CLASS-12
CHAPTER-SOLUTIONS
TOPICS-COLLIGATIVE PROPERTIES AND VAN'T HOFF FACTOR

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S No.	QUESTIONS
1.	A 4% solution (w/w) of sucrose (M = 342 g mol^{-1}) in water has a freezing point of 271.15 K. Calculate the freezing point of 5% glucose (M = 180 g mol^{-1}) in water. (Given : Freezing point of pure water = 273.15 K)
2.	Give reasons : (a) Cooking is faster in pressure cooker than in cooking pan. (b) Red Blood Cells (RBC) shrink when placed in saline water but swell in distilled water.
3.	A solution containing 1·9 g per 100 mL of KCl (M = 74·5 g mol^{-1}) is isotonic with a solution containing 3 g per 100 mL of urea (M = 60 g mol^{-1}). Calculate the degree of dissociation of KCl solution. Assume that both the solutions have same temperature.
4.	Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g/mol) in 250 g of water. (K_f of water = 1·86 K kg mol^{-1})
5.	Give reasons for the following : (a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers. (b) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.
6.	A 10% solution (by mass) of sucrose in water has a freezing point of 269·15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273·15 K. Given : (Molar mass of sucrose = 342 g mol^{-1}) (Molar mass of glucose = 180 g mol^{-1})
7.	30 g of urea (M = 60 g mol^{-1}) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23·8 mm Hg.
8.	What are colligative properties? Write the colligative property which is used to find the molecular mass of macromolecules.
9.	Calculate the boiling point of solution when 4 g of $MgSO_4$ (M=120 g/mol) was dissolved in 100 g of water, assuming $MgSO_4$ undergoes complete ionization. (K_b for water=0.52 K kg mol^{-1})
10.	Calculate the freezing point of solution when 1.9 g of $MgCl_2$ (M=95 g/mol) was dissolved in 50g of water, assuming $MgCl_2$ undergoes complete ionization. (K_f for water=1.86 K kg mol^{-1}).
11.	When 2.56 g of Sulphur was dissolved in 100 g of CS_2, the freezing point lowered by 0.383 K. Calculate the formula of sulphur (S_x) (molar mass of S = 32 g/mol). (K_f for CS_2=3.83 K kg mol^{-1})

12.	Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing. (i) 1.2% sodium chloride solution? (ii) 0.4% sodium chloride solution?
13.	A solution is prepared by dissolving 10g of non-volatile solute in 200g of water. It has a vapour pressure of 31.84 mm Hg at 308K. Calculate the molar mass of the solute. (Vapour pressure of pure water at 308K = 32 mm Hg)
14.	A solution containing 15 g urea (molar mass = 60 g/mol) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molarmass = 180 g/mol) in water. Calculate the mass of glucose present in one litre of its solution.
15.	Calculate the mass of compound (molar mass =256 g/mol) to be dissolved in 75 g of benzene to lower its freezing point by 0.48 K. (K_f=5.12 K kg mol^{-1})
16.	18 g of glucose, (M=180 g/mol) is dissolved in 1 kg of water in a sauce pan. At what temperature will this solution boil?
17.	Determine the osmotic pressure of a solution prepared by dissolving 2.5 x 10^{-2} g of K_2SO_4 (M=174 g/mol) in 2L of water at 25 °C, assuming that it is completely dissociated. (R=0.0821 L atm K^{-1} mol^{-1})
18.	A 1.00 molal aqueous solution of trichloroactic acid (CCl_3COOH) is its boiling point. The solution has the boiling point of 100.18°C. Determine the Van't Hoff factor for trichloro-acetic acid. (K_b for water=0.52 K kg mol^{-1})
19.	Calculate the amount of KCl which must be added to 1 kg of water so that the freezing point is depressed by 2K. (K_f for water=1.86 K kg mol^{-1}).
20.	Calculate the freezing point of an aqueous solution containing 10.50 g of $MgBr_2$ in 200 g of water. (Molar mass of $MgBr_2$ = 184 g mol^{-1}) (K_f for water=1.86 K kg mol^{-1}).
21.	Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250.0 g of water. (K_b for water=0.52 K kg mol^{-1})
22.	Define the terms, 'osmosis' and 'osmotic pressure'. What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions?
23.	What mass of NaCl be dissolved in 65 g of water to lower the freezing point by 7.5°C? The freezing point depression constant, K_f for water is 1.86 K kg mol^{-1}. Assume van't Hoff factor for NaCl is 1.87.
24.	100 mg of a protein is dissolved in enough water to make 10.0 mL of a solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C, what is the molar mass of protein? (R=0.0821 L atm K^{-1} mol^{-1}) (760 mm Hg=1 atm)
25.	A solution containing 8 g of a substance in 100 g of diethyl ether boils at 36.86 °C, where as pure ether boils at 36.60 °C. Determine the molecular mass of the solute. (K_b for ether=2.02 K kg mol^{-1})

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