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Answers Key:

5 Marks

1. (a) Van't Hoff factor (i) is the ratio of natural molecular mass (M_n) to the observed molecular mass (M_0)
   $i = \frac{M_n}{M_0}$
   (i) Now, i >1 when $M_n > M_0$. This can happen in case of electrolytes when the solute undergoes dissociation in solution and thus corresponds to lower value of molecular mass that is observed .from measurement of colligative property.
   (ii) i = 1 when $M_n = M_0$. This can occur if the solute does not undergo dissociation or association in solution.
   (iii) i < 1 when $M_n < M_0$. This can happen if the solute undergoes association in solution so that the value of observed molecular mass becomes larger.
   (b)$\Delta T_b = \frac{K_b W_B \times 10^3}{M_B \times W_A}$
   Now, if W_B is doubled and W_A is halved, the value of ΔT_b will becomes four times the original value.
2. (i) Neeru's mother wanted to make the vegetables fresh so, they can easily be peeled, cut and cooked.
   (ii) The phenomenon of the flow of solvent through a semipermeable membrane from pure solvent to the solution is known as osmosis.
   (iii) The process would be accelerated with increase of temperature as osmosis becomes faster with increase of temperature.
   (iv) Neeru's mother is an intelligent and responsible home-maker.
3.

Ideal solution	Non Ideal solution
It obeys Raoult's law over the entire range of concentration.	It does not obeys Raoult's law
Total vapour pressure of solution is the sum of vapour pressure of individual components.	Total vapour pressure of solution is not equal to the sum of vapour pressure of individual components.
Solute - solvent interactions are nearly same as in pure solvent.	Solute-solvent interactions are not same as solute-solute or solvent--solvent interactions.

3 Marks

4. **Maximum boiling azeotropes**
   Maximum boiling azeotropes are those which boil at a higher temperature than the boiling point of each component in a pure state, e.g., 68 % nitric acid and 32 % water by mass.
   Minimum boiling azeotropes
   Minimum boiling azeotropes are those which boil at a lower temperature than boiling point of each component in the pure state, e.g., 95.5 % ethyl alcohol and 4.5 % water by mass.
5. (i) For dilute solutions the elevation of boiling point (ΔT_b) is directly proportional to the molal concentration of the solute in a solution. Thus. $\Delta T_b \propto m$. or $\Delta T_b = K_b m$. Here m (molality) is the number of moles of solute dissolved in 1 kg of solvent and the constant of proportionality, K_b is called Boiling Point.
   (ii) The elevation in the boiling point is given by the expression $\Delta T_b = K_b.m$ -----(1)
   The molality is given by the expression $m = \frac{W_2}{M_2 W_1}$ .....(2)
   Substitute equation (2) in equation (1)
   $\Delta T_b = K_b . \frac{W_2}{M_2 W_1}$
   Hence, the expression for the molar mass of the solute is
   $M_2 = \frac{K_b W_2}{\Delta T_b W_1}$
6. Henry's law : It states that at constant temperature, the solubility of a gas in a liquid is directly proportional to the pressure of the gas.
   Applications : It is used
   (i) in the production of carbonated beverages
   (ii) in the deep sea diving
   (iii) in the function of lungs.

2 Marks

7. It is the extra pressure which must be applied on solution side so as to prevent the flow of solvent molecules from solution through semi-permeable
8. Mole fraction of a substance is defined as the ratio of number of moles of substance to the total number of moles of solute and solvent.
9. Molal Elevation Constant (Ebullioscopic Constant:) It is equal to elevation in boiling point of 1 molal solution, i.e. 1 mole of solute is dissolved in 1 kg of solvent. It is also called ebullioscopic constant. The units of k_b is K/m or ^oC/m or K kg mol^{-1}, where 'm' is molality.
10. **Reverse Osmosis:** If extra pressure is applied on the solution side and exceeds the osmotic pressure, the osmosis can be reversed. That is, pure water can be forced out of the solution to pass through the pores of the membrane in the opposite direction. This is called reverse osmosis.
11. Henry's Law: It states that the partial vapour pressure of gas in vapour phase(g) is directly proportional to the mole fraction of the gas in the solution.
    Applications of Henry's Law:
    (i) To minimise the painful effects accompanying the decompression of deep sea divers, oxygen diluted with less soluble helium gas is used as breathing gas.
    (ii) To increase the solubility of CO_2 in soft, drinks and soda water, the bottle is sealed under high pressure.