>, Page no- 135, 3<sup>rd</sup> paragraph, Line no- 18, 19, 20, 21)  
 197. (3) NCERT 11<sup>th</sup>, Page no-154, Paragraph-9.12, Line no-1 and 2  
 198. (1) (NCERT based - applied)  
 199. (4) (NCERT P.No. 158 -159 drug & alcohol abuse)  
 200. (4) (NCERT 12<sup>TH</sup> HR)