

CHEMISTRY

JEE MAINS
& ADVANCED

CLASS - XII

EXPLANATIONS

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ANSWER KEY

EXERCISE-I

Q.1 (4)	Q.2 (3)	Q.3 (4)	Q.4 (2)	Q.5 (4)	Q.6 (2)	Q.7 (1)	Q.8 (3)	Q.9 (3)	Q.10 (1)
Q.11 (3)	Q.12 (1)	Q.13 (3)	Q.14 (2)	Q.15 (4)	Q.16 (4)	Q.17 (3)	Q.18 (4)	Q.19 (1)	Q.20 (3)
Q.21 (1)	Q.22 (3)	Q.23 (3)	Q.24 (2)	Q.25 (2)	Q.26 (1)	Q.27 (1)	Q.28 (2)	Q.29 (2)	Q.30 (2)
Q.31 (2)	Q.32 (2)	Q.33 (1)	Q.34 (4)	Q.35 (2)	Q.36 (1)	Q.37 (2)	Q.38 (2)	Q.39 (1)	Q.40 (2)
Q.41 (1)	Q.42 (2)	Q.43 (3)	Q.44 (3)	Q.45 (3)	Q.46 (3)	Q.47 (1)	Q.48 (4)	Q.49 (1)	Q.50 (3)
Q.51 (2)	Q.52 (1)	Q.53 (3)	Q.54 (3)	Q.55 (3)	Q.56 (1)	Q.57 (1)	Q.58 (4)	Q.59 (2)	

EXERCISE-II

Q.1 (3)	Q.2 (2)	Q.3 (3)	Q.4 (3)	Q.5 (2)	Q.6 (2)	Q.7 (3)	Q.8 (4)	Q.9 (2)	Q.10 (2)
Q.11 (3)	Q.12 (1)	Q.13 (4)	Q.14 (3)	Q.15 (1)	Q.16 (3)	Q.17 (2)	Q.18 (1)	Q.19 (4)	Q.20 (1)
Q.21 (2)	Q.22 (4)	Q.23 (1)	Q.24 (2)	Q.25 (4)	Q.26 (3)	Q.27 (4)	Q.28 (2)	Q.29 (2)	Q.30 (2)
Q.31 (2)	Q.32 (4)	Q.33 (3)	Q.34 (3)	Q.35 (1)	Q.36 (2)	Q.37 (1)	Q.38 (4)	Q.39 (3)	Q.40 (1)
Q.41 (1)	Q.42 (1)	Q.43 (1)	Q.44 (2)	Q.45 (4)	Q.46 (1)	Q.47 (3)	Q.48 (4)	Q.49 (3)	Q.50 (4)
Q.51 (4)									

EXERCISE-III

MCQ/COMPREHENSION/STATEMENT/MATCHING

Q.1 (ACD)	Q.2 (A, B, C)	Q.3 (A, C)	Q.4 (ACD)	Q.5 (A, B, C)	Q.6 (A, B, C)	Q.7 (B, D)	Q.8 (B, D)
Q.9 (A, B, C)	Q.10 (AB)	Q.11 (A, C)	Q.12 (B)	Q.13 (C)	Q.14 (A)	Q.15 (B)	Q.16 (A)
Q.17 (B)	Q.18 (A) – q, s; (B) – q, s; (C) – q, s; (D) – q, s			Q.19 (A) - Q, (B) - P, (C) - R			
Q.20 (A) – (p, s, r); (B) – (p, q, t); (C) – (p); (D) – (p, q, t)		Q.21 ($V_{\text{final}} = 5 \cdot V_{\text{original}}$)		Q.22 2048 g/mol			
Q.23 64.0 g/mol	Q.24 (1)	Q.25 (3)	Q.26 (3)				

EXERCISE-IV

JEE-MAIN

PREVIOUS YEAR'S

Q.1 (3)	Q.2 (4)	Q.3 (2)	Q.4 (A)	Q.5 (4)	Q.6 (1)	Q.7 (2)	Q.8 (2)	Q.9 (4)	Q.10 (1)
Q.11 (3)	Q.12 (3)	Q.13 (1)	Q.14 (2)	Q.15 (3)	Q.16 (3)	Q.17 (3)	Q.18 (4)	Q.19 (3)	
Q.20 4.95 to 4.97	Q.21 (2)	Q.22 14.00 to 14.00	Q.23 1.74 to 1.76	Q.24 10.00 to 10.00					
Q.25 0.217 to 2.23	Q.26 (1)	Q.27 (4)	Q.28 (177)	Q.29 (2)	Q.30 (167.00)	Q.31 (600)			
Q.32 (48.00)	Q.33 (3)	Q.34 (5.00)							

JEE-ADVANCED

PREVIOUS YEAR'S

Q.1 (A, B)	Q.2 (A)	Q.3 (BD)	Q.4 (19)	Q.5 (0.05)	Q.6 (1.02 or 1.03)	Q.7 (0.20)
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SOLUTIONS



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EXERCISE-I

- Q.1** (4) $M = \frac{w}{m \times V(l)}$; $0.25 = \frac{w}{106 \times 0.25}$; $w = 6.625 \text{ gm}$
- Q.2** (3) We know that
 Molarity = $\frac{\text{Number of moles of solute}}{\text{Volume of solution in litre}}$
 $\therefore 2.0 = \frac{0.5}{\text{Volume of solution in litre}}$
 \therefore Volume of solution in litre
 $= \frac{0.5}{2.0} = 0.250 \text{ litre} = 250 \text{ ml.}$
- Q.3** (4) $N = \frac{W}{M} = \frac{828}{46} = 18, n = \frac{w}{m} = \frac{36}{18} = 2$
 $x_{H_2O} = \frac{n}{n+N} = \frac{2}{2+18} = \frac{2}{20} = 0.1$
- Q.4** (2)
- Q.5** (4)
- Q.6** (2) $\frac{X}{X + \frac{1000}{78}} = 0.2$
- Q.7** (1) Molarity of pure water = $\frac{1000}{18} = 55.6 \text{ M}$.
- Q.8** (3) $M = \frac{w \times 1 \text{ litre}}{m.wt. \times \text{Volume litre}} = \frac{4 \times 1}{40 \times 0.1} = 1 \text{ M}$.
- Q.9** (3)
- Q.10** (1)
- Q.11** (3)
- Q.12** (1)
- Q.13** (3)
- Q.14** (2)
- Q.15** (4)
- Q.16** (4)
- Q.17** (3)
- Q.18** (4)
- Q.19** (1) For the ideal solution ΔH_{mix} and $\Delta V_{\text{mix}} = 0$.
- Q.20** (3)
- Q.21** (1) $K_4[Fe(CN)_6]$ dissociates as $4K^+ + [Fe(CN)_6]^{4-}$, thus 1 molecule dissociates into five particles in the similar way $Al_2(SO_4)_3$ also gives five particles per molecule.
- Q.22** (3) $Ca(NO_3)_2 \rightarrow Ca^{2+} + 2NO_3^-$ it gives three ions hence the Van't Hoff factor = 3.
- Q.23** (3)
- Q.24** (2) Benzoic acid dimerises due to strong hydrogen bonding.
- Q.25** (2)
- Q.26** (1) Vapour pressure $\propto \frac{1}{\text{Boiling point}}$
 When vapour pressure decreases then *b.pt.* increases.
- Q.27** (1)
- Q.28** (2) The relative lowering of the vapour pressure of dilute solution is equal to the mole fraction of the solute molecule present in the solution.
- Q.29** (2) Given molecular mass of sucrose = 342
 Moles of sucrose = $\frac{100}{342} = 0.292 \text{ mole}$
 Moles of water $N = \frac{1000}{18} = 55.5 \text{ moles}$ and

Vapour pressure of pure water $P^0 = 23.8 \text{ mm Hg}$

According to Raoult's law

$$\frac{\Delta P}{P^0} = \frac{n}{n+N} \Rightarrow \frac{\Delta P}{23.8} = \frac{0.292}{0.292+55.5}$$

$$\Delta P = \frac{23.8 \times 0.292}{55.792} = 0.125 \text{ mm Hg.}$$

Q.30 (2)

Q.31 (2)

Q.32 (2) According to the Raoult's law for the non-volatile solute the relative lowering of vapour pressure of a solution containing a non-volatile is equal to the mole fraction of the solute.

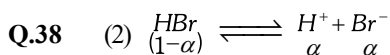
Q.33 (1) $K_b = \frac{M_1 RT_0^2}{1000 \Delta H_v} = \frac{18 \times 1.987 \times (373)^2}{1000 \times 9700} = 0.513^\circ \text{C}$

Q.34 (4) $m = \frac{K_b \times w \times 1000}{\Delta T_b \times W} = \frac{2.16 \times 0.15 \times 1000}{0.216 \times 15} = 100.$

Q.35 (2)

Q.36 (1) The boiling occurs at lower temperature if atmospheric pressure is lower than 76 cm Hg .

Q.37 (2) BaCl_2 furnishes more ions than KCl and thus shows higher boiling point $T_1 > T_2$.



Total = $1 + \alpha$ $i = 1 + \alpha = 1 + 0.9 = 1.9$

$$\Delta T_f = i K_f \times m = 1.9 \times 1.86 \times \frac{8.1}{81} \times \frac{1000}{100} = 3.53^\circ \text{C}$$

$$T_f = -3.53^\circ \text{C}.$$

Q.39 (1) $\Delta T_f = 1.86 \times \left(\frac{342}{342}\right) = 1.86^\circ$; $\therefore T_f = -1.86^\circ \text{C}.$

Q.40 (2) For NaCl $i = 2$

$$\Delta T_f = 2 K_f m = 2 \times 1.86 \times 1 = 3.72$$

$$T_s = T - \Delta T_f = 0 - 3.72 = -3.72^\circ \text{C}$$

Q.41 (1) By using, $m = \frac{K_f \times 1000 \times w}{\Delta T_f \times W_{\text{Solvent}} (\text{gm})} = \frac{5.12 \times 1000 \times 1}{0.40 \times 50}$

$$= 256 \text{ gm/mol}$$

Hence, molecular mass of the solute = 256 gmol^{-1}

Q.42 (2) Isotonic solution = $\frac{w_1}{m_1 V_1} = \frac{w_2}{m_2 V_2}$

$$= \frac{w_1}{342 \times 1} = \frac{6}{60 \times 1} = \frac{342 \times 6}{60} = 34.2.$$

Q.43 (3) $\pi = CRT$, $C = \frac{\pi}{RT} = \frac{0.0821}{0.821 \times 300} = 0.33 \times 10^{-2}.$

Q.44 (3) Molar concentration of cane sugar

$$= \frac{5}{342} \times \frac{1000}{100} = \frac{50}{342}$$

Molar concentration of $X = \frac{1}{m} \times \frac{1000}{100} = \frac{10}{m}$

$$\frac{10}{m} = \frac{50}{342} \text{ or } m = 68.4.$$

Q.45 (3)

Q.46 (3) $\pi = CRT = 0.2 \times 0.0821 \times 293 = 4.81 \text{ atm.}$

Q.47 (1) There is no net movement of the solvent through the semipermeable membrane between two solutions of equal concentration.

Q.48 (4) $\pi \propto T$; if T is doubled π is also doubled.

Q.49 (1) For two non-electrolytic solutions if isotonic, $C_1 = C_2$

$$\therefore \frac{8.6}{60 \times 1} = \frac{5 \times 1000}{m \cdot \text{wt.} \times 100} \quad \therefore m = 348.9$$

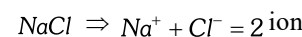
Q.50 (3) Vapour pressure is not a colligative property.

Q.51 (2)

Q.52 (1)

Q.53 (3) Na_2SO_4 has more osmotic pressure than NaCl solution because Na_2SO_4 gives 3 ions.

Q.54 (3) $\text{BaCl}_2 \Rightarrow \text{Ba}^{2+} + 2\text{Cl}^- = 3 \text{ ions}$



Glucose \Rightarrow No ionisation

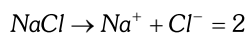
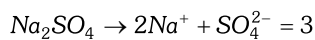
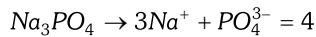
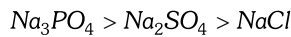
$\therefore \text{BaCl}_2 > \text{NaCl} > \text{Glucose}$

Q.55 (3) BaCl_2 gives maximum ions. Hence, it shows the highest boiling point.

Q.56 (1) NaCl contains the highest boiling point among the other compounds.

- Q.57** (1)
- Q.58** (4) We know that lowering of freezing point is a colligative property which is directly proportional to the number of particles formed by one mole of compound therefore $0.1M Al_2(SO_4)_3$ solution will have minimum freezing point.

- Q.59** (2) Colligative property in decreasing order



EXERCISE-II

- Q.1** (3) Mole of $H_2O = \frac{36}{18} = 2$
- Mole of glycerine = $\frac{46}{92} = 0.5$
- total mole = $2 + 0.5 = 2.5$
- Mole fractions of glycerine = $\frac{n_1}{n_1 + n_2} = \frac{0.5}{2.5}$
- $X_0 = 0.2$ Ans.
- Q.2** (2)
- Q.3** (3) As we know
- molarity = $\frac{10 \times d}{\text{molmt}}$
- x is % by wt.
- d is the density
- by putting their value we get
- 18.4 M
- Q.4** (3) Mole of HCl = $25 \times 3 + 75 \times 0.05$
- $$= 75 + 3.75 = 78.75$$
- $$M = \frac{78.75}{100} = .7875$$
- Q.5** (2) $[Cl^-] = 0.2 + \frac{0.2 + 0.1 \times 2}{0.5} = 0.8$
- Q.6** (2) $\frac{5.0 \text{ gm}}{10^6 \text{ gm}}$ of solutions
- so concentration of solution = 5 ppm

- Q.7** (3) V.P. depends on temperature.
- Q.8** (4) $P_{N_2} + P_{H_2O(v)} = 1 \text{ atm}$
- $$\therefore P_{H_2O} = 0.3 \text{ atm}$$
- $$\therefore P_{N_2} = 0.7 \text{ atm}$$
- Now new pressure of N_2 in another vessel of volume $V/3$ at same T is given by :
- $$P_{N_2} \times \frac{V_1}{3} = 0.70 \times V_1$$
- $$\therefore P_{N_2} = 2.1 \text{ atm}$$
- Since aqueous tension remains constant, and thus total pressure in new vessel.
- $$= P_{N_2} + P_{H_2O} = 2.1 + 0.3 = 2.4 \text{ atm.}$$
- Q.9** (2) Acc. of Rault's law $P = P_A + P_B$
- for non volatile solute = $P_B = 0$
- $$P_s = P_A^0 X_A$$
- X_A = mole fractions of solvent = $\frac{N_1}{N_1 + N_2}$
- so $P = P_0^0 N_1$ $P_A^0 = P_0^0$
- Q.10** (2) $x_A = \frac{1}{4} : x_B = \frac{3}{4}$
- $$P_s = \frac{1}{4} \times 100 + \frac{3}{4} \times 80 = 85$$
- $$y_A = \frac{P_A}{P_s} = \frac{100 \times \frac{1}{4}}{85} = \frac{25}{85} = x_A^1$$
- $$y_B = \frac{60}{85} = x_B^1$$
- $$P_{\text{distillate}} = \frac{25}{85} \times 100 + \frac{60}{85} \times 80 = 85.88 \text{ mmHg}$$
- Q.11** (3) $P = X_A P_A^0 + X_B P_B^0 = (P_A^0 - P_B^0) X_A + P_B^0$
- So $P_B^0 = 254$
- $$P_A^0 - P_B^0 = -119 P_A^0 = 135$$
- Q.12** (1) $P = P_B^0 X_B + P_T^0 X_T$
- $$120 = 150(X_B) + 50(1 - X_B)$$
- $$100 X_B = 70$$
- $$X_B = 0.7$$
- $$Y_B = \frac{X_B P_B^0}{P} = \frac{0.7 \times 150}{120} = 0.075 \frac{Y_B}{Y_T} = \frac{7}{1} Y_T$$
- $$= 1 - 0.875 = 0.125$$
- Q.13** (4) $P = 100 \times \frac{2}{5} + 300 \times \frac{3}{5}$
- $$= 40 + 180 = 220$$

Q.14 (3) Initially A = 3 mole ; B = 2 mole

$$600 = \frac{3}{5}P_A^0 + \frac{2}{5}P_B^0 \dots\dots 1$$

finally A = 4.5 mole ; B = 2 mole and c = 0.5 mole

$$630 = \frac{4.5}{7}P_A^0 + \frac{2}{7}P_B^0$$

$$P_A^0 = 940$$

$$P_B^0 = 90$$

Q.15 (1) Entropy of solvent is less than that of solution.

Q.16 (3) (2) for a ideal solution $\Delta G_{mix} < 0$.

Q.17 (2) According to Raoult's law

$$P_T = (0.08 \times 300 + 0.92 \times 800) \text{ torr} = (24 + 736) \text{ torr} = 760$$

$$\text{torr} = 1 \text{ atm}$$

$$P_{\text{exp.}} = 0.95 \text{ atm} < 1 \text{ atm}$$

Hence solution shows -ve deviation

$$\text{so } \Delta H_{\text{mix}} < 0, \text{ and } \Delta V_{\text{mix}} < 0.$$

Q.18 (1) It shows negative deviation from Raoult's law

$$p_s (\text{actual}) = 580 \text{ torr}$$

$$p_s (\text{Raoult}) = 0.4 \times 300 + 0.6 \times 800 = 600 \text{ torr.}$$

Q.19 (4) $C_6H_6 + C_6H_5CH_3$: ideal solution,
Non-ideal solution : 1, 2, 3.

Q.20 (1) (2) $CHCl_3 + CH_3COCH_3$

Q.21 (2) $\pi \alpha$ No. of partial/ion.

$$BaCl_2 = 3, NaCl = 2 \quad \text{glucose} = 1$$

So. order of $\pi = BaCl_2 > NaCl > \text{glucose}$.

Q.22 (4) As benzoic acid dimerises so number of moles decreases so osmotic pressure of benzoic acid is less than benzene.

Q.23 (1) Higher the number of particles higher will be osmotic pressure so (A) will be answer in case of (D) precipitaiton will take place so number of particles will decrease.

Q.24 (2) In option (2) oxidaton state of platinum is (iv)

$$x - 6 = -2$$

$$x = +4$$

Q.25 (4) $HA = H^+ + A^-$

$$(1 - \alpha) \alpha \quad \alpha$$

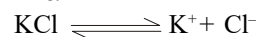
$$PH = 2 = [H^+] : 10^{-2} = C^2$$

$$\alpha = 0.1$$

$$i = 1 + \alpha = 1 + 0.1 = 1.01$$

Q.26 (3) (1) As we know

$$i = 1 + \alpha$$



$$(1 - \alpha) \quad \alpha \quad \alpha$$

$$i = 1 + \alpha = 50 \% \text{ dissociation}$$

$$i = 1.5$$



$$(1 - \alpha) \quad 2\alpha \quad \alpha$$

$$1 + 2\alpha, \alpha = .4$$

$$i = 1.8$$



$$(1 - \alpha) \quad \alpha \quad 3\alpha$$

$$1 + 3\alpha$$

$$i = 1.9$$



$$(1 - \alpha) \quad \alpha \quad 4\alpha$$

$$1 + 4\alpha$$

$$i = 1.8$$

Q.27 (4) $\frac{P^0 - P}{P^0} = 0.05 = X_B$

Where X_B = mole fraction of solute.

$$\text{Molality} = \frac{1000 \times X_B}{(X_A \times M_A)}$$

$$= 1000 \times 0.05 / 0.95 \times 18 = 2.92 \approx 3.0$$

Q.28 (2) Glucose does not dissociate

$$\Rightarrow i = 1$$

Q.29 (2) $i = 1 + \alpha(n - 1)$

$$2.74 = 1 + \alpha(3 - 1) \quad \Rightarrow \alpha = 0.87$$

$$\Rightarrow \text{Degree of dissociation} = 87\%$$

Q.30 (2)

$$(2) \text{R.L.V.P.} : \frac{P_A^0 - P_s}{P_A^0} = X_B$$

$$X_B = \frac{10 - 9}{10} = \frac{1}{10}$$

$$X_B = \frac{n_B}{n_A + n_B} = \frac{n_B}{n_A + n_B} = \frac{\frac{W_B}{M_B}}{\frac{W_A}{M_A} + \frac{W_B}{M_B}}$$

$$M_B = \frac{900}{10} = 90.$$

Q.31 (2) According to question $P_s = 0.95 P_0$
according raoult's law $P_s = P_0 X_A$ given $M_A = 0.3 M_B$

$$0.95 P_0 = P_0 \left(\frac{\frac{W_A}{M_A}}{\frac{W_A}{M_A} + \frac{W_B}{M_B}} \right)$$

M_A = molecular wt. of solvent
 M_B = molecular wt. of solute

$$0.95 = \frac{\frac{W_A}{0.3 M_B}}{\frac{W_A}{0.3 M_B} + \frac{W_B}{M_B}} W_A = \text{gram wt. of solvent}$$

W_B = gram wt. of solute

on solving $\frac{W_A}{W_B} = 5.7$.

Q.32 (4) $\frac{\Delta P}{P_0} = X_B$ So $X_B = \frac{760 - 750}{760} = \frac{1}{76}$ **Ans.**

Q.33 (3) More is the value of Vant Hoff factor, more will be RLVP.

Q.34 (3) $\frac{P^0 - P}{P^0} = X_{\text{solute}}$
 $P^0 - P \propto X_{\text{solute}}$
 $\frac{10}{20} = \frac{0.2}{X_{\text{solute}}}$
 $\Rightarrow X_{\text{solute}} = 0.4 \Rightarrow X_{\text{solvent}} = 0.6$

Q.35 (1) $\frac{P^0 - P}{P} = \frac{1000}{M_{\text{solvent}}} = m$
 $m = \frac{17.25 - 17.20}{17.20} \times \frac{1000}{18} = 0.1615$
 If $m = M = 0.1615$
 $XCl_3 \longrightarrow X + 3Cl$
 $M_{\text{total}} = S + 3S = 4S = 0.1615$
 $S = 0.040375 = 4.037 \times 10^{-2}$

Q.36 (2) (1) $NaCl \rightarrow Na^+ + Cl^-$
 $\Delta T_b = K_b \times ms$
 $\Delta T_b = 2K_b \times m$
 elavation of b.p. will be double in case of NaCl not b.p.
 (2) Will be correct because b.p. elavation will be double here in comprasion to glucose.
 (3) Elavation of b.p. is colligative property not b.p. so answer (2).

Q.37 (1) $i = 1 + (y - 1) \alpha$
 $i = 1 + y - 1 = y$

y	i
Na_2SO_4	3
$MgCl_2$	3
$Al(NO_3)_3$	4
$C_6H_{12}O_6$	1

$\Delta T_b = mK_b i$
 $iNa_2SO_4 = iMgCl_2$
 $(\Delta T_b)_{Na_2SO_4} = (\Delta T_b)_{MgCl_2}$
 $(B.P.)_{Na_2SO_4} = (B.P.)_{MgCl_2}$

Q.38 (4) $AlPO_4 \rightleftharpoons Al^{3+} + PO_4^{3-}$
 $i = 1 + x = 2$
 $\Delta T_b = \text{molality } K_b i \quad \therefore$
 $\frac{\Delta T_b}{K_b} = 0.02$.

Q.39 (3) 100% dissociation
 $\Delta T_f = (0.0054) = i K_f m$
 $= i \times 1.86 \times 0.001$
 $= i = 3$
 $= 3 \text{ particles } [MA_6]A_2$

Q.40 (1) Higher freezing point \Rightarrow lesser $\Delta T_f \Rightarrow$ lesser molality \Rightarrow lesser number of particles

Q.41 (1) $Ba_3(PO_4)_2 \rightleftharpoons 3 Ba^{2+} + 2 PO_4^{3-}$
 value of $i = 5$ (100% ionised)
 so $\Delta T_f = i k_f m$
 so $m = \frac{\Delta T_f}{i k_f} = \frac{0.05}{5} = 0.01$

Q.42 (1) $\Delta T_f = 0.2 \times 1.2 \times 1.86 = 0.45$
 therefore freezing point = $-0.45^\circ C$.

Q.43 (1) $\Delta T_b = i k_b m$
 so $i = \frac{2.08}{0.52 \times 1} = 4$
 so the complex is $K_3 [Fe(CN)_6]$
 $K_3 [Fe(CN)_6] \rightleftharpoons 3 K^+ + [Fe(CN)_6]^{3-}$

Q.44 (2) (i) $\Delta T_f = m \times K_f$
 $0.2 = \frac{X \times 1000}{100} \times 1.86 \quad X = \frac{0.2}{10 \times 1.86}$
 after freezing
 $\Delta T_f = m \times K_f$
 $\Delta T_f = \frac{X \times 1000}{(100 - y)} \times 1.86 \quad \Delta T_f = 0.25$
 On solving, Amount of ice $y = 20$ g ice

Q.45 (4) $M = 1 \quad d = 1.2 \quad \text{Mol mass} = 180$
 $m = \frac{1000 \times M}{1000d - M \times 180}$
 $= \frac{1000}{1200 - 180} = \frac{1000}{1020}$
 $\Delta T_b = \frac{1000}{1020} K_b = 0.98 K_b$

Q.46 (1) $\pi = CRT \quad 7.40 = n \times 0.0821 \times 300$
 $\pi = \frac{n}{V} RT \quad n = \frac{7.4}{0.0821 \times 300} = 0.3$.

Q.47 (3) (1) Isotonic solution has same conc.

$$\pi_1 = \pi_2 \quad C_1 = C_2 \quad n_1 = n_2 \quad \boxed{\frac{W_1}{M_1} = \frac{W_2}{M_2}}$$

So, $\frac{x}{180} = \frac{4}{60} \Rightarrow x = 12 \text{ g Ans.}$

Q.48 (4) For isotonic solution $\pi_1 = \pi_2$; $C_1 = C_2$; $n_1 = n_2$

$$\frac{W_1}{M_1} = \frac{W_2}{M_2} \Rightarrow \frac{10.5}{M} = \frac{180}{30} \Rightarrow M = \frac{10.5 \times 180}{30} = 63$$

Q.49 (3) As number of moles is maximum in case

urea > glucose > sucrose

$$\pi = CRT$$

It depends on number of moles

so osmotic pressure

$$P_2 > P_1 > P_3$$

i.e.,

Q.50 (4) Isotonic means equal osmotic pressure so,

$$\pi_1 = \pi_2$$

$$i_1 C_1 RT = i_2 C_2 RT$$

$$\text{so } i_1 C_1 = i_2 C_2$$

In case of (4) both the volume of (i) & (3) are equal.

so Answer (D)

Q.51 (4) Only solvent molecules can go through SPM, not the solute particles hence no blue colour formation

EXERCISE-III

Q.1 (ACD)

Q.2 (A, B, C) For -ve deviation

$$A-B > A-A$$

$$A-B > B-B$$

-ve deviation solution are non ideal solution.

Q.3 (A, C) polar - polar \rightarrow -ve deviation

Q.4 (ACD)

Q.5 (A, B, C) For ideal solution $\Delta H = 0$, $\Delta V = 0$, $\Delta S_{\text{mix}} \neq 0$.

Obey Raoult's law.

Q.6 (A, B, C) $C_6H_6 + C_6H_6CH_3$: ideal solution,

Non-ideal solution : A, B, C.

Q.7 (B, D) Number of particles from $K_4[Fe(CN)_6] = 5$
number of particles from $FeSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O = 5$
number of particles from $KCl \cdot MgCl_2 \cdot 8H_2O = 5$

Q.8 (B, D)

Solute

$$x \quad i = [1 + (y-1)x]$$

(A) KCl 2

0.5 1.5

(B) K_2SO_4 3

0.4 1.8

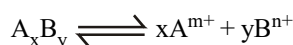
(C) $FeCl_3$ 4

0.3 1.9

(D) $SnCl_4$ 5

0.2 1.8

Q.9 (A, B, C)



Initial moles noo

At eq b.n(1- α) n α nya

$$i = \frac{\text{Total mol at equilibrium}}{\text{Initial mol}} = \frac{n[(1-\alpha) + x\alpha + y\alpha]}{n}$$

$$i = (1-\alpha) + x\alpha + y\alpha$$

It can also seen that all other expressions imply the same thing.

$$(A) \alpha = \frac{i-1}{x+y-1}$$

$$(B) i = (1-\alpha) + x\alpha + y\alpha.$$

$$(C) \frac{1-i}{1-x-y}$$

Q.10 (AB)

Q.11 (A, C)

$$i = 1 + (y-1)\alpha$$

$$i = 1 + y - 1 = y.$$

y i

Na_2SO_4 33

$MgCl_2$ 33

$Al(NO_3)_3$ 44

$C_6H_{12}O_6$ -1

$$\Delta T_b = mK_b i$$

$$i_{Na_2SO_4} = i_{MgCl_2}$$

$$(\Delta T_b)_{Na_2SO_4} = (\Delta T_b)_{MgCl_2}$$

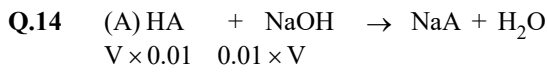
$$(B.P.)_{Na_2SO_4} = (B.P.)_{MgCl_2}$$

Q.12 (B) $\pi = iCRT$

$$0.369 = i \times \frac{1.8}{180} \times 0.0821 \times 300$$

$$i = 1.5$$

Q.13 (C) $i = \frac{M_{\text{theoretical}}}{M_{\text{observed}}} = \frac{180}{1.5} = 120 \text{ gm}$



$$0.01 \frac{V}{2V} = 0.005$$

$$\pi = 2 \times 0.005 \times 0.082 \times 300 = 0.246 \text{ atm}$$

Q.15. (B) $\frac{P^0 - P_s}{P_s} = \frac{n_A}{n_S}$

$$m = \frac{P^0 - P_s}{P_s} \times \frac{1000}{M_B}$$

$$P^0 = \frac{640 \times 600}{600} \times \frac{1000}{78} = 0.86$$

Q.16 (A) $P_s = X_A P_A^0 + X_B P_B^0$

$$300 = \frac{1}{4} \times P_A^0 + \frac{3}{4} P_B^0$$

after adding 1 mole

$$290 = \frac{2}{5} P_A^0 + \frac{3}{5} P_B^0$$

$$P^0 = 250$$

Q.17 (B) $\frac{P^0 - P_s}{P_s} = \frac{n_A}{n_B}$

$$\frac{P^0 - \frac{4}{5} P_0}{\frac{4}{5} P_0} = \frac{w}{\frac{60}{180}}$$

$$w = 150 \text{ gm}$$

Q.18 (A) - q, s ; (B) - q, s ; (C) - q, s ; (D) - q, s
 No of particles ↓, so vapour pressure ↑, i ↓
 $\Delta T_f = mK_f i$
 $\Delta T_f \downarrow$, freezing point ↑.

Q.19 (A) - Q, (B) - P, (C) - R
P → Q

where solute-solvent interaction solute-solvent interaction. then ideal solution.

B- solute-solvent interaction are weaker than solute-solvent so it shows positive deviation.

C- solute-solvent interactions stronger than solute-solvent interaction it will show negative deviation.

Q.20 (A) - (p, s, r); (B) - (p, q, t); (C) - (p); (D) - (p, q, t)
 (A) Acetone + CHCl_3 -ve deviation from Raoult's law
 $\Delta S > 0 \Delta H < 0 \Delta V < 0$

Maximum Boiling Azeotropes.

(B) Ethanol + Water +ve Deviation from Raoult's law
 $\Delta S > 0 \Delta H > 0 \Delta V > 0$ Minimum Boiling Azeotropes

(C) $\text{C}_2\text{H}_5\text{Br} + \text{C}_2\text{H}_5\text{I}$ Ideal solution No Azeotropes $\Delta H = 0 \Delta V = 0$

(D) Acetone + Benzene +ve Deviation from Raoult's law $\Delta H > 0 \Delta V > 0 \Delta S > 0$ Minimum Boiling Azeotropes.

Q.21 ($V_{\text{final}} = 5V_{\text{original}}$)
 Let original volume of solution = V_1
 Volume of solution after dilution = V_2

$$\pi_1 = C_1 RT_1 \Rightarrow \frac{w_B RT_1}{V_1}$$

$$\pi_2 = C_2 RT_2 \Rightarrow \frac{w_B RT_2}{V_2}$$

$$\frac{\pi_1}{\pi_2} = \frac{V_2 T_1}{V_1 T_2}$$

$$\frac{V_2}{V_1} = \frac{\pi_1}{\pi_2} \times \frac{T_2}{T_1}$$

$$\frac{500}{105.3} \times \frac{298}{283} = 5 \text{ (app)}$$

$$\therefore V_2 = 5V_1$$

Hence solution is diluted to 5 times

Q.22 2048 g/mol
 Solute - B, Solvent - A

$$\Delta T_f = \frac{K_f \times w_B \times 1000}{m_B \times w_A}$$

$$0.10 = \frac{5.12 \times 2.40 \times 1000}{m_B \times 60}$$

$$m_B = 2048 \text{ gm mol}^{-1}$$

Q.23 64.0 g/mol
 Solute - B, Water - A
 $\Delta T_b = 100.130 - 100 = 0.130$

$$\Delta T_b = K_b \times \frac{w_B \times 1000}{m_B \times w_A \text{ (gm)}}$$

$$0.130 = 0.513 \times \frac{3.24 \times 1000}{m_B \times 200}$$

$$m_b = 64 \text{ gm mol}^{-1}$$

Q.24 (1)

$$y_A = \frac{P_A^0 X_A}{P_A^0 X_A + P_B^0 X_B}$$

$$y_A = 1 + \frac{P_B^0 X_B}{P_A^0 X_A}$$

$$y_A = \frac{1}{1+(3)(3)} = \frac{1}{10} = 0.1$$

Q.25 3

$$\frac{P^0 - P}{P^0} = 0.05 = X_B$$

Where X_B = mole fraction of solute.

$$\text{Molality} = \frac{1000 \times X_B}{(X_A \times M_A)} = 1000 \times 0.05 / 0.95 \times 18 = 2.92 \approx 3.0$$

Q.26 3

$\text{Ca}(\text{NO}_3)_2 \rightarrow \text{Ca}^{2+} + 2\text{NO}_3^-$ it gives three ions hence the Van't Hoff factor = 3.

EXERCISE-IV

JEE-MAIN

PREVIOUS YEAR'S

Q.1 (3)

$$\frac{P^0 - P_s}{P^0} = \text{mole fraction of glucose}$$

Insufficient data (Assuming $P^0 = 760 \text{ mm}$)

No of moles of glucose = 0.1

No. of moles of water = 9.9

Mole fraction of glucose = 0.1 / 10

$$P_s = 752.4 \text{ mm}$$

Q.2 (4)

From Arrhenius equation

$$K = A.e^{-E_a/RT}$$

$$\text{So, } K_1 = A.e^{-E_{a1}/RT} \dots(i)$$

$$K_2 = A.e^{-E_{a2}/RT} \dots(ii)$$

$$\text{So, equation (ii)/(i)} \Rightarrow \frac{K_2}{K_1} = e^{\frac{(E_{a1} - E_{a2})}{RT}}$$

(As pre-exponential factors of both reactions is same)

$$\ln \left(\frac{K_1}{K_2} \right) = \frac{E_{a1} - E_{a2}}{RT} = \frac{10.000}{8.314 \times 300} = 4$$

Q.3 (2)

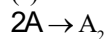
$$P_A = X_A P_A^0 = Y_A P_T$$

$$P_T = X_A P_A^0 + X_B P_B^0 = 0.4 \times 7 \times 10^3 + 0.6 \times 12 \times 10^3 = 10^4$$

$$0.4 \times 7 \times 10^3 = Y_A \times 10^4$$

$$Y_B = 1 - 0.28 = 0.72$$

Q.4 (1)



$$1 - \alpha = \frac{\alpha}{2}$$

$$1 - 0.8 = \frac{0.8}{2}$$

$$i = 1 - 0.8 + \frac{0.8}{2} = 0.6$$

$$\Delta T_f = K_f \times i \times m = 5 \times 0.6 \times \frac{x}{122} \times \frac{1000}{30} = 2 \text{ (Since } \Delta T_f = 2)$$

$$\therefore x = 2.44 \text{ g}$$

Q.5 (4)

$$\Delta T_b = K_b m$$

$$\Delta T_b = K_b \times 1 \Rightarrow 2 = K_b$$

$$\Delta T_f = K_f m$$

$$2 = 2K_f = K_f$$

$$\frac{K_f}{K_b} = \frac{1}{2}$$

Q.6 (1) Gases having higher K_H value are less soluble.

Q.7 (2) We know that,

Depression in freezing points (ΔT_f)

$$T^0_f - T_f = K_f \times m \times i$$

where, K_f = molal depression constant

$$m = \text{molality} = \frac{w_{\text{solute}} \times 1000}{M_{\text{solute}} \times w_{\text{solvent}}(\text{in g})}$$

i = van't Hoff factor

For diluted milk

$$\Delta T_{f1} = K_f \times m_1 \times i$$

$$\Rightarrow 0 - (-0.2) \Rightarrow 0.2 = K_f \times \frac{w_{\text{milk}} \times 1000}{M_{\text{milk}} \times w_l(\text{H}_2\text{O})} \times 1$$

For pure milk

$$\Delta T_{f2} = K_f \times m_2 \times i$$

$$\Rightarrow 0 - (-0.5) = 0.5 = K_f \times \frac{w_{\text{milk}} \times 1000}{M_{\text{milk}} \times w_2(\text{H}_2\text{O})} \times 1$$

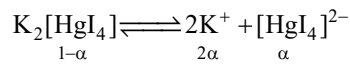
$$\text{So, } \frac{0.2}{0.5} = \frac{K_f}{K_f} \times \frac{w_{\text{milk}} \times 1000}{M_{\text{milk}} \times w_l(\text{H}_2\text{O})} \times \frac{M_{\text{milk}} \times w_2(\text{H}_2\text{O})}{w_{\text{milk}} \times 1000}$$

$$= \frac{w_2(\text{H}_2\text{O})}{w_1(\text{H}_2\text{O})}$$

$$\Rightarrow \frac{w_2(\text{H}_2\text{O})(\text{in pure milk})}{w_1(\text{H}_2\text{O})(\text{in diluted milk})} = \frac{2}{5}$$

i.e. 3 cups of water has to be added to 2 cups of pure milk.

Q.8 (2)



Total numebr of particle = $1 + 2\alpha$

Hence, Van't Hoff factor = $\frac{1+2\alpha}{1}$

$$= \frac{1+2 \times 0.4}{1} = 1 + 0.8 \Rightarrow 1.8$$

Q.9 (4)

$$P_{\text{total}} = X_A \cdot P_A^0 + X_B \cdot P_B^0$$

$$= 0.5 \times 400 + 0.5 \times 600 = 500 \text{ mmHg.}$$

Now, mole fraction of A in vapour,

$$Y_A = \frac{P_A}{P_{\text{total}}} = \frac{0.5 \times 400}{500} = 0.4$$

and mole fraction of B in vapour,

$$Y_B = 1 - 0.4 = 0.6$$

Correct option : (4)

Q.10 (1)

$$\pi_{XY} = 4\pi_{\text{BaCl}_2}$$

$$2 \times [XY] = 4 \times 3 \times 0.01$$

(Assuming same temperature)

$$\Rightarrow [XY] = 0.06 \text{ M}$$

\therefore Ans. is (1)

Q.11 (3)

$$\therefore P_N^0 > P_M^0$$

$$\therefore y_N > X_N$$

$$\& X_M > y_M$$

Multiply we get

$$y_N X_M > X_N y_M$$

\therefore Ans. is (3)

Q.12 (3) $p = k_H \times \left(\frac{n_{\text{gas}}}{n_{\text{H}_2\text{O}} + n_{\text{gas}}} \right) = k_H \left(1 - \frac{n_{\text{H}_2\text{O}}}{n_{\text{H}_2\text{O}} + n_{\text{gas}}} \right)$

$$\Rightarrow p = k_H - k_H \times \chi_{\text{H}_2\text{O}}$$

$$p = (-k_H) \times \chi_{\text{H}_2\text{O}} + k_H$$

Q.13 (1)

$$\prod = \frac{\left(\frac{0.6}{60} + \frac{1.8}{180} \right)}{0.1} \times 0.08206 \times 300$$

$$\prod = 4.9236 \text{ atm}$$

Q.14 (2) $K_f = 4 \text{ K-kg/mol}$

$$m = 0.03 \text{ mol/kg}$$

$$i = 3$$

$$\Delta T_f = iK_f \times m$$

$$\Delta T_f = 3 \times 4 \times 0.03 \times 0.36 \text{ K}$$

Q.15 (3) Lowering of vapour pressure = $p^0 - p = p^0 \cdot x_{\text{solute}}$

$$\therefore \Delta p = 35 \times \frac{0.6/60}{\frac{0.6}{60} + \frac{360}{18}}$$

$$= 35 \times \frac{.01}{.01 + 20} = 35 \times \frac{.01}{20.01}$$

$$= .017 \text{ mmHg}$$

Q.16 (3) $\Delta T_b = K_b \times m$

$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{K_{b(A)}}{K_{b(B)}} \text{ as } m_A = m_B$$

$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}} = \frac{1}{5}$$

Q.17 (3) Above mixture of liquids show positive deviation from Raoult's Law

Q.18 (4)

$$2 \times \text{mole of Urea} = \text{mole of NH}_3 \quad \dots(1)$$

$$\text{mole of NH}_3 = \text{mole of HCl} \quad \dots(2)$$

$$\therefore \text{mole of HCl} = 0.02 \text{ mole}$$

Q.19 (3) There will be lowering in vapour pressure in second beaker.

Q.20 4.95 to 4.97

$$10 = \frac{\text{Mass of Fe(in g)}}{100 \times 1000} \times 10^6$$

$$\text{or, mass Fe} = 1 \text{ g}$$

$$\text{FeSO}_4 \cdot 7\text{H}_2\text{O} (M = 277.85)$$

$$55.85 \text{ g in 1 mole}$$

$$1 \text{ g} - \frac{1}{55.85} \text{ mole}$$

$$\frac{1}{55.55} \times 277.55 \text{ g} = 4.97 \text{ g}$$

Q.21 (2) At a particular temperature as intermolecular force of attraction increases vapour pressure decreases.

Q.22 14.00 to 14.00
63% w/w d HNO₃ solution

$$M = \frac{63 \times 1.4}{63 \times 100} \times 1000 \text{ mole/L} = 14 \text{ mole/L}$$

Q.23 1.74 to 1.76

$$\Delta T_f = 0.2^\circ \text{C}$$

$$\Delta T_f = i k_f m$$

$$0.2 = 2 \times 2 \times \frac{w}{58.5} \times \frac{1000}{600}$$

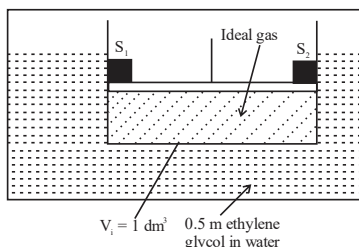
$$w = \frac{0.2 \times 58.5 \times 600}{1000 \times 4}$$

$$= \frac{1.2 \times 58.5}{40} = 1.76 \text{ g}$$

Q.24 10.00 to 10.00

$$\text{ppm} = \frac{10.3 \times 10^{-3}}{1030} \times 10^6 = 10$$

Q.25 0.217 to 2.23



$$K_f = 2.0$$

$$m = 0.5$$

$$\Delta T_f = K_f m$$

$$= 0.5 \times 2$$

$$T_{\text{initial}} = 272 \text{ K}$$

$$n = 0.1 \text{ mol}$$

$$V = 1 \text{ dm}^3$$

$$V = 1 \text{ dm}^3$$

$$P_{\text{gas}} = \frac{nRT}{V} = \frac{0.1 \times 0.08 \times 272}{1} = 2.176 \text{ atm}$$

After releasing piston $P_1 V_1 = P_2 V_2$

$$2.176 \times 1 = 1 \times V_2$$

$$V_2 = 1.176 \text{ dm}^3 \approx 2.18 \text{ dm}^3$$

Q.26 (1)

Osmosis can explain the given process. There are many phenomena which we observed in nature or at home.

Raw mango shrivel when pickled in brine.

The solvent molecules will flow through the membrane

from pure solvent to the solution. This process of flow of the solvent is called osmosis.

Q.27 (4)

The rate at which water molecules leaves the solution decreases.

Q.28 (177)

Isotonic solutions have the same osmotic pressure.

$$\pi_A = C_A RT; C_A = \frac{0.73 \times 1000}{M_A \times 250}$$

$$\pi_B = C_B RT; C_B = \frac{1.65}{M_B}$$

$$\pi_A = \pi_B = C_A = C_B$$

$$\therefore \frac{0.73 \times 1000}{M_A \times 250} = \frac{1.65}{M_B}$$

$$\frac{M_A}{M_B} = 1.77 = 177 \times 10^{-2}$$

Q.29 (2)

With temperature, the value of K_H (Henry's constant) increases and solubility of gas in liquid decreases

Ideally Henry's law is applicable for dilute solutions.

\therefore 55.5 molal solution of δ at 250 bar will not follow Henry's law.

Q.30 (167.00)

$$\text{For NaCl: } \pi_1 = iC_1 RT \Rightarrow C_1 = \frac{0.10}{2RT}$$

$$\text{For Glucose: } \pi_2 = iC_2 RT \Rightarrow C_2 = \frac{0.20}{RT}$$

When 1 L of NaCl solution and 2 L glucose solution are mixed.

$$\therefore C'_1 = \frac{0.10}{6RT} \text{ and } C'_2 = \frac{0.20 \times 2}{3RT} = \frac{0.40}{3RT}$$

$$\therefore \pi_{\text{Total}} = iC_1 RT + iC_2 RT = \frac{0.10}{3} + \frac{0.40}{3} = \frac{0.50}{3}$$

$$\pi_{\text{Total}} = 167 \times 10^{-3} \text{ atm}$$

Q.31 (600)

If X_1 and P_1^0 are the mole fraction and vapour pressure

of n-hexane in solution and X_2 and P_2^0 are the mole

fraction and vapour pressure of n-heptane in solution then

$$550 = X_1 P_1^0 + X_2 P_2^0 = \frac{P_1^0}{4} + \frac{3P_2^0}{4}$$

$$\Rightarrow P_1^0 + 3P_2^0 = 2200 \dots(1)$$

On addition of 1 more mole of n-heptane

$$560 = X_1'P_1^0 + X_2'P_2^0$$

$$\frac{P_1^0}{5} + \frac{4P_2^0}{5}$$

$$\Rightarrow P_1^0 + 4P_2^0 = 2800 \dots(2)$$

From (1) and (2), $P_2^0 = 600$ mm Hg

Q.32 (48.00)

Freundlich adsorption isotherm:

$$\frac{x}{m} = Kp^{1/n}$$

$$\Rightarrow \log \frac{x}{m} = \log K + \frac{1}{n} \log p$$

$$\frac{1}{n} = 2 \text{ and } \log K = 0.4771 = \log 3$$

$$\therefore K = 3$$

$$\frac{x}{m} = 3 \cdot p^2$$

mass of gas adsorbed per gram of adsorbent

$$= 3 \times (0.04)^2$$

$$= 48 \times 10^{-4}$$

Q.33 (3)

Relative lowering in vapour pressure (RLVP)

$$= \frac{P - P_s}{P} = \frac{n}{n + N}$$

$n \rightarrow$ moles of solute

$N \rightarrow$ moles of solvent

$$n_A = \frac{10}{100}, n_B = \frac{10}{200}, n_C = \frac{10}{10000}$$

From the above relation

RLVP(A) > RLVP(B) > RLVP(C)

A > B > C

Q.34 (5.00)

Molality of CaCl_2 solution = 0.05 m

$$\Delta T_b = i K_b m = 3 \times K_b \times 0.05 = 0.15 K_b$$

Molality of $\text{CrCl}_3 \cdot x\text{NH}_3 = 0.10$ m

$$\Delta T_b' = i K_b \times 0.10; \Delta T_b' = 2\Delta T_b$$

$$i K_b \times 0.10 = 2 \times 0.15 K_b \Rightarrow i = 3$$

Since, co-ordination number of Cr is 6.

\therefore The complex is $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$

$$\therefore x = 5$$

**JEE-ADVANCED
PREVIOUS YEAR'S**

Q.1 (A, B)

Q.2 (A)

As T increase, V.P. increases. So C & D options get rejected.

$$\Delta T_f = K_f \times m$$

$$273 - T_f = 2 \times \frac{34.5 / 46}{0.5}$$

$$\therefore T_f = 270 \text{ K}$$

Q.3 (BD)

For a mixture of two liquids L and M,

For ideal solution obey Raoult's law

$$P_L = (1 - X_M) P_L^0 = P_L^0 - X_M P_L^0$$

Graph between P_L & X_M has intercept = P_L^0 & slope

= -ve

But graph representing +ve deviation from Raoult's law therefore $M-L < M-M$ or $L-L$ Point Z represents intercept which is P_L^0 when $X_L \rightarrow 1$

Q.4 (19)

$$45 = P_A^0 \times \frac{1}{2} + P_B^0 \times \frac{1}{2}$$

$$P_A^0 + P_B^0 = 90 \dots\dots(i)$$

given $P_A^0 = 20$ torr

$$P_B^0 = 70 \text{ torr}$$

$$\Rightarrow 22.5 \text{ torr} = 20x_A + 70(1 - x_A) = 70 - 50x_A$$

$$x_A = 0.05$$

$$\text{So } \frac{x_A}{x_B} = \frac{0.05}{0.05} = 1$$

Q.5 (0.05)

From graph

For solvent 'X' $\Delta T_{bx} = 2$

$$\Delta T_{bx} = m_{\text{NaCl}} \times K_{b(x)} \dots\dots(1)$$

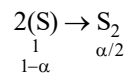
For solvent 'Y' $\Delta T_{by} = 1$

$$\Delta T_{by} = m_{\text{NaCl}} \times K_{b(y)} \dots\dots(2)$$

Equation (1)/(2)

$$\Rightarrow \frac{K_{b(x)}}{K_{b(y)}} = 2$$

for solute S



$$i = (1 - \alpha/2)$$

$$\Delta T_{b(x)(s)} = \left(1 - \frac{\alpha_1}{2}\right) K_{b(x)}$$

$$\Delta T_{b(y)(s)} = \left(1 - \frac{\alpha_2}{2}\right) K_{b(y)}$$

$$\text{Given } \Delta T = \Delta T_{b(x)(s)} = 3\Delta T_{b(y)(s)}$$

$$\left(1 - \frac{\alpha_1}{2}\right) K_{b(x)} = 3 \times \left(1 - \frac{\alpha_2}{2}\right) \times K_{b(y)}$$

$$2\left(1 - \frac{\alpha_1}{2}\right) = 3\left(1 - \frac{\alpha_2}{2}\right)$$

$$\alpha_2 = 0.7$$

$$\text{so } \alpha_1 = 0.05$$

Q.6 (1.02 or 1.03)

$$\frac{P^0 - P_s}{P^0} = \frac{n_{\text{solute}}}{n_{\text{solute}} + n_{\text{solvent}}}$$

$$\frac{650 - 640}{650} = \frac{n_{\text{solute}}}{n_{\text{solute}} + 0.5}$$

$$n_{\text{solute}} = \left(\frac{5}{640}\right)$$

$$\text{Molality} = \frac{5 \times 1000}{640 \times 39}$$

$$\Delta T_f = m \times K_b$$

$$= \frac{5.12 \times 5 \times 1000}{640 \times 39}$$

$$\Delta T_f \approx 1.0256$$

Q.7 (0.20)

$$P_T = P_A^0 X_A + P_B^0 X_B$$

$$0.3 = P_A^0 \times 0.25 + P_B^0 \times 0.75 \quad \dots(i)$$

$$0.4 = P_A^0 \times 0.5 + P_B^0 \times 0.5$$

$$0.8 = P_A^0 + P_B^0 \quad \dots(ii)$$

on solving eqⁿ (i) & (ii)

$$P_A^0 = 0.6, P_B^0 = 0.2$$