

## ANSWER KEY & SOLUTION KEY FINAL ROUND - 14 (PCB) Dt.23.04.2024

### PHYSICS

#### SECTION - A (35 Questions)

01. (1)  
 02. (1)  
 03. (2) Given,  $v = 3x^2 - 2x$ , differentiating  $v$ , we get

$$\frac{dv}{dt} = (6x - 2) \frac{dx}{dt} = (6x - 2)v$$

$$\Rightarrow a = (6x - 2)(3x^2 - 2x)$$

Now put,  $x = 2m$

$$\Rightarrow a = (6 \times 2 - 2)[3(2)^2 - 2 \times 2] = 80 \text{ m/s}^2$$

04. (3) Let force acting on mass  $m$  in equilibrium are

$$\vec{F}, \vec{F}_1, \vec{F}_2, \vec{F}_3, \vec{F}_4$$

$$\vec{F} + \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 = 0 \text{ [equilibrium condition]}$$

$$\Rightarrow \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 = -\vec{F} \quad \dots(i)$$

After cutting the string with force  $\vec{F}$ , the net force on mass  $m$

$$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4$$

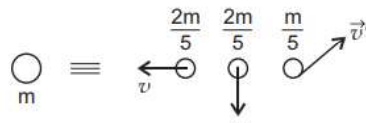
$$\Rightarrow \vec{a} = \frac{\vec{F}_{net}}{m} = -\frac{\vec{F}}{m} \quad \text{[from (i)]}$$

05. (1)  $U_2 = (2x^2 + 3y^2 + 3z)$

$$\vec{F} = -\left(\frac{\partial U}{\partial x} \hat{i} + \frac{\partial U}{\partial y} \hat{j} + \frac{\partial U}{\partial z} \hat{k}\right)$$

$$= -(4x\hat{i} + 9y^2\hat{j} + 2\hat{k})\text{N}$$

$$\vec{F}_{(1,2,3)} = -(4\hat{i} + 36\hat{j} + 2\hat{k})\text{N}$$

06. (2) 

By conservation of momentum

$$m(0) = \frac{2m}{5}(-v\hat{i}) + \frac{2m}{5}(-v\hat{j}) + \frac{m}{5}\vec{v}'$$

$$\Rightarrow \vec{v}' = 2v\hat{i} + 2v\hat{j}$$

$$\Rightarrow v' = \sqrt{(2v)^2 + (2v)^2} = 2\sqrt{2}v$$

07. (3)  $h = l(1 - \cos 60^\circ) = \frac{l}{2}, v^2 = 2gh = gl$

Now,  $T_{max} = mg + \frac{mv^2}{l}$  (at bottom most point)

$$\therefore T_{max} = 2mg = \mu_s (4mg)$$

$$\therefore \mu_s = 0.5$$

08. (4)  
 09. (3)  
 10. (3) The Statement I is correct but the Statement II is incorrect.

The air currents at the top have a larger velocity and thus less pressure at the top than at the bottom. The difference in pressure on the two sides of the wing produces the uplift.

Hence, the correct answer is option (3)

11. (1)  
 12. (1) Here,  $m_1 = 0.20 \text{ kg} = 200 \text{ g}$

$$\theta_1 = 150^\circ\text{C}$$

$$w = 0.025 \text{ kg} = 25 \text{ g}$$

$$m_2 = V \times d = 150 \times 1 = 150 \text{ g}, \theta_2 = 27^\circ\text{C}$$

Final temperature,  $\theta = 40^\circ\text{C}, c = ?$

As heat lost by metal = heat gained by water and calorimeter

$$\therefore m_1 c \Delta\theta_1 = (m_2 + w) \Delta\theta_2$$

$$200 \times c (150 - 40) = (150 + 25)(40 - 27)$$

$$\therefore c = \frac{175 \times 13}{200 \times 110} = 0.1.$$

13. (1)  
 14. (1) The electrostatics shielding is possible by metallic conductor.  
 15. (1)  
 16. (2)

Let assume unknown resistance = R  
 in balancing condition

$$\frac{3}{R} = \frac{60}{40} \Rightarrow R = 2 \Omega$$

Net resistance after shunting on unknown resistance

$$R_{eq} = \frac{S \times R}{S + R} = \frac{2 \times 2}{2 + 2} = 1\Omega$$

Now in balancing condition

$$\frac{3}{1} = \frac{x}{100 - x} \Rightarrow x = \frac{300}{4}$$

$$= 75 \text{ cm}$$

length changes by  $\Rightarrow 75 - 60 = 15 \text{ cm}$

17. (1) When the switch  $S$  is closed, bulb  $B_2$  lights up earlier. This is because growth of current in  $B_1$  is opposed by emf induced across  $L$ . As resistance  $R$  is same as that of the coil making up  $L$ , therefore, finally, both the bulbs acquire equal brightness.

18. (3)

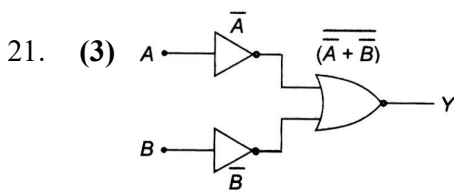
19. (1) From conservation of momentum :

$$MV = \frac{h}{\lambda} = hR \left(1 - \frac{1}{4}\right) \Rightarrow V = \frac{3}{4} \frac{hR}{M}$$

20. (2) As for first minima

$$\sin \theta = \lambda \Rightarrow a \sin 30^\circ = 600 \times 10^{-9}$$

$$\Rightarrow a = 1200 \times 10^{-9} \text{ m} \Rightarrow a = 1.2 \mu\text{m}$$



By dmorgan's theorem  $\overline{\overline{A + B}} = \overline{\overline{A}} \cdot \overline{\overline{B}} \Rightarrow A \cdot B$

22. (3) Knowledge based question.

23. (1) Distance between the car A and B remains constant.

Let the distance be 'x'

velocity of C w.r.t. A and B,  $v = 45 + 36 = 81 \text{ km/h}$

$$\text{Distance} = 81 \times \frac{5}{60} = 6.75 \text{ km}$$

24. (1) Amplitude  $A_1$  and  $A_2$  are added as vectors. Angle between these vectors is the phase difference

$((\beta_1 - \beta_2))$  between them.

$$\therefore R = \sqrt{A_1^2 + A_2^2 + 2A_1 A_2 \cos(\beta_1 - \beta_2)}$$

25. (3)

26. (2)

$$E = \frac{q}{4\pi\epsilon_0 r^2} \Rightarrow Ar = \frac{q}{4\pi\epsilon_0 r^2} \Rightarrow q = 4\pi\epsilon_0 Ar^3$$

27. (1) Using work energy theorem

$$W = \Delta KE = 0 - \left(\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2\right)$$

$$W = 0 - \frac{1}{2}mv^2 \left(1 + \frac{K^2}{R^2}\right)$$

$$= -\frac{1}{2} \times 50 \times (0.4)^2 \left(1 + \frac{1}{2}\right) = -6 \text{ J}$$

Absolute work = + 6 J

$$W = -6 \text{ J} \Rightarrow |W| = 6 \text{ J}$$

28. (1) When a metal wire elongates by hanging a load on it, the gravitational potential energy is decreased. Half of lost potential energy stored in form of elastic potential of wire and remaining half in form of heat.

29. (2)  $R = R_0 A^{1/3}$

$$\therefore \frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{27}{125}\right)^{1/3} = \frac{3}{5}$$

$$\therefore R_2 = \frac{5}{3} \times 3.6 = 6 \text{ fermi}$$

30. (2)  $V_{rms} = \sqrt{\frac{(T/2)V_0^2 + 0}{T}} = \frac{V_0}{\sqrt{2}}$

31. (2) Here,  $M = 0.005 \text{ H}$ ,  $I = I_0 \sin \omega t$

$$\frac{dI}{dt} = I_0 \cos \omega t (\omega)$$

$$\text{Max. value of } \frac{dI}{dt} = I_0 (\omega) \times 1$$

Max. value of emf induced in second coil

$$e_0 = M \left(\frac{dI}{dt}\right)_{\max} = 0.005 \times I_0 \omega$$

$$e_0 = 0.005 \times 10 \times 100\pi = 5\pi \text{ volt}$$

32. (3) Velocity

$$v = \omega \sqrt{a^2 - y^2} \text{ or } v^2 = \omega^2 (a^2 - y^2)$$

$$\text{or } \frac{v^2}{\omega^2} + y^2 = a^2$$

It is an equation of ellipse.

33. (2) Given  $V = 100 \pm 5 \text{ volts}$

$$l = 10 \pm 0.2 \text{ amperes}$$

$$R = \frac{V}{l}$$

$$\frac{R}{R} = \frac{V}{V} + \frac{l}{l}$$

$$\frac{R}{R} = \frac{5}{100} + \frac{0.2}{10} \Rightarrow \frac{R}{R} = \frac{7}{100}$$

$$\Rightarrow \% \text{ error} = \frac{R}{R} \times 100\% = 7\%$$

34. (3)  $P_{avg} = V_{rms} I_{rms} \cos(\Delta\phi)$

$$= \frac{200}{\sqrt{2}} \times \frac{50 \times 10^{-3}}{\sqrt{2}} \times \cos\left(\frac{\pi}{3}\right)$$

$$= \frac{10^4}{2} \times \frac{1}{2} \times 10^{-3}$$

$$= \frac{10}{4} = 2.5 \text{ W}$$

35. (4) Error in measuring 25 sec. =  $\frac{1}{5}$  sec. = 0.2 sec.  
 $\therefore$  percentage error =  $\frac{0.2}{25} \times 100\% = 0.8\%$

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

36. (2) At height  $r$  from centre of earth, orbital velocity

$$v = \sqrt{\frac{GM}{r}}$$

By principle of energy conservation

$$\text{KE of } m + \left(-\frac{GMm}{r}\right) = 0 + 0$$

( $\because$  At infinity, PE = KE = 0)

$$\text{or KE of } m = \frac{GMm}{r} = \left(\sqrt{\frac{GM}{r}}\right)^2 m = mv^2.$$

37. (3) There are  $n_0$  moles in each container initially

$$n = \frac{P_0 V_0}{RT_0} \quad \dots(i)$$

$$n_1 + n_2 = 2n$$

Let final common pressure is  $P$

$$\frac{PV_0}{2RT_0} + \frac{PV_0}{RT_0} = \frac{2P_0 V_0}{RT_0}$$

$$\frac{P}{2} + P = 2P_0 \Rightarrow P = \frac{4P_0}{3}$$

No of moles in container of temperature  $2T_0$

$$= \frac{PV_0}{2RT_0} = \frac{4P_0}{3} \times \frac{V_0}{2RT_0} = \frac{2}{3} \frac{P_0 V_0}{RT_0}$$

38. (1) Here, Initial angular speed of the wheel,

$$\omega_0 = 1800 \times \frac{2\pi}{60} \text{ rad s}^{-1} = 60\pi \text{ rad s}^{-1}$$

Final angular speed of the wheel,

$$\omega = 3000 \times \frac{2\pi}{60} \text{ rad s}^{-1} = 100\pi \text{ rad s}^{-1}$$

Time during which this change of speed takes place,

$$t = 20 \text{ s}$$

Let  $\alpha$  be angular acceleration of the wheel.

$$\therefore \alpha = \frac{\omega - \omega_0}{t} = \frac{100\pi - 60\pi}{20} \text{ rad s}^{-2} = 2\pi \text{ rad s}^{-2}$$

39. (3) Given that initially the system is at rest,

$$\text{i.e., } \vec{V}_{CM} = 0$$

$$\text{So } \vec{V}_{CM} = \text{constant} = 0$$

$$\text{i.e., } \frac{m\vec{v} + M\vec{V}}{m + M} = 0$$

$$\text{or } m\vec{v} + M\vec{V} = 0 \text{ [ as } (m + M) = \text{finite}]$$

$$\text{i.e., } M\vec{V} = -m\vec{v} \dots\dots\dots(i)$$

Furthermore, here it is given that ;

$$\vec{v}_{rel} = \vec{v} - \vec{V} \dots\dots\dots(ii)$$

Putting the value of  $\vec{v}$  from eq. (ii) in eq.(i), we get ;

$$M\vec{V} = -m(\vec{v}_{rel} + \vec{V})$$

$$\text{or } \vec{V} = -\frac{m\vec{v}_{rel}}{m + M}$$

Thus, it is clear that the direction of motion of balloon is opposite to that of climbing ( $\vec{v}_{rel}$ ), i.e., vertically down.

40. (4) ( $n$ ) = Number of particle passing from unit area in unit time =

$$\frac{\text{No. of particle}}{A \times t} = \frac{[M^0 L^0 T^0]}{[L^2][T]} = [L^{-2} T^{-1}]$$

$$[n_1] = [n_2] = \text{No. of particle in unit volume} = [L^{-3}]$$

$$\text{Now, from the given formula } [D] = \frac{[n][x_2 - x_1]}{[n_2 - n_1]}$$

$$= \frac{[L^2 T^{-1}][L]}{[L^{-3}]} = [L^2 T^{-1}].$$

41. (3) The magnetic field due to wire placed along  $x$ -axis will be zero. The point under consideration is semi finite position of the wires placed along  $y$ -axis and  $z$ -axis.

Magnetic field due to wire placed along  $y$ -axis,

$$\vec{B}_y = \frac{\mu_0 I}{4\pi r} (\hat{k})$$

Magnetic field due to wire placed along  $z$ -axis,

$$\vec{B}_z = \frac{\mu_0 I}{4\pi r} (-\hat{j})$$

$$\text{Hence, net magnetic field, } \vec{B} = \frac{\mu_0 I}{4\pi r} (\hat{k} - \hat{j})$$

After substituting the values, we get,

$$\vec{B} = \frac{\mu_0}{8\pi} (\hat{k} - \hat{j}) \text{T}$$

42. (2)  $\mu_r = 500$ ,  $I = 1 \text{ A}$ ,  $n = 500$  per metre

Magnetisation,  $I = \chi H = (\mu_r - 1)nI$

$$(500 - 1) 500 \times 1$$

$$I = 2.5 \times 10^5 \text{ Am}^{-1}$$

43. (3) Speed of wave from wave equation

$$v = \frac{(\text{coefficient of } t)}{(\text{coefficient of } x)}$$

$$v = \frac{1000}{(-3)} = \frac{1000}{3}$$

Since speed of wave  $\propto \sqrt{T}$

$$\text{So } \frac{1000}{3} = \sqrt{\frac{273}{T}} \Rightarrow T = 4.41^\circ\text{C}$$

44. (2) If the equation of unknown is

$$y' = y + y' = a \sin((\omega t - kx) - a \sin(\omega t + kx))$$

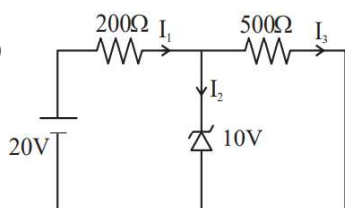
$$= -a[\sin(\omega t + kx) - \sin(\omega t - kx)]$$

$$-2a \cos \omega t \sin kx$$

At  $x = 0$ ,  $y'' = 0$ , i.e. a node is formed

45. (3)  $\delta_{\text{water}} = (\mu_g - 1)A = \left(\frac{a \mu_g}{a \mu_w} - 1\right)A$
- $$= \left(\frac{9}{8} - 1\right)A = \frac{A}{8}$$

46. (3)



Zener is in breakdown region.

$$I_3 = \frac{10}{500} = \frac{1}{50}$$

$$I_1 = \frac{10}{200} = \frac{1}{20}$$

$$I_2 = I_1 - I_3$$

$$I_2 = \left(\frac{1}{20} - \frac{1}{50}\right) = \left(\frac{3}{100}\right) = 30 \text{ mA}$$

47. (4) Intensity of EM wave is given by

$$I = \frac{P}{4\pi R^2} = u_{av} \cdot c = \frac{1}{2} \epsilon_0 E_0^2 \times c$$

$$\Rightarrow E_0 = \sqrt{\frac{P}{2\pi R^2 \epsilon_0 c}}$$

48. (4) At these points, the resultant field = 0

49. (1) Here
- $r_1 = 0.05 \text{ m}$
- ,
- $r_2 = 0.06 \text{ m}$

$$C = \frac{4\pi \epsilon_0 r_1 r_2}{(r_2 - r_1)} = \frac{0.05 \times 0.06}{0.01(9 \times 10^9)} = \frac{1}{3} \times 10^{-10} \text{ F}$$

Potential difference between the plates,  $V = 15,000 \text{ V}$

$\therefore$  Charge on the inner sphere,

$$CV = \frac{1}{3} \times 10^{-10} \times 15,000 = 5 \times 10^{-7} \text{ C}$$

50. (1) For the branch containing A, B and C

$$R_{eq} = \frac{3R}{2}$$

$$\text{Current in A: } I_1 = \frac{E}{R_{eq}} = \frac{2E}{3R}$$

$$\text{Current in each of B and C: } I'_1 = \frac{I_1}{2} = \frac{E}{3R}$$

for the branch containing D, E, F, G and H;

$$R_{eq} = \frac{7R}{3}$$

$$\text{Current through D and H: } I_2 = \frac{3E}{7R}$$

Current through each of E, F, and G;

$$I'_2 = \frac{I_2}{3} = \frac{E}{7R} \text{ Since } I_1 > I_2 > I'_1 > I'_2$$

$$A > D = H > B = C > E = F = G$$

## CHEMISTRY

### SECTION - A (35 Questions)

51. (4) Stability of +3 oxidatin states increases on accout of inert pair effect. Reducing character of hydrides increases down the group because bond dissociation energy decreases down the group.
52. (1)  $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]\text{Cl}$  exists in three geometrical isomeric forms and on of the geometrical isomers exhibit enantiomers.
53. (1) The given reaction is an example of disproportionation reaction. In this reaction, chlorine is oxidised as well as reduced. The oxidation states of chlorine in  $\text{ClO}^- (\text{aq})$ ,  $\text{ClO}_3^- (\text{aq})$  and  $\text{Cl}^-$  are +1, +5 and -1 respectively. Hence, (A) is false but (R) is true.
54. (1) Let A denotes benzene and B denotes toluene In 1 : 1 molar mixture of A and B, Mole fraction of A and B are

$$x_A = \frac{1}{2}, x_B = \frac{1}{2}$$

Vapour pressure of

$$A = p_A^\circ x_A = 12.8 \times \frac{1}{2} = 6.4 \text{ kPa}$$

Vapour pressure of

$$B = p_B^{\circ} x_B = 3.85 \times \frac{1}{2} = 1.925 \text{ kPa}$$

Thus, vapour will contain high percentage of benzene than toluene.

55. (1) Sodium phenoxide  
 56. (2) A-(i), B-(iv), C-(ii), D-(iii)  
 57. (2) Conceptual fact.  
 58. (3) Statement-1 is false, Statement-2 is true  
 59. (3) The equilibrium is affected when the pressure is constant and the value of  $\Delta n_g \neq 0$ .

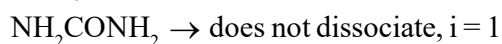
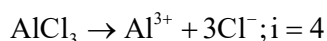
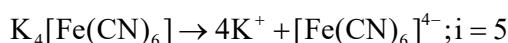
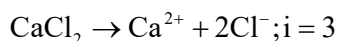
60. (3) Using formula  $\Delta E = hcR_H \left[ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$

For lowest energy of spectral lines in Lyman series,  
 $n_1 = 1, n_2 = 2$

$$\text{So, } \Delta E = hcR_H \left[ \frac{1}{(1)^2} - \frac{1}{(2)^2} \right] = hcR_H \times \frac{3}{4}$$

$$\Delta E = \frac{3}{4} hcR_H$$

61. (2) Adenine and thymine: guanine and cytosine  
 62. (3)  $C_2H_5Br + NaOC_2H_5$   
 $\xrightarrow{\Delta} C_2H_5-O-C_2H_5 + NaBr$   
 63. (1) A-III, B-I, C-II, D-IV  
 64. (3)  $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$   
Phosphine Sodium hypophosphite  
 65. (2) The dissociation of the given compounds are as follows



Since,  $K_4[Fe(CN)_6]$  given 5 ions in the solution. Hence, has maximum van't Hoff factor.

66. (2) (A) The molar mass of hydrogen peroxide is 34 g/mol, The molarity of 34 g of hydrogen

$$\text{peroxide in 500 mL is } \frac{34}{34} \times \frac{1000}{500} = 2 \text{ M.}$$

(B) The normality of hydrogen peroxide is twice its molarity. It is  $2 \times 2 = 4 \text{ N}$ .

(C) Percent w/V of hydrogen peroxide solution is

$$\frac{34 \text{ g} \times 1000 \text{ mL} / \text{L}}{500 \text{ mL}} = 68\%$$

(D) Volume strength =  $11.2 \times$  molarity  
 $= 11.2 \times 2 = 22.4 \text{ g/L}$

Hence, the correct match is

$$A-(iv), B-(iii), C-(i), D-(ii)$$

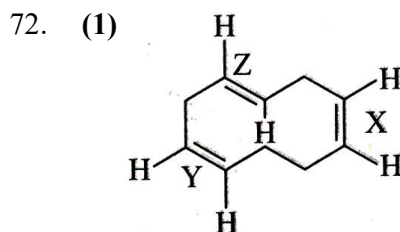
67. (1)  $(CH_3)_2CHOH + PBr_3 \longrightarrow$   
(iso-Propyl alcohol)  
 $(CH_3)_2CHBr \xrightarrow[\text{(aq)}]{KOH} CH_3-\underset{\substack{| \\ CH_3}}{CH}-OH$   
(A) (Propan-2-ol) (B)
68. (1) 1-(4); 2-(3); 3-(2); 4-(1)  
 69. (4) Zn (II)  
 70. (4) (a)-(iii), (b)-(i), (c)-(ii)  
 71. (4) According to Bohr model, radius of hydrogen atom

$$r_n = \frac{0.529 \times n^2}{Z} \text{ \AA}$$

where,  $n$  = number of orbit

$Z$  = atomic number ( $Z = 1$  for hydrogen)

$$r_3 = \frac{0.529 \times (3)^2}{1} = 0.529 \times 9 = 4.761 \text{ \AA}$$



73. (2) Diastereomers  
 74. (4) Work done is given as,  $W = -p_{\text{ext}} \times \Delta V$   
 Since, gas enters the vacuum bulb,  $p_{\text{ext}} = 0$ .  
 $\therefore$  Work done is zero.

75. (3) We know that,  $K_p = K_c (RT)^{\Delta n_g}$

$$\Delta n_g = 2 - 4 = -2$$

$$K_p = 0.50 (RT)^{-2} = 0.50 (0.082 \times 673)^{-2} = 1.64 \times 10^{-4}$$

76. (4) According to first law of thermodynamics,

$$\Delta U = q + W$$

For isothermal process,  $\Delta U = 0$

Hence,  $q = -W$

For cyclic process,  $\Delta U = 0$

Hence,  $q = -W$

For isochoric process,  $\Delta V = 0$

Hence,  $\Delta U = q$

$$(W = p\Delta V = 0)$$

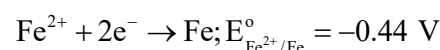
For adiabatic process,  $q = 0$

Hence,  $\Delta U = W$

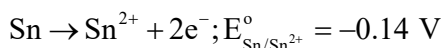
Thus, only option (4) is incorrect

77. (3) Half-cell reactions are

(i) At cathode,

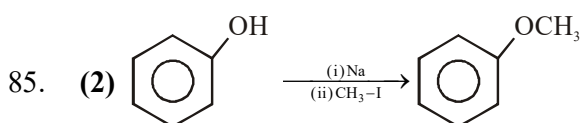


(ii) At anode,



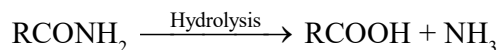
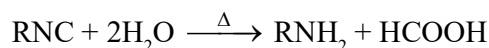
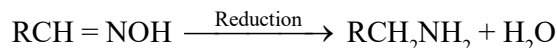
$$E_{\text{cell}}^{\circ} = E_{\text{Fe}^{2+}/\text{Fe}}^{\circ} - E_{\text{Sn}/\text{Sn}^{2+}}^{\circ} \\ = -0.44 + 0.14 = -0.30 \text{ V}$$

78. (1) Boiling point  $\propto$  Molar mass
79. (2)  $\text{CH}_3\text{MgI} + \text{H}_2\text{O}$  gives 1 mole of  $\text{CH}_4$   
16.6 gram of  $\text{CH}_3\text{MgI}$  is 0.1 mole gives 0.1 mole of  $\text{CH}_4$  gas = 2.24 L.
80. (2) Electronic configuration of Osmium is  $5d^66s^2$ . Since 5d and 6s sub-shells have nearly equal energy. All the 8 electrons participate in bonding.
81. (1) Poor shielding of one of 4f electrons by another in the subshell
82. (4) For first order reaction,  
rate =  $k[\text{N}_2\text{O}_5]$   
 $2.40 \times 10^{-5} = 3.0 \times 10^{-5} [\text{N}_2\text{O}_5]$   
 $\therefore [\text{N}_2\text{O}_5] = 0.8$
83. (4) Statement I is true but Statement II is false. The correct statement for II is  
 $E_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}$   
If  $E_{\text{cell}}$  should have a positive value for the cell to function then,  $E_{\text{cathode}} > E_{\text{anode}}$  should be followed.
84. (4) Benzoic acid



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

86. (3) Among the given statements, only A and D are incorrect while the statements B, C and E are correct.  
The correct form of incorrect statements are :  
Bonding molecular orbital has lower energy than antibonding molecular orbital  
In a stable molecule, the number of electron bonding in molecular orbital is always greater than the number of antibonding electrons.
87. (3) We know that,  
 $\Delta G = -2.303 RT \log K$   
 $= -2.303 \times 8.314 \times 298 \log 50$   
 $= -9694 \text{ J} = -9.694 \text{ kJ}$
88. (1) For a salt of weak acid and weak base;  
 $\text{pH} = 7 + \frac{1}{2} (\text{pK}_a - \text{pK}_b)$   
 $= 7 + \frac{1}{2} (5.23 - 4.75) = 7.24$
89. (4) If both the Assertion and Reason are incorrect
90. (2)  $\text{RCN} \xrightarrow{\text{Hydrolysis}} \text{RCOOH} + \text{NH}_3$



91. (1) de-Broglie wavelength of electron,

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2eVm}} \left( \because eV = \frac{1}{2}mv^2 \right)$$

$$= \frac{6.626 \times 10^{-34}}{\sqrt{2 \times 1.6 \times 10^{-19} \times V \times 9.1 \times 10^{-31}}}$$

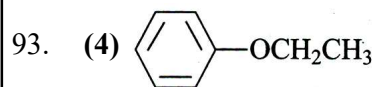
$$= \frac{6.626 \times 10^{-34}}{5.396 \times 10^{-25} [\text{V}]^{1/2}}$$

$$= \frac{1.227 \times 10^{-9}}{[\text{V}]^{1/2}} \text{ m}$$

$$= \frac{12.27 \times 10^{-10}}{[\text{V}]^{1/2}} \text{ m}$$

$$\frac{12.27}{[\text{V}]^{1/2}} \text{ \AA} \approx \left[ \frac{150}{\text{V}} \right]^{1/2} \text{ \AA}$$

92. (3) (i), (ii) and (iv) only



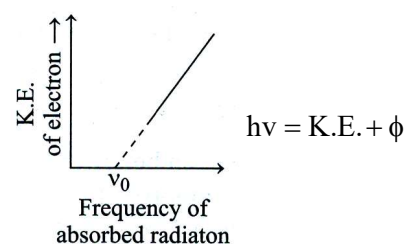
94. (2) (H-F.....H-F.....H-F),  $\text{NH}_3$  and  $\text{H}_2\text{O}$  will form a three-dimensional polymeric structure and H-bonds in HCl are not very strong as in HF. So, formation of polymeric structure is difficult.
95. (3) Follow IUPAC rule.
96. (2) For production of 180 g of glucose; heat energy is required = x kcal  $\text{mol}^{-1}$   
Number of moles of glucose to be produced

$$= \frac{1.6}{180}$$

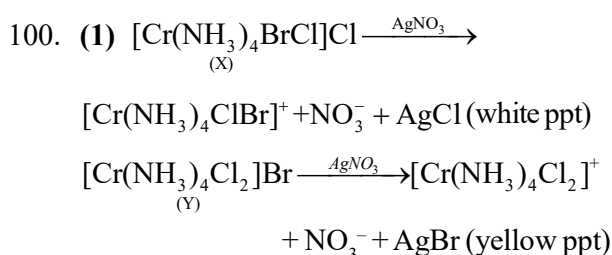
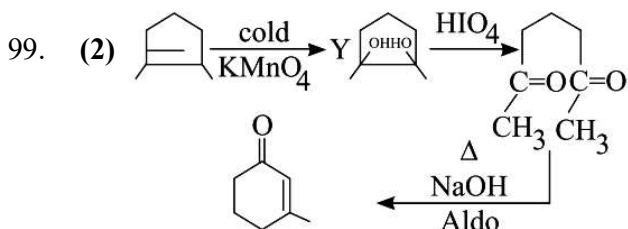
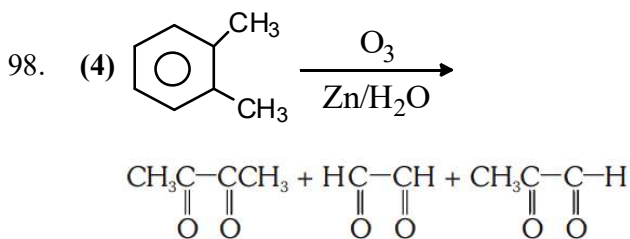
$$-0.64 = \frac{x}{180} \times 1.6$$

$$x = \frac{-0.64 \times 180}{1.60} \Rightarrow -72 \text{ kcal mol}^{-1}$$

97. (2) The correct graph regarding photoelectric effect is







## BOTANY

### Section - A (35 Questions)

101. (1) (NCERT 11<sup>th</sup> Page no- 21, Paragraph- 2.2.4, Line no-1-3)
102. (1) (NCERT 11<sup>th</sup> para 8.5.1 based conceptual / Page no.131)
103. (2) (NCERT 11<sup>th</sup> para 8.5.3.1 based / Page no.133)
104. (2) (NCERT 11<sup>th</sup>, Page no-7, 1<sup>st</sup> paragraph, Line no- 4)
105. (2) (NCERT 12<sup>th</sup>, Page no- 26, Figure- 2.8 (a))
106. (4) (NCERT 11<sup>th</sup> Page no.39 last line of 1<sup>st</sup> para.)
107. (3) (NCERT 12<sup>th</sup> Page no.248 fig 14.4 (a))
108. (2) (NCERT 11<sup>th</sup> Page No. 74; Sub-topic 5.5.1.2)
109. (3) (NCERT 12<sup>th</sup> Pg 83, 5.3.3 Linkage and Recombination based)
110. (1) (NCERT 12<sup>th</sup> Pg 89, Figure 5.14)
111. (2) (NCERT 11<sup>th</sup> Page no.29 3<sup>rd</sup> para )
112. (4) [NCERT 11<sup>th</sup>, Page 249, point 15.4.3.3]
113. (2) [NCERT 11<sup>th</sup>, Page 250, point 15.4.3.4 (Line no. 01)]
114. (3) (NCERT 12<sup>th</sup>, Pg. 83, Linkage based)
115. (3) (NCERT 11<sup>th</sup> Page No. 76; Sub-topic 5.6)
116. (1) (NCERT 11<sup>th</sup> Page No. 77; Figure 5.18)

117. (2) (NCERT 12<sup>th</sup>, Pg 99, 6.1.2 Packaging of DNA Helix, Para 3, Line 4)
118. (3) (NCERT 12<sup>th</sup>, Pg. 103, para 4-5, Pg 108, Line 4, Pg. 106, para 2, Pg 115, para 4, Line 8)
119. (3) (NCERT 11<sup>th</sup> para 10.2.1 based / Page no.165)
120. (3) (NCERT 11<sup>th</sup> page no. 213, 2<sup>nd</sup> paragraph 5<sup>th</sup> and 6<sup>th</sup> line)
121. (2) (NCERT 11<sup>th</sup> page no. 216, 13.7.2, 1 and page no. 219, 2<sup>nd</sup> paragraph)
122. (1) (NCERT 11<sup>th</sup>, Page no- 26, last paragraph, Line no- 1,2)
123. (2) (NCERT 12<sup>th</sup>, Page no- 25, Paragraph- 2, Line no- 4,5)
124. (1) (NCERT 11<sup>th</sup> para 10.1.1,10.2.1, based / Page no.163,164,165)
125. (4) (NCERT 12<sup>th</sup>, Pg 91, 5.8.3 Chromosomal Disorders, Para 2)
126. (3) [NCERT 11<sup>th</sup>, Page no. 89, Line no.- 12-14]
127. (3) (NCERT 11<sup>th</sup> Page no.30,3.1 3<sup>rd</sup> para.)
128. (2) (NCERT 11<sup>th</sup> Pg.233, 14.4)
129. (4) (NCERT 12<sup>th</sup>, Pg 76, 5.2.2.1 Incomplete Dominance concept)
130. (3) (NCERT 12<sup>th</sup>, Pg117, Figure 6.14 The lac Operon)
131. (3) (NCERT 12<sup>th</sup>, Pg. 108, Para 2, Line 10)
132. (3) (NCERT 12<sup>th</sup>, Pg. 75, 5.2.2 Law of Segregation, Line 5)
133. (3) (NCERT 11<sup>th</sup> Pg.230, 3<sup>rd</sup> Para, 13<sup>th</sup> line)
134. (4) (NCERT 12<sup>th</sup>, Pg 114, Para 1, Line 1 based)
135. (1) (NCERT 11<sup>th</sup>, Page no- 19, Paragraph- 2.1.2, Line no-6-8)

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

136. (4) (NCERT 11<sup>th</sup> Page No. 80; Sub-topic 5.9.2 and added family)
137. (1) (NCERT 11<sup>th</sup>, Page no- 21, Paragraph- 2.2.4, Line no-1-3)
138. (1) (NCERT 11<sup>th</sup> para 8.5.1 conceptual based / Page no.131)
139. (4) (NCERT 11<sup>th</sup> Page no.34 to 39 concept based.)
140. (3) (NCERT 12<sup>th</sup> Page no.243,14.3,2<sup>nd</sup> para,4<sup>th</sup> line.)
141. (4) [NCERT 11<sup>th</sup>, Page no. 92 (Figure 6.7), 93 (Line no.- 01-08)]
142. (2) (NCERT 11<sup>th</sup> conceptual – page no. 214, point (b) and (c))

143. (1) [NCERT 11<sup>th</sup>, Page 249 and 250, point 15.4.3.3]  
 144. (3) (NCERT 11<sup>th</sup> para 10.4.1 based / Page no.169)  
 145. (3) (NCERT 12<sup>th</sup>, Page no- 36, 1<sup>st</sup> paragraph, Line no- 1-4)  
 146. (4) (NCERT 11<sup>th</sup>, Living world, whole chapter conceptual)  
 147. (4) (NCERT 11<sup>th</sup> para 8.5.1 conceptual based / Page no.131)  
 148. (2) (NCERT 11<sup>th</sup>, Page no- 17, 3<sup>rd</sup> paragraph, Line no- 1-10)  
 149. (2) (NCERT 11<sup>th</sup> Pg.232, Fig. 14.3)  
 150. (3) (NCERT 12<sup>th</sup>, Page No 112, Para 2)

## ZOOLOGY

### Section - A (35 Questions)

151. (4) [NCERT 11<sup>th</sup> P.No.312, Synovial Joints]  
 152. (3) [NCERT 11<sup>th</sup> P.No.321, Line 9 to 12]  
 153. (4) (NCERT 11<sup>th</sup> Page No - 196 - Coagulation of blood)  
 154. (3) (NCERT 12<sup>th</sup> Page No - 148 - Malaria)  
 155. (4) (NCERT 11<sup>th</sup> Page No. 271)  
 156. (3) (NCERT 12<sup>th</sup> Page No. 148-149)  
 157. (1) (NCERT 11<sup>th</sup>; Page No. 52; Phylum Aschelminthes)  
 158. (4) [NCERT 11<sup>th</sup> P.No.318, Last 5 lines]  
 159. (4) (NCERT 11<sup>th</sup> p.no 118, para3, line 8)  
 160. (2) (NCERT 11<sup>th</sup> Page No - 185 - Mechanism of breathing)  
 161. (4) (NCERT 12<sup>th</sup>, p.no 51, line17)  
 162. (2) (NCERT 12<sup>th</sup>, p.no 53, Figure 3.12)  
 163. (4) [NCERT 11<sup>th</sup> Page No.304, Last Para]  
 164. (2) (NCERT 12<sup>th</sup> Page no.228,13.2.2,1<sup>st</sup> para.)  
 165. (2) (NCERT 12<sup>th</sup> p.no 61, para1, line 2)  
 166. (2) (NCERT 11<sup>th</sup> p.no 114, para3, line 3)  
 167. (2) (NCERT 11<sup>th</sup>, Page no- 144, Paragraph- 1, Line no- 1-3, and Page no-145, Figure- 9.1)  
 168. (2) (NCERT 11<sup>th</sup>,Page no- 155, Paragraph- 2, Line no- 1-6)  
 169. (3) (NCERT 12<sup>th</sup> para 10.2.3 / Page no.183 )  
 170. (3) (NCERT 12<sup>th</sup> 10.1 BIOTECHNOLOGICAL APPLICATIONS IN AGRICULTURE )  
 171. (3) (NCERT 12<sup>th</sup>, Page no-138, Figure-7.9)

172. (2) (NCERT 12<sup>th</sup>, Page no- 138, 1<sup>st</sup> paragraph, Line no- 5)  
 173. (4) [NCERT 12<sup>th</sup> P.No.213, Ethical Issues , 3<sup>rd</sup> para, 2<sup>nd</sup> Line]  
 174. (4)[NCERT 12<sup>th</sup> P.No.213, Biological Products , 6<sup>th</sup> line]  
 175. (3) [NCERT 12<sup>th</sup> P.No.202, PCR applied ]  
 176. (4) (NCERT 12<sup>th</sup>, Page no- 129, Paragraph- 7.3, Line no- 12, 13)  
 177. (2) (NCERT 11<sup>th</sup> ; Page No.57; Class- Osteichthyes)  
 178. (4) (NCERT 11<sup>th</sup> ; Page No. 334, last line of 1st paragraph)  
 179. (2) (NCERT 12<sup>th</sup> Page no.259,15.1.1,5<sup>th</sup> line)  
 180. (2) (NCERT 12<sup>th</sup> p.no 51, para 1, line1)  
 181. (2) (NCERT 11<sup>th</sup> ; Page No.297; 4th line of 4th paragraph)  
 182. (4) [NCERT 11<sup>th</sup> P.No.312, Disorders]  
 183. (4) (NCERT 11<sup>th</sup> Pg. No. 199-200)  
 184. (3) (NCERT 12<sup>th</sup> Page no.234, (ii), 1<sup>st</sup> para.)  
 185. (3) (NCERT 12<sup>th</sup> p.no 59, para2, line 8)

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

186. (3) (NCERT 11<sup>th</sup>, Conceptual (chemical coordination))  
 187. (2) (NCERT 11<sup>th</sup> ; Page No. 296 13th line of 1st paragraph)  
 188. (3) [NCERT 11<sup>th</sup> P.No.311,Pelvic Girdle,Page 310 3<sup>rd</sup> & 4<sup>th</sup> line,Page 312 Disorders ]  
 189. (2) [NCERT 11<sup>th</sup> P.No.317, Line 18-19 Applied ]  
 190. (2) [NCERT 12<sup>th</sup> P.No.211, Last Para]  
 191. (1) (NCERT 12<sup>th</sup>, Page no- 131, 2<sup>nd</sup> paragraph, Line no- 1-7)  
 192. (1) (NCERT 11<sup>th</sup>, Page no- 147, Table- 9.4)  
 193. (3) (NCERT 12<sup>th</sup> para 10.5 / Page no.186,187 )  
 194. (4) (NCERT 12<sup>th</sup> Page no.266,2<sup>nd</sup> para to 267,3<sup>rd</sup> para)  
 195. (4) (NCERT 11<sup>th</sup> p.no 101, para3, line 6)  
 196. (3) (NCERT 12<sup>th</sup>,p.no 60, para 1, line 10)  
 197. (3) (NCERT 12<sup>th</sup> Page No - 145 - Introduction)  
 198. (3) (NCERT 12<sup>th</sup> Page No - 150 - Immunity)  
 199. (4) (NCERT 11<sup>th</sup> Page No - 202 - Double Circulation)  
 200. (1) (NCERT 11<sup>th</sup> mixed question of A.K. and organisms and population.)