Chapter-2 SOLUTIONS

[MCQ'S – 1, FB – 1, 2M – 1, 3M – 3 (1T, 2NP)]

MCQ'S AND FB:

1. Name one concentration which is independent of temperature.
2. What is a colligative property?
3. What is the effect of increase in pressure on the solubility of a gas in a liquid?
4. What is the effect of increase in temperature on the solubility of a gas in a liquid?
5. What does the Van't Hoff factor ' i ' for a solute in a solvent account for?
6. What is the conclusion drawn when the vantHoff's factor
7. What is the only factor on which colligative property depends?
8. What happens to vapour pressure of a liquid when a non volatile solute is dissolved in it?
9. What happens to vapour pressure of water if a table spoon of sugar is added to it?
10. State Raoult's law of dilute solution containing non-volatile solute.
11. State Raoult's law of relative lowering of vapour pressure.
12. Why is osmotic pressure of sodium chloride solution higher than glucose solution?
13. Define the term reverse Osmosis.
14. What do you mean by 10% (w/v) aqueous solution of sodium chloride?
15. What do you mean by saying that the molarity of solution is 0.1?
16. Between 2M glucose solution and 1M glucose solution which one has a lower freezing point?
17. Write the mathematical form of Raoult's law of relative lowering of vapour pressure.
18. What would be the value of Van't Hoff factor 'i' for dilute solution of K_2SO_4?
19. Arrange the following solutions in increasing order of their Van't Hoff factor 'i': 0.1M $CaCl_2$, 0.1MKCl, 0.1M $Al_2(SO_4)_3$, 0.1M$C_6H_{12}O_6$.
20. What are isotonic solutions?
21. When is the value of Van't Hoff factor more than one?
22. When is the value of Van't Hoff factor less than one?
23. Give an example of a compound in which hydrogen bonding results in the formation of a dimer.
24. Define Van't Hoff factor.
25. Two liquids A and B boil at 145^0C and 190^0C respectively. Which of them has a higher vapour pressure at 80^0C?
26. What will be the mole fraction of water in methanol containing equal moles of water and methanol?
27. What is the significance of Henry's constant?
28. When do two solutions exhibit same osmotic pressure?
29. What happens to boiling point of water when common salt is dissolved in water?

30. Which colligative property is preferred for the determination of macromolecules (biomolecules/ polymers)?

31. Mention the enthalpy of mixing (ΔH_{mix}) value to form an ideal solution.

32. Mention the enthalpy of mixing (ΔH_{mix}) value to form a non-ideal solution showing positive deviation.

33. Mention the enthalpy of mixing (ΔH_{mix}) value to form a non-ideal solution showing negative deviation.

34. What is a binary solution?

35. At a given temperature and pressure N_2 gas is more soluble in water than He. Which one of them has higher value of K_H?

36. On mixing equal volumes of acetone and ethanol, what type of deviation from Raoult's law is expected?

37. On what factor the colligative property value depends.

38. Give an example for a liquid solution in which solute is a gas. **OR** Give an example for gas in liquid solution.

39. What is anoxia?

40. What are bends?

41. What is normal saline solution?

42. What happens when the blood cells are dipped in a solution having concentration more than normal saline solution?

43. What happens when the blood cells are dipped in a solution having concentration less than normal saline solution?

44. What happens when the blood cells are dipped in normal saline solution?

45. Components of a non-ideal binary solution cannot be completely separated by fractional distillation. Why?

46. What is the S.I unit of Ebullioscopic constant / molal elevation constant (K_b) of a solvent?

47. What is the S.I unit of Cryoscopic constant /molal depression constant (K_f) of a solvent?

48. What is Ebullioscopic constant?

49. What is Cryoscopic constant?

50. "Aquatic animals are more comfortable in cold water rather than in warm water". Give reason.

51. What is the value of 'i' for a solute which undergoes dimerisation when dissolved in a particular solvent?

52. What is the value of 'i' for a solute which undergoes Trimerisation when dissolved in a particular solvent?

53. What is the value of 'i' for a solute which does not undergo either association or dissociation when dissolved in a particular solvent?

54. Give an example for liquid mixture showing negative deviation from Raoult's law.

55. Give an example for liquid mixture showing positive deviation from Raoult's law.

56. Give an example for liquid mixture obeying Raoult's law.

Two marks questions:

1. State Henry's Law. Give its mathematical form.

2. What happens to the solubility of a gas in a liquid with increase in temperature? Give reason.

3. What is reverse osmosis? Mention any one of its use.

4. State Raoult's law for a solution of 2 volatile liquids. Give an example for liquid mixture that shows negative deviation from Raoult's law.

5. Give any two differences between ideal and non ideal solution.

6. Define term 'Mole fraction'. Write the formula.

7. State Henry's Law. Give any one application of it.

8. Explain the effect of temperature on solubility of gas in liquids.

9. How is K_H (Henry's law constant) related to solubility of gas in liquids?

10. Define vapour pressure. Why does vapour pressure of a liquid decreases when a non-volatile solute

11. Why NaCl solution freezes at lower temperature than water but boils at higher temperature than water?

12. Explain why equimolar aqueous solutions of sodium chloride and sodium sulphate are NOT isotonic?

13. Give one example each of solid in gas and liquid in gas solution.

14. State Raoult's law for a solution containing two volatile liquids. Give an example for a liquid mixture showing negative deviation from Raoult's law.

OR State Raoult's law of vapour pressure of liquid mixtures. Give an example for a liquid mixture showing negative deviation from Raoult's law.

15. Define Azeotropes. Give example.

16. What are isotonic solutions? Give example.

17. What are hypertonic solutions? Give example.

18. What are hypotonic solutions? Give example.

19. What will it happen if pressure greater than osmotic pressure is applied on the solution separated semipermiable membrane from the solvent?

Three marks questions:

1. Plot a graph of vapour pressure against mole fractions of the two volatile liquids forming an ideal solution. What is the change in enthalpy upon mixing the two components of an ideal solution?

2. State Henry's law and mention some important applications.

3. What are minimum and maximum boiling azeotropes? Give example each.

4. What do you mean by positive and negative deviations from Raoult's law?

5. With the help of vapour pressure- temperature diagram, explain the depression in freezing point of a solution of a non- volatile solute in a volatile solvent. How do you determine the molar masses of solute using the above properties?
6. With the help of vapour pressure- temperature diagram, explain the elevation in boiling point of a solution of a non- volatile solute in a volatile solvent. How do you determine the molar masses of solute using the above properties?
7. Derive the relationship between relative lowering of vapour pressure and mole fraction of a solute for a solution of a nonvolatile solute in a volatile solvent.

Vapour pressure of Chloroform ($CHCl_3$) at 298K are 200 mm Hg and 415 mm Hg respectively.

a) Calculate the vapour pressure of the solution prepared by mixing 25.5 g of $CHCl_3$ and 40g of CH_2Cl_2 at 298K and

b) Mole fraction of each component in vapour phase.

8. 0.6 ml of acetic acid (CH_3COOH) having density 1.06gml^{-1} is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was 0.0205^{0}C. Calculate the Van't Hoff factor & the dissociation constant of acid. Given K_f of H_2O =1.86 Kkgmol^{-1}.
9. Vapour pressure of pure water at 298K is 23.8 mm Hg. 50g of urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution & its relative lowering.
10. Calculate the mass of ascorbic acid (vitamin C, $C_6H_8O_6$) to be dissolved in 75g of acetic acid to lower its melting point by 1.5^{0}C K_f =3.9 K kgmol^{-1}.
11. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. When 0.5g of a non–volatile solute is added to 39.0g of benzene, vapour pressure of the solution is 0.845 bar. What is the molar mass of a non–volatile solute? [Given: molar mass of benzene = 78g mol^{-1}].
12. Vapour pressure of liquids A and B at 298 K is 300 mm of Hg and 450 mm of Hg respectively. If the total vapour pressure of a mixture of A and B is 405 mm of Hg. Calculate the mole fraction of A in the mixture.
13. The boiling point of benzene is 353.23 K. When 1.80g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. (K_b for benzene = 2.53 K kg mol^{-1})
14. 1.00g of a non-electrolyte solute is dissolved in 50g of benzene; freezing point of benzene was lowered by 0.40K. Calculate the molecular mass of solute, If K_f of benzene =5.12 K kgmol^{-1}.
15. On dissolving 2.34g of solute in 40gof benzene, the boiling point of the solution was higher than that of benzene by 0.81K. Calculate the molar mass of the solute. (K_b for benzene = 2.53 K kg mol^{-1})
16. A solution containing 18g of non-volatile non-electrolyte solute is dissolved in 200g of water freezes at 272.07K. Calculate the molar mass of the solute. Given K_f of H_2O =1.86 Kkgmol^{-1} and freezing point of H_2O = 273K.

17. A 4% non- volatile solute containing solution is isotonic with 0.702% urea solution. Calculate the molar mass of the non-volatile solute. Given molar mass of urea = 60 $gmol^{-1}$.

18. 5.8 g of a non-volatile solute is dissolved in 100g CS_2 (molar mass=76 g mol^{-1}). The vapour pressure of the solution was found to be 190mm of Hg. Calculate the molecular mass of the solute. The vapour pressure of CS_2 is 195mm Hg.

19. Acetone boils at 56.38 ^{0}C and a solution of 1.41g of an organic compound in 20g of acetone boils at 56.88 ^{0}C. Calculate the molar mass of the organic compound. Given: K_b for acetone =1.67 K kg mol^{-1}.

20. Calculate the osmotic pressure at 273K of a 5% (w/v) solution of urea (Mol Mass=60) (R=0.0821 L atm/degree/Mol).

21. Calculate the osmotic pressure of a 0.05% (w/v) solution of urea (Mol Mass = 60) in water at 20 ^{0}C (R=0.0821 L atm/degree/Mol)

22. 15.0 g of non-electrolyte solute is dissolved in 450g of H_2O. The resulting solution was found to freeze at -0.340C .Calculate the molar mass of the solute.

23. 1.71 g of cane sugar is dissolved in 0.5L of water at 300K. Calculate its osmotic pressure.