"Cultivating excellence in every student"

RAKESH KUMAR
M.Sc. (Chemistry) B.Ed.
CTET, PSTET, HPTET qualified

+917973739678
+919814516618
thakurkumar82@gmail.com
http://chemistryexpert.in/

Class:-XII (Sci.) **Name of Student……**
Subject:- Chemistry

Chapter-2: SOLUTIONS
(10 YEAR Questions)

1. What mass of NaCl (molar mass = 58·5 g mol^{-1}) must 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.

2. (a) Differentiate between molarity and molality for a solution. How does a change in temperature influence their values ?

   (b) 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)

   (K_f for water = 1.86 K kg mol^{-1})

   OR

   (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. (K_b for water = 0.512 K kg mol^{-1},

   Molar mass of NaCl = 58.44 g)

3. State the following :
   (i) Raoult's law in its general form in reference to solutions.
   (ii) Henry's law about partial pressure of a gas in a mixture.

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 25° C. Assuming that the gene fragment is a non-electrolyte, calculate its molar mass.**

5. 15·0 g of an unknown molecular material is dissolved in 450 g of water. The resulting solution freezes at −0·34°C. What is the molar mass of the material ? (K_f for water = 1·86 K kg mol^{-1})

OR

Explain the following :

(i) Henry's law about dissolution of a gas in a liquid

(ii) Boiling point elevation constant for a solvent

6. A solution of glycerol ($C_3H_8O_3$) 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 ? (K_b for water = 0·512 K kg mol^{-1})

7. **(a) Define the following terms:**

(i) Molarity (ii) Molal elevation constant (K_b)

(b) A solution containing 15 g urea (molar mass = 60 g mol^{-1}) per litre 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.

8. (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) in ·water is labeled as 10% (by mass). What would ·be the molality · and molarity of the solution? (Density of solution= i .2 g/m*l*)

9. 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})

OR

(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.

10. 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 25° C. Assuming that the gene fragment is a non-electrolyte, calculate its molar mass.

11. 18 g of glucose, $C_6H_{12}O_6$ (Molar Mass = 180 g mol^{-1}) is dissolved in 1 kg of water in a sauce pan. At what temperature will this solution boil ?

(K_b for water = 0.52 K kg mol^{-1}, boiling point of pure water = 373.15 K)

12. Determine the osmotic pressure of a solution prepared by dissolving 2.5×10^{-2} g of K_2SO_4 in 2L of water at 25 °C, assuming that it is completely dissociated.
(R = 0.0821 L atm K^{-1} mol^{-1}, Molar mass of K_2SO_4 = 174 g mol^{-1}).

13. 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point 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)

14. Calculate the freezing· point of the solution when 31 g of ethylene glycol ($C_2H_6O_2$) is dissolved in 500 g of water.(K_f for water= l,·86 K kg mol^{-1})

15. (a) Calculate the freezing point of solution when 1.9 g of $MgCl_2$ (M=95 g mol^{-1}) was dissolved in 50 g of water, assuming $MgCl_2$ undergoes complete ionization. (K_f for water = 1.86 K kg mol^{-1})
(b) (i) Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why? (ii) What happens when the external pressure applied becomes more than the osmotic pressure of solution?

16. (i) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of K_H (Henry's constant) and why ?
(ii) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotropes ?

17. Calculate the boiling point of solution when 4 g of $MgSO_4$ (M = 120 g mol^{-1}) was dissolved in 100 g of water, assuming $MgSO_4$ undergoes complete ionization.
(K_b for water = 0.52 K kg mol^{-1})

18. Write two differences between a solution showing positive deviation and a solution showing negative deviation from Raoult's law.

19. For a 5% solution of urea (Molar mass = 60 g/mol), calculate the osmotic pressure at 300 K. [R = 0·0821 L atm K^{-1} mol^{-1}]

OR

Visha took two aqueous solutions — one containing 7·5 g of urea (Molar mass = 60 g/mol) and the other containing 42·75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z.

20. (i) Write the colligative property which is used to find the molecular mass of macromolecules.
(ii) In non-ideal solution, what type of deviation shows the formation of minimum boiling azeotropes ?

21. 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 KC*l* solution. Assume that both the solutions have same temperature.

22. 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)

23. State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obeys Raoult's law at all concentrations.

24. Calculate the freezing point of an aqueous solution containing 10.5 g of Magnesium bromide in 200 g of water, assuming complete dissociation of Magnesium bromide. (Molar mass of Magnesium bromide = 184 g mol^{-1}, K_f for water = 1.86 K kg mol^{-1}).

25. Why a mixture of Carbon disulphide and acetone shows positive deviation from Raoult's law? What type of azeotrope is formed by this mixture?

26. A solution of glucose (Molar mass = 180 g mol^{-1}) in water has a boiling point of 100·20^{0}C. Calculate the freezing point of the same solution. Molal constants for water K_f and Kb are 1·86 K kg mol^{-1} and 0·512 K kg mol^{-1} respectively.

27. **(a) Calculate the boiling point of solution when 2 g of Na_2SO_4 (M = 142 g mol^{-1}) was dissolved in 50 g of water, assuming Na_2SO_4 undergoes complete ionization. (K_b for water = 0.52 K kg mol^{-1})**

(b) 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).

(K_f for CS_2 = 3.83 K kg mol^{-1} Atomic mass of Sulphur = 32 g mol^{-1})

(c) 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

28. For a 5% solution of urea (Molar mass = 60 g/mol), calculate the osmotic pressure at 300 K. [R = 0·0821 L atm K^{-1} mol^{-1}]

OR

Visha took two aqueous solutions — one containing 7·5 g of urea (Molar mass = 60 g/mol) and the other containing 42·75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z.

29. Calculate the mass of ascorbic acid (Molar mass = 176 g mol^{-1}) to be dissolved in 75 g of acetic acid, to lower its freezing point by 1·5°C. (K_f = 3·9 K kg mol^{-1})

30. (a) A solution contains 5·85 g NaCl (Molar mass = 58·5 g mol^{-1}) per litre of solution. It has an osmotic pressure of 4·75 atm at 27°C. Calculate the degree of dissociation of NaCl in this solution.

(Given : R = 0·082 L atm K^{-1} mol^{-1})

(b) State Henry's law. Why is air diluted with helium in the tanks used by scuba divers ?

OR

(a) When 19·5 g of $F - CH_2 - COOH$ (Molar mass = 78 g mol^{-1}) is dissolved in 500 g of water, the depression in freezing point is observed to be 1°C. Calculate the degree of dissociation of $F - CH_2 - COOH$.

[Given : K_f for water = 1·86 K kg mol^{-1}]

(b) Give reasons :

(i) 0·1 M KCl has higher boiling point than 0·1 M Glucose.

(ii) Meat is preserved for a longer time by salting.

.....