

Q1 What are Solutions?

Q2 What are binary solutions?

Q3 Define

- a) Mole fraction
- B) Molarity
- C) Molality
- D) Colligative properties
- E) Vant Hoff's factor
- F) Abnormal molecular masses
- G) Osmosis and Osmotic pressure
- H) Reverse osmosis
- I) Isotonic, hypotonic and hypertonic solutions

Q4 State Henry's law. Give its application.

Q5 state Raoult's law for liquid liquid solutions and non-volatile solute in liquid solution. Also derive expressions for the same.

Q6 what are ideal and non-ideal solutions? Give their characteristics along with examples.

Q7 Concentrated nitric acid used in lab is 68% nitric acid by mass in aqueous solution. What should be the molarity of this solution if the density of solution is 1.504 g/ ml?

Q8 Calculate the % composition in terms of mass of a solution obtained by mixing 300g of 25% and 400 g of 40% solution by mass.

Q9 An antifreeze solution is prepared from 222.6g of ethylene glycol ($C_2H_6O_2$) and 200g of water. Calculate the molality of the solution if the density of the solution is 1.072g/ml then what shall be the molarity of the solution?

Q10 what role does the molecular interactions plays in the solution of alcohol and water.

Q11 A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be carcinogen. The level of contamination was 15 ppm (by mass) (i) Express this in percent by mass. (ii) Determine the molality of chloroform in the water sample.

Q11 Why does gases nearly always tend to be less soluble in liquids as the temperature is raised?

Q12 The partial pressure of ethane over a saturated soln. containing 6.56×10^{-2} g of ethane is 1 bar. If the solution contains 5.00×10^{-2} g of ethane, then what shall be the partial pressure of the gas?

Q13 An aqueous solution of 2 % non-volatile solute exerts a pressure of 1.004 bar at the boiling point of the solvent. What is the molecular mass of the solute?

Q14 Calculate the mass of a nonvolatile solute (molecular mass 40) which should be dissolved in 114 g octane to reduce its vapour pressure to 80%.

Q15 A 5% solution (by mass) of cane sugar in water has freezing point of 271 K. Calculate the freezing point a 5% glucose in water if freezing point of pure water is 273. 15 K.

Q16 At 300 K, 36 g of glucose present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of solution is 1.52 bar at the same temperature. What would be its concentration?

Q17 Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water:

(i) phenol

(ii) toluene

(iii) formic acid

(iv) ethylene glycol

(v) chloroform

(vi) pentanol

Q18 Calculate the amount of benzoic acid (C_6H_5COOH) required for preparing 250 mL of 0.15 M solution in methanol.

Q19 The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given above. Explain briefly

Q20 Vapour pressure of water at 298 K is 17.535 mm Hg. Calculate vapour pressure of water at 293 K when 25 g of glucose is dissolved in 450 g of water.

Q21 Determine the amount of $CaCl_2$ ($i = 2.47$) dissolved in 2.5 litre of water such that its osmotic pressure is 0.75 atm at $27^\circ C$.

Q22 Heptane and octane form ideal solution. At 373 K, the vapour pressure of the two liquid components are 105.2 kPa and 46.8 kPa, respectively. What will be the vapour pressure, in bar, of a mixture of 25.0 g of heptane and 35.0 g of octane?

Q23 Two Elements A and B, form compounds having molecular formula AB_2 and AB_4 . When dissolved in 20 g of 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 molal depression constant for benzenes is $5.1 K kg mol^{-1}$. Calculate atomic mass of A and B.

Q24 Calculate the depression in the freezing point of water when 10.0 g of $CH_3CH_2CH(Cl)COOH$ is added to 250 g of water. $K_a = 1.4 \times 10^{-5}$ K_f for water = $1.86 K kg mol^{-1}$. The density of the solution is $0.904 g mL^{-1}$.

Q25 19.5 g of CH_2FCOOH is dissolved in 500 g of water. The depression in the freezing point observed is 1.0°C . Calculate the van't Hoff factor and dissociation constant of the acid. K_f for $\text{H}_2\text{O} = 1.86 \text{ K kg mol}^{-1}$ and density of solution is 1.124 g mL^{-1} .

Q26 Benzene and naphthalene (C_{10}H_8) form ideal solution over entire range of composition. The vapour pressure of pure benzene and naphthalene at 300 K are 50.71 mm Hg and 32.06 mm Hg respectively. Calculate mol fraction of benzene in vapour phase if 80 g of benzene is mixed with 100 g of naphthalene

Q27 Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at 25°C , assuming that it is completely dissociated