SHIKSHA CLASSES

Subject : Chemistry **BOARD ANSWER PAPER** **Total Marks : 20**

Class : XII **Topic: 2. Solutions**

Q.1 : A) Select and write the most appropriate answer from given alternatives in each sub-question. [4]

i) Bronze alloy is .... type of solution.

Ans: c) solid in solid

ii) Freezing point of equimolar aqueous solution will be highest from following.

Ans: b) HCl

iii) K_f is depression in freezing point produced by ....

Ans: c) 1 molal solute

iv) Van't Hoff equation is ....

Ans: d) all of these

Q.1 : B) Very short answer type Question. [2]

i) Which of the following solution will have highest boiling point? 0.5M NaCl and 0.5 M $CaCl_2$.

Ans. : 0.5 M $CaCl_2$ solution will have high boiling point than 0.5M NaCl solution

ii) What are isotonic solutions?

Ans. : Solutions which exerts same osmotic pressure are called isotonic solution.

Q.2 : Answer the following question.

(Any three) [6]

i) Define the term concentrated solution and dilute solution.

Ans:Concentrated solutions:

A solution containing relatively more amount of solute in solvent is called concentrated solution.

Dilute solution:

A solution containing relatively less amount of solute in solvent are called dilute solution.

ii) **What is molar depression in freezing point constant ? Give its unit.**

Ans: 1) Depression on freezing point produced by dissolving 1 mole of solute in 1 kg of solvent is called as molar depression in freezing point constant.

2) It is indicated by $K_f = \frac{\Delta T_f}{m}$

3) It is also called cryoscopic constant.

4) Unit is kKg mol^{-1} .

iii) What is effect of pressure on solubility of gas in liquid? Give mathematical equation for it.

Ans: 1) Solubility of gas in liquid increases with increase in pressure.

2) It is given by Henry's law, solubility of gas in liquid is directly proportional to the particle pressure of the gas present above the surface liquid.

$S \propto P$

S = KP (K is Henry's constant.)

iv) Give example of :

a) Gas in liquid solution

b) Solid in solid solution.

Ans:a) **Gas in liquid :**

Oxygen, CO_2 in water

b) **Solid in solid :**

alloys like brass, bronze

Q.3 : Answer the following question.

(Any one) [3]

i) **Derive relation of relative lowering of vapour pressure and mole fraction of solute.**

Ans: If P is vapour pressure of solution, P_1^0 is vapour pressure of pure solvent and x_2 is mole fraction of solute Then relative lowering of vapour pressure is

$$\frac{\Delta P}{P_1^0} = \frac{P_1^0 - P}{P_1^0} = x_2$$

Let W_2g of solute of molar mass M_2 be dissolved in W_1 g. of solvent of molar mass M_1, Hence number of moles of solvent, n_1 and number of moles of solute n_2.

$$n_1 = \frac{W_1}{m_1} \text{ and } n_2 = \frac{W_2}{m_2}$$

The mole fraction of solute.

$$x_2 = \frac{n_2}{n_1 + n_2} = \frac{W_2 / m_2}{W_1 / m_1 + W_2 / m_2}$$

$$\therefore \quad \frac{\Delta P}{P_1^0} = \frac{P_1^0 - P}{P_1^0} = x_2 = \frac{W_2 / m_2}{W_1 / m_1 + W_2 / m_2}$$

For dilute solution $n_1 >> n_2$

$\therefore$ n_2 may be neglected.

$$\frac{\Delta P}{P_1^0} = \frac{P_1^0 - P}{P_1^0} = \frac{W_2 / m_2}{W_1 / m_1}$$

$$\frac{\Delta P}{P_1^0} = \frac{W_2 m_1}{W_1 m_2}$$

$$\therefore m_2 = \frac{W_2 \times m_1 \cdot P_1^0}{\Delta P \times W_1}$$

ii) **The normal boilling point of ethyl acetate is 77.06^0C. A solution of 50g of a nonvolatile solute in 150g of ethyl acetate boils at 84.27^0C. Evaluate the molar mass of solute if K_b for ethyl acetate is 2.77^0C kg mol^{-1}.**

Ans: Given data :

$W_2 = 50$ g $\qquad W_1 = 150$ g

$$\Delta T_b = T_b - T_b^0 = 84.27^0 C - 77.06^0 C$$

$$= 7.21^0 C = 7.21 \text{ K}$$

So $K_b = 2.77^0$C kg mol^{-1}

$= 2.77$ K kg mol^{-1}

We know that $M_2 = \frac{K_b \cdot W_2 \times 1000}{\Delta T_b \cdot W_1}$

$$M_2 = \frac{1000 \text{g kg}^{-1} \times 2.77 \text{ kg mol}^{-1} \times 50 \text{ g}}{7.21 \text{ K} \times 150 \text{g}}$$

$$\boxed{M_2 = 128 \text{ g mol}^{-1}}.$$

Q.4 : Answer the following question.

(Any one) **[5]**

i) **a) Define ebullioscopic constant and its formula and units.**

Ans: Ebullioscopic constant is the

Boiling point elevation

Produced by 1 molal solution.

Formula $K_b = \frac{\Delta T_b}{m}$

Unit $\frac{K}{\text{mol kg}^{-1}} = \text{K kg mol}^{-1}$

b) 10 g of substance dissolved in 100 gm of water. The boiling point raised by 1^0C. Calculate molecular weight of substance ($K_b = 0.50$)

Ans: Given

$W_2 = 10$ g

$W_1 = 100$ g

$\Delta T_b = 1^0$ C

$K_b = 0.50$

$M_2 = ?$

$$\Delta T_b = K_b \times \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$M_2 = \frac{K_b \times W_2 \times 1000}{\Delta T_b \times W_1}$$

$$= \frac{0.5 \times 10 \times 1000}{1 \times 100}$$

$$= \frac{5000}{100} = 50 \text{ g mol}^{-1}$$

ii) a) Derive the equation of molar mass of solute from Boilling point elevation.

Ans: Let W_2 grams of solute having molar mass M_2 dissolved in W_1 grams of solvent having molar mass M_1 to form a dilute solution.

The expression for elevation in B.P. is

$$\Delta T_b = K_b \times m$$

But,

molality (m)

$$= \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$\therefore \Delta T_b = K_b \times \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$\therefore M_2 = \frac{K_b \times W_2 \times 1000}{\Delta T_b \times W_1}$$

b) Osmotic pressure of solution containing 6.8×10^{-3} Kg of protein per 1×10^{-4} m^3 of solution is 3.02×10^3 Pa at 37^0C. Calculate molar mass of protein. (R = 8.314JK $^{-1}$ mol^{-1})

Ans: **Given :**

$\pi = 3.02 \times 10^3$ *Pa*

$W_2 = 6.8 \times 10^{-3}$ kg

$W_1 = 1 \times 10^{-4}$ m^3

$T = 37 + 273$ K $= 310$ K

$R = 8.314$ JK^{-1}mol^{-1}.

$$M_2 = \frac{W_2}{\pi} \frac{RT}{V}$$

$$= \frac{6.8 \times 10^{-3} \times 8.314 \times 310}{3.02 \times 10^3 \times 1 \times 10^{-4} \text{ m}^3}$$

$= 58.06$ g mol^{-1}.

* * *


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