CHEMISTRY

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

SOLUTIONS

Textual Examples

1. Calculate the mole fraction of ethylene glycol $(C_2H_6O_2)$ in a solution containing

$20\ \%$ of $C_2H_6O_2$ by mass.

Watch Video Solution

2. Calculate the molarity of a solution containing 5g of NaOH in 500 mL solution.

Watch Video Solution

3. Calculate molality of 2.5 of ethanoic acid (CH_3COOH) in 75g of benzene.

Watch Video Solution

4. If N_2 gas is bubbled through water at 293 K, how many millimoles of N_2 gas would dissolve in 1 litre of water ? Assume that N_2 exerts a partial pressure of 0.987 bar. Given that Henry's law constant for N_2 at 293 K is 76.48 k bar.

Watch Video Solution

5. Vapour pressure of chloroform $(CHCl_3)$ and dichloromethane (CH_2Cl_2) at 298 K are 200 mm Hg and 415 mm Hg respectively. (i) Calculate the vapour pressure of the solution prepared by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at 298 K and (ii) mole fractions of each component in vapour phase.

Watch Video Solution

6. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5g when added to 39.0 g of benzene (molar mass 78 g mol^{-1}), vapour pressure of the solution, then, is 0.845 bar. What is the molar mass of the solid substance ?

Watch Video Solution

7. 18g of glucose, $C_6H_{12}O_6$, is dissolved in 1 kg of water in a saucepan. At what temperature will water boil at 1.013 bar ? K_b for water is 0.52 kg mol^{-1}.

Watch Video Solution

8. The boiling point of benzene is 353.23 K. When 1.80 g 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 is $2.53 \ \mathrm{K\,kg\,mol^{-1}}$.

Watch Video Solution

9. 45 g of ethylene glycol $(C_2H_6O_2)$ is mixed with 600 g of water. Calculate (a) the freezing point depression and (b) the freezing point of the solution.

Watch Video Solution

10. 1.00 g of a non-electrolyte solute dissolved in 50g of benzene lowered the freezing point of benzene by 0.40 K. The freezing point depression constant of benzene is 5.12 K kg mol^{-1}. Find the molar mass of the solute.

Watch Video Solution

11. $200\ \mathrm{cm}^2$ of an aqueous solution of a protein contains 1.26 g of the protein. The oxmotic pressure of such a solution at 300 K is

found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein.

Watch Video Solution

12. 2 g of benzoic acid (C_6H_5COOH) dissolved in 25g of benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant for benzene is 4.9 K kg mol^{-1}. What is the precentage association of acid if it forms dimer in solution ?

Watch Video Solution

13. 0.6 mL of acetic acid (CH_3COOH), having density $1.06 \ \mathrm{g\,mL^{-1}}$, is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was $0.0205^\circ C$. Calculate the van't Hoff factor and the dissociation constant of acid.

Watch Video Solution

Very Short Answer Questions

1. Define the term solution.

 Watch Video Solution

2. Define molarity.

 Watch Video Solution

3. Define molarity.

 Watch Video Solution

4. Give an example of a solid solution in which the solute is solid.

Watch Video Solution

5. Define mole fraction.

Watch Video Solution

6. Define mass percentage solution.

Watch Video Solution

7. What is ppm of a solution ?

Watch Video Solution

8. What role do the molecular interactions play in a solution of alcohol and water ?

Watch Video Solution

9. State Raoult's law.

Watch Video Solution

10. State Henry's law.

Watch Video Solution

11. What is Ebullioscopic constant ?

Watch Video Solution

12. What is Cryoscopic constant ?

Watch Video Solution

13. Define osmotic pressure.

Watch Video Solution

14. What are isotonic solutions ?

Watch Video Solution

15. 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.

Watch Video Solution

16. Calculate the mass precentage of aspirin $(C_9H_8O_4)$ in acetonitrile (CH_3CN) when 6.5

gm of $C_9H_8O_4$ is dissolved in 450g of CH_3CN.

Watch Video Solution

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

Watch Video Solution

18. The depression in freezing point of water observed for the same amount of acetic acid, dichloro-acetic acid and trichloro acetic acid increases in the order given above. Explain briefly.

Watch Video Solution

19. What is Van't Hoffs factor 'i' and how is it related to $'\alpha'$ in the case of a binary electrolyte (1 : 1) ?

Watch Video Solution

20. What is relative lowering of vapour pressure ?

Watch Video Solution

21. Calculate the mole fraction of H_2SO_4 in a solution containing $98\ \%\ H_2SO_4$ by mass.

Watch Video Solution

22. Define osmotic pressure.

Watch Video Solution

23. What is vapour pressure of a liquid ?

Watch Video Solution

24. What is elevation of boiling point ?

Watch Video Solution

25. What is depression of freezing point ?

Watch Video Solution

26. Calculate the molality of 10g of glucose in 90g of water.

Watch Video Solution

27. Calculate the mass percentage of benzene (C_6H_6) and carbon tetrachloride (CCl_4) if 22g of benzene is dissolved in 122g of carbon

tetrachloride.

Then, calculate the mass percentage from the formula

$$\text{Mass } \% = \frac{\text{Mass of one component}}{\text{Mass of solution}} \times 100$$

Watch Video Solution

28. What are colligative properties ? Give their names.

Watch Video Solution

29. Calculate the weight of Glucose required to prepare 500ml of 0.1 M solution.

Watch Video Solution

Short Anwer Questions

1. How many types of solutions are formed ? Givee an example for each type of solution.

Watch Video Solution

2. Define mass percentage, volume percentage and mass to volume percentage solutions.

Watch Video Solution

3. Concentrated nitric acid used in the laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the denisty of the solution is $1.504 \ \mathrm{mL}^{-1}$?

Watch Video Solution

4. A solution of glucose in water is labelled as $10\,\%$ w/w. What would be the molarity of the solution ?

Watch Video Solution

5. A solution of sucrose in water is labelled as $20\,\%$ w/w. What would be the mole fraction of each component in the solution ?

Watch Video Solution

6. How many ml of 0.1 HCl is required to react completely with 1.0g mixture of Na_2CO_3 and $NaHCO_3$ containing equi-molar amounts of both ?

Watch Video Solution

7. A solution is obtained by mixing 300g of $25\,\%$ solution and 400g of $40\,\%$ solution by mass. Calculate the mass percentage of the resulting solution.

Watch Video Solution

8. An antifreeze solution is prepared from 222.6g of ethylene glycol $[(C_2H_6O_2)]$ and 200g of water (solvent). Calculate the molality of the solution.

Watch Video Solution

9. Why do gases always tend to be less soluble in liquids as the temperature is raised ?

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

12. The vapour pressure of water is 12.3 k P_a at 300 K. Calculate the vapour pressure of 1 molal solution of a non-volatile solute in it.

Watch Video Solution

13. Calculate the mass of a non-volatile solute (molar mass $40\mathrm{g\,mol^{-1}}$) which should be

dissolved in 114g Octane to reduce its vapour pressure to 80%.

Watch Video Solution

14. A 5% solution (by mass) of cane suger in water has freezing point of 271K. Calculate the freezing point of 5% glucose in water if freezing point of water is 273.15 K.

Watch Video Solution

15. If the osmotic pressure of glucose solution is 1.52 bar at 300 K. What would be its concentration if R = 0.083L bar $\mathrm{mol}^{-1}\mathrm{K}^{-1}$?

Watch Video Solution

16. Vapour pressure of of water at 293K is 17.535 mm Hg. Calculate the vapour pressure of the solution at 293K when 25g of glucose is dissolved in 450g of water ?

Watch Video Solution

17. How is molar mass related to the elevation in boiling point of a solution ?

Watch Video Solution

18. What is an ideal solution ?

Watch Video Solution

19. What is relative lowering of vapour pressure ? How is it useful to determine the molar mass of a solute ?

Watch Video Solution

20. How is molar mass related to the depression in freezing point of a solution ?

Watch Video Solution

21. The vapour pressure of a solution containing non volatile solute is less than the vapour pressure of pure of solvent. Give reason.

Watch Video Solution

22. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50g urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and

its relative lowering.

Consider Raoult's law and formula for relative lowering in vapour pressure,

$$\frac{P_A^0 - P_s}{P_A^0} = \frac{n_B}{n_A} = \frac{W_B}{M_B} \times \frac{M_A}{W_A}$$

Where, $\frac{P_A^0 - P_s}{P_A^0}$ is called relative lowering in vapour pressure.

Watch Video Solution

23. Calculate the vapour pressure of a solution containing 9g of glucose in 162g of water at

293K. The vapour pressure of water of 293K is 17.535mm Hg.

Watch Video Solution

Long Answer Questions

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

Watch Video Solution

2. Heptane and Octane form an ideal solution. At 373 K the vapour pressure of the two liquid components are $105.2\ \mathrm{kP}_a$ and $46.8\ \mathrm{kP}_a$ respectively. What will be the vapour pressure of a mixture of 26.0 g heptane and 35g of octane ?

Watch Video Solution

3. A solution containing 30g of non-volatile solute exactly in 90g of water has a vapour

pressure of $2.8\ \mathrm{kP}_a$ at 298 K. Further 18g of water is then added to the solution and the new vapur pressure becomes $2.9\ \mathrm{kP}_a$ at 298 K. Calculate (i) The moar mass of the solute and (ii) Vapour pressure of water at 298 K.

Watch Video Solution

4. Two elements A and B from compounds having formula AB_2 and AB_4. When dissolved in 20g of Benzene (C_6H_6), 1g of AB_2 lowers the freezing point by 2.3 K whereas 1.0g 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.

Watch Video Solution

5. Calculate the depression in the freezing point of water when 10g of $CH_3CH_2CHClCOOH$ is added to 250g water. $K_a = 1.4 \times 10^{-3}$, $K_f = 1.86$ K kg mol^{-1}.

Watch Video Solution

6. 19.5g of CH_2FCOOH is dissolved in 500g of water. The depression in freezing point of water observed is $1.0^\circ C$. Calculate the Van't Hoff factor and dissociation constant of fluoroacetic acid.

Watch Video Solution

7. 100g of liquid A(molar mass 140g mol^{-1}) was dissolved in 1000g of liquid B(molar mass 180g mol^{-1}). The vapour pressure of pure liquid B was found to be 500 torr. Calculate

the vapour pressure of pure liquid A and its vapour pressure in the solution if the total vapour pressure of the solution is 475 torr.

Watch Video Solution

8. 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 $27^\circ C$.

Watch Video Solution

9. Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in two litre of water at $25^\circ C$ assuming that it is completely dissociated.

Watch Video Solution

10. Benzene and Toluene form ideal solution over the entire range of composition. The vapour pressure of pure benzene and toluene at 300 K are 50.71 mm of Hg and 32.06 mm of

Hg respectively. Calculate the mole fraction of benzene in vapour phase if 80g of benzene is mixed with 100g of toluene.

Watch Video Solution

Intext Questions

1. Calculate the mole fraction of benzene is solution containing 30% by mass in carbon tetrachloride.

Then calculate the mole fraction by using the

formula

Mole fraction of a component

$$= \frac{\text{Number of moles of the component}}{\text{Total number of moles of all components}}$$

$$x_A = \frac{n_A}{n_A + n_B}$$

Watch Video Solution

2. Calculate the molarity of each of the following solution :

(a) 30g of $CO(NH_3)_2.6H_2O$ in 4.3 L of solution.

(b) 30 mL of 0.5 MH_2SO_4 diluted to 500 mL.

(a) Molarity $= \dfrac{\text{moles of solute}}{\text{Volume of solution litre}}$

and moles of solute $= \dfrac{\text{mass of solute}}{\text{molar solution of solute}}$

So, first find molar mass by adding atomic masses of different elements, then find moles of solute and then molarity.

(b) Use molarity equation for dilution.

$M_1V_1 = M_2V_2$

(Before dilution) (After dilution)

Watch Video Solution

3. Calculate the mass of urea (NH_2CONH_2) required in making 2.5 kg of 0.25 molar aqueous solution.

We know that molarity (m) $= \frac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$

and moles of soute $= \frac{\text{Mass of solute}}{\text{Molar mass of solute}}$

So, find the molar mass of solute by adding atomic masses of different element present in it and mass by using the formula,

Molality $= \frac{\text{Mass of solute/molar mass of solute}}{\text{Mass of solvent in kg}}$

Watch Video Solution

Watch video solution

4. Calculate a) molality b) molarity and c) mole fraction of KI if the density of $20\,\%$ (mass / mass) aqueous KI is $1.202\ \ \mathrm{g\,mL^{-1}}$.

As density and % by mass is given, so find the mass of solute and solvent (as x % solution contains x g solute in (100 - x) g solvent).

Find volume of the solution, by using„

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$

Recall the formulae of molality, molarity and mole fraction, to calculate them.

Molality

$$= \frac{\text{Mass of solute/ molar mass of solute}}{\text{Mass of solventin kg}}$$

Watch Video Solution

5. H_2S, a toxic gas with rotten egg like smell, is used for the qualitative analysis. If the solubility of H_2S in water at STP is 0.195m, calculate Henry's law constant.

Watch Video Solution

6. Henry's law constant for CO_2 in water is 1.67×10^8 Pa at 298 K. Calculate the quantity of CO_2 in 500 mL of soda water when packed under 2.5 atm CO_2 pressure at 298 K.

Watch Video Solution

7. The vapour pressure of pure liquids A and B are 450 and 700 mm Hg respectively, at 350 K. Find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg. Also

find the composition of the vapour phase.

Apply Raoult's law

$$P_T = P_A^0 x_A + P_B^0 x_B = P_B^0 x_A + P_B^0(1 - x_A)$$

to calculate mole fraction of $A(x_A)$ and $B(x_B)$.

In vapour phase, partial pressure are used insted of number of moles.

Watch Video Solution

8. Boiling point of water 750 mm Hg is $99.63^\circ C$. How much sucrose is to be added to

500 g of water such that it boils at $100^{\circ} C$.

$\left[K_b \text{ for water is } 0.52 \ \ \mathrm{K\ kg\ mol^{-1}}\right]$

i) Since boiling point is changing, apply the formula for elevation in boiling point,

$\Delta \mathrm{T}_b = K_b m$

ii) $m = \dfrac{W_B}{M_B . W_A}$

So, $\Delta T_b = \dfrac{K_b . W_B}{M_B \times W_A}$

Or $W_B = \dfrac{\Delta T_b \times M_B \times W_A}{K_b}$

iii) Find ΔT_b as $\Delta T_b = T_b = T_b - T_b^0$

T_b= Boiling point of solution

T_b^0 = Boiling point of pure solvent

Watch Video Solution

9. 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 $1.5^\circ C$. $K_f = 3.9 \ \ \mathrm{K\,kg\,mol^{-1}}$.

Since, lowering of melting point is given apply the formula for lowering of melting point, i.e.,

$$\Delta T_f = K_f . m$$

$$\Delta T_f = \frac{K_f . W_B}{M_B \times W_A} \quad \text{or} \quad W_B = \frac{\Delta T_f . M_B . W_A}{K_f}$$

View Text Solution

10. Calculate the osmotic pressure in Pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 1,85,000 in 450 mL of water at $37^{\circ} C$.

Use the formula for osmotic pressure $(\pi) = \mathrm{CRT}$ and $\mathrm{C} = \frac{n}{V}$ and $\mathrm{n} = \frac{W_B}{M_B}$

View Text Solution