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| **D:\CE\WhatsApp Image 2021-05-08 at 4.35.03 PM.jpeg**  **“Cultivating excellence in every student”**    **RAKESH KUMAR**  **M.Sc. (Chemistry) B.Ed.**  **CTET, PSTET, HPTET qualified**  **thakurkumar82@gmail.com** |
| **Class:-XII (Sci.) Name of Student……………………**  **Subject:- Chemistry**  **Chapter-2: SOLUTIONS** |

(Assignment Questions)

**SECTION- A**

(Each question in this section carries 2 marks)

1. Calculate the boiling point of solution when 4 g of 𝑴𝒈𝑺𝑶𝟒 (𝑴 = 𝟏𝟐𝟎 𝒈 𝒎𝒐𝒍−𝟏) was dissolved in 100 g of water, assuming 𝑴𝒈𝑺𝑶𝟒 undergoes complete ionization.

(𝑲𝒃 𝒇𝒐𝒓 𝒘𝒂𝒕𝒆𝒓 = 𝟎.𝟓𝟐 𝑲 𝒌𝒈 𝒎𝒐𝒍−𝟏)

1. (i) On mixing liquid X and liquid Y, volume of the resulting solution decreases. What type of deviation from Raoult’s law is shown by the resulting solution? What change in temperature would be observed after mixing liquids X and Y?

(ii) What happens when we place the blood cell in water (hypotonic solution)? Give reason.

1. Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride.
2. 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?
3. State Raoult’s law for solutions, of volatile liquid components taking a suitable example, explains the meaning of positive deviation from Raoult’s law.
4. Define the term ‘osmotic pressure’. Describe how the molecular mass of a substance can be determined on the basis of osmotic pressure measurement.
5. State Henry's law correlating the pressure of a gas and its solubility in a solvent and mention two applications for the law.
6. Non-ideal solutions exhibit either positive or negative deviations from Raoult’s law. What are these deviations and why are they caused? Explain with one example for each type.
7. 18 g of glucose, 𝐂𝟔𝐇𝟏𝟐𝐎𝟔 (𝐌𝐨𝐥𝐚𝐫 𝐌𝐚𝐬𝐬 = 𝟏𝟖𝟎 𝐠 𝐦𝐨𝐥−𝟏) is dissolved in 1 kg of water in a sauce pan. At what temperature will this solution boil?
8. 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 (𝑲𝒇 = 𝟓.𝟏𝟐 𝑲𝒈 𝒎𝒐𝒍−𝟏)
9. Define an ideal solution and write one of its characteristics.
10. What is meant by positive deviations from Raoult’s law? Given an example? What is the sign of ∆𝐦𝐢𝐱𝐇 for positive deviation?
11. Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult’s law? Give an example.

**SECTION-B**

(Each question in this section carries 3 marks)

1. 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 = 32mm Hg)
2. A solution containing 8 g of a substance in 100 g of diethyl ether boils at 36.86 𝟑𝟔.𝟖𝟔0𝑪, where as pure ether boils at 𝟑𝟔.𝟔𝟎𝟎𝑪. Determine the molecular mass of the solute. (For ether 𝑲𝒃 = 𝟐.𝟎𝟐 𝒌 𝒌𝒈 𝒎𝒐𝒍−𝟏
3. Calculate the temperature at which a solution containing 54 g of glucose, 𝑪𝟔𝑯𝟏𝟐𝑶𝟔, 𝐢𝐧 250 g of water will freeze. [𝑲𝒇𝐟𝐨𝐫 𝐰𝐚𝐭𝐞𝐫 = 𝟏.𝟖𝟔 𝐊 𝐤𝐠 𝐦𝐨𝐥−𝟏]
4. A solution prepared by dissolving 8.95 mg of a gene fragment in 35.0 mL of water has an osmotic pressure of 0.335 torr at 250C. Assuming that the gene fragment is non-electrolyte, calculate its molar mass.
5. Calculate the temperature at which a solution containing 54g of glucose, (C6H12O6), in 250g of water will freeze. (𝐊𝐟 for water = 1.86 K 𝐦𝐨𝐥−𝟏 kg)
6. 100 mg of a protein is dissolved in just enough water to make 10.0 mL of solution. If
   1. this solution has an osmotic pressure of 13.3 mm Hg at 𝟐𝟓𝟎𝑪, What is the molar mass
   2. of the protein? (𝑹 = 𝟎.𝟎𝟖𝟐𝟏 𝑳 𝐚𝐭𝐦 𝐦𝐨𝐥−𝟏 𝐤−𝟏𝐚𝐧𝐝 𝟕𝟔𝟎 𝐦𝐦 𝐇𝐠 = 𝟏 𝐚𝐭𝐦.)
7. A solution prepared by dissolving 1.25 g of oil of winter green (methyl salicylate) in 99.0 of benzene has a boiling point of 80.31 °C. Determine the molar mass of this compound. (B.P. of pure benzene = 80.10 °C and 𝑲𝒃 for benzene = 2.53 °C kg m𝒐𝒍–𝟏)
8. Calculate the amount of KCl which must be added to 1 kg of water so that the freezing point is depressed by 2k. (𝑲𝒇 𝒇𝒐𝒓 𝒘𝒂𝒕𝒆𝒓 = 𝟏.𝟖𝟔 𝑲 𝑲𝒈 𝒎𝒐𝒍−𝟏)
9. 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing points of 1.62 K. Calculate the van’t Hoff factor and predict the nature of solute (associated or dissociated). (Given: Molar mass of benzoic acid = 𝟏𝟐𝟐 𝐠 𝐦𝐨l−𝟏, 𝐊𝐟 for benzene = 4.9 K Kg 𝐦𝐨𝐥−𝟏)
10. A 10% solution (by mass) of sucrose in water has freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water, if 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)

**SECTION – C**

(Each question in this section carries 5 marks)

1. 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)
2. (a) 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. (b) Write two differences between ideal solutions and non-ideal solutions.
3. A solution containing 15 g urea (molar mass = 60 g 𝐦𝐨𝐥−𝟏) per lit-re of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 180 g 𝐦𝐨𝐥−𝟏) in water. Calculate the mass of glucose present in one litre of its solution.
4. (a) What type of deviation is shown by a mixture of ethanol and acetone? Give reason. (b) A solution of glucose (molar mass = 180 g 𝒎𝒐𝒍−𝟏) in water is labeled as 10% (by mass). What would be the molality and molarity of the solution? (Density of solution =1.2𝒎𝑳−𝟏)
5. (a) State Raoult’s law for a solution containing volatile components. How does Raoult’s law become a special case of Henry’s law? (b) 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (𝑲𝒇 for benzene = kg 𝒎𝒐𝒍−𝟏).
6. (a) Define the following terms: (i) Ideal solution (ii) Azeotrope (iii) Osmotic pressure (b) A solution of glucose (𝑪𝟔𝑯𝟏𝟐𝑶𝟔) in water is labeled as 10% by weight. What would be the molality of the solution? (Molar mass of glucose = 180 g 𝒎𝒐𝒍−𝟏)

(b) 15.0 g of an unknown molecular material is dissolved in 450 g of water. The resulting Solution freezes at –𝟎.𝟑𝟒𝟎𝑪. What is the molar mass of the material?

(𝐊𝐟 𝐟𝐨𝐫 𝐰𝐚𝐭𝐞𝐫 = 𝟏.𝟖𝟔 𝐊 𝐤𝐠 𝐦𝐨𝐥−𝟏)

1. A solution of glycerol (𝐂𝟑𝐇𝟖𝐎𝟑) in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 𝟏𝟎𝟎.𝟒𝟐°𝐂. What mass of glycerol was dissolved to make this solution? (𝐊𝐛 for water = 0.512 K kg 𝐦𝐨𝐥−𝟏)
2. 100 mg of a protein is dissolved in enough water to male 10.0 mL of a solution. It this solution has an osmotic pressure of 13.3 mm Hg at 𝟐𝟓𝟎𝑪, what is the molar mass of protein? (𝑹 = 𝟎.𝟎𝟖𝟐𝟏 𝑳 𝒂𝒕𝒎 𝒎𝒐𝒍−𝟏 𝒂𝒏𝒅 𝟕𝟔𝟎 𝒎𝒎 𝑯𝒈 = 𝟏 𝒂𝒕𝒎).
3. (a) What is meant by: Colligative properties (b) what concentration of nitrogen should be present in a glass of water at room temperature? Assume a temperature of 𝟐𝟓𝟎 C, total pressure of 1 atmosphere and mole fraction of nitro gen in air of 0.78 [𝑲𝑯] for nitrogen = 𝟖.𝟒𝟐 × 𝟏𝟎−𝟕𝑴 𝒎𝒎 𝐇𝐠𝐥

(b) Calculate the freezing point of an aqueous solution containing 10.50 g of 𝐌𝐠𝐁𝐫𝟐 in 200 g of water. (Molar mass of 𝐌𝐠𝐁𝐫𝟐 = 𝟏𝟖𝟒 𝐠) (𝐊𝐟 for water = 1.86 K kg 𝐦𝐨𝐥−𝟏)

1. (a) Define the terms osmosis and osmotic pressure. Is the osmotic pressure of a solution a colligative property? Explain.

(b) Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250.0 g of water. (𝐊𝐛 𝐟𝐨𝐫 𝐰𝐚𝐭𝐞𝐫 = 𝟎.𝟓𝟏𝟐 𝐊 𝐤𝐠 𝐦𝐨𝐥−𝟏,𝐌𝐨𝐥𝐚𝐫 𝐦𝐚𝐬𝐬 𝐨𝐟 𝐍𝐚𝐂𝐥 = 𝟓𝟖.𝟒𝟒 𝐠).

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