~~Atomic Structure~~

Solution Booklet

Level II (Subjective Problems)

1 For a mixture of two solutions,

$$\pi = \frac{\pi_1 V_1 + \pi_2 V_2}{V_1 + V_2}$$

$$\therefore \quad \pi = \frac{(2.4)V + (1.6)V}{V + V} = 2 \text{ atm}$$

2 Similar to previous problem,

$$\pi = \frac{(1.2)(100) + (2.4)(300)}{100 + 300} = 2.1 \text{ atm}$$

3 Let the molar masses be M_A & M_B

$$\therefore \quad \pi_1 = \left(\frac{10}{M_A} + \frac{20}{M_B}\right) \times \left(\frac{RT}{0.5}\right)$$

$$\pi_2 = \left(\frac{6.67}{M_A} + \frac{30}{M_B}\right) \times \left(\frac{RT}{0.5}\right)$$

Given, $\pi_1 = \pi_2$

$$\frac{10}{M_A} + \frac{20}{M_B} = \frac{6.67}{M_A} + \frac{30}{M_B}$$

$$\Rightarrow \quad \frac{M_B}{M_A} = 3.$$

4 $\pi_{glucose} = (0.02)RT \qquad \pi_{Urea} = (0.05)RT$

$$\because \quad \pi_{Urea} > \pi_{glucose}$$

$\therefore$ External Pressure, $P = \pi_{Urea} - \pi_{glucose}$

$= 0.03RT = 0.73 \text{ atm}$

External pressure must be applied on Glucose solution.

Q5 (A) $Li_2CO_3 \rightleftharpoons 2Li^+ + CO_3^{-2}$

Solubility, $S = \frac{1.54}{74}$ mol/L = 0.02 M

$[Li^{+2}] = 2S \quad [CO_3^{-2}] = S$

$\therefore$ total ion conc. = 2S + S = 3S = 0.06 M

$\pi = (0.06)(RT) = 1.34$ atm.

(B) Using equation $\frac{P - P_s}{P_s} = \frac{n}{N} = (\text{molality}) \times \frac{18}{1000}$

P = 760 torr

P_s = 751 torr

$\therefore \frac{760 - 751}{751} = (\text{molality}) \times \frac{18}{1000}$

$\Rightarrow$ molality = 0.66.

for dilute solutions molality = molarity

$\therefore$ Osmotic Pressure, $\pi = (0.66)(R)(373)$

= 20.38 atm

(C) Normal Boiling Point, $T_b = 100°C$

$\therefore \Delta T_b = (101 - 100)°C = 1°C$

Using, $\Delta T_b = (\text{molality}) \times K_b$

$\Rightarrow$ molality $= \frac{1}{0.52} = 1.92$ = molarity

$\therefore$ O.P. $\pi = (1.92)(R)(374) = 58.9$ atm

6 for KCl, $\alpha = 0.86$

$\therefore i = 1 + (2-1)\,0.86 = 1.86$.

Let 'w' gms of KCl be added to 1 lt solution.

$\therefore$ Molarity of KCl solution $= \dfrac{w}{74.5}$

Osmotic pressure, $\pi_1 = iCRT$

$= (1.86)\left(\dfrac{w}{74.5}\right)RT$

for glucose solution,

100 mL contain 4 gms of glucose

$\therefore$ Molarity of glucose solution $= \dfrac{4}{180} \times \dfrac{100}{100}$

Osmotic Pressure, $\pi_2 = \left(\dfrac{4}{18}\right)RT$

Given $\pi_1 = \pi_2$

$\dfrac{1.86\,w}{74.5} = \dfrac{4}{18}$

$\Rightarrow w = 8.9$ gms

7 $K_b = \dfrac{RT_b^2}{1000\,L_v} = \dfrac{(8.314)(373)^2}{(1000)\left(\dfrac{40.97 \times 10^3}{18}\right)}$

$= 0.508$ K kg/mol

8 $\left.\begin{array}{l} \Delta T_{f_1} = m_1 K_f \\ \Delta T_{f_2} = m_2 K_f \end{array}\right\}$ $\Delta T_{f_1} = 2\Delta T_{f_2}$

$\Rightarrow m_1 = 2m_2$

for solution 1,

$$m_1 = \left(\frac{x}{60} + \frac{y}{180}\right)$$

for solution 2,

$$m_2 = \left(\frac{x}{180} + \frac{y}{60}\right)$$

Using $m_1 = 2m_2$

$$\frac{x}{60} + \frac{y}{180} = \frac{2x}{180} + \frac{2y}{60}$$

$$\Rightarrow \frac{x}{y} = 5$$

9 Let the molecular formula be $(CH_2O)_n$

$\therefore$ Mol. Wt = $30n$

from the given data,

$$\Delta T_b = 0.43 = \text{molality} \times K_b$$

$$0.43 = \left(\frac{15}{30n} \times \frac{1000}{100}\right) \times 0.512$$

$$\Rightarrow n = 6$$

$\therefore$ Mol. Formula = $C_6H_{12}O_6$

10 $\because$ Mol. Wt gets doubled

$$\therefore i = \frac{1}{2}$$

& $\Delta T_b = i \times (\text{molality}) \times K_b$

$$\Delta T_b = \frac{1}{2} \times \left(\frac{30}{154}\right) \times \left(\frac{1000}{250}\right) \times (2.16)$$

$$= 2$$

$\therefore$ Boiling point = $80.1 + 2 = 82.1°C$

11 Benzoic Acid is C_6H_5COOH (M.Wt = ~~122~~ 122g)
Let the degree of association be 'β'
Using $\Delta T_b = i \times molality \times K_b$

$$\Delta T_b = \left[1 + \left(\frac{1}{2} - 1\right)\beta\right] \times \left(\frac{112}{122}\right) \times \left(\frac{R T_b^2}{1000 L_v}\right)$$

Substituting given values,

$\beta = 75.4\%$ or $\beta = 0.754$

Also, observed molar mass $= \frac{122}{i} = \frac{122}{1 + \left(\frac{1}{2} - 1\right)\beta}$

$= 195.9$ gms

12 Let V mL of ethylene glycol be added.
∴ mass of solute added = 1.12 V gms
moles of solute $= \frac{1.12V}{62}$

$$\Delta T_f = 20 = \left[\frac{1.12V}{62 \times 5}\right] \times 1.86$$

$V = 2976$ mL

13 for Acetone solution,
$\Delta T_{f_1} = m_1 \times K_f$

for solution of 'A'
$\Delta T_{f_2} = m_2 \times K_f$

equating K_f,

$$\frac{\Delta T_{f_1}}{m_1} = \frac{\Delta T_{f_2}}{m_2}$$

$$\frac{1.27}{\frac{1.44}{58} \times \frac{1000}{100}} = \frac{1.2}{\frac{1.87}{M} \times \frac{1000}{100}}$$

$\Rightarrow M = 79.79$

14 Let the atomic mass of A be 'x' & B be 'y'

∴ Mol wt of $AB_2 = x + 2y$

Mol wt of $AB_4 = x + 4y$

for AB_2 solution,

$$2.3 = \left(\frac{1}{x+2y}\right)\frac{1000}{20} \times 5.1 \quad -①$$

for AB_4 solution,

$$1.3 = \left(\frac{1}{x+4y}\right)\frac{1000}{20} \times 5.1 \quad -②$$

Dividing & solving ① & ②,

we get, $x = 25.57g$ $y = 42.64g$

15 Let the density be 'd' gm/mL

∴ mass of glycol = 50d

Using $\Delta T_f = m \times K_f$

$$34 = \frac{50d}{62} \times \frac{1000}{50} \times 1.86$$

$\therefore d = 1.133$

16 for the neutralisation,

equivalents of Acid = equivalents of Alkali

$$\left(\frac{0.2}{M}\right) \times 1 = \frac{1}{10} \times \frac{15.1}{1000}$$

$\Rightarrow M = 132.4$ (Mol. Wt of Acid)

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for freezing point depression,

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

$$0.168 = (1+\alpha)\times\left(\frac{1}{132.4}\times\frac{1000}{100}\right)\times 1.86$$

$$\alpha = 0.195$$

17 Using $\Delta T_f = i \times m \times K_f$

$$(0.558) = i \times (0.1) \times (1.86)$$

$$\Rightarrow i = 3 = 1 + (n-1)$$

$$\Rightarrow n = 3$$

∴ each molecule must give 3 ions

formula $[Co(NH_3)_5Cl]Cl_2$

18 On cooling below the freezing point, water will seperate out in form of ice till the maintained temp. becomes the new freezing point.

Let 'w' gms of ice is formed

$$\therefore \Delta T_f = 3.72 = m \times K_f$$

$$= \frac{1}{(1000-w)}\times 1000 \times 1.86$$

$$\Rightarrow w = 500 \text{ gms.}$$

19 $\Delta T_f = i \times m \times K_f$

$$0.65 = (1+4\alpha)\times(0.15)\times(1.86)$$

$$\%\ \alpha = 33.2\%$$

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20 Using $\frac{P^\circ - P_s}{P_s} = \frac{n}{N}$

$$\frac{230 - P_s}{P_s} = \frac{10}{125} \times \frac{58}{75}$$

$$\Rightarrow P_s = 216.6 \text{ mmHg}$$

21 $$550 = P_A^\circ\left(\frac{1}{4}\right) + P_B^\circ\left(\frac{3}{4}\right) \quad -①$$

$$560 = P_A^\circ\left(\frac{1}{5}\right) + P_B^\circ\left(\frac{4}{5}\right) \quad -②$$

Solving ① & ②, $P_A^\circ = 400 \text{ mmHg}$
$P_B^\circ = 600 \text{ mmHg}$

22 $$300 = P_A^\circ\left(\frac{1}{3}\right) + P_B^\circ\left(\frac{2}{3}\right) \quad -①$$

$$400 = P_A^\circ\left(\frac{2}{4}\right) + P_B^\circ\left(\frac{2}{4}\right) \quad -②$$

Solving ① & ②, $P_A^\circ = 700$ torr
$P_B^\circ = 100$ torr

~~23~~ Let 'w' gms of H_2O gets transferred from 0.1 m solution to 0.2 m solution
∴ At ~~eqⁿ~~ equilibrium,

Cancelled (Wrong Question)

24 Let 'w' gms of water gets transferred.

At equilibrium,

$$\frac{20}{100+w} = \frac{10}{100-w}$$

$\Rightarrow$ $w = 33.33$ gms

25 Let 'w' gms of urea is taken.

Using, $\frac{P^\circ - P_S}{P_S} = \frac{n}{N}$

$$\frac{25}{75} = \frac{w}{60} \times \frac{18}{108}$$

$w = 120$ gms

26 Given $X_A = 0.3$ & $Y_A = 0.6$

$\Rightarrow$ $X_B = 0.7$ & $Y_B = 0.4$

$P_T = P_A^\circ X_A + P_B^\circ X_B = 0.3 P_A^\circ + 0.7 P_B^\circ$

also, $P_T Y_A = P_A^\circ X_A$

$$(0.3 P_A^\circ + 0.7 P_B^\circ)(0.6) = P_A^\circ (0.3)$$

$\Rightarrow$ $\frac{P_A^\circ}{P_B^\circ} = \frac{7}{2}$

28 Let the mass of X be 2m

$\therefore$ mass of Y = 3m

Let molar mass of X be M

$\therefore$ molar mass of Y = 2M

moles of X = $\frac{2m}{M}$ moles of Y = $\frac{3m}{2M}$

$$\text{Now, } P_T = 200\left(\frac{\frac{2m}{M}}{\frac{2m}{M}+\frac{3m}{2M}}\right) + 80\left(\frac{\frac{3m}{2M}}{\frac{2m}{M}+\frac{3m}{2M}}\right)$$

$$= 200 \times \frac{4}{7} + 80 \times \frac{3}{7} = 148.57 \text{ torr}$$

= [illegible]

29 $P_T = 200x_A + 75x_B = 200x_A + 75(1-x_A)$

$= 125x_A + 75$

Also, $P_T Y_A = P_A^\circ x_A$

$$(125x_A + 75)\frac{1}{2} = 200x_A$$

$$75 = 275x_A$$

$$x_A = 0.27$$

$$x_B = 0.73$$

30 $P_T = (P_A^\circ - P_B^\circ)x_A + P_B^\circ$

Given $P_T = 180x_B + 90$

$\Rightarrow P_B^\circ = 270$ (Benzene)

$P_A^\circ = 90$ (Toluene)

In the first solution,

mol of Benzene = 10 , mol of Toluene = 8

$$P_T = 270 \times \frac{10}{18} + 90 \times \frac{8}{18} = 190$$

for the vapour phase above the solution

$$Y_A = \frac{P_A^\circ X_A}{P_T} \quad \& \quad Y_B = 1 - Y_A$$

$$Y_A = \frac{90 \times}{190} \frac{8}{18} = \frac{4}{19} \quad \& \quad Y_B = \frac{15}{19}$$

Upon condensation, $Y_A = X_A'$ & $Y_B = X_B'$

$$P_T' = 270 \times \frac{15}{19} + 90 \times \frac{4}{19} = 232$$

$$Y_A' = \frac{90 \times}{232} \frac{4}{19} = 0.08$$

$$Y_B' = 0.92$$

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1)

Comprehension 1 –

$P_T = 120 \times \frac{2}{5} + 180 \times \frac{3}{5} = 156 \text{ mmHg}$ (C)

$Y_A = \frac{P_A^\circ X_A}{P_T} = \frac{120 \times 0.4}{156} = 0.308$

$Y_B = 1 - Y_A = 0.692$ ∴ (D)

2)

When last drop disappears,

$Y_A = 0.4$, $Y_B = 0.6$

$\frac{1}{P_T} = \frac{Y_A}{P_A^\circ} + \frac{Y_B}{P_B^\circ}$

$\Rightarrow P_T = 150 \text{ mmHg}$ (D)

Comprehension – 2

$2C_6H_5COOH \rightleftharpoons (C_6H_5COOH)_2$

$i = 1 + \left(\frac{1}{2} - 1\right)\alpha$

$= 1 - \frac{\alpha}{2}$ (C)

Refer theory (B)

6) $i = 1 + (5-1)0.6 = 1 + 4(0.6) = 3.4$ (C)

Comprehension-3

7) Refer theory (B)

8) Relative lowering in V.P. = X_{solute}

$= 0.4 = 40\%$

(C)

9) $i = 1 + (n-1)\alpha = 3$ for (D)

10) (C)

11) $\Delta T_f = i \times m \times K_f$

$0.45 = \left(1 - \frac{\alpha}{2}\right) \times \left(\frac{0.2}{60} \times \frac{1000}{20}\right) \times 5.12$

$\alpha = 0.945$ (B)

12) $\Delta T_f = i \times m \times K_f$

$= (1 + 0.3)(0.2)(1.86) = 0.48$

$\therefore T_f = -0.48^\circ C$ (A)

Objec

1) Theo

2) Mo

3) mol

mo

X

4) M

5) 1

6) mo

mol

X_r

7) M

Foundation Builders

Objective

1) Theory (A)

2) $Molarity = \left(\frac{8}{40}\right) = \frac{1}{5} = 0.2$ (C)

3) mol of $H_2O = 36/18 = 2$
mol of glycerine $= 46/92 = 0.5$

$$X_{glycerine} = \frac{0.5}{0.5+2} = \frac{1}{5} = 0.2 \quad (C)$$

4) $M = \frac{5/34}{100} \times 1000 = \frac{50}{34} \approx 1.5$ (B)

5) 1000 g solution contains 10 g $CaCO_3$
$\therefore$ 10^6 g solution will contain 10^4 g $CaCO_3$
i.e 10^4 ppm (D)

6) mol of NaCl $= 5.85/58.5 = 0.1$
mol of $H_2O = 90/18 = 5$
$X_{NaCl} = \frac{0.1}{5.1} = 0.0196$ (A)

7) $Molarity = \frac{Normality}{Valency\ factor} = \frac{0.2}{2} = 0.1$ (C)

8) Refer Theory (C)

9) Molarity $= \frac{(1.2/60)}{200} \times 1000 = 0.1M$ (C)

10) Let mass ~~be~~ of sugar be 'w' gms.

molality $= \frac{w/342}{(534.2-w)} \times 1000 = 0.2$

$\Rightarrow w = 34.2$ gms (B)

11) $i = 1$ (B)

12) $i = 5$ (A)

13) Refer Notes (B)

14) Required ratio $= \frac{i_1}{i_2} = \frac{5}{7} = 0.71$ (B)

15) $i = 1 + (2-1)\alpha = 1.95$

$\Rightarrow \alpha = 0.95$ (A)

~~16)~~ ~~$i = \frac{\text{Observed Mol. Wt}}{\text{Theo. Mol. Wt}} =$~~

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16) $i = \frac{\text{Calculated Mol Wt}}{\text{Observed Mol Wt}} = \frac{164}{65.4} = 2.5$

Also, $i = 1 + 2\alpha \Rightarrow \alpha = 0.75$ (D)

17) $i = 2$ for KCl when it is fully ionised (A)

18) for dimerisation, $i = 1 + \left(\frac{1}{2} - 1\right) = \frac{1}{2} = 0.5$

for trimerisation, $i = 1 + \left(\frac{1}{3} - 1\right) = \frac{1}{3} = 0.33$

(C)

19) for tetramerisation, $i = 1 + \left(\frac{1}{4} - 1\right) = \frac{1}{4} = 0.25$ (B)

20) for complete dimerisation, $i = 1/2$

$\therefore$ Obs. Mol. Wt $= \frac{\text{Calculated Mol. Wt}}{i}$

$\Rightarrow \qquad = 122/0.5 = 244$ (C)

21) (D)

22) $\pi = CRT \Rightarrow 20.4 = \left[\frac{(w/60)}{100} \times 1000\right] \times 0.0821 \times 298$

$\therefore$ w = 5 gms (A)

23) $\pi = CST \quad \therefore$ as conc $\downarrow$, $\pi \downarrow$

$\therefore \quad P_2 > P_1 > P_3$ (C)

24 Refer Notes (B)

25 $\pi = CRT$

$0.821 = C(0.0821)(300)$

$\Rightarrow C = 0.033M$ (D)

26 $i_{KNO_3} > i_{CH_3COOH}$

$\therefore P_1 > P_2$ (C)

27 (C)

28 (C)

29 total concentration must be same

$\therefore$ (D)

30 $\pi = \frac{\pi_1 V_1 + \pi_2 V_2}{V_1 + V_2}$

(B)

31 $\pi = \left(\frac{5/342 \times 1000}{100}\right)(0.0821)(288)$

$= 3.46$ atm (A)

32 $\pi = (1)(0.0821)(273) = 22.4$ atm (D)

33 (C) Alum has the highest value of 'i'

34 Least value of "i" will be for $AgNO_3$ ∴ (B)

35 (A) highest value of "i"

36 $i = 5.7/3 = 1.9 = 1 + (2-1)\alpha$
$\Rightarrow \alpha = 0.9$ (A)

37 $i = 5.85/3.2 = 1.82 = 1 + (2-1)\alpha$
$\Rightarrow \alpha = 0.82$ (C)

38 Osmosis will occur if two solutions seperated by SPM have different osmotic pressures
∴ (C)

39 Through SPM, only solvent (i.e Water) can pass. ∴ No blue color formation (D)

40 $\Delta T_f = m \times K_f = 0.05 \times 1.86 = 0.093$
∴ freezing point $= 0 - 0.093 = -0.093°C$

41 $\Delta T_f = mK_f \Rightarrow 1.8 = \left(\frac{0.48 \times 1000}{M \times 10.6}\right) \times 5$

$M = 125.79$ (C)

42 $\Delta T_f = mK_f$ & $\Delta T_b = mK_b$
$\Rightarrow \frac{\Delta T_f}{K_f} = \frac{\Delta T_b}{K_b}$
∴ $\Delta T_f = 1.82°C$
∴ $T_f = 0 - 1.82 = -1.82°C$ (C)

43 (D)

44 $\frac{i_A}{i_B} = \frac{2}{1}$ & $i_A = 1 \Rightarrow i_B = \frac{1}{2}$

$\therefore$ B undergoes association (C)

45 Highest freezing point will be for solution having least ΔT_f

$\therefore$ (D)

46 (A) Refer Theory

47 Same as Q45 (D)

48 $\Delta T_f = i \times m \times K_f$

$0.74 = i \times \left(\frac{20}{100} \times \frac{1000}{500}\right) \times 1.86$

$\Rightarrow i = 1$ $\therefore$ No dissociation (D)

49 Let the molecular formula be P_n

Using $\Delta T_b = m K_b$

$1.6 = \left(\frac{28}{31n} \times \frac{1000}{315}\right) \times 2.34$

$n \simeq 4$ (A)

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50 $\Delta T_f = i \times m \times K_f = 2 \times 1 \times 1.86 = 3.72$
$\therefore T_f = -3.72°C$ (B)

51 $\Delta T_f = m \times K_f \Rightarrow 0.52 = \left(\frac{6}{M} \times \frac{1000}{100}\right) \times 0.52$
$\Rightarrow M = 60g$ (B)

52 Lowest freezing point will be for the solution having highest ΔT_f.
$\therefore$ (A)

53 $\Delta T_f = m K_f = \frac{342}{342} \times 1.86 = 1.86$
$\therefore T_f = -1.86°C$ (B)

54 $\Delta T_b = i \times m \times K_b = 2 \times 0.1 \times 0.51 = 0.102$
$\therefore T_b = 100 + 0.102 = 101.1°C$ (B)

55 $\Delta T_b = m \times K_b \Rightarrow 0.66 = \left(\frac{3.3}{M} \times \frac{1000}{125}\right) \times 3.28$
$\Rightarrow M = 131.2g$ (D)

56 (C) Refer notes

57 $\Delta T_f = i \times m \times K_f \Rightarrow 0.00558 = i \times 0.001 \times 1.86$
$\Rightarrow i = 3$ $\therefore$ (C)

58 for 2^{nd} salt, $i = 3$

$\therefore$ (B)

59 i for $A_2B_3 = 1 + (5-1)0.6 = 3.4$

$\Delta T_b = i \times m \times K_b = 3.4 \times 1 \times 0.52 = 1.768$

$\therefore T_b = 373 + 1.768 = 374.768$ (D)

60 $K_b = \frac{RT_b^2}{1000 L_v}$

Substituting given values, $K_b = 0.512$ K kg/mol (A)

61 $\Delta T_f = i \times m \times K_f$ —①

$\Delta T_b = i \times m \times K_b$ —②

$\frac{①}{②} \Rightarrow \frac{\Delta T_f}{\Delta T_b} = \frac{K_f}{K_b}$

$\therefore \Delta T_b = 0.0512$ (B)

62 Using $K_b = \frac{RT_b^2}{1000 L_v}$

$\Delta H_{vap} = 33.9$ kJ/mol (B)

63 $\Delta T_f = i \times m \times K_f$

$2.6 = i \times \left(\frac{12.2}{122} \times \frac{1000}{100}\right) \times 5.2$

$\Rightarrow i = \frac{1}{2} = 1 + \left(\frac{1}{n} - 1\right)$

$\Rightarrow n = 2$ (B)

6~~4~~5 Using $\frac{P^\circ - P_s}{P_s} = (\text{molality}) \times \frac{18}{1000}$

$$\frac{296 - P_s}{P_s} = \frac{0.1 \times 18}{1000}$$

$$P_s = 295.466$$

$$\Rightarrow P - P_s = 0.534 \text{ torr} \quad (A)$$

65 Using $\frac{P^\circ - P_s}{P_s} = \frac{n}{N}$

$$\frac{0.25 - P_s}{P_s} = \frac{20}{120} \times \frac{46}{10}$$

$$\Rightarrow P_s = 0.141 \text{ atm} \quad (D)$$

6~~6~~7 Let 'w' gms of glucose is dissolved.
for same lowering in V.P., mole fraction of solute must be equal

$$\therefore \frac{w/180}{w/180 + \frac{100}{18}} = \frac{1/60}{\frac{1}{60} + \frac{50}{18}}$$

$$\Rightarrow w = 6 \text{ gms} \quad (C)$$

68 Refer theory

69 Refer theory

70 $P_T = P_A^\circ X_A + P_B^\circ X_B = (P_A^\circ - P_B^\circ)X_A + P_B^\circ$

$$0.35 = 0.323 X_A + 0.184$$

$$\Rightarrow X_A = 0.5139 \approx 0.514 \quad (A)$$

71 Refer theory

72 Refer theory

73 $P_T = 0.359 \times \frac{1}{5} + 0.453 \times \frac{4}{5} = 0.434$ (D)

74 $P_T = 119 \times \frac{1}{2} + 37 \times \frac{1}{2} = 78$

$Y_{Toluene} = \frac{37 \times 0.5}{.78} = 0.237$ (C)

75 $P_T = 408 \times 0.3 + 141 \times 0.7 = 122.4 + 58.7$

$= 221.1$ torr

$Y_6 = \frac{408 \times 0.3}{221.1} = 0.553$

$Y_7 = 0.446$ ∴ (B)

76 Using $\frac{P^0 - P_S}{P^0} = X_{solute}$

$\frac{30 - P_S}{30} = 0.1$

$\Rightarrow P_S = 27$ mmHg (D)

77 $n_{C_2H_5OH} = \frac{60}{46} = 1.3$

$n_{CH_3OH} = \frac{40}{32} = 1.25$

Using $P_T = P_A^\circ x_A + P_B^\circ x_B = 70 mm$ (A)

78 $84 = 70 \times 0.8 + P_B^\circ (0.2)$

$\Rightarrow P_B^\circ = 140$ (C)

79 as $x_A \to 0$, $x_B \to 1$ $\therefore \frac{P_B^\circ}{x_B} = P_B^\circ = 140$ (C)

80 $P_{AB} = 33x + 94$ $P_{AC} = 81x + 46$

$\Rightarrow P_B^\circ = 94$, $P_C^\circ = 46$, $P_A^\circ = 127$

$P_{ABC} = P_A^\circ x_A + P_B^\circ x_B + P_C^\circ x_C = 80$ (A)

81 Relative lowering in VP $= x_{solute} = 0.0125 = 1/80$

$\Rightarrow$ molality $= \frac{1 \times 1000}{79 \times 18} = 0.7$ (A)

82 as $x_A \to 1$, $P_A \to P_A^\circ = 140 + 120 = 260$ (C)

83 Refer Theory

84 Refer theory

85 $P_T = 100 \times 0.4 + 200 \times 0.6 = 160$

$Y_A = \frac{100 \times 0.4}{160} = 0.25$ (C)

86) Using $\frac{P^\circ - P_s}{P_s} = \frac{n}{N}$

$$\frac{100-95}{95} = \frac{w_1}{M_1} \times \frac{M_2}{w_2}$$

given $\frac{M_2}{M_1} = 0.3$

$\Rightarrow \frac{w_2}{w_1} = 5.7$ (B)

87) $P_T = 120 - 75x_B = 75x_A + 45$

$\Rightarrow P_B^\circ = 45$

$P_A^\circ = 120$ (C)

88) Using $\frac{P^\circ - P_s}{P^\circ} = X_{solute}$

$\frac{10}{P^\circ} = 0.2 \Rightarrow P^\circ = 50$

Also $\frac{20}{P^\circ} = X'_{solute} = 0.4$

$\therefore X'_{solvent} = 0.6$ (C)

89) Refer notes

90) Loss in wt of solution $\propto P_s$

Loss in wt of solvent $\propto P^\circ - P_s$

$\Rightarrow \frac{P^\circ - P_s}{P_s} = \frac{n}{N}$

$\frac{0.04}{2.5} = \frac{5 \times 18}{M \times 180} \Rightarrow M = 31.25g$ (A)