Solutions

Weightage = 7 Marks **1 Mark – 2Q** **5 Marks – 1Q**

I. Answer the following questions. Each question carries one mark.

1. Ornamental gold is an example for what type of solution?
   Ans : Solid Solution
2. Define Molality of a solution.
   Ans : Number of moles of a solute dissolved in 1 Kg of the solvent.
3. Define Molarity of a solution.
   Ans : Number of moles of a solute present in one litre of the solution.
4. How does molarity varies with temperature?
   Ans : Molarity decreases with increase in temperature.
5. What is the effect temperature on molality?
   Ans : Molality does not change with temperature.
6. Out of Molality and Molarity which is temperature dependent?
   Ans : Molarity
7. What is the effect of rise in temperature on the solubility of a gas in liquid?
   Ans : Solubility decreases
8. What is the effect of increase in pressure on the solubility of a gas in liquid?
   Ans : Solubility increases
9. Aquatic animals are more comfortable in cold water than in warm water. Give reason.
   Ans : Solubility of oxygen is more in cold water.
10. State Henry's law.
    Ans : At constant temperature the parital pressure of the gas in vapour phase is proportional to the mole fraction of the gas in solution.
11. Write the mathematical form of Henry's law.
    Ans : $P = K_H \lambda_g$
12. Name the law behind the dissolution of CO_2 in gas in soft drinks under pressure.
    Ans : Henry's law
13. Soda water bottles are sealed under high pressure. Give reason.
    Ans : To increase solubility of the gas in liquid.
14. At a given temperature O_2 gas is more soluble in water than N_2 gas. Which one of them has higher value of K_H?
    Ans : N_2
15. State Raoult's law of binary solution for two volatile components.
    Ans : For a solution containing two volatile liquids the partial pressure of each component is directly proportional to its mole fraction.
16. What are ideal solutions?
    Ans : Solutions which obey Raoult's law over the entire range of concentration are known as ideal solutions.
17. How does volume change on mixing two volatile liquids to form an ideal solution?
    Ans : No change in volume or $\Delta V_{mix} = 0$
18. On what factor the value of colligative property depends?
    Ans : Colligative property depends on the number of solute particles.

19. 10ml of liquid A is mixed with 10ml of liquid B. The volume of resultant solution is 19.9ml. What type of deviation is expected from Raoult's law?
    Ans : Negative deviation
20. What are isotonic solutions?
    Ans : Two solutions having same osmotic pressure at a given temperature are called isotonic solutions.
21. What is hypertonic solution?
    Ans : A solution having higher osmotic pressure than the other solution is called hypertonic solution.
22. What is hypotonic solution?
    Ans : A solution having lower osmotic pressure than the other solution is called hypotonic solution.
23. How does the size of blood cells changes when placed in an aqueous solution containing more than 0.9 %(m/v) sodium chloride.
    Ans : Size of blood cells decreases/ shrinks
24. How does the size of blood cells changes when placed in an aqueous solution containing les than 0.9% (m/v) sodium chloride?
    Ans : Size of blood cells increases / swells.
25. What is osmotic pressure?
    Ans : The external pressure applied on the concentrated solution to stop omosis is called osmotic pressure.

TWO MARK QUESTIONS :

26. What happens to the solubility of a gas in liquid with increase in temperature? Give reason.
    Ans : Decreses, because dissolution of a gas in liquid is an exothermic process.
27. Give any two applications of Henry's law
    Ans : i) It is used in the preparation of carbonated beverages.
    ii) It is used by scuba divers for respiration.
28. Write any two differences between ideal and non-ideal solutions,
    Ans :

Ideal solution	Non-Ideal solution
i) Obey's Raoult's law	i) Does not obey Raoult's law
ii) $\Delta V_{mix} = 0$	ii) $\Delta V_{mix} \neq 0$
iii) $\Delta H_{mix} = 0$	iii) $\Delta H_{mix} \neq 0$
iv) Do not form azeotropes	iv) form azeotropes

29. What are azeotropes? Give an example
    Ans : Binary liquid mixtures have same composition in liquid and vapour phase and boil at constant temperature are called azeotropes.
    Ex : 95.5% ethanol + 4.5 % water.
30. What is minimum boiling azeotrope? Give an example.
    Ans : Solution shows large positive deviation from Raoult's law
    Ex : 95.5% ethanol + 4.5 % water
31. What is maximum boiling azeotrope? Give an example.
    Ans : Solution shows large positive deviation from Raoult's law

Ex : 68% HNO_3+32%water

32. State Raoult's law of relative lowering of vapour pressure
Ans : It states that " In a solution containing non volatile solute the relative lowering vapour pressure is equal to mole fraction of the solute."

$$\frac{P^0-P}{P^0} = \chi_2$$

33. What is reverse osmosis? Mention any one of its use.
Ans : If the external pressure greater than osmotic pressure is applied on the solution, solvent molecules flow from solution to solvent through semi permeable membrane is called reverse osmosis.
It is used in desalination of sea water.

THREE MARK QUESTIONS :

34. 5.8g of a non volatile solute was dissolved in 100g of carbon disulphide (CS_2). The vapour pressure of the solution was found to be 190mm of Hg. Calculate the molar mass of the solute. Given the vapour pressure of pure CS2 is 195mm of Hg. Molar mass of CS_2 – 76gmol^{-1}

Ans : $M_2 = \frac{W_2M_1}{W_1\left(\frac{P^0-P}{P^0}\right)} = \frac{W_2M_1P^0}{W_1(P^0-P)} = \frac{5.8 \times 76 \times 195}{100 \times (195-190)}$ =171.91g mol^{-1}

35. The boiling point of benzene is 353.23K when 1.80g of a non-volatile solute was dissolved in 90g of benzene, the boiling point raised to 354.11K. Calculate the molar mass of the solute.
[K_b for benzene = 2.53K kg mol^{-1}]

Ans : $\Delta T_b = T_b - T_b^0 = 354.11K - 353.23 = 0.88K$

$$M_2 = \frac{K_b \times W_2 \times 1000}{\Delta T_b \times W_1} = \frac{2.53 \times 1.8 \times 1000}{0.88 \times 90} = 57.5 \text{gmol}^{-1}$$

36. 12.6 g of a non volatile electrolyte is dissolved in 75g of water. The freezing point of this solution is 271.9K. If molar depression constant is 1.86K kg mol^{-1}. Calculate the molar mass of solute. (Freezing point of pure water=273.15k)

Ans : $\Delta T_f = T_f^0 - T_f = 273.15 - 271.9 = 1.25K$

$$M_2 = \frac{K_f \times W_2 \times 1000}{\Delta T_f \times W_1} = \frac{1.86 \times 12.6 \times 1000}{1.25 \times 75} = 250 \text{ gmol}^{-1}$$

37. 300 Cm^3 of an aqueous solution of a protein contains 2.12g of the protein. The osmotic pressure of such a solution at 300K is found to be 3.89x10^{-3} bar. Calculate the molar mass of the protein. [R=0.0823Lbarmol^{-1}K^{-1}]
Ans :

$$M_2 = \frac{W_2RT}{\pi V} = \frac{2.12 \times 0.0823 \times 300}{3.89 \times 10^{-3} \times 0.3} = 44.852.44 \text{ gmol}^{-1}$$

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