Chapter-2

Solutions Marks 4 with option 6

Multiple choice questions (1 Mark)

1. Sugar dissolves in water because
   a. sugar is nonpolar
   b. water is polar
   c. it forms hydrogen bonding with water
   d. sugar and water are both polar

2. The solubility of a gas in water
   a. decreases with increase in temperature
   b. increases with increase in temperature
   c.decreases with decrease in temperature
   d. is not affected by temperature

3. The units of Henry's law constant are
   a. bar dm^3 mol^{-1}
   b. mol L^{-1} bar^{-1}
   c. L mol^{-1} bar^{-1}
   d. bar L^{-1} mol^{-1}

4. The colligative properties of solutions
   a. depend on nature of solute particles
   b. do not depend on number of solute particles
   c. do not depend on dissociation of solute in solvent
   d. **depend on number of solute particles**

5. Which of the following solutions /solvent has maximum vapor pressure ?
   a. 1M copper sulphate solution
   b. pure solvent water
   c. 0.5M copper sulphate solution
   d.2M copper sulphate solution

6. According to Raoult's law, relative lowering of vapor pressure of solution containing dissolved non-volatile solute
   a. is equal to mole fraction of solvent
   b. is equal to mole fraction of solute
   c. does not depend on mole fraction of solute
   d. is equal to molality of solution

7. Freezing point depression constant of a solvent is
   a. inversely proportional to molality of solution
   b. directly proportional to molarity of solution
   c. directly proportional to molality of solution
   d. expressed in K kg mol^{-1}

8. Which of the following statements is applicable for 0.1M urea solution and 0.1M sucrose solution?
   a. osmotic pressure of urea solution is greater than that of sucrose solution
   b. osmotic pressure of sucrose solution is greater than that of the urea solution
   c. sucrose solution is not isotonic with urea solution
   d. both the solutions have the same osmotic pressure

9. The Henry's law constant of a gas is 6.7×10^{-4} mol/(L bar). Its solubility when the partial pressure of the gas at 298 K is 0.65 bar is..
   a.4.355×10^{-4} mol/L
   b. 4.355×10^{-2} mol/L
   c. 2.225×10^{-6} mol/L
   d. 2.225×10^{-2} mol/L

Very short answer questions (1 Mark)

1. What are hypertonic solutions?
2. What is cryoscopic constant?
3. Write the effect of dissolution of a nonvolatile solute on the freezing point of solvent.
4. Write the expression for relative lowering of vapor pressure.
5. State Raoult's law.
6. State Henry's law.
7. What type of solutions exhibit positive deviations from Raoult's law?
8. What is the enthalpy change and volume change on mixing of two components forming an ideal solution?
9. The vapor pressures of pure liquids A and B are 0.600 bar and 0.933 bar respectively, at a certain temperature. What is the mole fraction of solute when the total vapor pressure of their mixture is 0.8 bar?

   (Ans:0.6004)
10. The vapor pressure of a pure liquid is 0.043 bar at a certain temperature. When a nonvolatile solute is dissolved into it, the vapor pressure of the solution is found to be 0.041 bar. What is the relative lowering of vapor pressure? **(Ans:0.0465)**

Short answer questions (Type- I) (2 Marks)

1. For a very dilute solution, the osmotic pressure is given by $\pi = n_2RT/V$ where V is the volume in L containing n_2 moles of nonvolatile solute. Establish the equation for molar mass of solute.
2. Distinguish between ideal and non-ideal solutions.
3. Write two points to explain why vapor pressure of solvent is lowered by dissolving nonvolatile solute into it.
4. In what way K_f and K_b are similar and in what way they are different?
5. Calculate total moles after dissociation in 0.1M KCl solution and 0.05M aluminum sulphate solution.Which of the two solutions will have higher freezing point depression.

   (Ans: KCl=0.2mol, $Al_2(SO_4)_3$= 0.25 mol. Aluminium sulfate solution has higher freezing point depression)
6. When 50 g of a nonvolatile solute is dissolved in a certain quantity of solvent, the elevation of boiling point is 2.0 K. What will be the elevation of boiling point when 30 g of solute is dissolved in the same amount of the same solvent**? (Ans:1.2 K)**
7. The Henry's law constant of methyl bromide (CH_3Br),is 0.159 mol L^{-1} bar $^{-1}$ at 25^0C.What is the solubility of methyl bromide in water at 25^0C and at pressure of 130 mmHg? **(Ans: 0.02755M)**
8. Explain the relationship between van't Hoff factor and degree of dissociation.

Short answer questions (Type- II) (3 Marks)

1. Derive the expression for molar mass of solute in terms of boiling point elevation of solvent.
2. Explain the phenomenon of osmosis with a suitable diagram.
3. Explain with the help of vapor pressure-temperature curves for solution and solvent, why boiling point of solvent is elevated when a nonvolatile solute is dissolved into it.
4. A solution containing 3 g of solute A (M=60 g/mol) in 1L solution is isotonic with a solution containing 8.55 g of solute B in 500 mL solution. What is the molar mass of B? **(Ans:342 g/mol)**
5. The vapor pressure of a pure solvent(water) at a certain temperature is 0.0227 bar. What is the vapor pressure of a solution containing 6 g of solute (M=60 g/mol) in 50 g of solvent? **(Ans:0.02188 bar)**
6. Explain the relationship between van't Hoff factor and degree of dissociation.

Long answer questions (4 Marks)

1. What are non-ideal solutions? Explain with reasons and diagrams the positive and negative deviations from Raoult's law shown by non-ideal solutions.
2. Explain with vapor pressure-temperature curves that the freezing point of a solvent is lowered by dissolving a nonvolatile solute into it. Give a reason for such lowering of freezing of solvent.
3. Definefollowing terms a) Reverse Osmosis b) Semi permeable membrane c) Osmotic pressure d) Isotonic solution.