CHEMISTRY

BOOKS - MODERN PUBLISHERS CHEMISTRY (HINGLISH)

SOLUTIONS

SOLVED EXAMPLES

1. If 11 g of oxalic acid are dissolved in 500 mL of solution (density = 1.1 g mL^{-1}), what is the mass % of oxalic acid in solution ?

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2. 2.46 g of sodium hydroxide (molar mass = 40) are dissolved in water and the solution is made to $100 cm^3$ in a volumetric flask. Calculate the molarity of the solution.

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3. Calculate the molality of a solution containing 20.7g of potassium carbonate dissolved in 500 mL of soluiton (assume density of solution = $1gmL^{-1}$)

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

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5. Calculate the mole fraction of ethylene glycol $(C_2H_6O_2)$ in a solution containing 20% of $C_2H_6O_2$ by mass.

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6. Calculate the normality of solution containing 31.5 g of hydrated oxalic acid $(H_2C_2O_4, 2H_2O)$ in 1250 mL of solution. Multiply answer with 10

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7. $2.82g$ of glucose (molar mass $= 180$) is dissolved in $30g$ of water. Calculate the (i) Molality of the solution (ii) mole fractions of (a) glucose (b) water.

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8. Calculate the molarity of pure water (d=1 g/mL).

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9. A solution has 25% of water,25% ethanol and 50% acetic acid by mass. Calculate the mole fraction of each component.

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10. Calculate the number of moles of methanol in 5 litres of its 2 m solution if the density of solution is 0.981 kgL^{-1} (Molar mass of methanol=32.0g mol^{-1}.

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11. 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.

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12. A solution of glucose $(\text{molar mass} = 180 gmol^{-1})$ in water is labelled as 10% (by mass). What would be the molarity and molality of the solution? Given that the density of the solution is $1.2 gmL^{-1}$.

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13. A commerically availabe sample of sulphuric acid is 15% H_2SO_4 by weight (density $= 1.10 gmL^{-1}$). Calculate (i) molarity (ii) normality and (iii) molality of the solution.

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14. A sugar syrup of weight $214.2g$ contains $34.2g$ of sugar $(C_{12}H_{22}O_{11})$. Calculate

a. the molal concentration.

b. the mole fraction of the sugar in the syrup.

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15. An antifreeze solution is prepared from $222.6g$ of ethylene glycol $[C_2H_4(OH)_2]$ and $200g$ of water. Calculate the molality of the solution. If the density of the solution is $1.072 gmL^{-1}$ then what shall be the molarity of the solution?

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16. What is the mole fraction of the solute in 2.5 m aqueous solutions ?

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17. Calculate the volume of 80% H_2SO_4 by weight (density $= 1.80 gmL^{-1}$) required to preapre 1L of 0.2 M H_2SO_4.

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18. The mole fraction fo benzene in a solution with toluene is 0.50 . Calculate the mass present of benzene in the solution.

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19. 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 per cent by mass.

(ii) Determine the molality of chloroform in the water sample.

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20. Molality(m) of a sulphuric acid solution in which the mol fraction of water is 0.85 is : Multiply your answer with 10 and then put value of it

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21. Volume of $0.1 M HCI$ required to react completely with 1g equimolar mixture of Na_2CO_3 and $NaHCO_3$ is

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22. A $6.90M$ solution of KOH contains 30% by weight of KOH. Calculate the density of the solution.

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23. If N_2 gas is bubbled through water at $293K$, how many millimoles of N_2 gas would dissolve in$1L$ of water. Assume thatN_2 exerts a partial pressure of 0.987 bar. Given that Henry law constant for N_2 at $293K$ is 76.48 kbar.

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24. The Henry's Law constant for oxygen dissolved in water is $4.34 \times 10^{-4} Catm^{-1}$ at $25^\circ C$. If partial pressure of exygen in are is 0.2 atm. Under ordinary atmospheric conditions, calculate the concentration (in moles/litre) of dissolved oxygen in water in equilibrium with air at $25^\circ C$.

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25. Dry air contains 79% N_2 and 21% O_2 . Determine the proportion of N_2 and O_2 (in terms of mole fractions) dissolved in water at 1 atm pressure . Henry's law constant for N_2 and O_2 in H_2O are 8.54×10^4 atm and 4.56×10^4 atm respectively.

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26. The vapour pressure of ethyl alcohol at 298 K is 40 mm of Hg. Its mole fraction in a solution with methyl alcohol is 0.80. What its vapour pressure in solution if the mixture obeys Raoult's law ?

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27. An aqueous solution of glucose is made by dissolving 10 g of glucose in 90 g water at 303 K. If the V.P. of pure water at 303 K be 32.8 mm Hg, what would be V.P. fo the solution ?

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28. At 298 K, the vapour pressure of pure benzene , C_6H_6 is 0.256 bar and the vapour pressure of pure toluene $C_6H_5CH_3$ is 0.0925 bar . If the mole fraction of benzene in solution is 0.40 (i) what is the total vapour pressure of the solution ? (ii) Calculate the composition of the vapour in terms of mole fraction.

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29. The vapour pressure of chloroform $(CHCl)_3$ and dichlorocethene (CH_2Cl_2) at $298K$ is $200mmHg$ and $415mmHg$, respectively. Calculate

a. The vapour pressure of the solution prepared by mixing $25.5g$ of $CHCl_3$ and $40g$ of $CH_2\_Cl(2)$ at $298K$.

b. Mole fractions of each components in vapour phase .

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30. Two liquids X and Y one mixing form an ideal solution. At $30^\circ C$ the vapour pressure of the solution containing 3 moles of X and 1 mole Y is

550 mm Hg. But when 4 moles of X and 1 mole of Y are mixe, the vapour pressur of the solution thus formed is 560 mm Hg. What will be the vapour presure of pure and Pure Y at this temerature ?

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31. Vapour pressure of water at $20^{\circ}C$ is 17.5 mm of Hg and lowering of vapour pressure of a sugar solution is 0.061 mm of Hg. Calculate .

(i) relative lowering of vapour pressure .

(ii) vapour pressure of the solution .

(iii) mole fraction of sugar and water .

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

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33. Calculate the mass of a non-volatile solute (molecular mass 40) which should be dissolved in $114g$ octane to reduce its vapour pressure to 80%.

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34. Calculate the vapour pressure of an aqueous solution which contains $5 mass per percent$ of $urea$. The vapour pressure of pure water is $23.5 mmHg$. The molar mass of $urea$ is 60.

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35. 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.

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36. Molal elevation constant for benzene is $2.52 Km^{-1}$, A solution of some organic substance in benzene boils at $0.12^{\circ} C$ higher than benzene . What is the molality of the solution ?

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37. The boiling a point of benzene is 353.23K. 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 K kg mol^{-1}.

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38. A solution containing 0.730 g of camphor (molar mass = 152) in 36.8g of acetone (b.p. $56.30^\circ C$) boils at $56.55^\circ C$. A solution of 0.564 g of an unknown compound in the same weight of solvent boils at $56.46^\circ C$. Calculate the molar mass of the unknown compound.

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39. $3.24g$ of sulphur dissolved in $400g$ benzene, boiling point of the solution was higher than that of benzene by $0.081K$. K_b for benzene is $2.53Kkgmol^{-1}$. If molecular formula of sulphur is S_n. Then find the value of n. (at.wt.of $S = 32$).

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40. What would be the molar mas of a compound if 6.21 g of it dissolved in 24.0 g of chloroform a solution that has a boiling point of $68.04^\circ C$? Given that the boiling point of pure chloroform is $61.7^\circ C$ and $K_bf \text{ or } chl \text{ or } of \text{ or } m = 3.63^\circ \frac{C}{m}$.

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41. A solution of glycerol $(C_3H_8O_3)$ in water was prepared by dissolving some glycerol in $500g$ of water. This solution has a boiling point of $100.42^\circ C$ while pure water boils at $100^\circ C$. What mass of glycerol was dissolved to make the solution ?

(K_b for water $= 0.512Kkgmol^{-1}$)

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42. A solution prepared by dissolving $1.25g$ of oil of winter green (methyl sallicylate) in $99.0g$ of benzene has a boiling point of $80.31^\circ C$. Determine the molar mass of this compound. ($B.P.$ of pure benzene $= 80.10^\circ C$ and K_b for benzene $= 2.53^\circ Ckg\text{mol}.1$)

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43. $18g$ of glucose $(C_6H_{12}O_6)$ is dissolved in $1kg$ of water in a saucepan. At what temperature will the water boil (at 1 atm) ? K_b for water is $0.52 K kg mol^{-1}$.

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44. $45g$ of ethylene glycol $C_2H_6O_2$ is mixed with $600g$ of water. Calculate (a) the freezing point depression and (b) the freezing point of solution. Given $K_f = 1.86 K kg mol^{-1}$.

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45. Addition of $0.643g$ of a compound to $50mL$ of benzene (density: $0.879 gmL^{-1}$) lower the freezing point from $5.51^\circ C$ to $5.03^\circ C$. If K_f for benzene is $5.12 K kg mol^{-1}$, calculate the molar mass of the compound.

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46. The molal freezing point depression constant of benzene(C_6H_6) is $4.90 K kg mol^{-1}$. Selenium exists as a polymer of the type Se_x. When $3.26g$ of selenium is dissolved in $226g$ of benzene, the observed freezing point is $0.112^\circ C$ lower than pure benzene. Deduce the molecular formula of selenium. (Atomic mass of $Se = 78.8 g mol^{-1}$)

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47. 1.02 g of urea when dissolved in 98.5 g of certain solvent decreases its freezing point by 0.211 K . 1.60 g of unknown compound when dissolved in 86.0 g of the same solvent depresses the freezing point by 0.34 K . Calculate the molar mass of the unknown compound (Molar mass of urea = 60 $g mol^{-1}$).

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48. Ethylene glycol $\left(\text{molar mass} = 62 g mol^{-1}\right)$ is a common automobile antyfreeze. Calculate the freezing point of a solution containing 12.4 g of this substance in 100 g of water. (Given $K_f f$ or $water = 1.86 K kg mol^{-1}$)

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49. Two elements A and B form compounds having molecular formula AB_2 and AB_4. When dissolved in $20g$ of benzene, $1g$of AB_2 lowers the freezing point by $2.3K$, whereas $1.0g$ of AB_4 lowers it by $1.3K$. The molar depression constant for benzene is $5.1 K kg mol^{-1}$. Calculate the atomic mass of A and B.

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50. $200 cm^3$ of an aqueous solution of a protein contains $1.26g$of the protein. The osmotic pressure of such a solution at $300K$ is found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein.

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51. If 1.71 g of sugar (molar mass = 342) are dissolved in $500cm^3$ of a solution at 300 K, what will be its osmotic pressure ?

$\left(R = 0.083L\overline{K}^{-1}mol^{-1}\right)$

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52. Osmotic pressure of a solution obtained by mixing $100mL$ of 1.4% solution of urea (mol mass = 60) and $100mL$ of 3.42% of cane sugar solution (mol mass = 342) at $20^{\circ}C\left(R = 0.0821LatmK^{-1}mol^{-1}\right)$

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53. At $300K$, $36g$ of glucose present per litre in its solution has an osmotic pressure of 4.98^{-}. If the osmotic pressure of the solution is 1.52^{-} at the same temperature, what would be its concentration?

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54. A solution of an organic compound was prepared by dissolving 6.8 g in 100 g of water . Calculate the osmotic pressure of this solution at 298 K when boiling point of solution is $100.11^\circ C$. Given K_b for water = 0.52 Km^{-1} and R = 0.082 litre atm $k^{-1}mol^{-1}$

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55. A solution prepared by dissolving 8.95 mg of a given fragment in 35.0 mL of has an osmotic pressure of 0.335 torr at $25^\circ C$. Assuming that the given fragment is non-electolyty. Calculate its molar mass.

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56. A solution containing 15 g urea (molar mass = $60gmol^{-1}$) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 180 $gmol^{-1}$) in water . Calculate the mass of glucose persent in one litre of its solution.

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57. Calculate the boiling point of solution when 2 g of $Na_2SO_4(M = 142 g mol^{-1})$ was dissolved in 50g of water , assuming Na_2SO_4 undergoes complete ionization . (k_b for water $= 0.52 K kg mol^{-1}$).

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58. Calculate the amount of $CaCI_2(\text{molar mass} = 111 g mol^{-1})$ which must be added to 500 g of water to lower its freezing point by 2 K assuming $CaCI_2$ to be completely dissoviated $\left(K_f f \text{ or } = 1.86 \text{K kg mol}^{-1}\right)$.

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59. At $25^\circ C$, 3 g of a solute A in 100 mL of an aqueous solution gave an osmotic pressure of 2.5 atmosphere . What is the nature of solute (

assoicated or dissociated) if its normal molar mass is 246?

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60. $0.5g\ KCl$ was dissolved in $100g$ water, and the solution, originally at $20^{\circ}C$ froze at $-0.24^{\circ}C$. Calculate the percentage ionization of salt. K_f per $1000g$ of water =$1.86^{\circ}C$.

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61. Two grams of benzoic acid (C_6H_5COOH) dissolved in $25.0g$ of benzene shows a depression in freezing point equal to $1.62K$. Molal depression constant for benzene is $4.9Kkg^{-1}mol^{-1}$. What is the percentage association of acid if it forms dimer in solution?

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62. A solution containing 3.100 g of $BaCl_2$ in 250 g of water boils at $100.083^{\circ} C$ .Calculate the Van't Hoff factor and molality of $BaCl_2$ in this solution . (k_b for water $= 0.52 Km^{-1}$, molar mass of $BaCl_2 = 208.3 g mol^{-1}$)

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63. The freezing point of a solution contaning $0.3 g$ of acetic acid in $43 g$ of benzene reduces by 0.3°. Calculate the Van's Hoff factor

"(K_f for benzene =$5.12 K kg mol^{-1}$)"

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64. A solution contins 0 .860 g of K_2SO_4 in 500 mL solution . Its osmotic pressure is found to be 0.690 atm at $27^{\circ} C$. Calculate the value of Van't Hoff factor . (At mass K = 39.0 , S = 32, O = 16 R = 0.082 atm $mol^{-1} K^{-1}$)

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65. $0.6mL$ of acetic acid (CH_3COOH) having density $1.06gmL^{-1}$ is dissolved in $1L$ 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 dissociation constant of the acid. K_f for $H_2O = 1.86Kkg^{-1}\text{mol}^{-1}\big)$

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66. Calculate the freezing point depression expected for 0.0711 m aqueous solution of Na_2SO_4 . If this solution actually freezes at $-0.320^\circ C$, what would be the value of Van't Hoff factor ?

(K_f for water is $1.86^\circ Cmol^{-1}$) .

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67. What mass of $NaCI\big(\text{molar mass} = 58.5gmol^{-1}\big)$ be dissolved in $65g$ of water to tower the freezing point by $7.5^\circ C$? The freezing point depression constant, K_f, for water is $1.86Kkgmol^{-1}$. Assume van't Hoff factor for $NaCI$ is 1.87.

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68. (a) Calculate the freezing point of solution when 1.9 g of $MgCl_2$ (M = 95 g Mol^{-1}) was dissolved in 50g of water, assuming $MgCl_2$ undergoes complete ionization. (K_f for water = 1.86 K kg mol^{-1}).

(b) (i) Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why?

(ii) What happens when the external pressure applied becomes more than the osmotic pressure of solution?

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69. Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250 g of water . ($K_b = 0.512$ K kg mol^{-1} and molar mass of NaCl = 58.44 g mol^{-1})

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70. A 1.00 molal aqueous solution of trichloroacetic acid $(\mathbb{C}l_3COOH)$ is heated to its boiling point. The solution has the boiling point of $100.18^\circ C$. Determine the van't Hoff factor for trichloroacetic acid. (K_b for water $= 0.512 K kg \text{mol}^{-1}$)

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71. A $0.1M$ solution of potassium sulphate K_2SO_4 is dissolved to the extent of 80%. What would be its osmotic pressure at $27(\circ)C$.

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72. 3.9 g of benzoic acid dissolved in 49 g of benzne shows a depreesion in freezing point of $1.62K$. Calculate the van't Haff factor and predict the nature of solutei (associated or dissociated). [Given : Molar mass of benzoic acid $= 122 gmol^{-1}$, K_f for benzene = 4.9 K kg mol^{-1}].

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PRACTICE PROBLEMS

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

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2. $18g$ of glucose (molar mass $180g\text{mol}^{-1}$) is present in $500CM^3$ of its aqueous solution. What is the molarity of the solution? What additional data is required if the molality of the solution is also required to be calculated?

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3. A solution of glucose $(C_6H_{12}O_6)$ in water is labelled as 10% by weight . What would be the molality of the solution ?

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4. What volume of 10 % (w/v) solution of Na_2CO_3 will be required to neturalise 100 mL of HCl solution containing 3.65 g of HCl ?

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5. What volume of 95% H_2SO_4 by weight $\left(d = 1.85gmL^{-1}\right)$ and what mass of water must be taken to prepare $100mL$ of 15% solution of H_2SO_4 $\left(d = 1.10gmL^{-1}\right)$

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6. What is the mole fraction of ethanol and water respectively in a sample of rectified spirit which contains 95 % of ehtanol by weight ?

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7. Calculate the mole fraction of water in mixture of 12 g water , 108 g acetic acid and 92 g ethanol.

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8. One litre of a solution of N/2 HCl was heated in beaker and it was observed that when the volume of solution got reduce to 600 mL, 3.25 g of HCl was lost. Calculate the normality of the resulting solution.

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9. Concentrated sulphuric acid has density of 1.9 g/mL and 99% H_2SO_4 by mass. Calculate the molarity of the acid.

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10. Calculate the molarity and mole fraction of the solute in aqueous solution containing $3.0g$ of urea per $250gm$ of water (Mol. Wt. of urea = 60)

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11. The molality of a solution of ethyl alcohol (C_2H_5OH) in water is 1.55 m . How many grams of ethyl alcohol are dissolved in 2 kg of water ?

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12. Commerically available concentrated hydrochloric acid contains 38% HCl by mass and density $1.19gcm^{-3}$. Calculate the molarity of this solution.

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13. Calculate the formality of sodium thiosulphate $(Na_2S_2O_3.5H_2O)$ solution , 1.24 g of which are dissolved in $100cm^3$ of the solution.

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14. 4.0 g of NaOH are present in one decilitre of solution . Calcute

Mole fraction of NaOH

Molality of solution

Molarity of solution.

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15. What would be the molality of a solution obtained by mixing equal volumes of 30% by weight $H_2SO_4(d = 1.218gmL^{-1})$ and 70% by weight $H_2SO_4(d = 1.610gmL^{-1})$? If the resulting solution has density $1.425gmL^{-1}$.

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16. If at a particular temperature, the density of $18 M H_2SO_4$ is $1.8 g cm^{-3}$, calculate (a) molality, (b) $\%$ concentrating by weight of solute and solvent (c) mole fraction of water and H_2SO_4.

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17. Calculate the number of molecules of oxalic acid $(H_2C_2O_4.2H_2O)$ in 100 mL of 0.2 N oxalic acid solition.

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18. In a solution of benzene in chlorofrom $(CHCl_3)$, the mole fraction on benzene is 0.45. Calculate its percentage by weight in the mixture .

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19. $8.0575 \times 10^{-2} kg$ of Glauber's slat is dissolved in water to obtain $1 dm^3$ of a solution of density $1077.2 kg m^{-3}$. Calculate the molarity, molality and mole fraction of Na_2SO_4 in solution.

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20. Calculate the molarity of a solution of $CaCl_2$ if on chemical analysis it is found that 500 mL of $CaCl_2$ solution contain $1.505 \times 10^{23} Cl^-$ ions.

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21. 100 mL of a solution containing 5 g of NaOH are mixed with 200 mL of $\frac{M}{5}$ NaOH solution . Calculate the molartiy of the resulting solutions.

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22. Density of $2.05M$ solution of acetic acid in water is $1.02g/mL$. The molality of same solution is:

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23. Concentrated HNO_3 is 69% by mass of nitric acid. Calculate the volume of the solution which contains $23g$ of HNO_3. (Density of concentrated HNO_3 solution is $1.41gml^{-1}$)

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24. Battery acid is 4.27 M H_2SO_4 (aq) and has density of $1.25mL^{-1}$. What is the molality of H_2SO_4 in the solution ?

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25. Hunderd gram of $Al(NHO_3)_3$ [molar mass $213 gmol^{-1}$] is dissolved in 1L of water at $20^{\circ}C$. The density of water at this temperature is $0.9982 cm^{-3}$ and the density of resulting solution is $0.999 gcm^{-3}$. Calculate the molarity and molality of this solution .

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26. What concentration of nitrogen should be present in a glass of water at room temperatrure ? Assume a temperature of $25^{\circ}C$, a total pressure of one atmosphere and mole fraction of nitrogen in air as 0.78 $(K_H$ for nitrogen=8.42x$10^{-7}\dfrac{M}{mmHg}$

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27. 1 kg of water under a nitrogen pressure of 1 atmosphere dissolves 0.02 gm of nitrogenat 293 k. Calculate Henry' s law constant :

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28. Cacluate the amount of CO_2 dissolved at 4 atm in 1 dm^3 of water at 298 K . The Henry's law constant for CO_2 at 298K is 1.67 k bar .

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29. At what partial pressure , oxygen will have a solubility of $0.06gL^{-1}$ in water at 298 K ? Henry's law constant (K_H) of O_2 in water at 303 K is 46.82 k bar .(Assume the density of the solution to be the same as that of water).

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30. The mole fraction of He gas in a saturated solution at $20^\circ C$ is 1.25×10^{-6}. Calculate the pressure of He gas above the solution . (K_H of He at $20^\circ C = 144.98$ k bar)

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31. The vapour pressure of methyl alcohol at $298K$ is 0.158 bar. The vapour pressure of this liquid in solution with liquid B is 0.095 bar. Calculate the mole fraction of methyl alcohol in the solution if the mixture obeys Raoult's law.

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32. At 293 K , ethyl acetate has vapour pressure of 72.8 torr of Hg and ethyl propionate has vapour pressure of 27.7 torr of Hg. Assuming their mixtures to obey Raoult's law determine the vapour pressure of a mixture containing 25 g of ethyl acetate and 50 g of ethyl propionate .

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33. An aqueous solution containing 28% by mass of a liquid A (molecular mass = 140) has a vapour pressure of 160 mm at $37^{\circ}C$. Find the vapour pressure of pure liquid A (the vapour pressure of water at $37^{\circ}C$ is 150 mm)

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34. Benzene and toluene form nearly ideal solution. At $298K$, the vapour pressure of pure benzene is 150 torr and of pure toluence is 50 torr. Calculate the vapour pressure of the solution, containing equal weights of two substances at this temperature?

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35. The vapour pressure of ethanol and methanol ate $44.5mmHg$ and $88.7mmHg$, respectively. An ideal solution is formed at the same temperature by mixing $60g$ of ethanol and $40g$ of methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour.

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36. Methanol and ethanol froms nearly ideal solution at 300 K. A solution is made by mixing 32g methanol and 23 g ethanol. Calculate the partial pressure of its constituents and the total pressure of the solution. (at 300 K , $p^{\circ}_{(CH_3OH)} = 90$ mm Hg, $p^{\circ}_{(C_2H_5OH)} = 51$ mm Hg).

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37. At $20^{\circ}C$, the vapour pressure of pure liquid A is $22mmHg$ and that of pure liquid B is $75mmHg$. What is the composition of the solution of these two components that has vapour pressure of $48.5mmHg$ at this temperature?

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38. Two liquids A and B have vapour pressure of 0.658 bar and 0.264 bar respectively. In an ideal solution of the two , calculate the mole fraction of A at which the two liquids have equal partical pressure .

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39. The liquids X and Y from ideal solution having vapour pressures 200 and 100 mm Hg respectively. Calculate the mole fraction of component X in vapour phase in equilibrium with an equimolar solution of the two .

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40. At a certain temperature , the vapour pressure (in mm Hg) of CH_3OH and C_2H_5OH solution is represented by P = 119 x + 135 where x is the mole fraction of CH_3OH . What are the vapour pressure of pure components at this temperature ?

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41. 30 g of urea (M=60g mol^{-1}) is dissolved in 846g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

(b) Write two differences between ideal solutions and non-ideal solutions,

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42. The vapour pressure of water is $12.3 kPa$ at $300 K$. Calculate vapour pressure of 1 molal solution of a solute in it.

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43. The vapour pressure of pure water at $20^{\circ} C$ is 17.5 mm of Hg. A solution of sucrose is prepared by dissoving 68.4 g of sucrese in 1000 g of water. Calculate the vapour pressure of the solution.

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44. The vapour pressure of pure benzene at a certain temperature is 262 bar . At the same temperature the vapour pressure of a solution containing 2 g of non - volatil , non -electrolytic solid in 100 g of benzene is 256 bar . What is the molecular mass of the solid ?

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45. The vapour pressures of pure liquids A B are 450 mm and 700 mm of Hg respectively at 350 K. Calculate the compositon of the liquid mixture if total vapour pressure is 600 mm of Hg. Also find the composition in the Vapour phase.

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46. The vapour pressure of a 5% aqueous solution of a non-volatile organic substance at $373K$. Is $745mm$. Calculate the molecular mass of the solute.

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47. At $25^{\circ} C$, the vapour pressure of pure water is 23.76mm of Hg and that of an aqueous dilute solution of urea is 22.98 mm of Hg . Calculate the molality of the solution .

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48. What weight of the non-volatile solute urea' $(NH_2 - CO - NH_2)$ needs to be dissolved in $100g$ of water in order to decrease the vapour pressure of water by 25% ? What will be the molality of the solution?

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49. What weight of the non -volatile solute, urea needs to be dissolved in 100g of water, in order to decrease the vapour pressure of water by 25%? What will be the molality of the solution?

Watch Video Solution

50. The vapour pressure of water at 298 K is 0.0231 bar and the vapour pressure of a solution of 108.24 g of a compound in 1000g of water at the same temperature is 0.0228 bar.Calculate the molar mass of the solute.

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51. A solution containing 8 g of substances in 100 g of diethyl ether bolis at $36.86^{\circ} C$, whereas pure ether boils at $35.60^{\circ} C$. Determine the molecular mass of the solute. (For ether $K_b 2.02 Kg \text{mol}^{-1}$)

Watch Video Solution

52. The boiling of a solution containing 1.5 g of dichlorobenzene in 100 g of benzene was higher by $0.268^{\circ} C$. Calculate the molar mass of dichlorobenzene (k_b for benzene 2.62 degree/molal)

Watch Video Solution

53. $18g$ of glucose $(C_6H_{12}O_6)$ is dissolved in $1kg$ of water in a saucepan. At what temperature will the water boil (at 1 atm) ? K_b for water is $0.52Kkgmol^{-1}$.

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54. The boiling point of water $(100^\circ C)$ becomes 100.52° C if 3 g of a non - volatile solute is dissolved in 20 ml of it . Calculate the molar mass of the solute (k_b for water $= 0.52Km^{-1}$).

Watch Video Solution

55. A solution containing 0.513 g of naphthalene (molar mass = 128) in 50 g of CCl_4 gives a boiling point elevation of $0.402^\circ C$ while a solution of 0.625 g of an unknown solute gives a boiling point elevation of $0.650^\circ C$. Find the molar mass of the unknown solute .

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56. 10 gram of a non -volatile solute when dissolved in 100 gram of benzene raises its boiling point 1°. What is the molecular mass of the solute ? (k_b for benzene $Kmol^{-1}$).

Watch Video Solution

57. What elevation in boiling point of alcohol is to be expected when 5 g of urea (molar mass = 60) are dissolved in 75 g of it ? The molal elevation constant for alcohol is $1.15^{\circ}C$.

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58. At solution containing 12.5 g of non - electrolyte substance in 175 g of water gave boiling point elevation of 0.70 K. Calculate the molar mass of the substance. Molal elevation constant (K_b) for water $0.52 \text{ K kg mol}^{-1}$?

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59. A 4% solution (w/w) of sucrose (M 342 g mol^{-1}) in water has a freezing point of 271.15K Calculate the freezing point of 5% glucose (M= 180 g mol^{-1}) in water.

(Given: Freezing point of pure water 273.15 K)

Watch Video Solution

60. Calculatate the mass of compound (molar mass = $256 gmol^{-1}$ be the dissolved in 75 g of benzene to lower its freezing point by $0.48K\left(k_f = 5.12 Kkgmol^{-1}\right.$.

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61. A solution containing 18 g of a non - electrolytic solute in 200g of H_2O freezes at 272.07 K . Find the molecular mass of the solute . ($K_f = 1.86 Km^{-1}$).

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62. 1.00g of non - electrolyte dissolved in 100 g of CS_2 , the freezing point lowered by 0.40 K. Find the molar mass of the solute .

(k_f for $CS_2 = 5.12 K kg mol^{-1}$).

Watch Video Solution

63. When 2.56 g of sulphur is dissolved in 100 g of CS_2, the freezing point of the solution gets lowerd by 0.383 K. Calculate the formula of sulphur (S_x). [Given K_f for CS_2=3.83 $K kg mol^{-1}$], [Atomic mass of sulphur=32g mol^{-1}]

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64. 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 $0^\circ C$ to $-10.0^\circ C$ (k_f for water = $1.86 \text{ K kg mol}^{-1}$).

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65. Visha took two aqueous solutions, one containing 7.5 g of urea (Molar mass = 60 g/mol) and the other containing 42.75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z.

Watch Video Solution

66. When 30.0 g of a non - volatile solute having the empirical fromual CH_2O are dissolved in 800g of water , the solution freezes at $-1.16^\circ C$. What is the molecular formula of the solute ? (k_f for water $= 1.86 Km^{-1}$)

View Text Solution

67. In winter, the normal temperature in a Himalayan's valley was found to be $-10^\circ C$. Is a 30% by mass of aqueous solution of ethylene glycol (molar mass = 62) suitable for car radiator ? (K_f for water = 1.86K/m) .

View Text Solution

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68. An aqueus solution freezes at 272.07 K while pure water freezes at 273 K. Determine the molality and boiling point of the solution. Given $K_f = 1.86 K / m, K_b = 0.512 K / m.$

Watch Video Solution

69. A solution of urea in water has a boiling point $101.128^\circ C$ .Calculate the freezing point of the same solution . Molal constant for water ,k_f and k_b are $1.86 Km^{-1}$ and $0.512 Km^{-1}$ respectively.

View Text Solution

70. Ethylene glycol $(HOH_2C - CH_2OH)$ is used as an antifreeze for water to be used in car radiators in cold places. How much ethylene glycol should be added to 1 kg of water to prevent it from freezing at $-10^\circ C$? Molal depression constant of water is 1.86 K kg mol^{-1}.

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71. A solution of sucrose (molar mass = 342 g/mol) is prepared by dissolving 68.4 g of it per litre of solution, what is its osmotic pressure at 273 K?

$(R = 0.081 L atm K^{-1} mol^{-1})$

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72. Osmotic pressure of a solution containing 3.5g of dissolved protein per 50 cc of a solution is 25 mm (Hg) at $37^{\circ} C$. Calculate the molar mass of protein.

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73. The osmotic pressure of a solution containing 9.2g of a substance (molar mass = 176) in 302 ml of solution was found to be 4.1 atmosphere at $15.5^{\circ} C$. Calculate the value of solution constant.

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74. Calculte the osmotic pressure of a solution obtained by mixing 100 mL of 4.5% solution of urea (mol. Mass =60) and 100 mL pf 3.42% solution of cane sugar (mol. Mass =342) at 300 K. $\left(Given R = 0.0821 Latm K^{-1} mol^{-1}\right)$

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75. Three grams of non - volatile solute whenn dissolved in a litre of water shows an osmotic pressure of 2 bar at 300K. Calculate the molar mass of the solute .$\left(R = 0.083 L\overline{K}^{-1} mol^{-1}\right)$.

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76. Calculate the osmotic pressure of a solutions containing 10 gram each of glucose $(C_6H_{12}O_6)$ and $(C_{12}H_{22}O_{11})$ in $1000 cm^3$ of the solution at $25^\circ C$.$(R = 0.083 L\overline{K}^{-1} mol^{-1})$.

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77. A solution containing 10.2 g of glycrine per litre is found to be isotonic with 2% solution of glucose $\left(\text{molar mass} = 180 gmol^{-1}\right)$. Calculate the molar mass of glycrine.

Watch Video Solution

78. A 5% solution of cane sugar is isotonic with 0.877% solution of urea. Calculate the molecular mass of urea if the molecular mass of cane sugar is 342.

Watch Video Solution

79. The concentration in g/L of a solution of cane sugar (Molecular weight = 342) which is isotonic with a solution containing 6 g of urea (Molecular weight = 60) per litre is

Watch Video Solution

Watch Video Solution

80. Osmotic pressure of a solution contaning 7 g.of a protein per $100cm^3$ of solution is 3.3×10^{-2} atm at $37^{\circ} C$. Calculate the molar mass of protein.

Watch Video Solution

81. A solution of an organic compound is preaped by dissolving 68.4 g in 1000 g of water .Calculate pressure of the solution at 293 K when elevation in boiling point is 0.104 and K_b for water is $0.53Km^{-1}$.

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82. A solution of an organic compund is prepared by dissolving 34.2 g in 500 g of water.Calculate the molecular mass of the compound and freezing point of the solution . Given that k_b for water = 0.52 Km^{-1} , b.pt of solution $= 100.14^{\circ} C$, K_f for water = $1.87Km^{-1}$.

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83. The average osmotic pressure of human blood is 7.7 atm at $40^\circ C$.

(a) What would be the total concentrationn of various solutes in the blood ?

(b) Assuming the concentration to be essentially the same as the molality , calculate the freezing point of blood (k_f for water $= 1.86^\circ C m^{-1}$).

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84. The osmotic pressure of blood is 8.2 atm at $37^\circ C$. How much glucose should be used per litre of for an intravenous injection that is isotonic with blood ?

Watch Video Solution

85. 600 mL of aqueous solution contining 2.5 g of a protein shows an osmotic pressure of 25mm Hg at $27^\circ C$.Determine the molecular mass of protein.

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86. A decinormal solution of NaCl exerts an osmotic pressure of 4.6 atm. at 300 K. Calculate its degree of dissociation. $(R = 0.082 Latm. K^{-1} mol^{-1})$

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87. Calculate the freezing point of the one molar aqueous solution (density $1.04 gL^{-1}$) of KCl (k_f for wateer $= 1.86 kgmol^{-1}$, atomic mass of K = 39 ,Cl = 35.5)

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88. KBr undergoes 80% dissociation in its 0.5M aqueous solution.Calculate the osmotic pressure of this solution at $287^{\circ} C$.

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89. Calculate the amount of sodium chloride (electrolyte) which must be added to one kilogram of water so that the freezing point is depressed by 3K. Give k_f for water = $1.86 K kg mol^{-1}$

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90. Phenol associates in benzene to from dimer $(C_6H_5OH)_2$. The freezing point of a solution containing 5g of phenol in 250 g of benzene is lowered by $0.70^\circ C$. Calculate the degree of association of phenol in benzene .(k_f for benzene $= 5.12 K m^{-1}$)

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91. 1.5 g of $Ba(NO_3)_2$ dissolved in 100g of water shows a depression in freezing point equal to $0.28^\circ C$. What is the percentage dissociation of the salt ? (k_f for water $= 1.86 K/m$ and molar mass of $Ba(NO_3)_2 = 261$).

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92. Calculate the difference between the boiling points of 0.2 m Na_2SO_4 and 0.5 m glucose assuming complete dissociation of Na_2SO_4. (K_b for water $= 0.52 Km^{-1}$).

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93. The freezing point of solution containing $0.2g$ of acetic acid in $20.0g$ of benzene is lowered by $0.45^{\circ} C$. Calculate the degree of association of acetic acid in benzene.

$(K_f = 5.12 K^{\circ} mol^{-1} kg^{-1})$

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94. Calculate the normal freezing point of a sample of sea water containing 3.8% NaCl and 0.12 % $MgCl_2$ by mass .(k_f for water $= 1.86 km^{-1}$).

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95. Calculate the molality of NaCl solution whose elevation in boiling point is equal to the depression in freezing point of 0.25 m sodium carbonate solution in water assuming complete dissociation of salts. ($k_f = 1.86 Km^{-1}, k_b = 0.52 Km^{-1}$)

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96. A $0.01 m$ aqueous solution of $K_3[Fe(CN)_6]$ freezes ar $-0.062^\circ C$. What is the apparent percentage of dissociation? $[K_f$ for water $= 1.86]$

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

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98. An aqueous solution containing 4.9 g of solute dissolved in 500 mL of the soluiton shows an osmotic pressure of 2.1 atmosphere at $27^{\circ} C$. What is the nature of the solute (associated or dissociated , if the molar mass of solute is 57a.m.u) ?

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99. 0.01 M solution of KCl and $CaCl_2$ are separately prepared in water. The freezing point of KCl is found to be $-2^{\circ} C$. What is the freezing point of $CaCl_2$ aq. Solution if it is completely ionized?

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100. Calculate the freezing point of an aquteous containing 10.50 g of $MgBr_2$ in 200 g of water (molar mass of $MgBr_2 = 184 mol^{-1}, K_f f$ or $water = 1.86 K kg mol^{-1}$)

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ADVANCED LEVEL (PROBLEMS)

1. Concentrated sulphuric acid has density of 1.9 g/mL and 99% H_2SO_4 by mass. Calculate the molarity of the acid.

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2. Calculate the density of H_2SO_4 solution whose molarity and molality are 10.8 M and 92.6m respectively.

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3. How many grams of wet NaOH contianing 15% water is required to prepare 6L of 0.5 M NaOH solution?

Watch Video Solution

4. Calculate the resulting molarity of a solution obtained by adding 6.2 g of KOH to 500 mL of $\frac{M}{5}$ KOH solution (density $= 1.06 gml^{-1}$). The density of resulting solution is $1.10 gmL^{-1}$.

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5. The mole fraction of urea in an aqueous urea solution containing 900 g of water is 0.05. If the density of the solution is $1.2 gcm^{-3}$, the molarity of urea solution is ________

Given data: Molar masses of urea and water are $60 g\text{mol}^{-1}$ and $18 g\text{mol}^{-1}$, respectively)

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6. The mole fraction of X in the vapours in equilibrium with homogenous mixtuer of liquids X and Y is 0.42. The vapour pressure of liquids X and Y at the same temperature are 406.5 and 140 torr respectively. Calculate the mole fraction of X in the solution.

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7. Liquids A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary solution of liquids A and B has vapour pressure 45 torr. At the same temperature, a new solution of A and B having mole fractions x_A and x_B, respectively, has vapours pressure of 22. torr. The value of x_A / x_B in the new solution is _____.

(Given that the vapour pressure of pure liquid A is 20 torr at temperature T).

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8. A solution of A and B with 30 mol % A is in equilibrium with its vapour which contains 40 mol% % B. Assuming that the solution and the vapour behave ideally, calculate the ratio of vapour pressure of pure A and pure B.

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9. How many grams of sucrose (molecular weight 342) should be dissolved in $100g$ water in order to produce a solution with $105^\circ C$ difference between the freezing point and the boiling point ? $\left(K_b = 0.51^\circ Cm^{-1}, \left(K_f = 1.86^\circ Cm^{-1}\right)\right.$

Watch Video Solution

10. If the boiling point of an aqueous solution containing a non-volatile solute is $100.15^\circ C$. What is its freezing point? Given latent heat of fusion and vapourization of water $80calg^{-1}$ and $540calg^{-1}$, respectively.

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11. A very small amount of a non-volatile solute (that does not dissociate) is dissolved in $56.8cm^3$ of benzene (density $0.889gcm^3$). At room temperature, vapour pressure of this solution is $98.88mmHg$ while that of benzene is $100mmHg$. Find the molality of this solution. If the freezing temperature of this solution is 0.73 degree lower than that of benzene, what is the value of molal the freezing point depression constant of benzene?

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12. Calculate the amount of ice that will separate out on cooling a solution containing 50g of ethylene glycol in 200g water to $-9.3^\circ C$ (K_f for water $= 1.86 \text{K kg mol}^{-1}$)

Watch Video Solution

13. At $10^{\circ} C$, the osmotic pressure of urea solution is $500 mm$.The solution is diluted and the temperature is raised to $25^{\circ} C$.when the osmotic pressure is found to be $105.3 mm$. Determine the extent of dilution.

Watch Video Solution

14. One hundred gram of a 5 m urea solution are cooled to $-6^{\circ} C$ .What amount of urea will seprate out ? $\left(K_f = 1.86 K m^{-1}\right)$?

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15. On dissolving 0.5 g of non-volatile, non-ionic solute to 39 g of benzene, its vapour pressure decreases from 650 mm of Hg to 640 mm of Hg. The depression of freezing point of benzene (in K) upon addition of the solute is ________.

(Given data: Molar mass & molar freezing point depression is 78 g mol^{-1}&$5.12 K kg mol^{-1}$]

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16. A 1.2% solution (w/v) of NaCl is isotonic with 7.2% solution(w/v) of glucose. Calculate degree of ionization and Van't Hoff factor of NaCl.

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17. To $500 cm^3$ of water, $3.0 \times 10^{-3} kg$ acetic acid is added. If 23% of acetic acid is dissociated, what will be the depression in freezing point? K_f and density of water are $1.86 K kg mol^{-1}$ and $0.997 g cm^{-3}$ respectively.

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18. The freezing point of a 0.08 molal solution of $NaHSO^4$ is $-0.372^\circ C$. Calculate the dissociation constant for the reaction.

K_f for water $= 1.86 K m^{-1}$

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19. A storage battery contains a solution of $H_2SO_4 38\%$ by weight. At this concentration, the Vant't Hoff factor is 2.50. At what temperature will the battery contents freeze? $(K_f = 1.86^{\circ} mol^{-1} kg)$

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20. A certain mass of a substance when dissolved in $100 g C_6H_6$ lowers the freezing point by $1.28^{\circ} C$. The same mass of solute dissolved in $100 g$ of water lowers of the freezing point by $1.40^{\circ} C$. If the substance has normal molecular weight in benzene and is completely dissocited in water, into how many ions does it dissocite in water ? K_f for H_2O and C_6H_6 are 1.86 and $5.12 K mol^{-1} kg$ respectively.

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21. The plot given below shows P - T curves (where P is the pressure and T is the temperature) for two solvent X and Y and isomolal solution of NaCl in these solvents. NaCl compeletly dissociates in both the solvents.

On addition of equal number of moles of nonvolatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is three times that solvent Y. Solute S is known to undergo dimerization is 0.7 in solvent Y , then what is the degree of dimerization in solvent X ?

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CONCEPTUAL QUESTIONS

1. Which aqueous solution has higher concentration : 1 molar or 1 molal solution of the same solute ?

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2. Ethanol is an organic compound, yet it is freeely miscible with water, Explain.

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3. What is the normality of .

(a) 1.5 M H_2SO_4, (b) 1.2 M CH_3COOH (c) 1.0 M NaOH ?

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4. Which out of molarity or molality will change with change in temperature and why ?

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5. Will the molarity of a solution at $50^\circ C$ be same, less or more than molarity at $25^\circ C$?

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6. The sum of mole fraction of all components of a solution is unity.

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7. Differentiate between molarity and molality of a solution .How can we change molality value of solution in to molarity value?

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8. How is partial pressure of a gas related to its mole fraction?

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9. At a same temperature , hydrgone is more soluble in water than helium . Which of them will have a higher value of K_H and why ?

Watch Video Solution

Watch Video Solution

10. What is the relation between normallity and molarity of a give solution of sulphuric acid ?

Watch Video Solution

11. What is the effect of temperataure on the solubility of sodium sulphtae decahydrate $(Na_2SO_4 10, H_2O)$?

View Text Solution

12. The dissolution of ammonium chloride in water is an endothermic process. What is the effect of temperature on its solubility?

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13. Given reason , at higher altitudes , people suffere from a disease called anoxia. In the disease, they become weak and cannot think clearly.

Watch Video Solution

14. What happens to the vapour pressure of water if a table spoon of sugar is added to it?

Watch Video Solution

15. Explain why cooking is faster in a pressure cooker.

Watch Video Solution

16. Why is the vapour pressure of liquid constant at a constant temperature ?

Watch Video Solution

17. Two liquids A and B are mixed and the resulting solution is found to be cooler. What do you conclude about the deviation from ideal behaviour?

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18. Can we separate the components of azeotropic mixture by distillation?

Watch Video Solution

19. Mixing of acetone with chloroform takes place with reduction in volume? What type of deviation from Raoult's law is shown in this case?

Watch Video Solution

20. The bottle of liquid ammonia is generally cooled before opening the seal. Assign reson.

Watch Video Solution

21. Two liquids A and B boil $145^{\circ} C$and $190^{\circ} C$respectivly. Which of them has a higher vapour pressre at $80^{\circ} C$?

Watch Video Solution

22. Two liquids A and$B$ on mixing produce a warm solution. Which type of deviation from Raoult's law does it show?

Watch Video Solution

23. A solution of chloroform and acetone is an axemple of maximum boiling azeotrope. Explain.

Watch Video Solution

24. The dissolution of ammonium chloride in water is an endothermic process. What is the effect of temperature on its solubility?

Watch Video Solution

25. Out of 0.1 molal aqueous solution of glucose and 0.1 molal aqueous solution of KCl, which one will have higher boiling point and why?

Watch Video Solution

26. Find the Van't Hoff factor of

a.CH_3COOH in H_2O ,

b.CH_3COOH in benzene

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27. What happens when the external pressure applied becomes more than the osmotic pressure of solution?

Watch Video Solution

28. Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing

1.2% sodium chloride

0.4% sodium chloride

1.2% sodium chloride

0.4% sodium chloride.

Watch Video Solution

29. When dehydrated fruits and vegetables are placed in water, they slowly swell and return to original form. Why? Would a temperature increase accelerate the process? Explain.

Watch Video Solution

Watch Video Solution

30. Why is great care taken in intravenous injections to have comparable concentration of solutions to be injected to that of blood plasma?

Watch Video Solution

31. Which colligative property is preferred for the molar mass determination of macromolecules (i.e.,proteins and polmers)?

Watch Video Solution

32. Will the depression in freezing point be same or different if 0.1 mole of sugar or 0.1 mole of glucose is dissolved in one litre of water ?

Watch Video Solution

33. Outer hard shells of two eggs are removed. One of the eggs is placed in pure water and the other is placed in saturated solution of sodium chloride. What will be observed and why?

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34. Are equimolar solutions of sodium chloride and urea isotonic? Why?

Watch Video Solution

35. Why is it advised to add ethylene glycol to water in car radiator while driving in a hill station?

Watch Video Solution

36. Sodium chloride solution freezes at lower temperature then water but boils at higher temperature than water. Explain.

Watch Video Solution

37. What is de-icing agent? How does it work?

Watch Video Solution

38. Why is camphor preferred as a solvent for measuring the molecular mass of naphthalene by Rast method?

Watch Video Solution

39. What will happen to the freezing point of a solution when mercuric iodide is added to an aqueous solution of potassium iodide ?

Watch Video Solution

40. Arrange the following in increasing order of freezing point:

$0.2 M NaOH, 0.2 M Na_2Co_3, 0.1 M AgNO_3, 0.1 M(NH_4)_2, SO_4, FeSO_4, H_2($

.

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41. Why an azeotropic mixture gets distilled without any CHMange is composition ?

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42. Under what condition Van't Hoff factor

(i) is

(a) equal to unity, (b) less than 1, and c greater than 1.

Explain your answer.

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43. State the condition resulting in reverse osmosis.

Watch Video Solution

44. Which of the following solution has higher freezing point ? Justify your answer.

$0.05 M AI_2(SO_4)_3$

$0.1 M K_3[Fe(CN)_6]$.

Watch Video Solution

NCERT FILE (IN-TEXT QUESTIONS)

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

Watch Video Solution

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

Watch Video Solution

3. Calculate the molarity of each of the following solutions :

a. $30g$ of $Co(NO_3)_2.6H_2O$ in $4.3L$ of solution

b. $30mL$ of $0.5MH_2SO_4$ diluted to $500mL$.

Watch Video Solution

4. Calculate the mass of urea (NH_2CONH_2) required in making $2.5kg$of 0.25molal aqueous solution.

Watch Video Solution

5. Calculate the (a) molality, (b) molartiy, and (c) mole fraction of KI if the density of $20\,\%$ (mass / mass) aqueous KI is $1.202 gmL^{-1}$.

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6. 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

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

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8. The vapour pressure of pure liquids A and B is 450 and $700 mmHg$, respectively, at $350K$. Find out the composition of the liquid mixture if the total vapour pressure is $600 mmHg$. Also find the composition of the vapour phase.

Watch Video Solution

9. Vapour pressure of pure water at $298K$ is $23.8 mmHg$. $50g$ of urea (NH_2CONH_2) is dissolved in $850g$ of water. Calculate the vapour pressure of water for this solution and its relative lowering.

Watch Video Solution

10. The boiling point of water at $750 mmHg$ is $99.63^\circ C$. How much sucrose is to be added to $500g$ of water such that it boils at $100^\circ C$.

Watch Video Solution

11. Calculate the mass of ascorbic acid (Vitamin $C, C_6H_8O_6$) to be dissolved in $75g$ of acetic acid to lower its melting poit by $1.5^\circ C$. $K_f = 3.9 Kkgmol^{-1}$

Watch Video Solution

12. Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving $1.0g$ of polymer of molar mass $185,000$ in $450mL$ of water at $37^\circ C$.

Watch Video Solution

NCERT FILE (TEXTBOOK EXERCISES)

1. Define the term solution. How many types of solutions are formed ? Write briefly about eaCHM type with an example.

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2. Suppose a solid solution is formed between two substances, one whose particles are very large and the other whose particles are very small. What kind of solide solution is this likely to be ?

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3. Define the following terms :

a. Mole fraction b. Molality

c. Molarity `d. Mass percentage.

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4. Concentrated nitric acid used for laboratory works is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of solution is $1.504 gmL^{-1}$?

Watch Video Solution

5. A solution of glucose in water is labelled as $10\text{percent}w/w$, what would be the molality and mole fraction of each component in the solution? If the density of the solution is $1.2gmL^{-1}$, then what shall be the molarity of the solution?

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6. Volume of $0.1MHCI$ required to react completely with 1g equimolar mixture of Na_2CO_3 and $NaHCO_3$ is

Watch Video Solution

7. A solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solutionby mass. Calculate the mass percentage of solute in the resulting solution.

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8. An antifreeze solution is prepared from $222.6g$ of ethylene glycol $\left[C_2H_4(OH)_2\right]$ and $200g$ of water. Calculate the molality of the solution. If the density of the solution is $1.072gmL^{-1}$ then what shall be the molarity of the solution?

Watch Video Solution

9. 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 per cent by mass.

(ii) Determine the molality of chloroform in the water sample.

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10. What role does the molecular interaction play in a solution of alcohol and water ?

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

Watch Video Solution

12. State Henry's law and mention some important applications ?

Watch Video Solution

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

Watch Video Solution

14. 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 ?

Watch Video Solution

15. An aqueous solution of 2 per cent $(wt. \ / wt)$ 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?

Watch Video Solution

16. Heptane and octane form ideal solution. At 373 K, the vapour pressures of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure of a mixture of 26.0 g of heptane and 35 g of octane ?

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17. The vapour pressure of water is $12.3kPa$ at $300K$. Calculate vapour pressure of 1 molal solution of a solute in it.

Watch Video Solution

18. Calculate the mass of a non-volatile solute (molecular mass 40) which should be dissolved in $114g$ octane to reduce its vapour pressure to 80%.

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19. A solution containing 30g of a non-volatile non-electrolyte solute exactly in 90g water has a vapour pressure of $2.8kPa$ at 298K. Further, 18g of water is then added to solution, the new vapour pressure becomes $2.9kPa$ at 298K. The solutions obey Raoult's law and are not dilute, molar mass of solute is

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20. A 5% solution (by mass) of cane sugar in water has freezing point of 271 K. Calculate the freezing point of a 5% glucose (by mass) in water. The freezing point of pure water is 273.15 K.

Watch Video Solution

21. Two elements A and B form compounds having molecular formula AB_2 and AB_4. When dissolved in $20g$ of benzene, $1g$of AB_2 lowers the freezing point by $2.3K$, whereas $1.0g$ of AB_4 lowers it by $1.3K$. The molar depression constant for benzene is $5.1Kkgmol^{-1}$. Calculate the atomic mass of A and B.

Watch Video Solution

22. At $300K$, $36g$ of glucose present per litre in its solution has an osmotic pressure of 4.98^{-}. If the osmotic pressure of the solution is 1.52^{-} at the same temperature, what would be its concentration?

Watch Video Solution

Watch Video Solution

23. Suggest the most important type of intermolecular attractive interaction in the following pairs :

$a.\ n-$ Hexane and $n-$ octane

$b.\ I_2$ and CCl_4

$c.\ NaClO_4$ and water

$d.$ Methanol and acetone

$e.$ Acetonitrile (CHM_3CN) and acetone (C_3H_6O)

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24. Based on solute $-$ solvent interactions, arrange the following in order of increasing solubility in $n-$octane and explain the result. Cyclohexane, KCl, CHM_3OH, CHM_3CN.

Watch Video Solution

25. Among the following compounds, identify which are insoluble, partially soluble, and highly soluble in water ?

$a.$ Phenol $b.$ Toluene

$c.$ Formic acid $d.$ Ethylene glycol

$e.$ CHMloroform $f.$ Pentanol

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26. If the density of some lake water is $1.25gmL^{-1}$ and contains $92g$ of $Na^{\oplus}$ ions per kg of water, calculate the molality of $Na^{\oplus}$ ions in the lake.

Watch Video Solution

27. If the solubility product of CuS is 6×10^{-16}, calculate the maximum molarity of CuS in aqueous solution.

Watch Video Solution

28. Calculate the mass percentage of aspirin $(C_9H_8O_4)$ in acetonitrile (CHM_3CN) when $6.5g$ of $C_9H_8O_4$ is dissolved in $450g$ of CHM_3CN.

Watch Video Solution

29. Nalorphene $(C_{19}H_{22}NO_3)$, similar to morphine , is used to combat withdrawal symptoms in narcotic users. The dose of nalorphene generally given is $1.5mg$. Calculate the mass of solution of $1.5 \times 10^{-3}m$ aqueous solution required for the above dose.

Watch Video Solution

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

Watch Video Solution

31. 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.

Watch Video Solution

32. Calculate the depression in freezing point of water when 10 g of $CH_3CH_3CH(CI)COOH$ is added to 250 g of water. $K_a = 1.4 \times 10^{-3}, K_f = 1.86 Kkgmol^{-1}$.

Watch Video Solution

33. $19.5g$ of CH_2FCOOH is dissolved in $500g$ of water . The depression in the 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

34. Vapour pressure of water at 293 K is 17.535 mm Hg. Calculate the vapour pressure of water at 293 K when 25 g of glucose is dissoved in 450 g of water.

Watch Video Solution

35. Henry's law constant for the molality of methane in benzene at 298 K is $4.27 \times 10^5 mm$ Hg. Calculate the solubility of methane in benzene at 298 K under 760 mm Hg.

Watch Video Solution

36. $100g$ of liquid $A($ molar mass $140gmol^{-1})$ was dissolved in $1000g$ of liquid $B($ molar mass $180gmol^{-1})$. 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 $475T \text{ or } r$

Watch Video Solution

37. Benzene and toluene form ideal solution over the entire range of composition. The vapour pressure of pure benzene and naphthalene at $300K$ are $50.71 mmHg$ and $32.06 mmHg$, respectively. Calculate the mole fraction of benzene in vapour phase if $80g$ of benzene is mixed with $100g$ of naphthalene.

Watch Video Solution

38. The air is a mixture of a number of gases. The major components are oxygen and nitrogen with approximate proportion of $20\% : 79\%$ by volume at $298K$. The water is in equilibrium with air at a pressure of $10 atm$ At $298K$ if Henry's law constants for oxygen and nitrogen at $298K$ are $3.30 \times 10^7 mm$ and $6.51 \times 10^7 mm$, respectively, calculate the composition of these gases in water.

Watch Video Solution

39. Determine the osmotic pressure of a solution prepared by dissolving $25mg$ of K_2SO_4 in $2L$ of water at $25^\circ C$, assuming that it is completely dissociated.

Watch Video Solution

NCERT EXEMPLAR PROBLEMS (MULTIPLE CHOICE QUESTIONS (TYPE -I))

1. Which of the following units is useful in relating concentration of solution with its vapour pressure?

A. mole fraction

B. parts per million

C. mass percentage

D. molality

Answer: A

Watch Video Solution

2. On dissolving sugar in water at room temperature solution feels cool to touch. Under which of the following cases dissolution of sugar will be most rapid?

A. Sugar crystals in cold water

B. Sugar crystals in hot water,

C. Powdered sugar in cold water.

D. Powdered sugar in hot water.

Answer: D

Watch Video Solution

3. At equilibrium the rate of dissolution of a solid solute in a volatile liquid solvent is ______ .

A. less than the rate of crystallisation

B. greater than the rate of crystallisation

C. equal to the rate of crystallisation

D. zero

Answer: C

Watch Video Solution

4. A beaker contains a solution of substance'A' precipitation of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is.........

A. saturated

B. supersaturated

C. unsaturated

D. concentrated

Answer: B

Watch Video Solution

5. Maximum amount of a solid aolute that can be dissolved in a specified amount of a given liquid solvent does not depend upon...........

A. Temperature

B. Nature of solute

C. Pressure

D. Nature of solvent

Answer: C

Watch Video Solution

6. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to.......

A. low temperature

B. low atmospheric pressure

C. high atmospheric pressure

D. both low temperature and high atmospheric pressure

Answer: B

Watch Video Solution

7. Considering the formation, breaking and stregth of hydrogen bond, pradict which of the following mixture will show a positive devition from Raoult's law?

A. Methanol and acetone.

B. Chloroform and acetone.

C. Nitric acid and water.

D. Phenol and aniline.

Answer: A

Watch Video Solution

8. Colligative properties depend on ___

A. the nature of the solute particles dissolved in solution.

B. the number of solute particles in solution.

C. the physical properties of the solute particles dissolved in solution.

D. the nature of solvent particles.

Answer: B

Watch Video Solution

9. Which of the following aqueous solution should have the highest boiling point ?

A. $1.0 M NaOH$

B. $1.0 M Na_2SO_4$

C. $1.0 M NH_4NO_4$

D. $1.0 M KNO_3$

Answer: B

Watch Video Solution

10. The unit of ebullioscopic constant is _______ .

A. K kg mol^{-1} or K $(\text{molality})^{-1}$

B. mol kg k^{-1} or $K^{-1}(\text{molality})$

C. kg mol^{-1} or $k^{-1}(\text{molality})^{-1}$

D. K molkg^{-1} or K (molality)

Answer: A

Watch Video Solution

11. In coparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M $MgCl_2$ solution is......

A. the same

B. about twice

C. about three times

D. about six times

Answer: C

Watch Video Solution

12. An unriped mango placed in a concentrated salt solution to prepare pickle shrivels because......

A. it gains water due to osmosis.

B. it loses water due to reverse osmosis.

C. it gains water due to reverse osmosis.

D. it loses water due to osmosis.

Answer: D

Watch Video Solution

13. At a given temperature, osmotic pressure of a concentrated solution of a substance __

A. is higher than that of a dilute solution.

B. is lower than that of a dilute solution.

C. is same as that of a dilute solution.

D. cannot be compared with osmotic pressure of dilute solution

Answer: A

Watch Video Solution

14. Which of the following statements is false?

A. Two different solutions of sucrose of same molality prepared in different solvents will have the same depression in freezing point.

B. The osmotic pressure of a solution is given by the equation $\pi = cRT$ (where c is the molarity of the solution).

C. Decreasing order of osmotic pressure for 0.01 M aqueous solutions of barium chloride, potassium chloride, acetic acid and sucrose is $BaCl_2, > KCl > CH_3COOH >$ sucrose.

D. According to Raoult's law, the vapour pressure exerted by a volatile component of a solution is directly proportional to its mole fraction in the solution.

Answer: A

Watch Video Solution

15. The values of van't Hoff factors for KCl, NaCl and K_2SO_4 , respectively , are ___

A. 2, 2 and 2

B. 2, 2 and 3

C. 1, 1 and 2

D. 1, 1 and 1

Answer: B

Watch Video Solution

16. Which of the following statements is false

A. Units of atmospheric pressure and osmotic pressure are the same.

B. In reverse Osmosis, solvent molecules move through a semipermeable membrane from a region of lower concentration of solute to a region of higher concentration.

C. The value of molal depression constant depends on nature of solvent.

D. Relative lowering of vapour pressure, is a dimensionless quantity.

Answer: B

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17. Value of Henry's constant K_H...

A. increases with increase in temperature.

B. decreases with increase in temperature.

C. remains constant.

D. first increases then decreases.

Answer: A

Watch Video Solution

18. Value of Henry's constant K_H...

A. greater for gases with higher solubility.

B. greater for gases with lower solubility.

C. constant for all gases.

D. not related to the solubility of gases.

Answer: B

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19. Consider the figure given below and mark the correct option.

A. water will move from side (A) to side (B) if a pressure lower than osmotic pressure is applied on piston (B).

B. water will move from side (B) to side (A) if a pressure greater than osmotic pressure is applied on piston (B)

C. water will move from side (B) to side (A) if a pressure equal to osmotic pressure is applied on piston (B).

D. water will move from side (A) to side (B) if pressure equal to osmotic pressure is applied on piston (A).

Answer: B

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20. We have three aqueous solutions of NaCl labelled as A, B and C with concentration $0.1M, 0.01\text{and}0.001$ M , respectively . The value of van't Hoff factor for these solutions will be in the order :

A. $i_A < i_B < l_C$

B. $i_A > i_B > i_C$

C. $i_A = i_B = i_C$

D. $i_A < i_B > i_C$

Answer: C

Watch Video Solution

21. On the basic of information given below mark the Correct option .Information:

(P)In bromoethane and choroethane mixture intermolar interactions of A.A and B.B tupesare nearly same as A .B type intersections.

(Q) In ethanol and acetone mixture A.A or B.B type inetermolecular interaction are stronger than A.B type interactions.

(R) In chloroform and acetone mixture A.A or B.B type intermolecular interactions are weaker than A. B type interactions.

A. Solution (B) and (C) will follow Raoult's law.

B. Solution (A) will follow Raoult's law.

C. Solution (B) will show negative deviation from Raoult's law.

D. Solution (C) will show positive deviation from Raoult's law.

Answer: B

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22. Two beakers of capacity 500 mL were taken. One of these beakers, labelled as "A", was filled with 400 ml water whereas the beaker labelled "B" was filled with 400 mL of 2 M solution of NaCl. At the same temperature both the beakers were placed in closed containers of same material and same capacity as shown in figure given below:

At a given temperature, which of the following statement is correct about the vapour pressure of pure water and that of NaCl solution.

A. vapour pressure in container (A) is more than that in container (B).

B. vapour pressure in container (A) is less than that in container (B).

C. vapour pressure is equal in both the containers.

D. vapour pressure in container (B) is twice the vapour pressure in container (A)

Answer: A

View Text Solution

23. If two liquids A and B from minimum boiling azeotrope at some specific composition then

A. A-B interactions are stronger than those between A-A or B-B.

B. vapour pressure of solution increases because more number of molecules of liquids A and B can escape from the solution.

C. vapour pressure of solution decreases because less number of molecules of only one of the liquids escape from the solution.

D. A-B interactions are weaker than those between A-A or B-B.

Answer: D

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24. 4 L of 0.02 M aqueous solution of NaCl was diluted by adding 1 L of water. The molality of the resultant solution is........

A. 0.004

B. 0.008

C. 0.012

D. 0.016

Answer: D

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25. On the basis of information given below mark the correct option.

Information : On adding acetone to methanol some of the hydrogen bonds between methanol molecules breaks.

A. At specific composition, methanol-acetone mixture will form minimum boiling azeotrope and will show positive deviation from Raoult's law.

B. At specific composition, methanol-acetone mixture forms maximum boiling azeotrope and will show positive deviation from Raoult's law

C. At specific composition, methanol-acetone mixture will form minimum boiling azeotrope and will show negative deviation from Raoult's law

D. At specific composition, methanol-acetone mixture will form maximum boiling azeotrope and will show negative deviation from Raoult's law.

Answer: B

Watch Video Solution

26. K_H value for Ar(g),CO(g), HCHO(g) and $CH_4(g)$ are 40.39 , 1.67 , 1.83×10^{-5} and 0.413 respectively. Arrange these gases in the order of their increastively solubility.

A. $HCHO < CH_4 < CO_2 < Ar$

B. $HCHO < CO_2 < CH_4 < Ar$

C. $Ar < CO_2 < CH_4 < HCHO$

D. $Ar < CH_4 < CO_2 < HCHO$

Answer: C

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NCERT EXEMPLAR PROBLEMS (MULTIPLE CHOICE QUESTIONS (TYPE -II))

1. Which of the following factor (s) affect the solubility of a gaseous solution in the fixed volume of liquid solvent?

(i) Nature of solute

(ii) Temperatute

(iii) Pressure

A. nature of solute (ii) temperature (iii) pressure

B. (i) and (iii) at constant T

C. (ii) and (iii) constant P

D. (iii) only

Answer: A::B

Watch Video Solution

2. Intermolecular forces between two benzene molecules are nearly of same strength as those between two toluene molecules. For a mixture of benzene and toluene, which of the following are not true?

A. $\Delta_{\text{mix}} H = zero$

B. $\Delta_{\text{mix}} V = zer0$

C. These will form minimum boiling azeotrope .

D. These will not form ideal solution.

Answer: C::D

Watch Video Solution

3. Relative lowering of vapour pressure is a colligative property because

A. It depends on the concentration of a non electrolyte solute in solution and does not depends on the nature of the solute molecules.

B. It depends on number of particles of electrolyte solute in solution and does not depends on the nature of the solute particles

C. It depends on the concentratio of an electrolyte is solution as well as on the nature of the solute molecules.

D. It depends of the conentration of an electrolyte or non electrolyte solute in solution as well as on the nature of solute molecules.

Answer: A::B

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4. van't Hoff factor (i) is given by the expression

A. $i = \dfrac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$

B. $i = \dfrac{\text{Abnormal molar mass}}{\text{Normal molar mass}}$

C. $i = \dfrac{\text{Observed colligative property}}{\text{Calculated colligative property}}$

D. $i = \dfrac{\text{Calculated colligative property}}{\text{Observed colligative property}}$

Answer: A::C

Watch Video Solution

5. Isotonic solutions must have the same...........

A. solute

B. density

C. elevation in boiling point

D. depression in freezing point

Answer: B::C

Watch Video Solution

6. Which of the following binary mixture will have same composition in liquid and vapour phase?

A. Benzene - Toluence

B. Water - Nitric acid

C. Water - Ethanol

D. n-Hexane - n-Heptane

Answer: B::C

Watch Video Solution

7. What are isotonic solutions?

A. solute and solvent both are same

B. osmotic pressure is same

C. solute and solvent may or not be same

D. solute is always same solvent may be different.

Answer: A::B

Watch Video Solution

8. For a binary ideal liquid solution, the variation total vapour pressure versus composition of solution is given by which of the curves?

A.

B.

C.

D.

Answer: A::D

Watch Video Solution

9. Colligative properties are observed when........

A. a non volatile solid is dissolved in a volatile liquid

B. a non volatile liquid is dissolved in another volatile liquid.

C. a gas is dissolved in non vol

D. solute is always same solvent may be different.

Answer: A::B

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NCERT EXEMPLAR PROBLEMS (SHORT ANSWER TYPE QUESTIONS)

1. Components of a binarey mixture of two liquids A and B were being separted by distillation. After some time separation of components stopped and composition of vapour phase vecame same as that of liquid phase. Both the components stated coming in the distillate. Explain why this happened ?

Watch Video Solution

2. Explain in why on addition of 1 mole of NaCl to 1L of water, the boiling point of water increases, while addition of 1 mole of methyl alcohol to 1 L of water decreases its boiling point .

Watch Video Solution

3. Explain the solubility rule "like dissolves like" in terms of intermolecular forces that exist in solutions,

Watch Video Solution

4. Concentration terms such as mass percentage, ppm, mole fraciton and molality are independent of temperature, however molarity is a function of temperature. Explain.

Watch Video Solution

5. What is the significance of Hanry's law constant K_H ?

Watch Video Solution

6. why are the aquatic species more comofortable in cold water in comparision to warm water?

Watch Video Solution

7. (a) Explain the following phenomena with the help of Henry's law.

(i) Painful condition known as bends.

(ii) Feeling of weakness and discomfort in breating at high altitude.

(b) Why soda water bottle kept at room temperature fizzes on opening?

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8. Why is the vapous pressure of an aqueous solution of gulucose lower than that of water ?

Watch Video Solution

9. How does sprinking of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon involved in the process.

Watch Video Solution

10. What is "semi permeable membrane"?

Watch Video Solution

11. Give an example of a material used for makin gsemipermeable membrance for carrying out reverse osmosis.

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NCERT EXEMPLAR PROBLEMS (MATCHING TYPE QUESTIONS)

1. Match the items given in Column I and Column II.

View Text Solution

2. Match the items given in column I with type of solutions given in Column II.

View Text Solution

3. Match the laws given in Column I with expresions given in Column II.

View Text Solution

View Text Solution

4. Match the terms given in Column I with expressions given in Column II.

View Text Solution

NCERT EXEMPLAR PROBLEMS (ASSERTION AND REASON TYPE QUESTIONS)

1. Assertion (A) Molarity of a solution in liquid state changes with temperature.

Reason (R) The volume of a solution charges with change in temperature.

A. Assertion and reason both are correct statemens and reason is correct explanation for assertion.

B. Assertioin and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

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2. Assertion (A) When methyl alcohol is added to water, boiling point of water increases.

Reason (R) When a volatile solute is added to a volatile solvent evevation in boiling point is observed.

A. Assertion and reason both are correct statemens and reason is correct explanation for assertion.

B. Assertioin and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: D

Watch Video Solution

3. Assertion (A) When NaCl is added to water a depression in freezing point is observed.

Reason (R) The lowering of vapour pressure of a solution causes depression in the freezing point.

A. Assertion and reason both are correct statemens and reason is correct explanation for assertion.

B. Assertioin and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

Watch Video Solution

4. Assertion (A) When solution is separted from the pure solved semipermeable membrane, the solvent molecules pass through it from pure solvent side to the solution side.

Reason (R) Diffusion solvent occurs from a region of concentration solution to a region of low concentration soluton.

A. Assertion and reason both are correct statemens and reason is correct explanation for assertion.

B. Assertioin and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: C

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QUICK MEMORY TEST (SAY TRUE OR FALSE)

1. Both molality and mole fraction are independent of temperature.

Watch Video Solution

2. The solubilities of all ionic substances increase with increase of temperature.

Watch Video Solution

3. Depression in freezing point of solution of electrolytes are generally

Watch Video Solution

4. If observed value of the colligative property is more than the normal value of same property then Van't Hoff factor is more than one.

Watch Video Solution

Watch Video Solution

5. Van't Hoff factor, $i < 1$ if there is association of the solute in the solution.

Watch Video Solution

6. In coparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M $MgCl_2$ solution is......

Watch Video Solution

7. Lowering in vapour pressure is a colligative property.

Watch Video Solution

8. Two liquids A and B boil at $125^\circ C$ and $146^\circ C$ respectively. Liquid A will have higher vapour pressure.

View Text Solution

9. Why is freezing point depression of 0.1 M sodium chloride solution nealy twice than that of 0.1 M glucose solution ?

Watch Video Solution

10. Why does a solution of ethanol and cyclohexane show positive deviation from Raoult's law?

Watch Video Solution

11. Colligative properties of a solution depends upon

Watch Video Solution

12. Which liquids pair shows a positive deviation from Raoult's law?

Watch Video Solution

QUICK MEMORY TEST (COMPLETE THE MISSING LINKS)

1. For a non-ideal solution showing positive deviation from Raoult's law, ΔH_{mixing} mixing is .... and δV_{mixing} is ....

View Text Solution

2. The solubility of sodium hydroxide increases with increase of temperature.

Watch Video Solution

3. For 100% dissociation of $K_4\left[Fe(CN)_6\right]$, Van't Hoff factor i=................ .

Watch Video Solution

4. If observed molar mass of a solute is more than calculated molar mass, then the solute undergoes .... in the solvent.

View Text Solution

5. Assertion (A): $0.1M$ solution of $NaCl$ has greater osmotic pressure than $0.1M$solution of glucose at same temperature.

Reason (R): In solution, $NaCl$ dissociates to produce more number of particles.

Watch Video Solution

6. The molarity of pure water is

Watch Video Solution

7. The boiling point of $0.1MKCl$ solution is ....than $100^{\circ}C$.

Watch Video Solution

Watch Video Solution

8. A solution which has lower osmotic pressure compared to that of other solution is called ....

Watch Video Solution

9. ΔH_{mixing} for solution having positive deviations from Raoult's law is ....

Watch Video Solution

10. The best colligative property used for the determination of molecular mases of polymers is :

Watch Video Solution

11. Desalination of sea water is based on the phenomenon............

Watch Video Solution

12. People taking lot of salt experience puffiness or swelling of the body due to

Watch Video Solution

QUICK MEMORY TEST (CHOOSE THE CORRECT ALTERNATIVE)

1. The concentration term independent of temperature is molarity/molality.

View Text Solution

2. Chloroform + Benzene form non-ideal solution showing positive/negative deviations.

View Text Solution

3. A pure NaCl solution with concentration more than 0.91% is called hypertonic/hypotonic.

Watch Video Solution

4. Assertion (A): $0.1M$ solution of $NaCl$ has greater osmotic pressure than $0.1M$solution of glucose at same temperature.

Reason (R): In solution, $NaCl$ dissociates to produce more number of particles.

Watch Video Solution

5. A solution showing a large positive deviation from ideal behaviour have

Watch Video Solution

6. The freezing of aqueous 0.1 M Na_2CO_3, solution is less / more than 0.2 M NaOH solution.

Watch Video Solution

7. For a solute undergoing association in a solvent, the van't hoff factor

Watch Video Solution

8. What will happen if pressure greater than the osmotic pressure is applied on the solution separated by a semi-permeable membrane from the solvent?

Watch Video Solution

9. Elevation in boiling point of 0.1 m $CaCl_2$, solution less / more than 0.1 m NaCl solution.

Watch Video Solution

REVISION EXERCISES (MULTIPLE CHOICE QUESTIONS)

1. Which of the following concentration terms is independent on temperature ?

A. Normality

B. Mass - Volume per cent

C. Molality

D. Molarity

Answer: C

Watch Video Solution

2. Colligative properties of the solution depend on:

A. the nature of the solute

B. the nature of the solvent

C. the number of particles of solute

D. the molecular mass of solute

Answer: C

Watch Video Solution

3. What are constant boiling mixture called?

A. ideal solutions

B. azeotropes

C. isotonic

D. None of these

Answer: B

Watch Video Solution

4. The molality of pure water is

A. 55.5

B. 50.5

C. 18

D. 60.5

Answer: A

Watch Video Solution

5. The value of Henry's constant K_H.

A. increases with increase in temperature

B. decreases with increase in temperature

C. remains constant

D. first increases, then decreases

Answer: A

Watch Video Solution

6. An aqueous solution containing 6 g of urea in 500 mL of solution has a density equal to 1.05. If the molar mass of urea is 60, then the molality of solution is :

A. 0.2

B. 0.19

C. 0.1

D. 1.2

Answer: B

Watch Video Solution

7. The mole fraction of solute in 2.5 m aqueous solution is

A. 0.055

B. 0.043

C. 0.86

D. 0.25

Answer: B

Watch Video Solution

8. Battery acid is $4.27 M H_2SO_4$, (aq) and has the density of 1.25 g mL^{-1}.

The molality of H_2SO_4, in the solution is

A. 3.416 m

B. 3.342 m

C. 5.135 m

D. 2.135 m

Answer: C

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9. A 7 M solution of potassium hydroxide (KOH) in water contains 40% by weight of KOH. The density of the solution is

A. 1.96

B. 1.28

C. 0.49

D. 0.98

Answer: D

Watch Video Solution

10. The vapour pressure of a pure liquid 'A' is 70 torr at $27^{\circ}C$. It forms an ideal solution with another liquid B. The mole fraction of B is 0.2 and total pressure of the solution is 84 torr at $27^{\circ}C$. The vapour pressure of pure liquid B at $27^{\circ}C$ is :

A. 14 torr

B. 56 torr

C. 140 torr

D. 70 torr

Answer: C

Watch Video Solution

11. The vapour pressure of a solution prepared by dissolving 1 mol of liquid A and 2 mol of liquid B has been found to be 38 torr. The vapour pressure of pure A and pure B are 45 and 36 torr respectively. The solution

A. shows negative deviation

B. is a minimum boiling azeotrope

C. is an ideal solution

D. has A Hmixing positive

Answer: A

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12. Which pair will not form an ideal solution ?

A. C_2H_5Br and C_2H_5I

B. C_6H_5Br and C_6H_5I

C. C_6H_6 and $C_6H_5CH_3$

D. C_2H_5I and C_2H_5OH

Answer: D

Watch Video Solution

13. The partial pressure of oxygen in air is 0.2 atm. What is the conentration of dissolved oxygen in water in equilibrium with air at 25° C ? (K_H for oxgyen at $25^\circ C$ is 4.3410^4 atm).

A. $2.56 \times 10^{-4} M$

B. $3.68 \times 10^{-6} M$

C. $4.26 \times 10^{-4} M$

D. $2.96 \times 10^{-6} M$

Answer: A

Watch Video Solution

14. A solution of solute X in benzene boils at $0.126^\circ C$ higher than benzene. What is the molality of the solution ?

A. 0.05

B. 2

C. 1

D. 20

Answer: A

Watch Video Solution

15. The osmotic pressure of 0.2 molar solution of urea at $300K(R = 0.082)$ litre atm $mol^{-1}K^{-1}$ is

A. 4.92 atm

B. 1 atm

C. 0.2 atm

D. 27 atm

Answer: A

Watch Video Solution

16. An aqueous solution containing 1g of urea boils at $100.25^{\circ}C$. The aqueous solution containing 3g of glucose in the same volume will boil be

A. $100.75^{\circ}C$

B. $100.5^{\circ}C$

C. $100^{\circ}C$

D. $100.25^{\circ}C$

Answer: D

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17. When $0.6g$ of urea dissolved in $100g$ of water, the water will boil at $(K_b$ for water $= 0.52kJ.\ mol^{-1}$ and normal boiling point of water $= 100^{\circ}C)$:

A. 372.48 K

B. 273.52 K

C. 373.052 K

D. 273.052 K.

Answer: C

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18. The osmotic pressure of equimolar solutions of $BaCl_2$,$NaCl$,and glucose follow the order

A. $BaCl_2, \ > NaCl > \ $ glucose

B. $BaCl_2 > \text{glucose} > NaCl$

C. $\text{Glucose} > BaCl_2 > NaCl$

D. $NaCl > BaCl_2 > \text{glucose}$

Answer: A

Watch Video Solution

19. The van't Hoff factor for $0.1 M Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is

A. 91.3%

B. 0.87

C. 1

D. 0.74

Answer: B

Watch Video Solution

20. 0.01 M solution each of urea, common salt and sodium sulphate are taken, the ratio of depression in freezing point of these solutions is

A. $1:1:1$

B. $1:2:1$

C. $1 : 2 : 1$

D. $1 : 2 : 3$

Answer: C

View Text Solution

21. Which of the following solutions shows maximum depression in freezing point?

A. $0.5 M Li_2SO$

B. 1 M NaCl

C. $0.5 M Al_2(SO_4)_2$

D. $0.5 M BaCl_2$

Answer: C

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22. The number of moles of NaCl in 3 litres of 3 M solution is:

A. 1

B. 3

C. 9

D. 27

Answer: C

Watch Video Solution

23. $CaCl_2$ is used as

A. to minimise the effect of snow on roads

B. to minimise pollution

C. to minimise the accumulation of dust on the road

D. to minimise the wear and tear of the roads

Answer: A

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24. For solutes which do not undergo any association or dissociation in a solute, van't Hoff factor (i) will be

A. less than 1

B. more than 1

C. equal to 1

D. zero

Answer: C

Watch Video Solution

25. Which of the following 0.1 m aqueous solution is likely to have the highest boiling points ?

A. Na_2SO_4

B. KCl

C. Glucose

D. Urea

Answer: A

Watch Video Solution

26. Which of the following aqueous solutions will have the minimum freezing point ?

A. 0.1 m $FeCl_3$

B. 0.1 m $BaCl_2$

C. 0.1 m NaCl

D. 0.1 m Urea

Answer: A

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27. Which has the minimum freezing point ?

A. same boiling point

B. same vapour pressure

C. same melting point

D. same osmotic pressure

Answer: D

Watch Video Solution

28. Mole fraction of a solute in 2.5 molal aqueous solution is

A. 0.43

B. 0.043

C. 4.3

D. 43

Answer: B

Watch Video Solution

29. Which of the following is not ture for acidic solutions at room temperature.

A. molality

B. molarity

C. mass%

D. mole fraction

Answer: B

Watch Video Solution

30. Two solutions A and B are separated by semipermeable membrane. If liquid flows from A to B, than

A. A is more concentrated than B

B. A is less concentrated than B

C. both A and B are of same concentration

D. both A and B get diluted

Answer: B

Watch Video Solution

31. The van't Hoff factor i for a compound which undergoes dissociation in one solvent and association in other solvent is respectively.

A. less than one and greater than one

B. less than one and less than one

C. greater than one less than one

D. greater than one and greater than one

Answer: C

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32. At the higher altitudes the boiling point of water lowers because

A. the atmospheric pressure is low

B. the atmospheric pressure is high

C. the temperature is low

D. the temperature is high

Answer: A

Watch Video Solution

33. Maximum amount of a solid slute that can be dissolved in a specified amount of a given liquid solvent does not depend upon ....

A. pressure

B. temperature

C. nature of solute

D. nature of solvent

Answer: A

Watch Video Solution

34. Low concentration of oxygen in the blood ndtissues of people living at high altitude is due to.......

A. low temperature

B. low atmospheric pressure

C. high atmospheric pressure

D. none of the above

Answer: B

Watch Video Solution

35. The units of ebullioscopic constant is.

A. $Kkgmol^{-1}$

B. $molkgk^{-1}$

C. $kmolkg^{-1}$

D. none of the above

Answer: A

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36. Molar solution means 1 mole of solute present in

A. 1000 g of solvent

B. 1000 g of solution

C. 1 litre of solvent

D. 1 litre of solution

Answer: D

Watch Video Solution

37. Increasing the temperature of an aqueous solution wil case

A. decrease in molality

B. decrease in molarity

C. decrease in mole fraction

D. decrease in mass percent

Answer: B

Watch Video Solution

38. Colligative properties depend on ___

A. shapes of the particles

B. nature of the particles only

C. nature of the solvent only

D. number of particles only

Answer: D

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39. Molal elevation constant.

A. Cryoscopic constant

B. Gas constant

C. Ebullioscopic constant

D. Freezing point depression constant

Answer: C

Watch Video Solution

40. Which of the following has highest value of Van't Hoff factor?

A. 0.1 M $Al_2(SO_4)_3$

B. 0.1 M $C_6H_{12}O_6$

C. 0.1 M K_2SO_4

D. $0.1 M NaCl$

Answer: A

Watch Video Solution

REVISION EXERCISES (PASSAGE BASED QUESTIONS)

1. Ethylene glycol in water is commonly used as an antifreeze solution is car radiators. 12.4 g of this substance is dissolved in 100 g of water (k_f and k_b for water are $1.86km^{-1}$ and $0.52km^{-1}$ respectively).

What is the mole fraction of ethylene glycol in the solution ?

Watch Video Solution

2. Ethylene glycol $(\text{molar mass} = 62gmol^{-1})$ is a common automobile antyfreeze. Calculate the freezing point of a solution containing 12.4 g of this substance in 100 g of water. (Given $K_f f \text{ or } water = 1.86Kkgmol^{-1})$

Watch Video Solution

3. Ethylene glycol $(\text{molar mass} = 62gmol^{-1})$ is a common automobile antyfreeze. Calculate the freezing point of a solution containing 12.4 g of this substance in 100 g of water. (Given $K_f f \text{ or } water = 1.86Kkgmol^{-1})$

Watch Video Solution

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Watch Video Solution

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Watch Video Solution

6. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , 37° C Hence , molarity of an intravenous

glucose solution be to have the same osmotic pressure as blood is :

Watch Video Solution

7. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , 37° C Hence , molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is :

Watch Video Solution

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Watch Video Solution

9. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , 37° C Hence , molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is :

Watch Video Solution

10. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , 37° C Hence , molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is :

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11. Given below is the sketch of a plant for carrying out a process .

Name the process occurring in the above plant.

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12. Given below is the sketch of a plant for carrying out a process .

To which container does the net flow of solvent take place ?

View Text Solution

13. Given below is the sketch of a plant for carrying out a process .

Name one SPM which cane be used in this plant.

View Text Solution

14. Given below is the sketch of a plant for carrying out a process .

Give one particle use of the plant.

View Text Solution

15. Given below is the sketch of a plant for carrying out a process .

Give one use of the process opposite to the process in.

View Text Solution

REVISION EXERCISES (ASSERTION REASON QUESTIONS)

1. Assertion (A): $\Delta_{mix}H$ and $\Delta_{mix}V$ are zero for an ideal solution.

Reason (R): The interactions between the particles of the components of a solution are almost identical as between the particles in liquids.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: A

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2. Assertion (A): The increasing pressure on water decreases its freezing point.

Reason (R):The density of water is maximum at $273K$.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: C

Watch Video Solution

3. Assertion (A): $0.1M$ solution of glucose has same increment in freezing point than has $0.1M$ solution of urea.

Reason (R): K_f for both has different value.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: D

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4. Assertion (A): Cooking time in pressure cooker is reduced.

Reason (R): The boiling point inside the pressure cooker is raised.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: A

Watch Video Solution

5. The sum of mole fraction of all components of a solution is unity.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: B

Watch Video Solution

6. Assertion (A): Sodium chloride used to clear snow on the roads.

Reason (R): Sodium chloride depresses the freezing point of water.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: A

Watch Video Solution

7. Assertion (A): The osmotic pressure of $0.1M$ urea solution is less than $0.1MNaCl$ solution.

Reason (R): Osmotic pressure is not a colligative property.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: C

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8. Assertion (A): The elevation in boiling point for two isotonic solutions may not be same.

Reason (R): The boiling point depends upon the concentration of the solute.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: C

Watch Video Solution

9. Assertion (A): Iodine is more soluble in CCl_4 than in water.

Reason(R): Non-polar solutes are more soluble in non-polar solvents.

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: A

Watch Video Solution

10. Camphor is often used in molecular mass determination because

A. Assertion and reason both are correct statements and reason is correct explanation for assertions.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion is wrong statement but reason is correct statement.

Answer: C

Watch Video Solution

REVISION EXERCISES (VERY SHORT ANSWER QUESTIONS)

1. Give one example of (a) solution of a gas in a liquid (b) solution of number of gases.

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2. Why does not molality of the solution cange with temperature ?

Watch Video Solution

Watch Video Solution

3. What will be mole fraction of water in methanol solution containing equal number of moles of water and methanol ?

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4. Molal depression constant is calculated from the enthalpy of fusion (ΔH_f) and boiling point of solvent using the relation

Watch Video Solution

5. As branching in alkane increases, boiling point decreases due to

Watch Video Solution

6. Sodium choride or calcium chloride is used to clear snow from the roads. Why?

Watch Video Solution

7. What is the effect of increase in temperature on the solubility of a gas in water ?

Watch Video Solution

8. Vant Hoff Factor

Watch Video Solution

9. The factor or process which best explains the rise of water from roots (100 mts) to the top of tall tree is

Watch Video Solution

10. What is the effect of temperature on molarity of a solution?

Watch Video Solution

11. Calculate the normality of 1.5 MH_2SO_2

Watch Video Solution

12. How are ΔT_b and ΔT_f related to the molar mass of the solute ?

Watch Video Solution

13. Define molarity and also write its formula.

Watch Video Solution

14. Two liquids A and B boil $145^\circ C$and $190^\circ C$respectivly. Which of them has a higher vapour pressre at $80^\circ C$?

Watch Video Solution

15. Under what condition Van't Hoff factor

(i) is

(a) equal to unity, (b) less than 1, and c greater than 1.

Explain your answer.

Watch Video Solution

16. Under what condition Van't Hoff factor

(i) is

(a) equal to unity, (b) less than 1, and c greater than 1.

Explain your answer.

Watch Video Solution

17. (a) Define Kohlraush's law.

Watch Video Solution

18. Rubbing isopropyl alcohol often gives a cooling sensation to the skin. Why?

Watch Video Solution

19. Azeotropic mixture:

Watch Video Solution

20. Explain why concentration in terms of molality is preferred in comparison to molarity.

Watch Video Solution

21. The enthalpy of reaction, $\Delta_r H$, is

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22. Which law defines entropy in thermodynamics

Watch Video Solution

23. The sum of mole fraction of all components of a solution is unity.

Watch Video Solution

24. Differentiate between molarity and molality of a solution .How can we change molality value of solution in to molarity value?

Watch Video Solution

25. Calculate the value of van't Hoff factor for a dilute solution of K_2SO_4 in water.

Watch Video Solution

26. State the condition resulting in reverse osmosis.

Watch Video Solution

REVISION EXERCISES (SHORT ANSWER QUESTIONS)

1. Define the following terms: Ray

A. Molality

B. Osmotic pressure

C. Van't Hoff factor

D. Molarity

Watch Video Solution

2. The mole fraction of solute in one molal aqueous solution is ....

Watch Video Solution

3. When and why is molality preferred over molarity in handling solution in Chemistry?

Watch Video Solution

4. Ethanol has higher boiling point than ethanol because

Watch Video Solution

5. Define Avogadro's law

Watch Video Solution

6. Colligative property.

Watch Video Solution

7. Colligative properties of the solution depend on:

Watch Video Solution

8. Define osmotic pressure of a solution. How is the osmotic pressure orelated to the concentration of a solute in a solution ?

Watch Video Solution

9. 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 ?

Watch Video Solution

10. Why a person suffering from high blood pressure is advised to take minimum quantity of common salt?

Watch Video Solution

11. Dry seeds when placed in water swell up due to

Watch Video Solution

12. The bottle of liquid ammonia is generally cooled before opening the seal. Assign reson.

Watch Video Solution

13. $K_4[Fe(CN)_6]$ is used to detect

Watch Video Solution

14. What is osmotic pressure and how is it related with the molecular mass of a non-volatile substance? What advantage the osmotic pressure method has over the elevation of boiling point method for determining molecular masses?

Watch Video Solution

15. What are minimum boiling azeotropes? Give one example.

Watch Video Solution

16. Vapour pressure of the solution of a non- volatile solute is always __.

Watch Video Solution

17. Sodium chloride solution freezes at lower temperature then water but boils at higher temperature than water. Explain.

Watch Video Solution

18. Define osmotic pressure.

Watch Video Solution

19. Colligative property.

Watch Video Solution

20. What will happen if an animal cell is placed in hypertonic solution ?

Watch Video Solution

21. The relative lowering in vapour pressure is:

Watch Video Solution

22. Ideal And Non Ideal Solution

Watch Video Solution

23. Colligative properties

Watch Video Solution

24. Mention two applications of Hess's law.

Watch Video Solution

25. When mercuric iodide is added to aqueous KI solution:

Watch Video Solution

26. A solution showing a large positive deviation from ideal behaviour have

Watch Video Solution

27. Which colligative property is generally used for determining the moar mass of a solute ?

Watch Video Solution

28. Define an ideal solution and write one of its characteristics.

Watch Video Solution

29. State Raoult's law for the solution containing volatile components. What is the similarity .

between Raoult's law and Henry's law ?

Watch Video Solution

30. Azeotropic mixture:

Watch Video Solution

31. What type of liquids form ideal solutions?

Watch Video Solution

32. Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing

1.2% sodium chloride

0.4% sodium chloride

1.2% sodium chloride

0.4% sodium chloride.

Watch Video Solution

33. $CaCl_2$ is preferred over NaCl for clearing ice on roads particularly in very cold countries. This is because:

Watch Video Solution

34. Define the following terms:

(i) Colligative properties (ii) Molality (m)

Watch Video Solution

35. Sodium chloride solution freezes at lower temperature then water but boils at higher temperature than water. Explain.

Watch Video Solution

36. Depression in freezing point of solution of electrolytes are generally

Watch Video Solution

37. (a) State Henry's law.

(b) At the same temperature, CO_2, gas is more soluble in water than O_2 , gas. Which one of them will have higher value of K_H?

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38. Calculate the value of van't Hoff factor for a dilute solution of K_2SO_4 in water.

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39. Why vapour pressure of a liquid decreases when a non $-$ volatile solute is added to it ?

Watch Video Solution

40. What will be the Van't Hoff factor for a dilute aqueous solution of $BaCI_2$?

Watch Video Solution

41. Statement-1 : When metyl alcohol is added to water, boliling point of water increases.

Statement-2 : When a volatile solute is added to a volatile solvent elevation in boiling point is observed.

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42. Colligative properties

Watch Video Solution

43. Boiling point of an ideal liquid solution containing non-volatile solute depends on:

Watch Video Solution

44. Define osmotic pressure of a solution. How is the osmotic pressure orelated to the concentration of a solute in a solution ?

Watch Video Solution

45. For a non-volatile solute

Watch Video Solution

46. Define the following terms:

(i) Ideal solution

(ii) Molarity (M)

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47. Define the following terms:

(i) Abnormal molar mass (ii) Van't Hoff factor (i)

Watch Video Solution

48. The azeotropic solution of two miscible liquids:

Watch Video Solution

49. Derive the relationship between relative lowering in vapour pressure and molar mass of the solute.

Watch Video Solution

50. State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obeys Raoult's law at all concentrations.

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51. Write two differences between an ideal solution and a non-ideal solution.

Watch Video Solution

52. State Henry's law and mention some important applications ?

Watch Video Solution

53. What is reverse osmosis? Write any one of its applications.

Watch Video Solution

54. State Roult's law for solution law for volatile liquid components. Taking a sutiable example, explanin the meaning of poitive from Raoult' law .

Watch Video Solution

55. Define the terms, 'osmosis' and 'osmotic pressure'. What is the advantage of using osmotic pressure as compared to other colligative for the determination of molar masses of solutes in solutions?

Watch Video Solution

56. State (i) Charles's law (ii) Dalton's law of partial pressures.

Watch Video Solution

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

Watch Video Solution

58. State Raoult's law for a binary solution containing volatile components.

Watch Video Solution

59. (i) Gas A is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of K_H (Henry's constant) and why?

(ii) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotrops ?

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60. Give reasons for the following :

(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers .

(b) Aquatic animals are more comfortable in cold water than in warm water .

(c) Elevation of boiling point of $1 M KCl$ solution is nearly double than that of 1 M sugar solution.

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REVISION EXERCISES (LONG ANSWER QUESTIONS)

1. What type of non-idealities are exhibited by cyclohexane-ethanol and acetone-chloroform mixture? Give reasons for your answer.

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2. What is osmotic pressure ? Why it is a colligative property ?

Watch Video Solution

3. Calculate the molarity of a solution containing $5g$ of NaOH in $450mL$ solution.

Watch Video Solution

4. Converting molarity to mole fraction, mass percent and molality: A $0.750M$ solution of H_2SO_4 in water has a density of $1.049gmL^{-1}$ at $20^\circ C$. What is the concentration of this solution in (a) mole fraction, (b) mass percent. And (c) molality?

Watch Video Solution

5. (a) Define the terms osmosis and osmotic pressure. Is the osmotic pressure of a solution a colligative property? Explain.

(b) Calculate the boiling point of a solution prepared by adding $15.00g$ of $NaCl$ to $250.0g$ of water. (K_b for water $= 0.512Kkg\text{mol}^{-1}$, Molar mass of $NaCl = 58.44g$)

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6. Number of moles of a solute per kilogram of a solvent is called

A. Mole fraction

B. Molality

C. Molarity

D. Molar mass

Watch Video Solution

7. The van't Hoff factor can be expressed as :

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8. The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighting $0.5g$ when added to

$39.0g$ of benzene (molar mass $78 g mol^{-1}$). The vapour pressure of the solution then is 0.845 bar. What is the molar mass of the solid substance?

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9. The boiling a point of benzene is 353.23K. 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 K kg mol^{-1}.

Watch Video Solution

10. (i) Prove that depression in freezing point is a colligative property.

(ii) 45 g of ethylene glycol $(C_2H_6O_2)$ is mixed with 600g of water . Calculate the freezing point depression. (K_f for water = 1.86 k kg mol^{-1})

Watch Video Solution

11. (i) Prove that osmotic pressure is a colligative property.

(ii) Calculate the molar of urea solution if it exerts an osmotic pressure of 2.45 atmosphere at 300K. (R = 0.0821 L atm. $mol^{-1}K^{-1}$).

Watch Video Solution

12. Vapor pressure of a solution of Volatile components and composition of vapor: Consider a solution containing $738g$ of water and $253g$ of ethanol (C_2H_5OH) at $323K$. At this temperature, the vapour pressure of pure ethanol is $0.292atm$ and the vapor pressure of pure water is $0.122atm$. Calculate the vapour pressure of the solution and mole fraction of every component in vapour phase.

Watch Video Solution

13. (a) Define the following terms:

(i) Molarity

(ii) Molal elevation constant (k_b)

(b) A solution containing 15 g (molar mass=60 g mol^{-1}) per liter of solution water has the same osmotyic pressure (isotonic) as a solution of glucose (molar mass =180g mo^{-1}) in water calculte the mass of glucose present in one liter of its solution.

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14. (a) Define the following terms :

(i) Mole fraction

(ii) Ideal solution

(b) 15.0g of an unknown molecular material is dissolved in 450g of water . The resulting solution freezes at $-0.34^{\circ} C$. What is the molar mass of the material ?

$\left(K_f\right.$ for water = 1.86 K kg $\left.mol^{-1}\right)$

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15. (a) Explain the following :

(i) Henry's law about dissolution of a gas in a liquid

(ii) Boiling point elevation constant for a solvent

(b) 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 $100.42^\circ C$. what mass of glycerol was dissolved to make this solution ? (K_b for water = 0.512 K kg mol^{-1})

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

(b) 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. $\left(K_f \text{ for benzene } = 5.12 kg mol^{-1}\right)$

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17. A solution of glucose $\left(\text{molar mass } = 180 g mol^{-1}\right)$ in water is labelled as 10% (by mass). What would be the molarity and molality of the solution? Given that the density of the solution is $1.2 g mL^{-1}$.

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18. (a) Define the following terms:

(i) Molarity

(ii) Molal elevation constant (k_b)

(b) A solution containing 15 g (molar mass=60 g mol^{-1}) per liter of solution water has the same osmotyic pressure (isotonic) as a solution of glucose (molar mass =180g mo^{-1}) in water calculte the mass of glucose present in one liter of its solution.

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19. What type of devation is shown by a mixture of ethnol and acetone ? What type of azeotrope is formed on mixing the two ?

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20. (a) A 10% solution (by mass) of sucrose in water has freezing point of 269.15K. Calculate the freezing point of 10% glucose in water, if the freezing point of pure water is 273.15K.

Given: (molar mass of sucrose=342 g mol^{-1})

(Mola mass of glucose =180g mol^{-1})

(b) Define the following terms:

(i) Molality (m)

(ii) Abnormal molar mass

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21. 30 g of urea (M=60g mol^{-1}) is dissolved in 846g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

(b) Write two differences between ideal solutions and non-ideal solutions,

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REVISION EXERCISES (NUMERICAL PROBLEMS)

1. Depression in freezing point of 0.1 molal solution of HF is $-0.201^{\circ} C$. Calculate percentage degree of dissociation of HF. $\left(K_f = 1.86 K kg mol^{-1}\right)$.

Watch Video Solution

2. 100 mg of a protein was disoved in just enough water to make 10 mL of the solution. If the solution has an osmotic pressure of 13.3 mm Hg at $25^{\circ} C$, what is the mass of prtein $\left(R = 0.0821 L atm mol^{-1} K^{-1}\right)$

Watch Video Solution

3. 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 $0^{\circ} C$ to $-10.0^{\circ} C$ (k_f for water = $1.86 \text{ K kg mol}^{-1}$).

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4. $15.0g$ of an unknown molecular material was dissolved in $450g$ of water. The reusulting solution was found to freeze at $-0.34.^{\circ} C$. What is the the molar mass of this material. (K_f for water $= 1.86 K kg mol^{-1}$)

Watch Video Solution

5. What mass of $NaCI(\text{molar mass} = 58.5 g mol^{-1})$ be dissolved in $65g$ of water to tower the freezing point by $7.5^{\circ} C$? The freezing point depression constant, K_f, for water is $1.86 K kg mol^{-1}$. Assume van't Hoff factor for $NaCI$ is 1.87.

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6. 6 g of a substance is dissolved in 100 g of water depresses the freezing point by $0.93^{\circ} C$. The molecular mass of the substance will be: (K_f for water $= 1.86^{\circ} C$/molal)

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7. 5.85 g of NaCl are dissolved in 90 g of water. The mole fraction of NaCl is-

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8. Calculate the boiling point of a 1M aqueous solution (density 1.04 g Ml^{-1}) of Potassium chloride $\left(K_b \text{ for water } = 0.52Kkg\text{mol}^{-1}, \text{ Atomic masse } : K = 39u, CI = 39.$

Assume, Potassium chloride is completely dissociated in solution.

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9. Calculate the osmotic pressure of 0.5% solution of glucose (molecular mass 180) at $18^{\circ}C$. The value of solution constant is $0.0821\text{litre-atm K}^{-1}\text{mol}^{-1}$

Watch Video Solution

10. Calculate the molar mass of a substance $1g$ of which when dissolved in $100g$ of water gave a solution boiling at $100.1^{\circ}C$ at a pressure of 1 atm (K_b for water $= 0.52 K kg mol^{-1}$)

Watch Video Solution

11. 0.70 g of an organic compund when dissolved in 32g of acetone produces in an elevation in boiling point of $0.25^{\circ}C$. Calculate the molecular mass of the organic compound. $(K_b \text{ for acetone } = 1.72 K kg mol^{-1})$.

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12. Calculate the freezing point depression and boiling point elevation of a solution of $10.0g$ of urea $(M_B = 60)$ in $50.0g$ of water at $1 atm.$ pressure. K_b and K_f for water $0.52^{\circ}Cm^{-1}$ and $1.86^{\circ}Cm^{-1}$ respectively.

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13. The vapour pressure of pure benzene at a certain temperature is $640 mmHg$. A non-volatile solid weighing $2.175g$ is added to $39.0g$ of benzene. The vapour pressure of the solution is $600 mmHg$. What is the molar mass of the solid substance?

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14. $18g$ of glucose $(C_6H_{12}O_6)$ is dissolved in $1kg$ of water in a saucepan. At what temperature will the water boil (at 1 atm) ? K_b for water is $0.52 K kg mol^{-1}$.

Watch Video Solution

15. The freezing point depression of 0.1 molal solution of acetic acid in benzene is 0.256 K , K_f for benzene is 5.12 K Kg mol^{-1}. What conclusion can you draw about the molecular state of acetic acid in benzence ?

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16. (a) Define the following terms :

(i) Mole fraction

(ii) Ideal solution

(b) 15.0g of an unknown molecular material is dissolved in 450g of water . The resulting solution freezes at $-0.34^{\circ}C$. What is the molar mass of the material ?

$\left(K_f\right.$ for water = 1.86 K kg $\left.mol^{-1}\right)$

Watch Video Solution

17. $1.0g$ of non-electrolyte solute dissolved in $50.0g$ of benzene lowered the freezing point of benzene by $0.40K$. The freezing point depression constant of benzene is $5.12kgmol^{-1}$. Find the molecular mass of the solute.

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HIGHER ORDER THINKING SKILLS

1. Why a person suffering from high blood pressure is advised to take minimum quantity of common salt?

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2. The mixture of ethanol and water cannot be separated by distillation because

Watch Video Solution

3. Explain why the melting point of a substance gives an indication of the purity of a substance.

Watch Video Solution

4. If glycerol and methanol were sold at the same price in the market, which would be cheaper for perparing an antifreeze solution for the radiator of an automobile ?

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5. What will be the freezing point of a 0.5 m KCl solution ? The molal freezing point constant of water is $1.86^{\circ}Cm^{-1}$.

Watch Video Solution

6. Why is camphor preferred as a solvent for measuring the molecular mass of naphthalene by Rast method?

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7. The following figure shows vapour pressure curves of two pure liquids and solution of the two. Which curves I, II, or III represent pure liquids and which represents the solution ?

View Text Solution

8. The vapour pressure of high $b.pt.$ liquids is........then the vapour pressure of a low boiling liquid:

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9. The vapour pressure of pure benzene and toluene at $40^\circ C$ are 184.0 torr and 59.0 torr, respectively. Calculate the partial presure of benzene and toluene, the total vapour pressure of the solution and the mole fraction of benzene in the vapour above the solution that has 0.40 mole fraction of benzene. Assume that the solution is ideal.

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10. $45g$ of ethylene glycol $C_2H_6O_2$ is mixed with $600g$ of water. Calculate (a) the freezing point depression and (b) the freezing point of solution. Given $K_f = 1.86 K kg mol^{-1}$.

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11. The degree of dissociation of $Ca(NO_3)_2$ in a dilute aqueous solution, containing $7.0g$ of the salt per $100g$ of water at $100^\circ C$ is 70%. If the vapour pressure of water at $100^\circ C$ is $760mm$, calculate the vapour pressure of the solution.

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12. A motor vehicle raditor was filled with $8L$of water to which $2L$of methyl alcohol $\left(density 0.8 gmL^{-1}\right)$ was added. What is the lowest temperature at which the vehicle can be parked outdoors without the danger that the water in the raditor will freeze? Given that K_f for water is $1.86 K kg mol^{-1}$

Watch Video Solution

13. Benzene and toluene form nearly ideal solution. If at $300 K P_{\text{bentezne}} = 103.01 \text{mm}$.

(i) Calculate the vapour pressure of a solution containing 0.6 mole fraction of toluene.

(ii) Calculate the mole fraction of toluene in the vapour form for this composition of liquid.

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14. The freezing point of a solution containing $50 cm^3$ of ethylene glycol in $50 g$ of water is found to be $-34^\circ C$. Assuming ideal behaviour, Calculate the density of ethylene glycol $\left(K_f\right.$ for water = $1.86 K kg mol^{-1}$).

Watch Video Solution

COMPETITION FILE (A. MULTIPLE CHOICE QUESTIONS(MCQ))

1. 2.5 litre of 1 M NaOH solution are mixed with another 3 litre of 0.5 M NaOH solution Then the molarity of the resulting

A. 0.80 M

B. 0.1 M

C. 0.73 M

D. 0.50 M

Answer: C

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2. The volumes of $4NHCI$ and $10NHCI$ required to make 1 litre of $6NHCI$ are

A. 0.75 litre of 4 N HCl and 0.25 litre of 10 N HCl

B. 0.25 litreof 4 N HCl and 0.75 litre of 10 N HCl

C. 0.67 litre of 4 N HCl and 0.33 litre of 10 N HCl

D. 0.50 litre of 4 N HCl and 0.20 litre of 10 N HCl

Answer: C

Watch Video Solution

3. The mole fraction of methanol in its 4.5 molal acqueous solution is

A. 0.25

B. 0.125

C. 0.100

D. 0.075

Answer: D

Watch Video Solution

4. Density of 3M NaCl solution is 1.28 g/cc. The molality of the solution is

A. 2.79 molal

B. 0.279 molal

C. 1.279 molal

D. 3.85 molal

Answer: A

Watch Video Solution

5. What volumes of 10 M HCl and 3 M HCl should be mixed to get 1L of 6 M HCl solution?

A. 200800

B. 700300

C. 250750

D. 400600

Answer: C

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6. What volume of 96% H_2SO_4 solution (density 1.83 g/mL) is required to prepare 4 litre of 3.0 M H_2SO_4 solution ?

A. $14.7mL$

B. $29.4mL$

C. $6.8mL$

D. $13.60mL$

Answer: D

Watch Video Solution

7. Which of the following plots represents the behavior of an ideal binary liquid solution ?

A. plot of $1/p_{\text{total}}$ vs y_A is linear (mol fraction of A in vapour phase).

B. plot of p_{total} vs y_B is linear.

C. plot of p_{total} vs y_A is linear.

D. plot of $1/p_{\text{total}}$ vs y_B is non- linear

Answer: A

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8. When a gas is bubbled through water at 298 K, a very dilute solution of gas is obtained . Henry's law constant for the gas is 100 kbar. If gas exerts a pressure of 1 bar, the number of moles of gas dissolved in 1 litre of water is

A. 0.555

B. 5.55

C. 0.0555

D. 55.5

Answer: A

Watch Video Solution

9. The vapour pressure of two pure isomeric liquids X and Y are 200 torr and 100 torr respectively at a given temperature. Assuming a solution of these components to obey Raoults law, the mole fraction of component X in vapour phase in equilibrium with the solution containing equal amounts of X and Y, at the same temperature is :

A. 0.22

B. 5.55

C. 0.0555

D. 55.5

Answer: D

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10. If two substances A and B have $p_A^\circ : p_B^\circ = 1:2$ and have mole fraction in solution as 1:2 then mole fraction of A in vapour phase is

A. 0.25

B. 0.80

C. 0.50

D. 0.20

Answer: B

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11. Normal boiling point of a liquid is that temperature which vapour pressure of the liquid is equal to:

A.

B.

C.

D.

Answer: A

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12. Two liquids P and Q have vapour pressures 450 and 200 torr respectively at certain temperature. In an ideal solution of the two, the mole fraction of P at which two liquids have equal partial pressures is.

A. 0.80

B. 0.308

C. 0.444

D. 0.154

Answer: B

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13. An aqueous solution of glucose boils at $100.01^{\circ}C$.The molal elevation constant for water is $0.5kmol^{-1}kg$. The number of molecules of glucose in the solution containing $100g$ of water is

A. 1.2×10^{21}

B. 2.0×10^{22}

C. 3.0×10^{23}

D. 6.0×10^{11}

Answer: A

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14. The vapour pressure of a solvent decreased by 10 mm of Hg when a non-volatile solute was added to the solvent. The mole fraction of solute in solution is 0.2, what would be the mole fraction of solvent if the decrease in vapour pressure is 20 mm of Hg?

A. 0.6

B. 0.8

C. 0.4

D. 0.2

Answer: A

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15. For an aqueous solution freezing point is $-0.186^{\circ}C$. The boiling point of the same solution is $(K_f = 1.86^{\circ} mol^{-1} kg)$ and $(K_b = 0.512 mol^{-1} kg)$

A. $0.93^{\circ}C$

B. $-0.93^{\circ}C$

C. $1.86^{\circ}C$

D. $-1.86^{\circ}C$

Answer: D

Watch Video Solution

16. The vapour pressure of pure liquid solvent 0.50 atm When a non-volatile solute B is added to the solvent ,its vapour pressure drops to 0.30 atm Thus,mole fraction of the component B is

A. 0.33

B. 6.0

C. 3.0

D. 0.66

Answer: C

Watch Video Solution

17. Which of the following have equal boiling point ?

A. Urea (NH_2CONH_2)

B. Glucose $(C_6H_{12}0_6)$

C. Sodium chloride $(NaCl)$

D. Calcium chloride $(CaCl_2)$

Answer: C

Watch Video Solution

18. Which one of the following pairs of solution can we expect to be isotonic at the same temperature

A. 0.1 M urea and 0.1 M NaCl

B. 0.1 M urea and 0.1 M $MgCl_2$,

C. 0.1 M NaCl and 0.1 M Na_2SO_4

D. 0.1 M $Ca(NO_3)_2$, and $0.1 M Na_2SO_4$

Answer: D

Watch Video Solution

19. A 0.2 molal aqueous solution of a weak acid HX is 20% ionized. The freezing point of the solution is $\left(k_f = 1.86 K kg \text{mole}^{-1}\right.$ for water):

A. $-0.45^\circ C$

B. $-0.90^\circ C$

C. $-0.31^\circ C$

D. $-0.53^\circ C$

Answer: A

Watch Video Solution

20. An electrolyte A gives 3 ions and B is a non-electrolyte. If 0.1 M solution of B produces an osmotic pressure P, then 0.05 M solution of A will produce an osmotic pressure, assuming that the electrolyte is completely ionised :

A. plot of $1/p_{\text{total}}$ vs y_A is linear (mol fraction of A in vapour phase).

B. $1.5p$

C. $0.5p$

D. $0.75p$

Answer: B

Watch Video Solution

21. Which of the following $0.10M$ aqueous solution will have the lowest freezing point?

A. $Al_2(SO_4)_3$

B. $C_6H_{12}O_6$

C. $C_{12}H_{22}O_{11}$

D. KI

Answer: A

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22. In a 0.2 molal aqueous solution of a weak acid HX the degree of ionization is 0.3. Taking K_f for water as 1.85, the freezing point of the solution will be nearest to

A. $-0.360^\circ C$

B. $0.206^\circ C$

C. $+0.480^\circ C$

D. $-0.480^\circ C$

Answer: D

Watch Video Solution

23. Which of the following solutions are isotonic with one another?

1. $0.15M$ urea 2. $0.05MCaCI_2$

3. $0.1 M MgSO_4$ 4. $0.15 M$ glucose

Select the correct answer using the codes given below.

A. 1 and 4

B. 2 and 3

C. 1,2 and 4

D. 2,3 and 4

Answer: C

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24. If P° and P_S are the vapour pressure of the solvent and its solution respectively and x_1 and x_2 are the mole fraction of the solvent and solute respectively, then

A. p_A° / p_B°

B. p_B° / p_A°

C. $p_A^\circ - p_B^\circ$

D. $p_B^\circ - p_A^\circ$

Answer: B

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25. A solution showing a large positive deviation from ideal behaviour have

A.

B.

C.

D.

Answer: C

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26. Dry air was passed successively through a solution of 5 g of a solutte in 80 g of water and then through pure water. The loss in mass of solution was 2.5 g and that of pure solvent was 0.04 g The molecular mass of the solute is :

A. 48

B. 32

C. 40

D. 35

Answer: A

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COMPETITION FILE (B. MULTIPLE CHOICE QUESTIONS(MCQ))

1. $0.002m$ aqueous solution of an ionic compound $Co(NH_3)_5(NO_2)CI$ freezes at $-0.00732^\circ C$.Number of moles of ions which 1 mole of ionic compound produces in water will be $\left(K_f = 1.86^\circ C / m\right)$

A. 3

B. 4

C. 1

D. 2

Answer: D

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2. At 300 K the vapour pressure of an ideal solution containing 1 mole of liquid A and 2 moles of liquid B is 500 mm of Hg. The vapour pressure of the solution increases by 25 mm of Hg, if one more mole of B is added to the above ideal solution at 300K. Then the vapour pressure of A in its pure state is

A. 300 mm of Hg

B. 40 mm of Hg

C. 500 mm of Hg

D. 600 mm of Hg

Answer: A

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3. Henry's law constant of oxygen is 1.4×10^{-3} mol $\text{lit}^{-1}\text{atm}^{-1}$ at 298 K. How much of oxygen is dissolved in 100 mL at 298 K when the partial pressure of oxygen is 0.5 atm?

A. 1.4g

B. 3.2g

C. 22.4mg

D. 2.24mg

Answer: D

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4. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ions, Na^+ and carbonate ions, CO_3^{2-} are respectively (Molar mass of $NaCO_3 = 106 gmol^{-1}$)

A. 1.90 M and 1.910 M

B. 0.477 M and 0.0477 M

C. 0.955 M and 1.910 M

D. 1.910 M and 0.955 M

Answer: D

Watch Video Solution

5. An aqueous solution is 1.00 molalin KI. Which change will cause the vapour pressure of the solution to increase ?

A. addition of 1.00 molal KI

B. addition of water

C. addition of NaCl

D. addition of Na_2SO_4

Answer: B

Watch Video Solution

6. A solution of sucrose (molar mass $= 342 g mol^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be: (K_f for water $= 1.86 K kg mol^{-1}$)

A. $+0.372^{\circ} C$

B. $-0.570^{\circ} C$

C. $-0.372^{\circ} C$

D. $-0.520^{\circ} C$

Answer: C

Watch Video Solution

7. The van't Hoff factor i for a compound which undergoes dissociation in one solvent and association in other solvent is respectively.

A. less than one and greater than one

B. less than one and less than one

C. greater than one and less than one

D. greater than one and greater than one

Answer: C

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8. P_A and P_B are the vapour pressure of pure liquid components ,Aand B respectively of an ideal binary solution,If x_A represents the mole fraction of component A, the total pressure of the solution will be

A. $p_A + x_A(p_B - p_A)$

B. $p_A + x_A(p_A - p_B)$

C. $p_B + x_A(p_B - p_A)$

D. $p_B + x_A(p_A - p_B)$

Answer: D

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9. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of solution is :

A. $0.001M$

B. $0.1M$

C. $0.02M$

D. $0.01M$

Answer: D

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10. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of solution is :

A. $90.0 gcon HNO_3$

B. $70.0 gconc. HNO_3$

C. $54.0 gconc HNO_3$

D. $45.0 gconc. HNO_3$

Answer: D

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11. 0.01 M solution of KCl and $CaCl_2$ are separately prepared in water. The freezing point of KCl is found to be $-2^{\circ} C$. What is the freezing point of $CaCl_2$ aq. Solution if it is completely ionized?

A. $-2^{\circ}C$

B. $-3^{\circ}C$

C. $-1.5^{\circ}C$

D. $-1.66^{\circ}C$

Answer: B

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12. Henry's law constant for the solubility of nitrogen gas in water at $298K$ is $1.0 \times 10^{-5} atm$. The mole fraction of nitrogen in air is 0.8.The number of moles of nitrogen from air dissolved in $10 mol$ of water at $298K$ and $5 atm$ pressure is

A. 1×10^{-4}

B. 2×10^{-4}

C. 1×10^{-5}

D. 2×10^{-5}

Answer: C

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13. If 2 mL of acetone is present in 45 mL of its aqueous solution ,calculate the concentration of this solution .

A. 20

B. 40

C. 50

D. 60

Answer: C

Watch Video Solution

14. Of the following $0.10m$ aqueous solutions,which one will exhibits the largest freezing point depression?

A. KCl

B. $C_6H_{12}O_6$

C. $Al_2(SO_4)_3$

D. K_2SO_4

Answer: C

Watch Video Solution

15. The boiling point of $0.2 mol kg^{-1}$ solution of X in water is greater than equimolal solution of Y in water. Which of the following statements is true in this case?

A. Molecular mass of X is less than the molecular mass of Y.

B. Y is undergoing dissociation in water while X undergoes no change.

C. X is undergoing dissociation in water.

D. Molecular mass of X is greater than the molecular mass of Y.

Answer: C

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16. Which of the following electrolytes has the same value of van't Hoff factor (i)is that of $Al_2(SO_4)_3$(if all are 100% ionised?

A. $Al(NO_3)_3$

B. $K_4[Fe(CN)_6]$

C. K_2SO_4

D. $K_3[Fe(CN)_6]$

Answer: B

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17. What is the mole fraction of the solute in a 1.00 m aqueous solution ?

A. 0.0354

B. 0.0177

C. 0.177

D. 1.770

Answer: B

Watch Video Solution

18. The density of 2.0 M solution of a solute is $1.2 gmL^{-1}$. If the molecular mass of the solute is $100 gmol^{-1}$, then the molality of the solution is

A. 2.0m

B. 1.2m

C. 1.0m

D. 0.6m

Answer: A

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19. For associative solutes

A. $\alpha = \frac{n(i-1)}{1-n}$

B. $\alpha = \frac{i(n-1)}{1+n}$

C. $\alpha = \frac{i(n+1)}{1-n}$

D. $\alpha = \frac{i(n+1)}{n-1}$

Answer: A

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20. Vapour pressure of a solvent containing nonvolatile solute is:

A. 103 mm Hg

B. 99 mm Hg

C. 97 mm Hg

D. 101 mm Hg

Answer: C

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21. Which of the following statements about the composition of the vapour over an ideal $1:1$ mol mixture of benzene and toluene is correct? Assume that the temperature is constant at $25^{\circ}C$. (Given: vapour pressure Date at $25^{\circ}C$, benzene=12.8 kP, toluene=3.85 kPa)

A. The vapour will contain equal amounts of benzene and toluene.

B. Not enough information is given to make a prediction.

C. The vapour will contain a higher percentage of benzene.

D. The vapour will contain a higher percentage of toluene.

Answer: C

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22. At $100^{\circ} C$ the vapour pressure of a solution of $6.5g$ of an solute in $100g$ water is $732mm$.If $K_b = 0.52$, the boiling point of this solution will be :

A. $102^{\circ} C$

B. $103^{\circ} C$

C. $101^{\circ} C$

D. $100^{\circ} C$

Answer: C

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23. Which one of the following is incorrect ?

A. $\Delta H_{\text{mix}} = 0$

B. $\Delta V_{\text{mix}} = 0$

C. $\Delta P = P_{\text{obs}} - P_{\text{calculated by Raoult's law}} = 0$

D. $\Delta G_{\text{mix}} = 0$

Answer: D

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24. The van't hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

A. 0

B. 1

C. 2

D. 3

Answer: D

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25. IF molality of the dilute solution is doubled the value of molal depression constant (K_f) will be _____.

A. halved

B. tripled

C. unchanged

D. doubled

Answer: C

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26. For an ideal solution, the correct option is:

A. $\Delta_{\text{mix}} S = 0$ at constant T and P

B. $\Delta_{\text{mix}} V \neq 0$ at constant T and P

C. $\Delta_{\text{mix}} H = 0$ at constant T and P

D. $\Delta_{\text{mix}} G = 0$ at constant T and P

Answer: C

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27. The mixture that forms maximum boiling azeotrope is :

A. Water + Nitric acid

B. Ethanol + Water

C. Acetone + Carbon disulphide

D. Heptane + Octane

Answer: A

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28. At $80^\circ C$ the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at

$80^{\circ} C$ and 1 atm pressure, the amount of 'A' in the mixture is (1 atm $= 760 mmHg)$

A. 50 mol precent

B. 53 mol percent

C. 34 mol percent

D. 48 mo percent

Answer: A

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29. The vapour pressure of water at 20° C is 17.5 mm Hg. If 18 g of gulucose$(C_6H_{12}O_6)$ is added to 178.2 g of water at 20° C, the vapour pressure of the resulting solution will be:

A. $17.325 mmHg$

B. $17.675 mmHg$

C. $15.750 mmHg$

D. $16.500 mmHg$

Answer: A

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30. Two liquids X and Y form an ideal solution. The mixture has a vapour pressure of 400 mm at 300 K when mixed in the molar ratio 1:1. when mixed in the molar ratio of 1:2 at the same temperatre the vapour pressure of the mixture is 350 mm. The vapour pressure of the two pure liquids X and Y respectively are

A. 250 mm, 550 mm

B. 350 mm, 450 mm

C. 350 mm, 700 mm

D. 550 mm , 250 mm

Watch Video Solution

31. 6% (W/V) solution of urea will be isotonic with:

A. 0.05 M solution of glucose

B. 6% solution of glucose

C. 25% solution of glucose

D. 1 M solution of glucose

Answer: D

Watch Video Solution

32. The difference between the boiling point and freezing point of an aqueous solution containing sucrose (molecular mass $= 342 gmol^{-1}$) in 100 g of water is 105.04. If K_f and K_b of water are 1.86 and $0.51 Kgmol^{-1}$ respectively, the weight of sucrose in the solution is about

A. 34.2g

B. 342 g

C. 7.2 g

D. 72g

Answer: D

Watch Video Solution

33. Two liquids X and Y form an ideal solution. At 300K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 550 mm Hg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 mm Hg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively

A. 200 and 300

B. 300 and 400

C. 400 and 600

D. 500 and 300

Answer: C

Watch Video Solution

34. If sodium sulphate is considered to be completely dissociated into cations and anions in aqueous solution , the change in freezing point of water (ΔT_f) when 0.01 mole of sodium sulphate is dissociated in 1 kg of water is : ($K_f = 1.86$ K kg mol^{-1})

A. 0.0744 K

B. 0.0186 K

C. 0.0372 K

D. 0.0558 K

Answer: D

Watch Video Solution

35. On mixing, heptane and octane form an ideal solution. At $373K$ the vapour pressure of the two liquid components (heptane and octane) are $105kPa$ and kPa respectively. Vapour pressure of the solution obtained by mixing 25.0 of heptane and $35g$ of octane will be (molar mass of heptane $= 100gmol^{-1}$ and of octane $= 114gmol^{-1}$):-

A. 96.2 Pka

B. 144.5 k Pa

C. 72.0 kPa

D. 36.1 kPa

Answer: C

Watch Video Solution

36. A solution containing 1.8 g of a compound (empirical formula CH_2O) in 40 g of water is observed to freeze at -0.465°C. The molecules formulea of the compound is (K_f of water =1.86kg Kmol^{-1}):

A. $C_2H_4O_2$

B. $C_3H_6O_3$

C. $C_4H_8O_4$

D. $C_5H_{10}O_5$

Watch Video Solution

37. A 3.5 molal aqueous solution of methyl alchol (CH_3OH) is supplied. What is the mole fraction of methyle alcohol in the solution ?

A. 0.086

B. 0.050

C. 0.100

D. 0.190

Answer: A

Watch Video Solution

Watch Video Solution

38. Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at $-6^{\circ} C$ will be $\left(K_f \text{ for water } = 1.86 K kg mol^{-1}\right.$, and molar mass of ethylene glycol $\left. = 62 g mol^{-1}\right)$

A. 400.00 g

B. 304.60g

C. 804.32g

D. 204.30g

Answer: C

Watch Video Solution

39. The degree of dissociation (α) of a weak electrolyte, $A_x B_y$ is related to van't Hoff's factor (i) by the expression:

A. $\alpha = \dfrac{x+y-1}{i-1}$

B. $\alpha = \dfrac{x+y+1}{i-1}$

C. $\alpha = \dfrac{i-1}{(x+y-1)}$

D. $\alpha = \dfrac{i-1}{x+y+1}$

Answer: C

Watch Video Solution

40. The molality of a urea solution in which $0.0100g$ of urea, $[(NH_2)_2CO]$ is added to $0.3000dm^3$ of water at STP is

A. $5.55 \times 10^{-4}m$

B. $33.3m$

C. $3.33 \times 10^{-2}m$

D. $0.555m$

Answer: A

Watch Video Solution

41. A5% solution of cane sugar (molar mass $=342$)is isotonic with 1% of a solution of an known solute.The molar mass of unknown solute in g/mol is

A. 171.2

B. 68.4

C. 34.2

D. 136.2

Answer: B

Watch Video Solution

42. 58.5 g of NaCl and 180 g of glucose were separately dissolved in 1000 mL of water. Identify the correct statement regarding the elevation of boiling point (bp) of the resulting solutions.

A. NaCl solution will show higher elevation of b.pt.

B. Glucose solution will show higher elevation of b.pt.

C. Both the solutions will show equal elevation of b.pt.

D. The b.pt. of elevation will be shown by neither of the solutions.

Answer: A

Watch Video Solution

43. Freezing point of an aqueous solution is $-0.186^{\circ}C$. Elevation of boiling point of the same solution is ....if $K_b = 0.512K\text{molality}^{-1}$and $K_f = 1.86K\text{molality}^{-1}$:

A. 0.52

B. 1.04

C. 1.34

D. 0.134

Watch Video Solution

44. The mass of a non-volatile solute of molar mass $40g \quad mol^{-1}$ that should be dissolved in 114 g of octane to lower its vapour pressure by 20% is

A. 8g

B. 11.4g

C. 9.8 g

D. 12.8g

Answer: A

Watch Video Solution

45. Two liquids A and B have P_A° and P_B° in the ratio of 1 : 3 and the ratio of number of moles of A and B in liquid phese are 1 : 3 then mole fraction of 'A' in vapour phase in equilibrium with the solution is equal to :

A. 0.33

B. 0.2

C. 0.25

D. 0.52

Answer: B

Watch Video Solution

46. K_f for water is $1.86 K kg mol^{-1}$. IF your automobile radiator holds $1.0 kg$ of water, how many grams of ethylene glycol $(C_2H_6O_2)$ must you add to get the freezing point of the solution lowered to $-2.8^{\circ} C$?

A. 93 g

B. 39 g

C. 27 g

D. 72 g

Answer: A

Watch Video Solution

47. The measured freezing point depression for a 0.1 m aqueous CH_3COOH solution is $0.19^\circ C$. The dissociation aconstant (K_b) for the acid at this concentration will be $\left(K_f = 1.86 \text{ K kg mol}^{-1}\right)$

A. 4.76×10^{-5}

B. 4×10^{-5}

C. 8×10^{-5}

D. 2×10^{-5}

Answer: B

Watch Video Solution

48. A solution of $1.25 of 'P'$ in 50g of water lawers freezing point by $0.3^{\circ} C$. Molar mass of 'P' is 94. $K_{f(\text{water})} = 1.86 \text{K kg mol}^{-1}$. The degree of association of 'P' in water is

A. 0.8

B. 0.6

C. 0.65

D. 0.75

Answer: A

Watch Video Solution

49. Consider separate solution of $0.500 M C_2H_5OH(aq), 0.100 M Mg_3(PO_4)_2(aq), 0.250 M KBr(aq)$ and $0.125 M Na_3PO_4(aq)$ at $25^{\circ} C$. Which statement is true about these solutions, assuming all salts to be strong electrolytes?

A. 0.500 M $C_2H_5OH_{(aq)}$, has the highest osmotic pressure.

B. They all have the same osmotic pressure.

C. 0.100 M $Mg_3(PO_4)_{2(\text{aq})}$ has the highest osmotic pressure.

D. 0.125 M $Na_3PO_{4(\text{aq})}$ has the highest osmotic pressure.

Answer: B

Watch Video Solution

50. The vapor pressure of acetone at $20^\circ C$ is 185 torr. When $1.2g$ of a non-volatile solute was dissolved in $100g$ of acetone at $20^\circ C$, it vapour pressure was 183 torr. The molar mass $\left(gmol^{-1}\right)$ of solute is:

A. 128

B. 488

C. 32

D. 64

Answer: D

Watch Video Solution

51. If p° and p_a are the vapour pressures of the solvent and solution respectively and n_1 and n_2 are the mole fractions of solvent and solute respectively. Then,

A. $P^\circ = P\left[\dfrac{n_1}{n_1+n_2}\right]$

B. $p^\circ = P\left[\dfrac{n_1}{n_1+n_2}\right]$

C. $P = P^\circ\left[\dfrac{n_2}{n_1+n_2}\right]$

D. $P = P^\circ\left[\dfrac{n_1}{n_1+n_2}\right]$

Answer: C

Watch Video Solution

52. $45g$ of ethylene glycol $C_2H_6O_2$ is mixed with $600g$ of water. Calculate (a) the freezing point depression and (b) the freezing point of solution.

Given $K_f = 1.86 K kg mol^{-1}$.

A. 272

B. 271

C. 270

D. 274

Answer: B

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53. $18g$ glucose $(C_6H_{12}O_6)$ is added to $178.2g$ water. The vapour pressure of water (in torr) for this aqueous solution is:

A. 7.6

B. 76

C. 752.4

D. 759

Answer: C

Watch Video Solution

54. The freezing point of benzene decreases by $0.45^{\circ} C$ when $0.2g$ of acetic acid is added to $20g$ of benzene. IF acetic acid associates to form a dimer in benzene, percentage association of acetic acid in benzene will be $\left(K_f \text{for benzene} = 5.12 K kg mol^{-1}\right)$

A. 0.646

B. 0.804

C. 0.746

D. 0.946

Answer: D

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55. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point ?

A. $\left[Co(H_2O)_6\right]Cl_3$

B. $\left[Co(H_2O)_5Cl\right]Cl_2.\ H_2O$

C. $\left[Co(H_2O)_4Cl_2\right]Cl.2H_2O$

D. $\left[Co(H_2O)_3Cl_3\right]3H_2O$

Answer: D

Watch Video Solution

56. $18g$ of glucose $(C_6H_{12}O_6)$ is dissolved in $1kg$ of water in a saucepan. At what temperature will the water boil (at 1 atm) ? K_b for water is $0.52Kkgmol^{-1}$.

A. 373.15K

B. 373.67K

C. 374.19 K

D. 373.10K

Answer: C

Watch Video Solution

57. The Henry's law constant for O_2, dissolved in water is 4.34×10^4 atm at certain temperature. If the partial pressure of O_2, in a gas mixture that is in equilibrium with water is 0.434 atm, what is the mole fraction of O_2, in the solution?

A. 1×10^{-5}

B. 1×10^{-4}

C. 2×10^{-5}

D. 1×10^{-6}

Answer: A

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58. Acetic acid dissolved in benzene shows a molecular mass of:

A. 1.62 and 98.3

B. 0.81 and 98.3

C. 0.5 and 86

D. 1 and 98.3

Answer: A

Watch Video Solution

59. Relative lowering of vapour pressure of a dilute solution of glucose dissolved in 1 kg of water is 0.002. The molality of the solution is .

A. 0.004

B. 0.222

C. 0.111

D. 0.021

Answer: C

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60. Two liquids A and$B$ on mixing produce a warm solution. Which type of deviation from Raoult's law does it show?

A. positive and positive

B. positive and negative

C. negative and negative

D. negative and positive

Answer: D

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61. Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous is reaction of Y .if molecular weight of X is A then molecular weight of Y is :

A. 2A

B. 3A

C. A

D. 4A

Answer: B

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62. The osmotic pressure of a dilute solution of a compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in $\text{mol}L^{-1}$) in solution is:

A. 6×10^{-2}

B. 4×10^{-2}

C. 16×10^{-4}

D. 4×10^{-2}

Answer: D

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63. A solution is prepared by dissolving 0.6 g of urea (molar mass $= 60 g \text{mol}^{-1}$) and 1.8 g of glucose (molar mass $= 180 g \text{mol}^{-1}$) in 100 mL of water at $27^\circ C$. The osmotic pressure of the solution is:

$\left(R = 0.8206 L \text{atm} K^{-1} \text{mol}^{-1}\right)$

A. 4.92 atm

B. 1.64 atm

C. 2.46 atm

D. 8.2 atm

Answer: A

Watch Video Solution

64. 1g of a non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_b(A)}{\Delta T_b(B)}$ is

A. $5:1$

B. $10:1$

C. $1:5$

D. $1:0.2$

Answer: C

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65. Elevation in the boiling point for 1 molal solution of glucose is 2K. The depression in the freezing point for 2 molal solution of glucose in the same solvent is 2K. The relation between $K_b \text{ and } K_f$ is

A. $K_b = 0.5K_f$

B. $K_b = 2K_f$

C. $K_b = 1.5K_f$

D. $K_b = K_f$

Answer: B

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66. Which one of the following statements regarding Henry's law is not correct?

A. The value of K_H increases with the nature of the gas

B. Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids.

C. The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution.

D. Different gases have different K. (Henry's lawconstant) values at the same temperature.

Answer: B

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67. Molecules of benzoic acid (C_6H_5COOH) dimerise in benzene. 'w' g of the acid dissolved in 30g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is : (Given that $K_f = 5KKg\text{mol}^{-1}$ Molar mass of benzoic acid $= 122g\text{mol}^{-1}$)

A. 1.8g

B. 2.4g

C. 1.0g

D. 1.5g

Answer: B

Watch Video Solution

68. A solution containing 62 g ethylene glycol in 250 g water is cooled to $-10^{\circ}C$. If K_f for water is 1.86 K mol^{-1}, the amount of water (in g) separated as ice is :

A. 32

B. 48

C. 16

D. 64

Answer: D

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69. Liquids A and B form an ideal solution in the entire composition range. At 350K, the vapor pressure of pure A and pure B are 7×10^{3} Pa and 12×10^3 Pa, respectively. The composition of the vapor in equilibrium with a solution containing 40 mole percent of A at this temperature is :

A. $x_A = 0.37, x_B = 0.63$

B. $x_A = 0.28, x_B = 0.72$

C. $x_A = 0.76, x_B = 0.6$

D. $x_A = 0.4, x_B = 0.6$

Answer: B

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70. The vapour pressures of pure liquids A and B are 400 and 600 mm Hg respectively at 298 K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fractions of components A and B in vapour phase, respectively are :

A. 450 mmHg, 0.4, 0.6

B. 500 mmHg, 0.5, 0.5

C. 450 mmHg, 0.5, 0.5

D. 500mmHg, 0.4, 0.6

Answer: D

Watch Video Solution

71. K_2HgI_4 is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is :

A. 1.8

B. 2.2

C. 2

D. 1.6

Answer: A

Watch Video Solution

72. Molal depression constant for a solvent is $4.0 K kg \text{mol}^{-1}$ The depression in the freezing point of the solvent for $0.03 mol kg^{-1}$ solution of K_2SO_4 is: (Assume complete dissociation of the electrolyte)

A. 0.12K

B. 0.36K

C. 0.18K

D. 0.24K

Answer: B

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73. The Henry's law constant for the solubility of N_2 gas in water at $298K$ is $1.0 \times 10^5 atm$. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at $298K$ and $5atm$.

Pressure is:

A. 4.0×10^{-4}

B. 4.0×10^{-5}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

Answer: A

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74. Dissolving $120g$ of urea (mol wt $= 60)$ in 1000g of water gave a solution of density 1.15 g/mL. The molarity of the solution is

A. 1.78 M

B. 2.00 M

C. 2.05M

D. 2.22M

Answer: C

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75. The freezing point (in $^\circ C$) of solution containing 0.1 g of $K_3[Fe(CN)_6]$ (mol.wt. 329) in 100 g of water ($K_f = 1.86$ K kg mol^{-1}) is

A. -2.3×10^{-2}

B. -5.7×10^{-2}

C. 5.7×10^{-3}

D. -1.2×10^{-2}

Answer: A

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76. For a dilute solution containing $2.5g$ of a non-volatile non-electrolyte solution in $100g$ of water, the elevation in boiling point at 1 atm pressure is $2^{\circ}C$. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is:

(take $k_b = 0.76Kkgmol^{-1}$)

A. 724

B. 740

C. 736

D. 718

Answer: A

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77. Pure water freezes at 273 K and 1 bar. The addition of 34.5 g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as 2 K $kgmol^{-1}$. The figures shown below represent plots of vapour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is$46gmol^{-1}$ Among the following, the option representing change in the freezing point is

A.

B.

C.

D.

Answer: B

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COMPETITION FILE (C. MULTIPLE CHOICE QUESTIONS(MCQ))

1. Colligative properties of a solution depends upon

A. independent of the nature of solute .

B. inversely proportional to molecular mass of solute

C. proportional to the amount of solvent

D. independent of the amount of solvent

Answer: A::B::C

Watch Video Solution

2. Under what condition do non-ideal solutions show negative deviations?

A. acetone + ethyl alcohol

B. acetic acid + pyridine

C. chloroform + benzene

D. carbon tetrachloride + toluene

Answer: B::C

Watch Video Solution

3. Which of the following forms is an ideal solution?

A. chlorobenzne + Bromobenzen

B. Hexane + Heptane

C. Ethanol + Cyclohenxane

D. Acetic acid + Pyridine

Answer: A::B

Watch Video Solution

4. In the depression of freezing point experiment, it is found that the:

A. the vapour pressure of the solution is less than that of pure solvent .

B. the vapour pressure of the solution is more than that of pure solvent .

C. only solute molecules solidify at the freezing point

D. only solvent molecules solidify at the freezing physical.

Answer: A::D

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5. An aqueous solution freezes at 272.4 K while pure water freezes at 273 K. Given $K_f = 1.86 K kg \text{mol}^{-1}$,$K_b = 0.512 K kg \text{mol}^{-1}$ and vapour pressure of water at 298 K = 23.756 mm Hg. Determine the following.

Molality of the solution is

A. freezing point of solution $= -3.72^{\circ} C$

B. boiling point of soution $= 100.512^{\circ} C$

C. osmotic pressure $= 3.76$ atm

D. observed molecular mass = 37.25 (approx.assuming degree of dissociation = 1).

Answer: B::D

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6. Which of the following statements is / are wrong ?

A. The value of colligative property decreases when solute undergoes dissociation.

B. For $AlCl_3$, the Van't Hoff factor is 3.

C. Solvent rises from soil to the the top of a tall tree due to osmosis.

D. Aqueous solution of NaCl freezes at lower temperature than water.

Answer: A::B

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7. Benzene and naphthalene form an ideal solution at room temperature. For this process,the true statement(s) is (are)

A. ΔG is positive

B. ΔS_{system} is positive

C. $\Delta S_{\text{surrounding}} = 0$

D. $\Delta H = 0$

Answer: B::C::D

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8. $0.5m$ solution of urea is isotonic with

A. 18% (m/v) solution of glucose

B. 0.5 M solution of $BaCl_2$

C. 1M solution of surcose

D. 1M solution of acetic acid

Answer: A::C

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9. Mixture (s) showing positive deviation from Raoult's law at $35^{\circ} C$ is (are)

A. carbon tetrachloride + methanol

B. carbon disulphide + acetone

C. benzene + toluene

D. phenol + aniline

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10. For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M is solution is shown in the following figure . Here x_L and x_M represent mole fractions of L and M , respectively , in the solution. The correct statement (s) applicable to this system is (are).

A. attractive intermolecular interactions between L - L in pure liquid L and M - M in pure liquid M are stronger that those between L - M when mixed in solution.

B. the point Z represents vapour pressure fo pure liquid M and Raoult's law is obeyed when $x_L \rightarrow 0$.

C. the point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $x_L = 0$ to $x_L = 1$

D. the point Z represent vapour pressue of pure liquid L and Raoult' s law is obeyed when $x_L \rightarrow 1$

Answer: A::D

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COMPETITION FILE (D. MULTIPLE CHOICE QUESTIONS(MCQ))

1. The vapour pressure of a pure liquid A is $40 mmHg$ at $310 K$. The vapour pressure of this liquid in a solution with liquid B is $32 mmHg$. The mole fraction of A in the solution, if it obeys Raoult's law, is:

A. 0.6

B. 0.5

C. 0.2

D. 0.8

Answer: D

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2. Vapour pressure of a liquid depends upon its

A. For solution showing - ve deviations, ΔV_{mixing} and ΔH_{mixing} are +ve.

B. For solutions showing negative deviaitons, the interactions between the components are greater than the pure components

C. For solutions showing + ve deviaitons , $\Delta V_{\text{mixing}} = +ve$ but $\Delta H_{\text{mixing}} = +ve$

D. For solution showing -ve deviations, $\Delta V_{\text{mixing}} = -ve$ but ΔH_{mixing} = + ve.

Answer: B

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3. Vapour pressure of a liquid depends upon its

A. 100 mm Hg

B. 35 mm Hg

C. 30 mm Hg

D. 1.86 mm Hg

Answer: B

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4. Vapour pressure of a liquid depends upon its

A. $\Delta G_{\text{mix}} = 0$

B. $\Delta H_{\text{mixing}} = 0$

C. $\Delta G_{\text{mix}} = 0, \Delta S_{\text{mix}} = 0$

D. $\Delta S_{\text{mixing}} = 0$

Answer: B

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5. A solution of sucrose (molar mass $= 342 gmol^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be: $(K_f$ for water $= 1.86 K kg mol^{-1})$

A. -0.744°

B. $-0.372^{\circ}C$

C. $-0.186^{\circ}C$

D. $-0.093^{\circ}C$

Answer: A

Watch Video Solution

6. A solution of sucrose (molar mass $= 342\text{g mol}^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be :

(K_f for water $= 1.86\text{K kg mol}^{-1}$)

A. 0.0220 atm

B. 0.238 atm

C. 0.0238 atm

D. 0.220 atm

Answer: C

Watch Video Solution

7. A solution of sucrose (molar mass $= 342 g mol^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be: (K_f for water $= 1.86 K kg mol^{-1}$)

A. 11.79 g

B. 1.179 g

C. 2.34 g

D. 23.4 g

Answer: B

Watch Video Solution

8. A solution of sucrose (molar mass $= 342 g mol^{-1}$) has been prepared by dissolving 68.5g of sucrose in 1000g of water. The freezing point of the solution obtained will be: $(K_f$ for water $= 1.86 K kg mol^{-1})$

A. 0.72

B. 0.8

C. 0.92

D. 0.88

Answer: D

Watch Video Solution

9. An electrolyte A gives 3 ions and B is a non-electrolyte. If 0.1 M solution of B produces an osmotic pressure P, then 0.05 M solution of A will produce an osmotic pressure, assuming that the electrolyte is completely ionised :

A. 0.02p

B. 0.8p

C. 0.4p

D. 0.6p

Answer: B

Watch Video Solution

10. A 0.2 molal aqueous solution of weak acid (HX) is 20% ionised. The freezing point of this solution is (Given, $K_f = 1.86^\circ Cm^{-1}$ for water)

A. $101.04^\circ C$

B. $100.104^\circ C$

C. $100.1248^\circ C$

D. $100.52^\circ C$

Answer: C

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11. Which of the following expressions is not acceptable?

(i) $\Delta P = P_f - P_i$

(ii) $\Delta_w = w_f - w_i$

(iii) $\Delta q = q_f - q_i$

(iv) $\Delta U = U_f - U_i$

A. 0.5 M H_3PO_3

B. 0.5 M Na_3PO_4

C. $0.5MNaCl$

D. 0.5 M Aniline

Answer: B

Watch Video Solution

12. An aqueous solution freezes at

$-0.186^\circ C\left(K_f = 1.86^\circ\right.$,$K_b = 0.512^\circ$. What is the elevation in boiling point?

A. $1:1:2:3$

B. $3:2:1:1$

C. $1:2:3:4$

D. $2:2:3:4$

Answer: A

Watch Video Solution

13. If K_f value of H_2O is 1.86. The value of ΔT_f for 0.1 m solution of non-volatile solute is

A. $7.8 mol L^{-1}$

B. $1.5 mol L^{-1}$

C. $0.075 mol L^{-1}$

D. $0.15 mol L^{-1}$

Answer: D

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COMPETITION FILE (MARTIX MATCH TYPE QUESTIONS)

1. Match the behaviour of solution in Column I with the example listed in Column II.

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2. Match the type of solution in Column I with the characteristic property metioned in Column II.

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COMPETITION FILE (INTEGER TYPE OR NUMERICAL VALUE TYPE QUESTIONS)

1. The liquid pair of acetone-chloroform shows a positive deviation form Raoult's law.

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2. The depressions in freezing point for 1 M urea, 1 M glucose and 1M NaCl are in the ration :

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3. CH_3OH and C_2H_5OH may be distinguished chemically :

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4. An electrolyte A_2B_3 ionizes in water upto 75%. The van't Hoff factor for it is .

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5. The depression in freezing expected for 0.6 m $Al_2(SO_4)_3$ solution will be 'n' times compared with 0.2 m Na_2SO_4 solution. The value of n is.

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6. 29.2% (w/w) HCl stock solution has a density of 1.25 g mL^{-1}. The molecular weight of HCl is 36.5 g mol^{-1}. The volume (mL) of stock solution required to prepare a 200mL solution of 0.4 M HCl is :

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7. MX_2 dissociates into M^{2+} and X^- ions in an aqeous solution, with a degree dissociation (α) of 0.5. The ratio of the observed depression of freezing point of the aqueous solution to the value of the depression of freezing point in the absence of ionic dissociation is

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8. If the freezing point of a 0.01 molal aqueous solution of a cobalt (III) chloride-ammonia complex (which behaves as a strong electrolyte) is $-0.0558^{\circ} C$, the number of chloride (s) in the coordination sphere of the complex if $\left[K_f \text{ of water } = 1.86 K kg mol^{-1}\right]$

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9. The mole fraction of a solute in a solutions is 0.1. At $298K$ molarity of this solution is the same as its molality. Density of this solution at 298 K is $2.0 gcm^{-3}$. The ratio of the molecular weights of the solute and solvent, $\frac{MW_{\text{solute}}}{MW_{\text{solvent}}}$ is

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10. Liquids A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary solution of liquids A and B has vapour pressure 45 torr. At the same temperature, a new solution of A and B having mole fractions x_A and x_B, respectively, has vapours pressure of 22. torr. The value of x_A / x_B in the new solution is _____. (Given that the vapour pressure of pure liquid A is 20 torr at temperature T).

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11. The plot given below shows P - T curves (where P is the pressure and T is the temperature) for the solvents X and Y and isomolal solutions of NaCl in these solvents. NaCl completely dissociates in both the solvents.

On addition of equal number of moles of a non - volatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is the three times that of solvent Y . Solute S is known to undergo dimerization in these solvents. If the degree of dimerization is 0.7 in solvent Y, the degree of dimerization solvent X is ....

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12. On dissolving 0.5 g of non-volatile, non-ionic solute to 39 g of benzene, its vapour pressure decreases from 650 mm of Hg to 640 mm of Hg. The depression of freezing point of benzene (in K) upon addition of the solute is ________.

(Given data: Molar mass & molar freezing point depression is 78 g mol^{-1}&$5.12 K kg mol^{-1}$]

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13. The mole fraction of urea in an aqueous urea solution containing 900 g of water is 0.05. If the density of the solution is $1.2 gcm^{-3}$, the molarity of urea solution is ________

Given data: Molar masses of urea and water are $60 g\text{mol}^{-1}$ and $18 g\text{mol}^{-1}$, respectively)

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UNIT PRACTICE TEST

1. The vapor pressure of acetone at $20^{\circ} C$ is 185 torr. When $1.2g$ of a non-volatile solute was dissolved in $100g$ of acetone at $20^{\circ} C$, it vapour pressure was 183 torr. The molar mass $\left(gmol^{-1}\right)$ of solute is:

A. 128.8

B. 64.4

C. 32.2

D. 257.6

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2. Which one of the following is incorrect for ideal solution?

A. $\Delta H_{\text{mix}} = 0$

B. $\Delta V_{\text{mix}} = 0$

C. $\Delta p_{\text{obs}} \quad - p_{\text{calculated form Raoult's law}} = 0$

D. $\Delta G_{\text{mix}} = 0$

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3. The Van't Hoff factor of benzoic acid solution in benzene is 0.5. In this solution. Benzoic acid

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4. Assertion : Addition of a nonvolatile solute to a volatile solvent increases the boiling point.

Reason : Addition of nonvolatile solute results in lowering of vapour pressure.

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5. State the condition resulting in reverse osmosis.

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6. A compound X undergoes tetramerisation in a given organic solvent. The van't Hoff factor is

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7. Why does a solution of ethanol and cyclohexane show positive deviation from Raoult's law?

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8. How many grams of potassium chloride should be added to 1.5 kg of water to lower its freezing point to $-7.5^{\circ}C$?

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9. A solution cantains 0.8960 g of K_2SO_4 in 500 mL. Its osmotic pressure is found to be 0.69 atm at $27^\circ C$. Calculate the value of Van't Hoff factor.

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10. The freezing point depression of 0.1 molal solution of benzoic acid in benzene is $0.526K$. For benzene K_f is $5.12Kkg\text{mol}^{-1}$. 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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11. Benzene and toluene form ideal solution over the entire range of composition. The vapour pressure of pure benzene and naphthalene at $300K$ are $50.71mmHg$ and $32.06mmHg$, respectively. Calculate the mole fraction of benzene in vapour phase if $80g$ of benzene is mixed with $100g$ of naphthalene.

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12. The relative lowering in vapour pressure is:

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13. Calculate the normal boiling point of a sample of sea water found to contain3.5% of $NaCl$ and 0.13% of $MgCl_2$ by mass. The normal boiling of point of water is $100^\circ C$ and $K_b(\text{water}) = 0.51 K kg mol^{-1}$. Assume that both the salts are completely ionised.

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14. Calculate the volume of 80% H_2SO_4 by weight (density = 1.8 g/ml) required to prepare 1L of 0.2 M solution.

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