Q1 - 2024 (01 Feb Shift 1)

We have three aqueous solutions of NaCl labelled as ' A ', ' B ' and ' C ' with concentration 0.1M, 0.01M&0.001M, respectively. The value of van t' Haft factor (i) for these solutions will be in the order.

(1) $i_A < i_B < i_C$

(2) $i_A < i_C < i_B$

(3) $i_A = i_B = i_C$

(4) $i_A > i_B > i_C$

Q2 - 2024 (01 Feb Shift 2)

Mass of ethylene glycol (antifreeze) to be added to 18.6 kg of water to protect the freezing point at $-24^{\circ}\mathrm{C}$ is _____ kg (Molar mass in gmol^{-1} for ethylene glycol 62, $\mathrm{K_f}$ of water $= 1.86\ \mathrm{K\ kg\ mol}^{-1}$)

Q3 - 2024 (27 Jan Shift 1)

A solution of two miscible liquids showing negative deviation from Raoult's law will have :

(1) increased vapour pressure, increased boiling point

(2) increased vapour pressure, decreased boiling point

(3) decreased vapour pressure, decreased boiling point

(4) decreased vapour pressure, increased boiling point

Q4 - 2024 (27 Jan Shift 2)

The quantity which changes with temperature is:

(1) Molarity

(2) Mass percentage

(3) Molality

(4) Mole fraction

Q5 - 2024 (29 Jan Shift 1)

A solution of H_2SO_4 is $31.4\% H_2SO_4$ by mass and has a density of $1.25\ g/mL$. The molarity of the H_2SO_4 solution is _____ M (nearest integer)

[Given molar mass of $H_2SO_4 = 98\ g\ mol^{-1}$]

Q6 - 2024 (29 Jan Shift 1)

The osmotic pressure of a dilute solution is 7×10^5 Pa at 273 K. Osmotic pressure of the same solution at 283 K is _____ $\times 10^4 Nm^{-2}$.

Q7 - 2024 (29 Jan Shift 2)

Molality of $0.8M H_2SO_4$ solution (density $1.06\ g\ cm^{-3}$) is _____ $\times 10^{-3}$ m.

Q8 - 2024 (30 Jan Shift 1)

What happens to freezing point of benzene when small quantity of napthalene is added to benzene?

(1) Increases

(2) Remains unchanged

(3) First decreases and then increases

(4) Decreases

Q9 - 2024 (30 Jan Shift 1)

The mass of sodium acetate (CH_3COONa) required to prepare 250 mL of 0.35M aqueous solution is _____ g. (Molar mass of CH_3COONa is $82.02\ g\ mol^{-1}$)

Q10 - 2024 (30 Jan Shift 2)

If a substance ' A ' dissolves in solution of a mixture of ' B ' and ' C ' with their respective number of moles as n_A, n_B and n_C, mole fraction of C in the solution is:

(1) $\frac{n_C}{n_A \times n_B \times n_C}$

(2) $\frac{n_C}{n_A + n_B + n_C}$

(3) $\frac{n_C}{n_A - n_B - n_C}$

(4) $\frac{n_B}{n_A + n_B}$

Q11 - 2024 (30 Jan Shift 2)

The solution from the following with highest depression in freezing point/lowest freezing point is

(1) 180 g of acetic acid dissolved in water

(2) 180 g of acetic acid dissolved in benzene

(3) 180 g of benzoic acid dissolved in benzene

(4) 180 g of glucose dissolved in water

Q12 - 2024 (31 Jan Shift 1)

Identify the mixture that shows positive deviations from Raoult's Law

(1) $(CH_3)_2CO + C_6H_5NH_2$

(2) $CHCl_3 + C_6H_6$

(3) $CHCl_3 + (CH_3)_2CO$

(4) $(CH_3)_2CO + CS_2$

Answer Key

Q1 (1)	**Q2** (15)	**Q3** (4)	**Q4** (1)
Q5 (4)	**Q6** (73)	**Q7** (815)	**Q8** (4)
Q9 (7)	**Q10** (2)	**Q11** (1)	**Q12** (4)

Q1

Salt	Values of i (for different conc. of a Salt)		
	0.1 M	0.01 M	0.001 M
NaCl	1.87	1.94	1.94

1 approach 2 as the solution become very dilute.

Q2

$$\Delta T_f = iK_f \times \text{molality}$$

$$24 = (1) \times 1.86 \times \frac{W}{62 \times 18.6}$$

$$W = 14880\text{gm}$$

$$= 14.880 \text{ kg}$$

Q3

Solution with negative deviation has

$$P_T < P_A 0 X_A + P_B 0 X_B$$

$$P_A < P_A 0 X_A$$

$$P_B < P_B{}^0 X_B$$

If vapour pressure decreases so boiling point increases.

Q4

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solution}}$$

Since volume depends on temperature, molarity will change upon change in temperature.

Q5

$$M = \frac{n_{\text{solute}}}{V} \times 1000$$

$$= \frac{\left(\frac{31.4}{98}\right)}{\left(\frac{100}{1.25}\right)} \times 1000$$

$$= 4.005 \approx 4$$

Q6

$\pi = \mathrm{CRT}$

$\Rightarrow \frac{\pi_1}{\pi_2} = \frac{\mathrm{T}_1}{\mathrm{T}_2}$

$\Rightarrow \pi_2 = \frac{\pi_1\, \mathrm{T}_2}{\mathrm{T}_1} = \frac{7 \times 10^5 \times 283}{273}$

$= 72.56 \times 10^4 \mathrm{Nm}^{-2}$

Q7

$$\mathrm{m} = \frac{\mathrm{M} \times 1000}{\mathrm{d}_{\mathrm{sol}} \times 1000 - \mathrm{M} \times \text{ Molar mass }_{\text{solute}}}$$

$815 \times 10^{-3}\ \mathrm{m}$

Q8

On addition of naphthalene to benzene there is depression in freezing point of benzene.

Q9

Moles = Molarity × Volume in litres

$= 0.35 \times 0.25$

Mass = moles × molar mass

$= 0.35 \times 0.25 \times 82.02 = 7.18\ \mathrm{g}$

Ans. 7

Q10

Mole fraction of $C = \frac{n_C}{n_A + n_B + n_C}$

Q11

$\Delta \mathrm{T_f}$ is maximum when $\mathrm{i} \times \mathrm{m}$ is maximum.

1) $\mathrm{m}_1 = \frac{180}{60} = 3, \mathrm{i} = 1 + \alpha$

Hence

$\Delta \mathrm{T_f} = (1 + \alpha) \cdot \mathrm{k_f} = 3 \times 1.86 = 5.58^{\circ}\mathrm{C} (\alpha < 1)$

2) $\mathrm{m}_2 = \frac{180}{60} = 3, \mathrm{i} = 0.5, \Delta \mathrm{T_f} = \frac{3}{2} \times \mathrm{k_f}' = 7.68^{\circ}\mathrm{C}$

3) $\mathrm{m}_3 = \frac{180}{122} = 1.48, \mathrm{i} = 0.5, \Delta \mathrm{T_f} = \frac{1.48}{2} \times \mathrm{k_f}' = 3.8^{\circ}\mathrm{C}$

4) $m_4=\frac{180}{180}=1, i=1, \Delta T_f=1 \cdot k_f^{\prime}=1.86^{\circ} C$

As per NCERT, $k_f^{\prime}\left(H_2 O\right)=1.86 k \cdot k g m o l^{-1}$

$k_f^{\prime}(\text{ Benzene })=5.12 k \cdot k g m o l^{-1}$

Q12

$(CH_3)_2CO + CS_2$ Exibits positive deviations from Raoult's Law