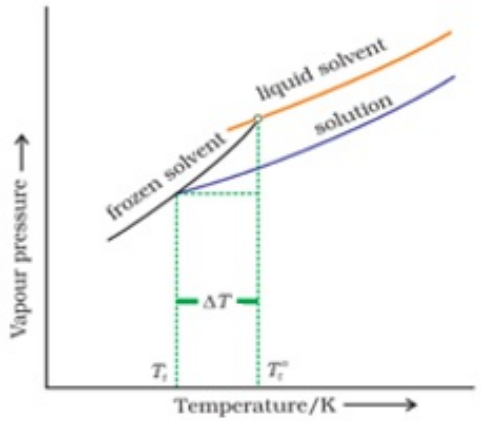
CBSE Test Paper-03

Class - 12 Chemistry (Solutions)

1. Which of the following types of compounds will have Vant Hoff factor = 1?
   a. strong electrolytes
   b. None of these
   c. non electrolytes
   d. weak electrolytes
2. The sum of all mole fraction for a mixture is always equal to
   a. 0
   b. 1
   c. 3
   d. 2
3. The e.m.f of the cell in which the reaction:

   $2Ag^+(aq) + H_2(g) \rightarrow 2Ag(s) + 2H^+(aq)$

   Occurs is 0.80 V. The standard reduction potential of Ag^+ / Ag electrode is:
   a. 0.80 V
   b. -0.40 V
   c. -0.80 V
   d. 0.40 V
4. The following graph shows



   a. Depression in freezing point of the solvent
   b. Relative lowering of vapour pressure

c. Elevation in boiling point of the solvent
d. Osmotic pressure

5. The boiling point of a solvent containing a non-volatile solute:
   a. None of these
   b. does not change
   c. is elevated
   d. is depressed
6. What is meant by reverse osmosis?
7. What do you expect to happen when Red Blood Corpuscles (RBC's) are placed in
   i. 1% NaCl solution
   ii. 0.5% NaCl solution.
8. Define the term colligative properties?
9. A person suffering from high blood pressure should take less common salt, why?
10. Define Henry's law about solubility of a gas in a liquid.
11. State Raoult's law for a binary solution containing volatile components.
12. One litre of sea water weight 1030 g and contains about $6 \times 10^{-3} g$ of dissolved. Calculate the concentration of dissolved oxygen in ppm?
13. Calculate the molarity of each of the following solutions:
    a. 30 g of $Co(NO_3)_2 \cdot 6H_2O$ in 4.3 L of solution
    b. 30 mL of 0.5 M H_2SO_4 diluted to 500 mL.
14. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.
15. Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water?
    i. phenol
    ii. toluene
    iii. formic acid
    iv. ethylene glycol
    v. chloroform
    vi. pentanol.

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1. c. non electrolytes

   Explanation: non electrolytes- since no association or dissociation.

2. b. **Explanation:** $X_A = \frac{N_A}{(N_A+N_B)}$ and $X_B = \frac{N_B}{(N_A+N_B)}$

   So $X_A + X_B = 1$

3. a. 0.80 V

   Explanation: $2Ag^+_{(aq)} + H_{2(g)} \rightarrow 2Ag_{(s)} + 2H^+_{(aq)}$

   Formula: $E_o = E_{cathode} - E_{anode}$

   $E_o = E_{Ag^+/Ag} - E_{H^+/H2} = +0.80-0 = +0.80$ V

   $$\begin{array}{l} At\ Cathode: 2Ag^+ + 2e^- \rightarrow 2Ag\ E_o = +0.80\ V \\ At\ Anode: H_2(g) \rightarrow 2H^+(aq) + 2e^-\ E_o = 0\ V \\ \hline Overall\ Cell\ reaction: 2Ag^+_{(aq)} + H_{2(g)} \rightarrow 2Ag_{(s)} + 2H^+_{(aq)}\ \ E_o = 0.80\ V \end{array}$$

4. a. Depression in freezing point of the solvent

   Explanation: This graph is for depression in freezing point. Freezing point is the temperature at which vapour pressure of pure solid solvent becomes equal to vapour pressure of solution.

5. c. is elevated

   Explanation: When a non volatile solute is added the elevation in BP takes place with decrease in vapour pressure.

6. Reverse osmosis is the process of movement of solvent through a semipermeable membrane from the solution to the pure solvent by applying pressure greater than osmotic pressure on the solution side.

7. i. Red blood cells will shrink due to plasmolysis as the water flows out of the cells. Here the solution is hypertonic.
   ii. Red blood cells will swell and may even burst as the water flows into the cells. Here the solution is hypotonic.

8. The properties which depends upon amount of solute and not upon the nature of

solute are called colligative properties.

9. Common salt contains Na^+ and Cl^- which increase osmotic pressure of blood, therefore increase blood pressure. So an increase in salt intake retains the fluids which raises the blood pressure by increasing the blood volume and can increase the work load on the heart.

10. Henry's law states that the solubility of a gas in a liquid is directly proportional to the pressure of the gas. Alternatively, Henry's law states that,' the mass of a gas dissolved per unit volume of the solvent at a given temperature is proportional to the pressure of the gas in equilibrium with the solution.

11. Raoult's law states that,' At a given temperature, for a solution of volatile liquids,the partial vapour pressure of each volatile component in the solution is directly proportional to its mole fraction or equal to the product of the vapour pressure of the pure component and its mole fraction.

    $P_A = P^0_A X_A$, $P_B = P^0_B.X_B$

    Where P_A and P_B are the partial vapour pressure of volatile component A and B respectively. P^0_A and P^0_B are vapour pressure of pure A and B respectively. X_A and X_B are mole fraction of A and B respectively.

12. Mass of $O_2 = 6 \times 10^{-3} g$

    ppm of O_2 in 10^{30} g sea water = $\frac{\text{mass of } o_2}{\text{mass of sea water}} \times 10^6$

    $= \frac{6 \times 10^{-3}}{1030} \times 10^6 = 5.8 \text{ppm}.$

13. Molarity is given by:$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume solution in litre}}$

    1. Molar mass of $Co(NO_3)_2\ 6H_2O$ = 59 + 2 (14 + 3 × 16) + (6 × 18)= 291 g mol^{-1}

       Therefore, Moles of $Co(NO_3)_2 \cdot 6H_2O = \frac{30}{291} mol$

       = 0.103 mol

       Therefore, molarity $= \frac{0.103 mol}{4.3 L}$

       = 0.023 M

    2. Number of moles present in 1000 mL of 0.5 M H_2SO_4 = 0.5 mol

       ∴ Number of moles present in 30 mL of 0.5 M $H_2SO_4 = \frac{0.5 \times 30}{1000} mol$

= 0.015 mol

Therefore, molarity= $\frac{0.015}{0.5\,L} mol$

= 0.03 M

14. Given, vapour pressure is reduced to 80% when non-volatile solute is dissolved in octane. It means

if $p_1^0 = 100\,atm\,, then\, p_1 = 80\,atm.$

$M_B = 40\,g\,mol^{-1}, w_A = 114g$

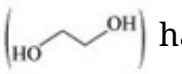
and $M_1\,(C_8H_{18}) = 114\,g\,mol^{-1}$

$$\frac{p_1^0 - p_1}{p_1^0} = \frac{\frac{w_B}{M_B}}{\frac{w_B}{M_B} + \frac{w_A}{M_A}}$$

$$\frac{100-80}{100} = \frac{\frac{w_B}{40}}{\frac{w_B}{40} + \frac{114}{114}}$$

$$0.2 = \frac{w_B}{w_B + 40}$$

$$w_B = 10g.$$

15. i. Phenol (C_6H_5OH) has the polar group -OH and non-polar group $-C_6H_5$. Thus, phenol is partially soluble in water.
    ii. Toluene $(C_6H_5 - CH_3)$ has no polar groups. Thus, toluene is insoluble in water.
    iii. Formic acid $(HCOOH)$ has the polar group -OH and can form H-bond with water. Thus, formic acid is highly soluble in water.
    iv. Ethylene glycol  has polar -OH group and can form H-bond. Thus, it is highly soluble in water.
    v. Chloroform is insoluble in water.
    vi. Pentanol $(C_5H_{11}OH)$ has polar -OH group, but it also contains a very bulky non-polar $-C_5H_{11}$ group. Thus, pentanol is partially soluble in water.