Chapter No.	Subject	Topic	Class	Batch
14	Chemistry	Solutions	XII	Bulls Eye

1 Marks

1. Define 'solution'?
2. Define the term 'concentration?
3. How does change in temperature changes the molarity and molality values?
4. Define the term – solubility?
5. What is the effect of pressure on solubility of a gas?
6. State Henry's Law.
7. State Raoult's Law.
8. What are the factors on which vapour pressure depends?
9. The vapour pressure of solvent gets lowered, when a non- volatile solute isadded to it. Why?
10. Name two ways by which vapour pressure of a liquid can be lowered.
11. Define the term colligative properties?
12. What are the possible deviations from ideal behaviors?
13. Give one example of each deviation?
14. Why is the boiling point elevated when a non – volatile solute is dissolved in aliquid?
15. How is boiling point changed when mass of solvent is doubled?
16. Define cryoscopic constant?
17. When does the measurement of colligative property leads to abnormal molecularmass?
18. When is the value of i less then unity?
19. The molecular mass of a solute is 120 g/mol and van't Hoff factor is 4.What is its abnormal molecular mass?
20. Define mole fraction.
21. Explain the Henry's law about dissolution of a gas in a liquid.
22. State the main advantage of molarity over molality as the unit of concentration.
23. What is meant by molality of the solution?
24. Define ideal solution.
    State Raoult's law.
    Or
    Define Raoult's law in its general form in reference to solutions.
    Or
    State Raoult's law for a solution of volatile liquids.
25. Define the term azeotrope.
26. Define the term osmotic pressure.
27. Define the following terms.

(i)Isotonic solutions
(ii) van't Hoff factor

28. Explain boiling point elevation constant for a solvent or Ebullioscopic constant.
29. What is meant by reverse osmosis?
30. Define the term van't Hoff factor
31. What is meant by colligative properties?

2 Marks

1. Calculate the volume of water which could be added to 20 ml of 0.65 m HCl todilute the solution to 0.2 m?
2. A solution is prepared by dissolving 11g glucose in 200 cm^a water at 30^0 C.What is the mass Percentage of glucose in solution? The density of water30^0C is 0.996 $glcm^3$?
3. Find the molality and molarity of a 15% solution of H_2SO_4 when its densityis 1.10 glcm3 & molar mass = 98 amu.
4. Calculate the mole fraction of ethanol and water in a sample of rectified spiritwhich contains 46% ethanol by mass?
5. Calculate the % composition in terms of mass of a solution obtained by mixing300g of a 25% & 400 g of a 40% solution by mass?
6. One litre of sea water weight 1030g and contains about 6×10^{-3} g of dissolved 02.Calculate the concentration of dissolved oxygen in ppm?
7. The density of 85% phosphoric acid is 1.70 g/cm^3. What is the volume of a solutionthat contains 17g of phosphoric acid?
8. Carbon tetrachloride and water are immiscible whereas alcohol and water aremiscible. Explain on the basis of molecular structures of there compounds.
9. Plot a graph between vapour pressure and mole fraction of a solution obeyingRaoult's Law at constant temperature?
10. Why do mountaineers carry oxygen cylinder while climbing mountains?
11. Name different colligative properties?
12. Give the characteristics of ideal solution?
13. A mixture of chlorobenzene and bromobenzene is a nearly an ideal solutionbut a mixture of chloroform and acetone is not Explain?
14. Define the term azeotrope?
15. Draw the graphs of both deviations from ideal behaviours?
16. 0.90g of a non – electrolyte was dissolved in 87.90g of benzene. This raised theboiling point of benzene by 0.250C. If the molecular mass of non – electrolyteis 103.0 g/mol, calculate the molal elevation constant for benzene?
17. Show graphically the depression in freezing point on adding a non volatilesolute?

18. When 20g of a non – volatile solid is added to 250 ml of water, the freezingpoint of water becomes -0.90C. Calculate molecular mass of the solid if kf ofwater is 1.86^0Ckg/mol.

19. What happens when red blood cells are placed in 0.1% NaCl solution?

20. How is osmotic pressure of a solution related to its concentration?

21. Calculate the osmotic pressure of 0.25 M solution of urea at 37^0C. R = 0.083 Lbar/mol/k.

22. An aqueous solution of glucose, $C_6H_{12}O_6$ has osmotic pressure of 2.72 atm at298k. How many moles of glucose were dissolved per litre of solution?

23. Give various expressions for van't Hoff factor?

24. How are the various colligative properties modified after consideration ofvan't Hoff factor?

25. The boiling point elevation of 0.6 g acetic acid in 100g benzene is0.1265k. What conclusion can you draw about the state of solutein solution? Molar elevation constant for benzene is 2.53 deg per molar?

26. A weak electrolyte AB in 5% dissociated in aqueous solution? What is thefreezing point of a 0.10 molar aqueous solution of AB? K_f = 1.86 deg/molal?

27. The osmotic pressure of a 0.0103 molar solution of an electrolyte is found tobe 0.70 atm at 2730C. Calculate van't Hoff factor. R=0.082 L atm/1 mol/k?

28. A solution of glucose ($C_6H_{12}0_6$) in water is labelled as 10% by weight. What would be the molarity of the solution? (Molar mass of glucose=180 g mol^{-1}).

29. If the density of water of a lake is 125 g mL^{-1} and one kg of lake water contains 92 g of Na^+ ions, calculate the molarity of Na^+ ions in this lake water.(At. mass of Na = 23 g mol^{-1}).

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

31. State Henry's law and mention its two important applications.
    Or
    State the law correlating the pressure of a gas and its solubility in a liquid. State an application of this law.
    Or
    State Henry's law correlating the pressure of a gas and its solubility in a solvent and mention two applications for the law.

32. Distinguish between the terms molality and molarity. Under what conditions are the molarity and molality of a solution nearly thesame?

33. The solubility of pure nitrogen gas at 25°C and 1 atm is 6.8 x 10^{-4} mol L^{-1}. What is the concentration of nitrogen dissolved in water under atmospheric conditions? The partial pressure of nitrogen gas in the atmosphere is 0.78 atm.

34. State Raoult's law for a solution containing volatile components. How does Raoult's law become a special case of Henry's law?

35. Explain why a solution of chloroform and acetone shows negative deviation from Raoult's law?

36. 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,

37. What is meant by positive and negative deviations from Raoult's law and how is the sign of $\Delta_{mix}H$ related to positive and negative deviations from Raoult's law?

38. State Raoult's law for solutions of volatile liquids. Taking suitable examples, explain the meaning of positive and negative deviations from Raoult's lav;.
39. State how the vapour pressure of a solvent is affected when a non-volatile solute is dissolved in it?
40. What is meant by negative deviation from Raoult's law? Draw a diagram to illustrate the relationship between vapour pressure and mole fractions of components in a solution to represent negative deviation.

41. An aqueous solution of sodium chloride freezes below 273 K. Explain the lowering in freezing point of water with the help of a suitable diagram.

42. 18 g glucose, $C_6H_{12}0_6$ (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).

43. A 1.00 molar aqueous solution of trichloroacetic and (CCI_3COOH) is heated to its boiling point. The solution has the boiling point 100.18^0C. Determine the van't Hoff factor for trichloroacetic acid. (K_b for water = 0.512 K kg mol^{-1})

44. Define the term osmosis and osmotic pressure Is the osmotic pressure of a solution a colligative property? Explain.

45. What is van't Hoff factor? What possible values can it have if the solute molecules undergo dissociation?

46. The molecular masses of polymers are determined by osmotic pressure method and not by measuring other colligative properties. Give two reasons.

47. Define the term 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?

48. Find the boiling point of a solution containing 0.520 g of glucose ($C_6H_{12}0_6$) dissolved in 80.2 g of water [Given, K_b for water = 0.52 K m^{-1}]
49. Find the freezing point of a solution containing 0.520 g glucose ($C_6H_{12}0_6$) dissolved in 80.2 g of water [Given, K_f for water = 1.86 K m^{-1}].

50. Define the term osmotic pressure. Describe how the molecular mass of a substance can be determined by a method based on measurement of osmotic pressure?

51. The depression in freezing point of water observed for the same molar. Concentrations of acetic acid, trichloroacetic acid and trifluoro acetic acid increases in the order as stated above. Explain.

3 Marks

1. Obtain a relationship between relative lowering of vapour pressure and molefraction of solute?

2. The vapour pressure of CS2at 5000C is 854 mm Hg .A solution of 2.0g sulphurin 100g of CS_2 has a vapour pressure of 848.9 mm Hg .Calculate the formulaof sulphur molecule.

3. At 4000C , the vapour pressure of water is 55.3 mm Hg .Calculate the vapourpressure at the same temperature over 10% aqueous solution of urea [$CO(NH_2)_2$]?

4. How much urea (molar mass 60 g/mol) should be dissolved in 50g of water sothat its vapour pressure at room temperature is reduced by 25%?

5. What concentration of nitrogen should be present in a glass of water at room temperature? Assume a temperature of 25°C, a total pressure of 1 atmosphere and mole fraction of nitrogen in air of 0.78. (K_H for nitrogen = 8.42x10^{-7}M/mm Hg).

6. Henry's law constant for $C0_2$ dissolving in water is 1.67 x 10^8 Pa at 298 K. Calculate the quantity of $C0_2$ in 1 L of soda water when packed under 2.5 atm $C0_2$ pressure at 298 K.

7. The partial pressure of ethane over a saturated solution containing 6.56×10^{-3} g of ethane is 1 bar. If the solution were to contains 5.0×10^{-2} g of ethane, then what will be the partial pressure of the gas?

8. Determine the osmotic pressure of a solution prepared by dissolving 2.5×10^{7} g of K_2SO_4 in 2 L 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_6 = 174g mol^{-1}).

9. 1.00 g of a non-electrolyte solute when dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (K_f for benzene = 5.12 Kkg mol^{-1})

10. Calculate the amount of KCI which must be added to 1 kg of water so that the freezing point is depressed by 2 K. (K_f for water= 1.86 K kg mol^{-1}).

11. At 25° C, the saturated vapour pressure of water is 3.165 k Pa {23.75 mm Hg). Find the saturated vapour pressure of a 5% aqueous solution of urea (carbamide) at the same temperature. {Molar mass of urea = 60.05 g mol^{-1}).

12. 15.0 g of 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

    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}).

13. 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 186 K kg mol^{-1}).

    Or

    Calculate the boiling point of a solution prepared by adding 15.00 g of NaCI to 250.0 g of water. (K_b, for water = 0.512 K kg mol^{-1}, molar mass of NaCI = 58.44g mol^{-1}).

14. What would be the molar mass of a compound if 6.21 g of it dissolved in 24.0 g of chloroform form a solution that has a boiling point of 68.04°C. The boiling point of pure chloroform is 61.7°C and the boiling point elevation constant, K_b for chloroform is 3.63°C/m.

    Or

    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 the gene fragment is non-electrolyte, determine its molar mass.

15. What mass of NaCI must be dissolved in 65.0 g of water to lower the freezing point of water by 7.50°C? The freezing point depression constant (K_f) for water is 1.86°C/m. Assume van't Hoff factor for NaCI is 1.87. (Molar mass of NaCI = 58.5 g mol^{-1}),

16. A 0.561 m solution of unknown electrolyte depresses the freezing point of water by 2.93°C. What is van't Hoff factor for this electrolyte? The freezing point depression constant *(K_f)* for water is 1.86°C kg mol^{-1}.

17. Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20 g of phenol in 1.0 kg of benzene has its freezing point lowered by 0.69 K. Calculate the fraction of phenol that has dimerised (Given K_f for benzene = 5.1 Km'^{1}).

    Or

    An aqueous solution containing 12.48 g of barium chloride in 1.0 kg of water boils at 373.0832 K. Calculate the degree of dissociation of barium chloride.
    (Given, K_b for H_20 = 0.52 Km^{-1}, molar mass of $BaCl_2$ = 208.34 g mol^{-1}).

18. At 300 K, 36 g of glucose, $C_6H_{12}0_6$ present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of another glucose solution is 1.52 bar at the same temperature, calculate the concentration of the other solution.

    Or

    Calculate the boiling point of one molar aqueous solution. Density of KBr solution is 1.06 g mL^{-1}. (K_d for H_20 = 0.52 K kg mol^{-1}, atomic mass; K = 39, Br = 80).

19. A solution prepared by dissolving 1.25 g of oil of winter green {methyl salicylate) in 99.0 g of benzene has a

boiling point of 80.31°C. Determine the molar mass of this compound. (Boiling point of pure benzene = 80.10°C and K_b for benzene = 2.53°C kg mol^{-1}).

20. What mass of ethylene glycol (molar mass 62.0 g mol^{-1}) must be added to 5.50 kg of water to lower the freezing point of water from 0°C to - 10.0°C? (K_f for water = 1.86 K kg mol^{-1}).

21. Calculate the amount of sodium chloride which must be added to one kilogram of water so that the freezing point of water is depressed by 3 K. (Given, K_f = 1.86 K kg mol^{-1}, atomic mass of Na = 23, Cl = 35.5).
22. A solution of urea in water has a boiling point of 373.128 K. Calculate the freezing point of the same solution. (Given, for water K_f = 1.86 Km^{-1} and K_b = 0.52 Krn^{-1})
23. 0.1 mole of acetic acid was dissolved in 1 kg of benzene. Depression in freezing point of benzene was determined to be 0.256 K. What conclusion can you draw about the state of thesolute in solution? (Given, K_f for benzene = 5.12 Km^{-1}).

24. Calculate the mass of ascorbic acid ($C_6H_80_6$) to be dissolved in 75 g of acetic acid to lower its melting point by 1.5°C. *(*K_f for acetic acid is 3.9 K kg mol^{-1}).
25. 100 mg of a protein is dissolved in jus enough water to make 10.0 mL of solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C, what is the molar mass of the protein? (R = 0.0821 L atm mol^{-1} $K^{-1}$and 760 mm Hg = 1 atm).

26. Calculate the freezing point depression expected for 0.0711 m aqueous solution of Na_2S0_4. If this solution actually freezes at - 0.3 20°C, what would be the value of van't Hoff factor? (K_f for water is 1.86°C mol^{-1}).

27. Calculate the freezing point of a solution containing 18 g glucose, $C_6H_{12}0_6$ and 68.4 g sucrose, $C_{12}H_{22}O_n$ in 200 g of water. The freezing point of pure water is 273 K and K_f for water is 1.86 Km^{-1}.

28. Calculate the temperature at which a solution containing 54 g of glucose,($C_6H_{12}0_6$) in 250 g ofwater will freeze. *(*K_f for water - 1.86 K kg mol^{-1} and molar mass of glucose = 180 g mol^{-1}).

29. A solution containing 8 g of a substance in 100 g of diethyl ether boils at 36.86°C, whereas pure ether boils at 35.60°C. Determine the molecular mass of the solute (For ether, K_b = 2.02 K kg mol^{-1}).

30. A 5% solution (by mass) of cane sugar in water has a freezing point of 271K. Calculate the freezing point of 5% (by mass) solution of glucose in water. The freezing point of pure water is 273.15 K. (Molar mass of cane sugar = 342 g mol^{-1} and molar mass of glucose= 180 g mol^{-1}).
31. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}), which should be dissolved in 114 g of octane to reduce its vapour pressure to 80%.. (Molar mass of octane = 114 g mol^{-1}).

32. The boiling point elevation of 0.30 g acetic acid in 100 g benzene is 0.0633 K Calculate the molar mass of acetic acid from this data. Whatconclusion can you draw about the molecular state of the solute in the solution? (Given, K_b for benzene = 2.53 K kg mol^{-1}).

33. Calculate the depression in freezing point of water when 200 g of $CH_3CH_2CHClCOOH$ is added to 500 g of water. (Given, K_a = 1.4 x 10^{-3}, K_f = 1.86 K kg mol^{-1}).

34. The freezing point of a solution containing 0.2 g of acetic acid in 20.0 g of benzene is lowered by 0.45°C. Calculate

    (i) the molar mass of acetic acid from this data
    (ii) van't Hoff factor.
    (For benzene, K_f = 5.12 K kg mol^{-1}).

    What conclusion can you draw from the value of van't Hoff factor obtained?

5 Marks

1. (i) Define the terms osmosis and osmotic pressure. Is the osmotic pressure of a solution a colligative property? Explain.
   (ii)Calculate the boiling point of a solution prepared by adding 15.00 g of NaCI to 250.0 g of water. *(*K_b for water =0.512 K kg mol^{-1}, molar mass of NaCI = 58.44 g).

2. (i)The molecular masses of polymers are determined by osmotic pressure method and not by measuring other colligative properties. Give two reasons.
   (ii) At 300 K, 36 g of glucose, $C_6H_{12}0_6$ present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of another glucose solution is 1.52 bar at the same temperature, calculate the concentration of the other solution.

3. (i) List any four factors on which the colligative properties of a solution depend.
   (ii) Calculate the boiling point of one molar aqueous solution (density 1.06 g mL^{-1}) of KBr.
   (Given, K_b for H_20 = 0.52 K kg mol^{-1},At. mass : K =39, Br = 80).

4. (i) 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?
   (ii) A solution prepared from 1.25 g of oil of wintergreen (methyl salicylate) in 90.0 g of benzene has a boiling point of 80.31°C. Determine the molar mass of this compound. (Boiling point of pure benzene = 80.10°C (K_b for benzene = 2.53°C kg mol^{-1}).

5. (i) What is van't Hoff factor? What possible values can it have if the solute molecules undergo dissociation?
   (ii) An aqueous solution containing 12.48 g of barium chloride in 1.0 kg of water boils at 373.0832 K. Calculate the degree of dissociation of barium chloride.
   (Given K_b for H_20 = 0.52 K m^{-1}.Molar mass of $BaCl_2$ 208.34 g mol^{-1}).