Solutions

Short Answer Type Questions

1. Components of a binary mixture of two liquids A and B were being separated by distillation. After some time separation of components stopped and composition of vapour phase became same as that of liquid phase. Both the components started coming in the distillate. Explain why this happened.

2. Explain why on addition of 1 mol of NaCl to 1 litre of water, the boiling point of water increases, while addition of 1 mol of methyl alcohol to one litre of water decreases its boiling point.

3. Explain the solubility rule "like dissolves like" in terms of intermolecular forces that exist in solutions.

4. Concentration terms such as mass percentage, ppm, mole fraction and molality are independent of temperature, however molarity is a function of temperature. Explain.

5. hat is the significance of Henry's Law constant K ?

6. Why are aquatic species more comfortable in cold water in comparison to warm water?

7. (a) Explain the following phenomena with the help of Henry's law.
   (i) Painful condition known as bends.
   (ii) Feeling of weakness and discomfort in breathing at high altitude.
   (b) Why soda water bottle kept at room temperature fizzes on opening?

8. Why is the vapour pressure of an aqueous solution of glucose lower than that of water?

9. How does sprinkling of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process.

10. What is "semi permeable membrane"?

11. Give an example of a material used for making semipermeable membrane for carrying out reverse osmosis.

Matching Type Questions

Note : In the following questions match the items given in Column I and Column II.

1. Match the items given in Column I and Column II.

Column I	Column II
(i) Saturated solution	(a) Solution having same osmotic pressure at a given temperature as that of given solution.
(ii) Binary solution	(b) A solution whose osmotic pressure is less than that of another.
iii) Isotonic solution	(c) Solution with two components.
iv) Hypotonic solution	(d) A solution which contains maximum amount of solute that can be dissolved in a given amount of solvent at a given temperature.
(v) Solid solution	(e) A solution whose osmotic pressure is more than that of another.
vi) Hypertonic	(f) A solution in solid phase.

solution	(y) A solution in solid phase.

2. Match the items given in Column I with the type of solutions given in Column II.

Column I	Column II
(i) Soda water	(a) A solution of gas in solid
(ii) Sugar solution	(b) A solution of gas in gas
iii) German silver	(c) A solution of solid in liquid
iv) Air	(d) A solution of solid in solid
(v) Hydrogen gas in palladium	(e) A solution of gas in liquid
	(f) A solution of liquid in solid

3. Match the laws given in Column I with expresions given in Column II.

Column I	Column II
(i) Raoult's law	(a) $\Delta T_f = K_f m$
(ii) Henry's law	(b) $\Pi = CRT$
(iii) Elevation of boiling point	(c) $p = x_1 p_1^\circ + x_2 p_2^\circ$
(iv) Depression in freezing point	(d) $\Delta T_b = K_b m$
(v) Osmotic pressure	(e) $p = K_H x$

4. Match the terms given in Column I with expressions given in Column II.

Column I	Column II
(i) Mass percentage	(a) $\dfrac{\text{Number of moles of the solute component}}{\text{Volume of solution in litres}}$
(ii) Volume percentage	(b) $\dfrac{\text{Number of moles of a component}}{\text{Total number of moles of all the components}}$
(iii) Mole fraction	(c) $\dfrac{\text{Volume of the solute component in solution}}{\text{Total volume of solution}} \times 100$
(iv) Molality	(d) $\dfrac{\text{Mass of the solute component in solution}}{\text{Total mass of the solution}} \times 100$
(v) Molarity	(e) $\dfrac{\text{Number of moles of the solute components}}{\text{Mass of solvent in kilograms}}$

Assertion and Reason Type Questions

Note : In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(i) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(ii) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(iii) Assertion is correct statement but reason is wrong statement. (iv) Assertion and reason both are incorrect statements.
(v) Assertion is wrong statement but reason is correct statement.

1. **Assertion :** Molarity of a solution in liquid state changes with temperature.
   Reason : The volume of a solution changes with change in temperature.
2. **Assertion :** When methyl alcohol is added to water, boiling point of water increases.
   Reason : When a volatile solute is added to a volatile solvent elevation in boiling point is observed.
3. **Assertion :** When NaCl is added to water a depression in freezing point is observed.
   Reason : The lowering of vapour pressure of a solution causes depression in the freezing point.
4. **Assertion :** When a solution is separated from the pure solvent by a semi- permeable membrane, the solvent molecules pass through it from pure solvent side to the solution side.
   Reason : Diffusion of solvent occurs from a region of high concentration solution to a region of low concentration solution.

Long Answer Type Questions

1. Define the following modes of expressing the concentration of a solution. Which of these modes are independent of temperature and why?
    - (i) w/w (mass percentage)
    - (ii) V/V (volume percentage)
    - (iii) w/V (mass by volume percentage)
    - (iv) ppm. (parts per million)
    - (v) x (mole fraction)
    - (vi) M (Molarity)
    - (vii) m (Molality)

2. Using Raoult's law explain how the total vapour pressure over the solution is related to mole fraction of components in the following solutions.
    - (i) $CHCl_3$ (l) and CH_2Cl_2(l)
    - (ii) NaCl(s) and H_2O (l)

3. Explain the terms ideal and non-ideal solutions in the light of forces of interactions operating between molecules in liquid solutions.

4. Why is it not possible to obtain pure ethanol by fractional distillation? What general name is given to binary mixtures which show deviation from Raoult's law and whose components cannot be separated by fractional distillation. How many types of such mixtures are there?

5. When kept in water, raisin swells in size. Name and explain the phenomenon involved with the help of a diagram. Give three applications of the phenomenon.

6. Discuss biological and industrial importance of osmosis.

7. How can you remove the hard calcium carbonate layer of the egg without damaging its semiprermiable membrane? Can this egg be inserted into a bottle with a narrow neck without distorting its shape? Explain the process involved.

8. Why is the mass determined by measuring a colligative property in case of some solutes abnormal ? Discuss it with the help of Van't Hoff factor.