CBSE Test Paper-01

Class - 12 Chemistry (Solutions)

1. The molal depression constant depends upon
   a. Vapour pressure of the solution
   b. Heat of solution of the solute in the solvent
   c. Nature of the solvent
   d. Nature of the solute
2. Which among the following show negative deviation?
   a. Chloroform and benzene
   b. Acetone and benzene
   c. Methyl alcohol and water
   d. Carbon tetrachloride and chloroform
3. For ideal solution the volume of mixing of the pure components to form the solution is
   a. $\triangle V_{mix} = -ve$
   b. $\triangle V_{mix} = +ve$
   c. $\triangle V_{mix} = 0$
   d. None of these
4. Which will form maximum boiling azeotrope?
   a. $C_2H_5OH + H_2O$
   b. None of these
   c. $HNO_3 + H_2O$
   d. $C_6H_6 + C_6H_5CH_3$
5. When blood cells are placed in pure water, blood cells
   a. Become white in colour
   b. Shrinks
   c. Diffuses in water
   d. Swells up
6. Why melting point of a substance is used as a criterion for testing the purity of the substance?

7. Name two ways by which vapour pressure of a liquid can be lowered.
8. Define the term osmotic pressure.
9. Define cryoscopic constant?
10. Why is osmotic pressure considered to be a colligative property?
11. Why is ether not miscible in water?
12. What type of mixtures of two liquids distill over at one temperature and why?
13. Find the molality and molarity of a 15% solution of H_2SO_4 when its density is 1.10 g/cm^3 & molar mass = 98 amu.
14. Calculate the molality of a solution containing 20.7 g of potassium carbonate dissolute in 500 ml of solution, assume density of solution = 1 g/ml.
15. Two elements A and B form compounds having formula AB_2 and AB_4. When dissolved in 20 g of benzene (C_6H_6), 1 g of AB_2 lowers the freezing point by 2.3 K whereas 1.0 g of AB_4 lowers it by 1.3 K. The molar depression constant for benzene is $5.1\,K\,kg\,mol^{-1}$. Calculate atomic masses of A and B.

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1. c. Nature of the solvent
   Explanation: K_f is characteristic of solvent.
2. a. Chloroform and benzene
   Explanation: The vapour pressure is lower than the solution, therefore it shows negative deviation.
3. c. $\triangle V_{mix} = 0$
   Explanation: For ideal solution there is no increase or decrease in volume on mixing.
4. c. HNO_3 + H_2O
   Explanation: Negatively deviated non ideal solution.
5. d. Swells up
   Explanation: It swells up due to osmosis process and eventually burst.
6. A pure compound has a sharp melting point. Impurities present if any, lower the melting point of the compound (just because depression in freezing point takes place).
7. The two ways by which vapour pressure can be lowered are –
   i. By decreasing the temperature.
   ii. By adding a non- volatile solute.
8. Osmotic pressure is the hydrostatic pressure applied on solution which just prevents the flow of solvent molecules through semipermeable membrane. It may be also defined as the excess pressure which must be applied to a solution to prevent the passage of solvent into it through a semipermeable membrane.
9. When 1 mole of a solute (that neither dissociates nor associates) is dissolved in 1 kg of solvent, the depression in freezing point is called cryoscopic constant.
10. osmotic pressure is given as $\pi = CRT$ or $\pi = \frac{n}{v}RT$

Osmotic pressure depends only on the number of moles 'n' of the solute present in a definite volume of the solution V and there is no factor involving the nature of the solute. Also, osmotic pressure depends upon the molar concentration of solution. Hence, it is a colligative property.

11. Ether is not miscible in water because it cannot form H-bonds with water. However lower members of ethers are soluble in water. The solubility of ethers decreases from lower members to higher members due to increase in size of alkyl group which decreases the formation of hydrogen bonds with water.

12. Two types of liquid mixtures distil over at one temperature. Such mixtures are called azeotropic mixtures or constant boiling mixture.
    i. Those which show positive deviation from Raoult's law and have the mole fraction corresponding to which the vapour pressure is maximum.
    ii. Those which show negative deviation from Raoult's law and have the mole fraction corresponding to which the vapour pressure is lowest.. Hence for one of the intermediate composition, the total vapour pressure of such a solution will be highest and the boiling point will be lowest. At this point the composition of liquid and vapour phase is same and the liquid mixture boils at constant temperature and remains unchanged in composition. Therefore, this liquid mixture distills over as if it is a pure liquid. Solution acquires the property of boiling at constant temperature and remains unchanged in composition.

13. Volume = mass/density
    $= 100g/1.10glcm^3 \ = 90.9cm^3$
    M = % $\times$ density $\times$ 10/molar
    mass of solute $= 15 \times 1.1 \times \frac{10}{98} = 1.68M$
    Molarity = $\frac{\text{no. of moles of } H_2SO_4}{\text{volume of solution}} \times 1000$
    Molality = $\frac{\text{no. of moles of solute}}{\text{mass of solvent in kg}}$
    $\frac{(15/98)}{85g} \times 1000$ = 1.8 M

14. Molar mass of K_2CO_3
    = }{M_2\;=(2\;\times39)\;+(1\times12)+(3\times16)\;=138g/mol}
    Amount of solute (K_2CO_3) w_2 =20.7g

Amount of water mass of solvent

= 500 - 20.7 = 479.3 g

$\therefore$ Molality $= \frac{\mathrm{W_2} \times 1000}{\mathrm{M_2} \times \mathrm{W_1}}$

$= \frac{20.7 \times 1000}{138 \times 479.3}$

= 0.313 m

15. We know that

$M_2 = \frac{1000 \times w_2 \times k_f}{\Delta T_f \times w_1}$

Then, $M_{AB_2} = \frac{1000 \times 1 \times 5.1}{2.3 \times 20}$

= $110.87 gmol^{-1}$

$M_{AB_4} = \frac{1000 \times 1 \times 5.1}{1.3 \times 20}$

= $196.15 gmol^{-1}$

Now, we have the molar masses of AB_2 and AB_4 as 110.87gmol^{-1} and 196.15gmo^{-1} respectively.

Let the atomic masses of A and B be x and y respectively.

Now, we can write:

$x + 2y = 110.87 \ldots\ldots\ldots\ldots\ldots (i)$

$x + 4y = 196.15 \ldots\ldots\ldots\ldots\ldots (ii)$

Subtracting equation (i) from (ii), we have

2y = 85.28

$\Rightarrow y = 42.64$

Putting the value of y=42.64 in equation (1), we have

$x + 2 \times 42.64 = 110.87$

$\Rightarrow x = 25.59$

Hence, the atomic masses of A and B are 25.59 u and 42.64 u respectively.