Chapter – 02

Solutions

01. Why does chemist prefer to refer concentration of the solution in terms of molality?

02. When is the value of Van't Hoff factor more than one?

03. Why is an increase in temperature observed on mixing chloroform with acetone?

04. What type of deviation is shown by a mixture of ethanol and acetone? What type of azeotrope is formed by mixing ethanol and acetone?

05. 10 cm^3 of a liquid A was mixed with 10 cm^3 of liquid B. The volume of the resulting solution was found to be 19.9 cm^3. What do you conclude?

06. Two liquids X and Y boil at 110^0C and 130^0C respectively. Which one of the following has a higher vapor pressure at 50^0C?

07. Why the elevation of the boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution

08. How is it that alcohol and water-miscible in all proportions?.

09. What is the sum of the mole fractions of all the components in a three-component system?

10. What is meant by 'reverse osmosis'?

Short Answer Type Questions

11. What is meant by positive deviations from Raoult law? Give an example. What is the sign of $\Delta_{mix}H$ a positive deviation?

12. State Henery's law. Why do gases always tend to be less soluble in liquids as the temperature is raised?

13. State Raoult law for a solution containing volatile components. Name the solution which follows Raoult's law at all concentrations and temperatures.

14. The mixture of chloroform and acetone shows a negative deviation from Raoult's law. Explain.

15. State Raoult law for the solution containing volatile components. What is the similarity between Raoulti law and Henry's law?

16. State Raoult law for a solution containing volatile components. Write two differences between an ideal solution and a non-Ideal solution.

17. State Henry's law for solubility of a gas in a liquid. Explain the significance of Henry's constant (K_H). If at the same temperature, hydrogen is more soluble in water than helium, which of them will have a higher value of K_H, and why?

18. Calculate the freezing point of a solution contain bog of glucose (molar mass = 180 g mol^{-1}) in 250 g of water. $\left(K_f \text{ of water} = 1.86 \text{ K Kg mol}^{-1}\right)$

19. Give reasons for the following

(i) Measurement of the osmotic pressure method is preferred for the determination of macromolecules such as proteins and polymers.

(ii) Aquatic animals are more comfortable in cold water than in warm water.

20. Define azeotropes. What type of azeotrope is formed by a positive deviation from Raoult's law? Givan an example.

Long Answer Type Questions

21. A normal freezing point of nitrobenzene ($C_6H_5NO_2$) is 278.82 K. A 0.25 molal solution of a certain solute in nitrobenzene causes a freezing point depression of 2 degrees. Calculate the value of K_f for nitrobenzene.

22. An aqueous solution freezes at 272.4 K, while pure water freezes at 273.0 K. Determine (i) Molality of solution (ii) Boiling point of solution (iii) lowering of the vapor pressure of water at 298 K. (Given K_f = 1.86 K kg mol^{-1}, K_b = 0.512 K kg mol^{-1} and Vapour pressure of water at 298 K = 23.756 mm Hg.)

23. 3.9 gm of benzoic acid dissolved in 49 gm 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). Give molar mass of benzoic acid = 122 g mol^{-1}, K_f for benzene = 4.9 K kg mol^{-1}.

24. Calculate the amount of $CaCl_2$ (molar mass 111 $g\,mol^{-1}$). Which must be added to 500g of water to lower its freezing point by 2k, assuming that $CaCl_2$ is completely dissociated. (K_f for water = 1.86 K $kg\ mol^{-1}$).

25. At 300 K, 36 g glucose present per liter in its solution has osmatic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bar, at the same temperature, what would be its concentration?

26. Urea forms an ideal solution in water. Determine the vapor pressure of an aqueous solution containing 10% by mass of urea at 40^0C (Vapour pressure of water at 40^0C = 55.3 mm Hg).

27. (i) 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 = $342\ \mathrm{g\,mol^{-1}}$)(molar mass of glucose = $180\ \mathrm{g\,mol^{-1}}$)

(ii) Define the following terms.

(a) Molality (m) (b) Abnormal molar mass

28. 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 7.5^0C? 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.

29. (i) 30g of urea $\left(\mathrm{M = 60g\ mol^{-1}}\right)$ is dissolved in 846 g of water. Calculate the vapor pressure of water for this solution if the vapor pressure of pure water at 298 K is 23.8 mm Hg.

(ii) Write two difference between the ideal solution and non-ideal solution

30. 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 torrs $25^0\mathrm{C}$. Assuming that the gene fragment is a non-electrolyte, calculate molar mass.