CBSE Test Paper-02

Class - 12 Chemistry (Solutions)

1. The rate at which a solid dissolves in liquid does not depend on
   a. Concentration
   b. Particle size
   c. Temperature
   d. Pressure
2. The tanks used by divers are filled with air diluted with
   a. Helium
   b. Argon
   c. Nitrogen
   d. Hydrogen
3. Normality of 0.3 M phosphoric acid is
   a. 0.6
   b. 0.1
   c. 0.9
   d. 0.5
4. To neutralize completely 40 mL of 0.1M aqueous solution of KOH, the volume of 0.1M aqueous solution of phosphoric acid required is
   a. 40 mL
   b. 20 mL
   c. 10 mL
   d. 60 mL
5. Which among the following show positive deviation?
   a. Chloroform and benzene
   b. Acetone and aniline
   c. Hydrochloric acid and water
   d. Acetone and carbon disulphide
6. Define the following terms:
   i. Molality
   ii. Molarity

7. What are constant boiling mixtures called?
8. What are the factors on which vapour pressure depends?
9. Show graphically the depression in freezing point on adding a non-volatile solute?
10. Define the terms Mass percentage.
11. 0.90 g of a non-electrolyte was dissolved in 87.90 g of benzene. This raised the boiling point of benzene by 0.25^0C. If the molecular mass of non-electrolyte is 103.0 g/mol, Calculate the molal elevation constant for benzene?
12. The density of 85% phosphoric acid is $1.70g/cm^3$. What is the volume of a solution that contains 17 g of phosphoric acid?
13. A 0.1539 molal aqueous solution of cane sugar (mol mass = 342 g mol^{-1}) has a freezing point of 271 K while the freezing point of pure water is 273.15 K. What will be the freezing point of an aqueous solution containing 5 g of glucose (mol. Mass = 180 g mol^{-1}) per 100 g of solution.
14. Calculate the mass percentage of benzene (C_6H_6) and carbon tetrachloride (CCl_4) if 22 g of benzene is dissolved in 122 g of carbon tetrachloride.
15. a. Explain giving examples the term colligative molality. Why do we sometimes get abnormal molecular masses of the substances using colligative properties of the solutions?
    b. The freezing point depression of 0.1 molal solution of benzoic acid in benzene is 0.256 K. For benzene k_f is 5.12 K kg mol^{-1}. Calculate the value of Van't Hoff factor for benzoic acid in benzene. What conclusion can you draw about the molecular state of benzoic acid in benzene.

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Solutions

1. d. Pressure

   Explanation: The rate at which a solid dissolves in liquid does not depend on pressure.

2. a. Helium

   Explanation: Size of Helium is small so does not causes “Bents” to divers when the dive back to surface. As it is less soluble.

3. a. 0.9

   Explanation: $N = M \times n_f$

   $N = 0.3 \times 3 = 0.9$

4. b. 20 mL

   Explanation: $M_1 v_1 = M_2 v_2$

   $N = M \times n_f$

   V=20ml

5. d. Acetone and carbon disulphide

   Explanation: (Solute- solute and > solute – solvent interactions Solvent – solvent)

6. a. Molality is defined as the number of moles of the solute per kilogram of solvent.

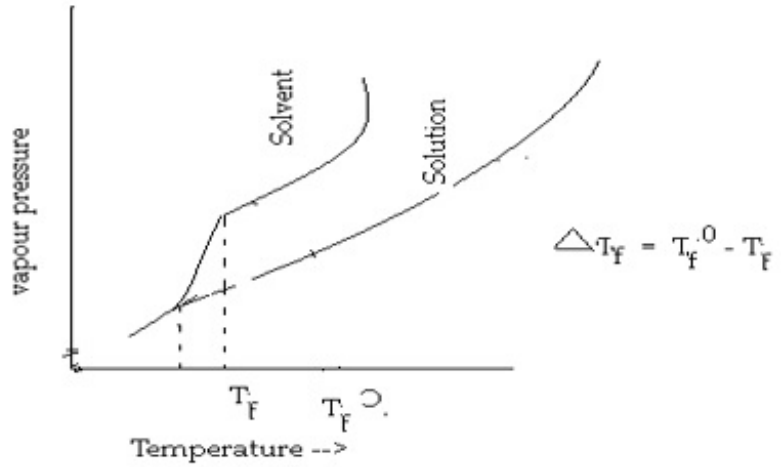
   Molality(m) = $= \frac{Moles \text{ of solutes}}{\text{Mass of solvent in Kg}}$

   b. Molarity (M) = Number of moles of solute dissolved in one litre of solution.

   Molarity(M) $= \frac{\text{No. of Moles of solute}}{\text{Volume of solution in litre}}$

7. Azeotropes or azeotropic mixtures (meaning in greek boiling without change).

8. The factors on which vapour pressure depends are –
   1. Temperature of the liquid.
   2. Nature of the liquid.

9. 

10. **Mass percentage:** The mass percentage of a component in a given solution is defined as the mass of the component per 100g of the solution.
Mass % of a component $= \frac{\text{Mass of the component in the solution}}{\text{Total mass of the solution}} \times 100$

11. $\Delta T_b = K_b \frac{Wsolute}{Wsolvent} \times \frac{1000}{Msolute}$
$K_b = \Delta T_b \times Msolute \times \frac{Wsolvent}{Wsolute} \times \frac{1}{1000}$
$= 103 \times 0.25 \times \frac{87.90}{0.90} \times \frac{1}{1000}$
= 2.514 Kg/mol.

12. 85 g phosphoric acid is present in 100 g of solution. 17 g of phosphoric acid is present in $\frac{100}{85} \times 17 = 20\text{g of soution}$
Volume of 17 g of 85% acid = $\frac{mass}{density}$
$= \frac{20g}{1.70gcm^{-3}} = 11.8\text{cm}^3$

13. ΔT_f = 273.15 - 271K
= 2.15 K
$\Delta T_f = K_f \cdot m$
$m = \frac{\Delta T_f}{K_f}$
$0.1539 = \frac{2.15}{K_f}, K_f = \frac{2.15}{0.1539}$
W_2 = 5g
M_2 = 180 g mol^{-1}
$\Delta T_f = K_f \times m$
$= \frac{2.15}{0.1539} \times \frac{5}{180} \times \frac{1000}{95}$ = 4.08 K

$\Delta T_f = T_f^0 - T_f$

$T_f = T_f^0 - \Delta T_f$

T_f = 273 - 4.08 = 268.92K

Freezing point of the solution T_f = 268.92K

14. Mass of solution = Mass of benzene (C_6H_6) + Mass of CCl_4

    = 22 g + 122 g = 144 g

    Mass percentage of $C_6H_6 = \frac{\text{Mass of benzene}}{\text{Mass of solution}} \times 100$

    $= \frac{22g}{144g} \times 100$ = 15.28%

    Mass percentage of $CCl_4 = \frac{122g}{144g} \times 100$ = 84.72% or 100-15.28 = 84.72%

15. The colligative properties like elevation in boiling point and depression in freezing point depend upon molality of solution, this is called colligative molality. We get abnormal molecular mass if the solute either undergoes association or dissociation.

    $\Delta T_f = iK_f \times m$

    $0.256 = i \times 5.12 \times 0.1$

    $i = \frac{0.256}{0.512} = \frac{1}{2}$

    As the value of van't hoff factor is less than 1, the benzoic acid undergoes association in solution.

    Benzoic acid exists as dimer in benzene.