CHEMISTRY

BOOKS - KALYANI CHEMISTRY (ENGLISH)

SOLUTIONS

Example

1. 400 mL solution of carbonate (density, 1.1.gmL^{-}) contains 22g of sodium carbonate. Calculate the mass per cent of sodium carbonate in solution.

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2. Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample

of the acid if the density of the solution is 1.504g mL^{-1}?

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3. If the density of water of a lake is $1.25gmL^{-1}$ and one kg of lake water contains 92 g of Na^{+} ions, calculate the molarity of Na^{+} ions in this lake water. (Gram atomic mass of $Na = 23\text{g mol}^{-1}$)

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4. A solution of glucose in water is labelled as 10% w/w. what would be the molality and mole fraction of each component in the solution? If the density of solution 1.2 g mL^{-1}, then what shall be the molarity of the solution?

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5. A solution is obtained by mixing 300g of 25% solution ad 400 g of 40% solution by mass. Calculate the mass percentage of the resulting solution.

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6. A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be carcinogenic in nature. 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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7. The mole fraction of methyl alcohol in an aqueous solution is 0.02. Calculate the molality of the solution.

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8. A solution of glucose in water is labelled as 10% w/w. what would be the molality and mole fraction of each component in the solution? If the density of solution 1.2 g mL^{-1}, then what shall be the molarity of the solution?

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9. How many mL of 0.1 M HCl are required to react completely with 1 g mixture of Na_2CO_3 and $NaHCO_3$ containing equimolar amounts of both?

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10. A sugar syrup of weight 214.2 g contains 34.2 g of sugar $(C_{12}H_{22}O_{11})$. Calculate (i) molal concentration (ii) mole fraction of sugar in the syrup.

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11. Calculate the mole fraction of water in a sodium hydroxide solution which has 80 g of NaOH and 54g of H_2O.

[Relative atomic masses : Na = 23, O = 16, H = 1]

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12. Calculate the molality of potassium carbonate solution which is formed by dissolving 2.5 gm of it in one litre solution. (density of solution of 0.85 g/mL).

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13. Calculate the normality of the solution obtained by mixing 10 mL of N/5 HCl and 30 mL of N/10 HCl.

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14. If the molality of an aqueous solution of cane sugar is 0.4445, what is the mole fraction of cane sugar?

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15. A solution to be used in a hand lotion is prepared by mixing 90.0g of water, 9.2g of ethyl alcohol and 18.4g of glycerol $(C_3H_8O_3)$. Calculate the mole fraction of glycerol present in it.

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16. Calculate the mole fraction of an unknown solute in 2.0 m aqueous solution.

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17. The Henry's law constant for a solution of acetone in chloroform is 0.2 bar when the solution is at 308 K. Calculate the value of vapour pressure of acetone when its mole fraction is 0.14.

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18. The partial pressure of ethane over a solution containing 6.56×10^{-3} g of ethane is 1 bar. If the solution contains 5.00×10^{-2}g of ethane, then what shall e the partial pressure of the gas?

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19. If O_2 gas is bubbled through water at 293 K, how many millimoles of O_2 gas would dissolve in 1 litre of water? Assume that the partial pressure of O_2 is 0.987 bar. Given that Henry's law constant for O_2 at 293K is 34.86 kbar.

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20. The vapour pressures of benzene and toluene at 293 K are 75 mm and 22 mm Hg respectively. 23.4g of benzene and 64.4 g of toluene are mixed. If the two form and ideal solution, calculate the mole fraction of benzene in the vapour phase assuming that the vapours are in equilibrium with the liquid mixture at this temperature.

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21. An aqueous solution is made by dissolving 10g of glucose $(C_6H_{12}O_6)$ in 90g of water at 300K. If the vapour pressure of pure water at 300 K is 32.8 mm Hg, what would be the vapour pressure of the solution?

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22. The vapour pressure of benzene and toluene are 150 mm and 50 mm respectively. A solution is prepared by mixing equal weights of benzene and toluene. Assuming the solution to be ideal, calculate the vapour pressure of the solution.

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23. Two liquids A and B form ideal solutions. At 300 K, the vapour pressure of a solution containing 1 mole of A and 3 moles of B is 550 mm Hg . At the same temperature , if one more mole of B is added to this solution, the vapour pressure of the solution increases by 10 mm Hg. The vapour pressures of A and B in their pure states are respectively

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24. Heptane and octane form an ideal solution. At 373K, 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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25. 100g of liquid A (molar mass 140g mol^{-1}) was dissolved in 1000g of liquid B (molar mass 180g mol^{-1}). The vapour pressure of pure liquid B was found to be 500 torr. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution If the total vapour pressure of the solution is 475 torr.

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

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27. The vapour pressure of water is 12.3 kPa at 300 K. calculate vapour pressure of 1 molal solution of a non-volatile solute in it.

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28. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114g octane to reduce its vapour pressure to 80%.

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29. What is the mass of a non-volatile solute (molar mass 60) that needs to be dissolved in 100 g 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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30. A solution containing 30 g of a non-volatile solute exactly in 90 g water has a vapour pressure of 2.8 k P_a at 298 K. Further 18 g of water is then added to solution, the new vapour pressure becomes 2.9 k P_a at 298 K. Calculate.

(i) Molecular mass of the solute

(ii) Vapour pressure of water at 298 K.

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31. A solution is prepared by dissolving 2.0g of sucrose and 2.0 gurea in 100g of water at 298 K. Calculate the vapour pressure of the solution, if the vapour pressure of pure water at 298 K is 23.756 torr. (Molecular weight of urea = 60 and sucrose = 342).

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32. Boiling point of water at 750 mm Hg is $99.63^{\circ}C$. How much sucrose is to be added to 500g of water such that it boils at $100^{\circ}C$.

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33. The boiling point of pure water is 373 K. calculate the boiling point of an aqueous solution containing 18 g of glucose (M.W. = 180) in 100g of water. Molal elevation constant of water is 0.52 K kg mol^{-1}.

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34. A solution of 1.35g of non-volatile solute in 72.3 mL of water boils at 0.162°C higher than the boiling point of water. Calculate the molecular weight of the substance. Latent heat of vapourization of water is 540 cal/g.

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35. Boiling point of pure chloroform is 334.0 K and a solution of 3.4×10^{-14} kg of camphor $(C_{10}H_{16}O)$, in 25.3 $\times 10^{-3}$ kg of chloroform boils at 334.3 K. Calculate K_b and $\Delta_{\text{vap}}H$ for chloroform.

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36. The freezing point of nitrobenzene is 278.8 K. A 0.25 molal solution of a substance (molecular weight : 120) in nitrobenzene has a freezing point of 276.8 K. Calculate the molal depression constant of nitrobenzene.

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37. The cryoscopic constant of water is 1.86 K mol^{-1} kg. An aqueous solution of cane sugar freezes at $-0.372^{\circ}C$. Calculate the molality of the solution.

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38. An aqueous solution containing 0.2g of compound A in 21.7g of water freezes at 272.814 K. If the value of K_f for water is 1.86K kg mol^{-1}, calculate molecular weight of compound A.

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

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40. A solution containing 10 g of urea (Mol. wt. 60) in one kg of water freezes at the same temperature as another solution containing 15g of solute S in same amount of water. Calculate molecular mass of S.

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41. An aqueous solution contains 5% by weight of urea and 10% by weight of glucose. What will be its freezing point ? (K_f for water $= 1.86^\circ \quad \text{mol}^{-}\text{kg}$)

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42. The osmotic pressure of blood is 7.65 atm. at $27^\circ C$. How much glucose should be used per litre to prepare an intravenous injection that has the same osmotic pressure as blood.

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43. Calculate the osmotic pressure of a solution containing 3.42g of sucrose in 1 litre of water at 400 K.

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44. The weights of solutes present in two isotonic solutions A and B are in the ratio 2:3. If the solutes are non-electrolytes, how are their molecular weights related ?

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45. A solution containing 8.6g per dm^3 of urea (mol. wt. 60) was found to be isotonic with a 5 per cent solution of an organic non volatile solute. Calculate molecular weight of the latter.

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46. Equal weights of two substances X and Y are dissolved in equal volumes of water. The osmotic pressure of the solution containing Y is five times the osmotic pressure of the solution containing X. What is the molecular weight of X if that of Y is 60?

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47. The depression in the freezing point of a sugar solution was found to be $0.402^{\circ}C$. Calculate the osmotic pressure of the sugar solution at $27^{\circ}C$. $\left(K_f = 1.86 \ \ \mathrm{K\ kg\ mol^{-1}}\right)$.

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48. Calculate the osmotic pressure of a solution obtained by mixing $100cm^3$ of $1.5\,\%$ solution of urea (mol. Mass=60) and $100cm^3$ of $3.42\,\%$ solution by cane sugar (mol. Mass = 342) at $20^{\circ}C$. (R=0.082 litre atm/deg/mole)

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49. Albumins are the most abundant proteins in blood. At $25^{\circ}C$, 3.5 g of albumin in 100 ml of water produces and osmotic pressure is 0.014 atm. What is the molecular weight of albumin?

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

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51. phenol associates in benzene to a certain extent in dimerisation reaction. A solution containing 0.02 kg of phenol in 1.0 kg of benzene has its freezing point depressed 0.69 k. $[K_f(C_6H_6) = 5.12 kkg\text{mol}^{-1}]$. The degree of association:

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52. An aqueous solution containing 12.48g of barium chloride in 1.0 kg of water boils at 373.0832 K. Calculate the degree of dissociation of barium chloride. [Given K_b for $H_2O = 0.52Km^{-1}$, Molar mass of $BaCl_2 = 208.34\text{g mol}^{-1}$]

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53. Calculate the freezing point of an aqueous solution containing 10.50 g of $MgBr_2$ in 200 g of water (Molar mass of $MgBr_2 = 184g$). (K_f for water $= 1.86\ \text{K kg mol}^{-1}$)

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

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56. Calculate the freezing point of 1 molal NaCl solution assuming NaCl to be 100% dissociated in water. (K_f for water $= 1.86^{\circ}\text{mol}^{-}$).

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57. 2g of benzoic acid dissolved in 25g of benzene shows a depression in freezing point equal to 1.62K. What is the percentage association of benzoic acid if it forms a dimer in solution ? (K_f for benzene = 4.9 K kg mol^{-1})

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Follow Up Problems

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

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2. Calculate the molarity of each of the following solutions: (a) 30 g of $Co(NO_3)_2.6H_2O$ in 4.3 L of solution (b) 30 mL of 0.5 M H_2SO_4 diluted to 500 mL.

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3. What will be the molarity of 30 mL of 0.5 M H_2SO_4 solution diluted to 500 mL ?

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4. The density of 10% by mass of KCl solution in water is 1.06 g mL^{-1}. Calculate molarity and molality of the solution.

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5. Battery acid is 4.27 MH_2SO_4 and has density of 1.25 g mL^{-1}. What is the molality of H_2SO_4 in this solution?

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6. Calculate the moles of methanol in 5 litres of its 2m solution, if the density of the solution is 0.981 kg L^{-1}. (Molar mass = 32.0 g mol^{-1}).

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7. A commercially available sample of H_2SO_4 is 15% H_2SO_4 by mass. Its density is 1.10g cm^{-3}. Calculate its molarity.

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8. An antifreeze solution is prepared from 222.6 g of ethylene glycol $(C_2H_6O_2)$ and 200 g of water. Calculate the molality of the solution. If the density of the solution is 1.072g mL^{-1}, then what shall be the molarity of the solution?

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

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

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

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12. Calculate the mole fraction of rectified spirit (95% ethyl alcohol by mass).

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13. Calculate the mass percentage of aspirin $(C_9H_8O_4)$ in acetonitrile (CH_3CN) when 6.5 g of $C_9H_8O_4$ is dissolved in 450 g of CH_3CN.

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14. Nalorphene $(C_{19}H_{21}O_NO_3)$, similar to morphine, is used to combat withdrawal symptoms in narcotic users. Dose of nalorphene generally given is 1.5 mg. calculate the mass of $1.5 - 10^{-3}m$ aqueous solution required for the above dose.

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

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16. How many gram of sodium hydroxide pellets containing 12% moisture are required to prepare 60 litre of 0.5N solution.

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17. Calculate the normality of a solution obtained by mixing 200 mL of 1.0 N NaOH and 100 mL of pure water.

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18. Calculate the normality of a solution obtained by mixing 100 mL of 0.2 N KOH and 100 mL of 0.1 MH_2SO_4.

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

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20. The molality and molarity of a H_2SO_4 solution are 94.13 and 11.12 respectively. Calculate the density of the solution.

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21. An aqueous solution of urea containing 18 g urea in 1500 cm^3 of solution has density equal to 1.052. If the molecular weight of urea is 60, find the molality of the solution.

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

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23. 1 litre of water under a nitrogen pressure of 1 bar dissolves 2×10^{-5} kg of nitrogen at 293 K. Calculate Henry's law constant.

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24. The Henry's law constant for CO_2 in water at 298 K is 1.67 kbar. Calculate the solubility of CO_2 at 298 K when the pressure of CO_2 is one bar.

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

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26. The vapour pressure of 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 $27^\circ C$. Find the vapour pressure of pure liquid B at $27^\circ C$.

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27. Methanol and ethanol form nearly ideal solution at 300 K. A solution is made by mixing 32g methanol and 23g ethanol. Calculate the partial pressure of its constituents and total pressure of the solution. $[\text{at } \ 300K. p^0(CH_3OH) = 90mmHg, p(C_2H_5OH) = 51mmHg]$

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28. The vapour pressures of pure liquid A and pure liquid B at $20^\circ C$ are 22 and 75 mm of Hg respectively. A solution is prepared by mixing equal moles of A and B. Assuming the solution to be ideal, calculate the vapour pressure of the solution.

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29. The vapour pressure of a pure liquid A at 300 K is 150 torr. The vapour pressure of this liquid in a solution with a liquid Bis 105 torr. Calculate the mole fraction of A in the solution if the mixture obey's Raoult's law.

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30. The vapour pressure of pure benzene at $25^{\circ}C$ is 639.7 mm Hg and vapour pressure of a solution of solute in benzene at the same temperature is 631.9 mm Hg. Calculate the molality of the solution.

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31. Calculate the vapour pressure at 295K of a 0.1 M solution of urea (NH_2CONH_2, molar mass = 60). The density of solution may be taken as 1g cm^{-3}. The vapour pressure of pure water at 295K is 20 mm.

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32. An aqueous solution is made by dissolving 10g of glucose $(C_6H_{12}O_6)$ in 90g of water at 300K. If the vapour pressure of pure water at 300 K is 32.8 mm Hg, what would be the vapour pressure of the solution?

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

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34. What mass of non-volatile solute, sucrose, need to be dissolved in 100g of water to decrease the vapour pressure of water by 30%?

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35. A solution is made by dissolving 1.0 gurea and 2.0g sucrose in 100 g water at 298 K. predict the vapour pressure of solution if the vapour pressure of water at 298 Kis 23.756 torr.

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36. A solution containing 12.5g of a non electrolyte substance in 175g of water gave a boiling point elevation of 0.70 K. Calculate the molar mass of the substance. (Elevation constant for water, K_b = 0.52 K kg mol^{-1})

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37. 18 g of glucose, $C_2H_{12}O_6$ is dissolved in 1 kg of water in a saucepan. At what temperature will the water boil at (1.013 bar pressure). K_b for water is 0.52 K kg mol^{-1}.

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38. 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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39. For a solution of 3.795g of sulphur in 100g CS_2 the boiling point was 319.81 K. For pure CS_2 the boiling point is 319.45 K and the enthalpy of vapourisation is 351.87.Jg^{-1} . What is the molar mass and formula of sulphur in CS_2?

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40. The freezing point of cyclohexane is $6.5^{\circ}C$. A solution of 0.65g of naphthalene in 19.2g of cyclohexane froze at $1.2^{\circ}C$. What is the molecular mass of naphthalene? The cryoscopic constant for cyclohexane is 20.1 Kmol^{-1}kg.

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41. An aqueous solution freezes at $-0.2^{\circ}C$. What is the molality of the solution ?

Determine also (i) elevation in the boiling point

(ii) lowering in vapour pressure at $25^{\circ}C$, given that $K_f = 1.86^{\circ}C \text{ kg mol}^{-1}$, $K_b = 0.512^{\circ}C \text{ kg mol}^{-1}$, and vapour pressure of water at $25^{\circ}C$ is 23.756 mm.

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42. Water is used in car radiators. In winter season, ethylene glycol is added to water so that water may not freeze. Assuming ethylene glycol to be non-volatile, calculate minimum amount of ethylene glycol that must be added to 6.0 kg of water to prevent it from freezing at $-0.3^{\circ}C$. The molal depression constant of water is 1.86°.

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43. Find the elevation in boiling point and (ii) depression in freezing point of a solution containing 0.520g glucose $(C_6H_{12}O_6)$ dissolved in 80.2g of water. For water $K_f = 1.86k/m$. $K_b = 0.52K/m$.

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44. 45 g fo ethylene glycol $(C_2H_6O_2)$ is mixed with 600 g of water. Calculate (a) the freezing point depression and (b). The freezing point of the solution.

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45. 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. the freezing point depression constant of benzene is 5.12 K kg mol^{-1}. Find the molar mass of the solute.

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46. A solution of a polymer containing 5g dm^{-3} was found to give an osmotic pressure of 600 Nm^{-2} (4.5 mm Hg) at $15^{\circ}C$. Calculate the molecular mass of the polymer.

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47. A 10% solution of sucrose (molar mass 342) is isotonic with 1.754% solution of urea. Calculate the molecular mass of urea.

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48. Calculate the osmotic pressure of an aqueous solution containing 1g each of sucrose and glucose per dm^3 at 300K. If this pressure was measured and it were not known that the solute was a mixture, what molecular weight would be expected ?

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49. Calculate the concentration of that solution of sugar which has osmotic pressure 2.46 atmosphere at $27^{\circ} C$.

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50. A 4 per cent solution of sucrose $(C_{12}H_{22}O_{11})$ is isotonic with 3 percent solution of an unknown organic substance. Calculate the molecular weight of the unknown substance.

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51. Calculate the osmotic pressure of a solution obtained by mixing 100 mL of 1.6 percent solution of cane sugar (molecular mass = 342 at 293 K) with 3.4% solution of urea (molecular mass = 60).

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52. $200cm^3$ of an aqueous solution of a protein contains 1.26 g 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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53. A 5% solution of $CaCl_2$ at $0^\circ C$ developed 15 atmospheric pressure. Calculate the degree of dissociation. (mol. wt. (M) of $CaCl_2 = 111$ a.m.u., R = 0.0821 L atm. $K^{-1}\text{mol}^{-1}$)

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54. Freezing point of ether was lowered by $0.6^\circ C$ on dissolving 2.0g of phenol (C_6H_5OH, mol. wt. 94) in 100 g of ether. The molal depression constant for ether is 5.12°. Calculate the molecular mass of phenol in solution and comment on your result.

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55. 0.6 mL of acetic acid (CH_3COOH). Having density $1.06\ \text{g}\ mL^{-1}$, is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was $0.0205^\circ C$. Calculate the van't Hoff factor and the dissociation constant of acid.

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56. Calculate the b.pt. of 1 molar aqueous solution of KBr. Given that the density of solution is $1.06 gmL^-$, K_b, for water is 0.52 K kg mol^- [Atomic mass of K = 39. Br=80]

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57. 3.100 g of $BaCl_2$ in 250g of water boils at $100.83^\circ C$. Calculate the value of van't Hoff factor and molality of $BaCl_2$ in this solution. (K_f for water = 0.52 Km^{-1}, molar mass of $BaCl_2 = 208.3\ \text{g mol}^{-1}$).

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58. 0.01 m aqueous solution of $K_3\left[Fe(CN)_6\right]$ freezes at $-0.062^\circ C$. What is the apparent percentage of dissociation ? (K_f for water $= 1.86 \ \mathrm{K\,kg\,mol^{-1}}$)

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Exercise Part I Objective Questions

1. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^\circ C$, $-1.86^\circ C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

When a solute is dissolved in a solvent, the vapour pressure of the solution.....

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2. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

If the vapour pressure at a particular composition of two liquids is the lowest, then its boiling point must be.....

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3. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T,

$-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

A colligative property is one which depends upon the.....and not on the.....

.

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4. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

The osinotic pressure (π) of a solution $=CR\times$ ....

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5. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

The freezing point of 1 m NaCl solution assuming NaCl to be 100% ionized in water is.....

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6. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole,

molal, same extent, solution, equivalent.)

The osinotic pressure (π) of a solution $= CR \times$ ....

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7. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, > 1, < 1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^\circ C$, $-1.86^\circ C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

The sum total of the mole fractions of the components of the solution is equal to.....

Watch Video Solution

8. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

A solution obtained by dissolving 342g of sugar $(C_{12}H_{22}O_{11})$ in 1000 g water is.....molal.

Watch Video Solution

9. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

Van't Hoff factor, i for KCl is .....

Watch Video Solution

10. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

When an egg is kept in a saturated solution of NaCl after dissolving its hard shell in dil. HCl, the egg will ..... because the solution inside the egg is ..... than NaCl solution.

Watch Video Solution

11. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of

solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

Depression of freezing point is a colligative property because it depends upon the ..... of solute particles and not upon the ..... of solute.

Watch Video Solution

12. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

The van't Hoff factor of NaCl solution is ..... one hence the value of normal colligative property is ..... the observed colligative property of this solution.

Watch Video Solution

13. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, > 1, < 1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

Molal elevation constant, K_b for a solvent is the elevation in its boiling point when ..... of a solute is dissolved in ..... of the solvent.

Watch Video Solution

14. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, > 1, < 1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T,

$-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

Osmotic pressure is ..... to mechanical pressure which must be applied to ..... to prevent osmosis.

Watch Video Solution

15. Fill in the blanks choosing appropriate word/words from these given in the brackets :

(increases, decreases, the highest, the lowest, elevation, directly depression, molality, mole fraction, >1, <1, ΔV, ΔS, number of solute particles, nature of solute particles, hypotonic, T, $-3.72^{\circ}C$, $-1.86^{\circ}C$, zero, one, two, more than, less than, 1 kg, 1 mole, molal, same extent, solution, equivalent.)

Equi ..... solutions of different non-volatile solutes in a particular solvent will show fall in freezing point to the .....

Watch Video Solution

16. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Vapour pressure of the solution is always more than that of the pure solvent.

Watch Video Solution

17. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Addition of sodium chloride lowers the boiling point of solution.

Watch Video Solution

18. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

The relative lowering of vapour pressure of a solvent by a solute is proportional to the molality of the solution.

Watch Video Solution

19. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

The molality of a solution depends on the temperature.

Watch Video Solution

20. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Freezing point is a colligative property.

Watch Video Solution

21. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

The value of observed molecular weight is higher than its normal value if the solute undergoes dissociation in the solvent.

Watch Video Solution

22. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Molality of the solution is the number of moles of solute present pre kilogram of solution.

Watch Video Solution

23. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Colligative properties depend upon the nature of solute particles.

Watch Video Solution

24. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Molal elevation constant and molal depression constant are equal in magnitude.

Watch Video Solution

25. Correct the following statements by changing the underlined part of the sentence. (Do not change the whole sentence):

1 Molal solution of urea will show the higher value of osmotic pressure than the 1 molal solution of NaCl.

Watch Video Solution

26. Match the following

(i)	Ideal solution	(a)	osmosis
(ii)	Isotonic solutions	(b)	$i > 1$
(iii)	Semipermeable membrane	(c)	Relative lowering of vapour p
(iv)	Dissociation of solute molecules	(d)	$i < 1$
(v)	Number of solute particles	(e)	osmotic pressure
(vi)	Association of solute particles	(f)	same osmotic pressure
(vii)	Colligative property.	(g)	Raoult's law

Watch Video Solution

Exercise Part I Objective Questions Choose The Correct Alternative

1. Colligative properties like osmotic pressure, elevation in boiling point etc. depend upon

A. number of solute particles and polarity of solvent

B. on the degree of polarity of solute

C. only on the number of solute particles

D. number of solute particles and the nature of solute.

Answer: A

Watch Video Solution

2. The correct statement out of the following is :

A. The boiling point of the solution falls on increasing the amount of solute

B. The boiling point of solution increases on diluting the solution

C. The freezing point of the solution is raised on adding more of solute

D. The freezing point of the solution decreases on increasing the amount of solute.

Answer: D

Watch Video Solution

3. A colligative property out of the following is :

A. change in free energy

B. change in pressure

C. heat of vapourization

D. osmotic pressure.

Answer: D

Watch Video Solution

4. A semipermeable membrane allows

A. solution to pass through it

B. solute to pass through it

C. solvent to pass through it.

D.

Answer: C

Watch Video Solution

5. The flow of solvent through a semipermeable membrane towards the solution side is known as

A. adsorption

B. absorption

C. diffusion

D. osmosis.

Answer: D

Watch Video Solution

6. The osmotic pressure of a solution is

A. the excess pressure on the solvent side

B. the pressure exerted by the solute molecules

C. the excess pressure exerted on the solution side to prevent osmosis.

D.

Answer: C

Watch Video Solution

7. In high altitudes, the boiling point of water decreases because

A. the atmospheric pressure is high

B. the temperature is low

C. the atmospheric pressure is low

D. the temperature is high.

Answer: C

Watch Video Solution

8. How much of NaOH is required to neutralize 1500 cm^3 of 0.1 NHCl? (Na=23)

A. 40g

B. 4g

C. 6g

D. 60g

Answer: C

Watch Video Solution

9. Colligative properties are used for the determination of

A. molar mass

B. equivalent mass

C. arrangement of molecules

D. melting and boiling points

Answer: A

Watch Video Solution

10. 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

11. 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

12. At equilibrium, the rate of dissolution of a solid solute in a volatile liquid solvent is

A. less than the rate of crystallization

B. greater than the rate of crystallization

C. equal to the rate of crystallization

D. zero

Answer: C

Watch Video Solution

13. 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

14. Maximum amount of a solid solute 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

15. 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

16. Considering the formation, breaking and strength of hydrogen bond , predict which of the following mixtures will show a positive deviation

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

17. 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

18. Which of the following aqueous solutions should have the highest boiling point ?

A. 1.0M NaOH

B. $1.0MNa_2SO_4$

C. $1.0MNH_4NO_3$

D. $1.0MKNO_3$

Answer: B

Watch Video Solution

19. The unit of ebulioscopic constant is ____

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

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

C. $\mathrm{kg\ mol}^{-1}K^{-1}$ or $K^{-1}(\mathrm{molality})^{-1}$

D. $\mathrm{K\ mol\ kg}^{-1}$ or K (molality)

Answer: A

Watch Video Solution

20. In comparison 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

21. An unripe 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

22. 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

23. 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 π = 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

24. 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

25. 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

Watch Video Solution

26. 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

27. The value of Henry's constant K_H.....

A. greater for gases with higher solubility.

B. greater for gases with lower solubility.

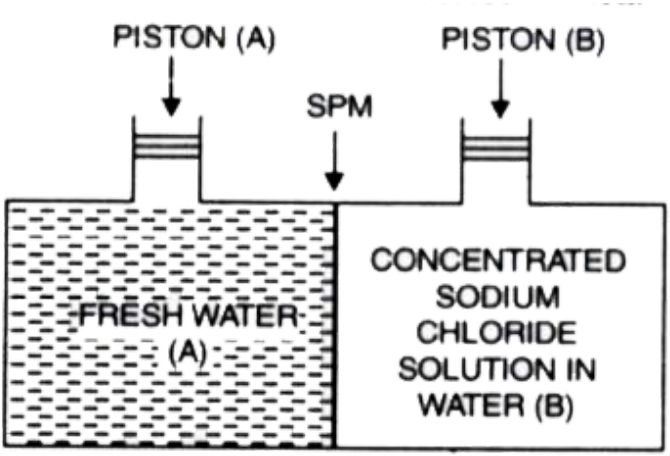
C. constant for all gases.

D. not related to the solubility of gases.

Answer: B

Watch Video Solution

28. Consider the Fig. and make 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

Watch Video Solution

29. We have three aqueous solutions of NaCl lebelled as'A' , 'B' and 'C' with concentrations 0.1 M, 0.01 M and 0.001 M respectively. The value of van't Hoff factor for these solution will be in the order.....

A. $i_A < i_B < i_C$

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

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

Information:

(I)In bromoethane and chloroethane mixture intermolecular interactions of A-A and B-B type are nearly same as A-B type interactions.

(II)In ethanol and acetone mixture A-A or B-B type intermolecular interactions are stronger than A-B type interactions.

(III)In chloroform and acetone mixture A-A and 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.

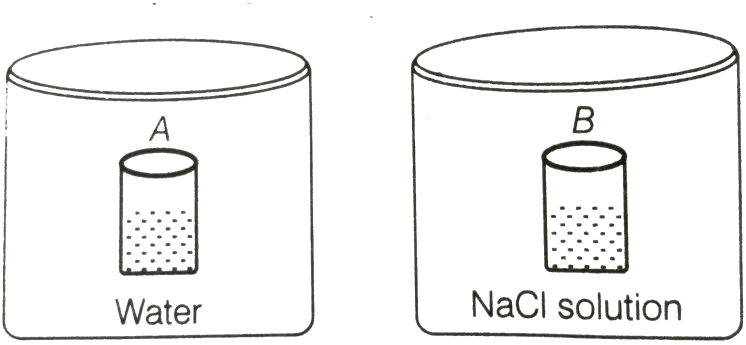
C. Solution (B) will show negative deviation from Raoult's law.

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

Answer: B

Watch Video Solution

31. 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 2M solution of NaCl. At the same temperature both the beakers ware placed in containers os same material and same capacity as shown in figure.



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

Watch Video Solution

32. if two liquids A and B form minimum boiling azeotrope at some specific composition then ____

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

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

Watch Video Solution

33. 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

Watch Video Solution

34. 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 break .

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: A

Watch Video Solution

35. K_H values for $Ar_{(g)}, CO_{2(g)}, HCHO_{(g)}$ 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 increasing 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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Exercise Part Ii Descriptive Questions Very Short Answer Questions

1. What is a true solution ?

Watch Video Solution

2. What is a ternary solution?

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3. Give the names of any two methods which are used to determine the vapour pressure.

Watch Video Solution

4. Azeotropic mixtures are

Watch Video Solution

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

Watch Video Solution

6. What are maximum boiling azetropes? Give one example.

Watch Video Solution

7. Give an example of nearly ideal solution.

Watch Video Solution

8. Why is boiling point of a solvent elevated upon the addition of a non-volatile solute ?

Watch Video Solution

9. Why is freezing point depressed when a non-volatile solute is added to a solvent ?

Watch Video Solution

10. What is an antifreeze?

Watch Video Solution

11. Define molal elevation constant or ebullioscopic constant.

Watch Video Solution

12. Define cryoscopic constant.

Watch Video Solution

13. Why is osmotic pressure considered as colligative property?

Watch Video Solution

14. What are isotonic solutions ?

Watch Video Solution

15. Hypotonic and Hypertonic solution

Watch Video Solution

16. Why NaCl solution freezes at lower temperature than water but boils at hig' er temperature ?

Watch Video Solution

17. Why does molality of a solution remains unchanged with change in temperature while its molarity changes ?

Watch Video Solution

18. Why is the cooking temperature in pressure cooker higher than that in the open pan?

Watch Video Solution

19. Solution A is obtained by dissolving 1 g of urea in 100 g of water and solution B is obtained by dissolving 1 g of glucose in 100 g of water. Which solution will have a higher boiling point and why?

Watch Video Solution

20. Which of the following solutions shows positive deviation from Raoult's law ?

Watch Video Solution

21. When is the value of van't Hoff factor more than one?

Watch Video Solution

22. Give one example each when van't Hoff factor is 2 and $\frac{1}{2}$.

Watch Video Solution

23. How is that the boiling points of the following solutions in water are different:

(i) 0.1 M NaCl solution

(ii) 0.1 M sugar solution?

Watch Video Solution

24. Mention a large scale use of the phenomenona of reverse osmosis.

Watch Video Solution

25. What is the sum of mole fractions of all the components in a three-component system?

Watch Video Solution

26. State Raoult's law for a solution of volatile liquids.

Watch Video Solution

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

Watch Video Solution

28. What will be the nature of the solution when ethyl alcohol and water are mixed ?

Watch Video Solution

29. What happens when blood cells are placed in pure water?

Watch Video Solution

30. Which will have a higher boiling point, 0.1 M NaCl or 0.1 M $BaCl_2$ solution in water?

Watch Video Solution

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

Watch Video Solution

32. State the formula relating pressure of a gas with its mole fraction in a liquid solution in contact with it.

Watch Video Solution

33. In the determination of molar mass of A^+B^-, using a colligative property, what may be the value of van't Hoff factor if the solute is 50% dissociated ?

Watch Video Solution

34. What is the effect of temperature on the molality of solution?

Watch Video Solution

35. Differentiate between molality and molarity of a solution . What is the effect of change in temperature of a solution on its molality and molarity ?

Watch Video Solution

36. Two liquids X and Y boil at $110^{\circ}C$ and $130^{\circ}C$, respectively. Which one of them has higher vapour pressure at $50^{\circ}C$?

Watch Video Solution

37. State Henry's law. What is the effect of temperature on the solubility of a gas in a liquid ?

Watch Video Solution

38. 10 mL of a liquid A were mixed with 10 mL of liquid B. The volume of resulting solution was found to be 19.9 mL. What do you conclude?

Watch Video Solution

39. Why does a solution of ethanol and cyclohexane shows positive deviations?

Watch Video Solution

40. At same temperature, oxygen is more soluble in water than hydrogen. Which of them will have a higher value of K_H and why?

Watch Video Solution

41. Give reason when 30 mL of ethyl alcohol and 30 mL of water are mixed, the volume of resulting solution is more than 60 mL.

Watch Video Solution

42. 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

43. Two liquids A and B boil at $130^\circ C$ and $160^\circ C$, respectively. Which of the them has higher vapour pressure at $80^\circ C$.

Watch Video Solution

44. Define mole fraction of a solute in a solution.

Watch Video Solution

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

Watch Video Solution

46. Why is freezing point depression of 0.1 M sodium chloride solution nearly twice that of 0.1 M glucose solution ?

Watch Video Solution

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

Watch Video Solution

48. What is the expected value of van't Hoff factor for $K_3\left[Fe(CN)_6\right]$ in dilute solution?

Watch Video Solution

49. How is that alcohol and water are miscible in all proportions?

Watch Video Solution

50. Osmotic Pressure

Watch Video Solution

51. What is meant by reverse osmosis?.

Watch Video Solution

52. 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

53. 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

54. What will be the van't Hoff factor for a compound which undergoes dimerisation in an organic solvent ?

Watch Video Solution

55. Is it advisable to use ethylene glycol in car radiators during summer?

Watch Video Solution

56. What is the van't Hofffactor for a compound which undergoes tetramerisation in an organic solvent ?

Watch Video Solution

57. How is the vapour pressure of a solvent afffected when anon volatile solute is dissolved in it?

Watch Video Solution

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

Watch Video Solution

59. What do you mean by saying that the molarity of a solution is one.

Watch Video Solution

60. What is the relation between normality and molarity of a solution?

Watch Video Solution

61. Write expressions for the Raoult's law for non-volatile solutes.

Watch Video Solution

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

Watch Video Solution

63. State any two characteristics of ideal solutions.

Watch Video Solution

64. What type of liquids form ideal solutions?

Watch Video Solution

65. What temperature change is expected during the mixing of two liquids whose solutions show a negative deviation?

Watch Video Solution

66. Why is benzene insoluble in water but soluble in toluene?

Watch Video Solution

67. Why is an increase in temperature observed on mixing chloroform with acetone?

Watch Video Solution

68. Give an example of a compound in which hydrogen bonding results in the formation of a dimer.

Watch Video Solution

69. Under what conditions non-ideal solutions show positive deviations?

Watch Video Solution

70. What are constant boiling mixtures called ?

Watch Video Solution

71. What do you understand by colligative properties?

Watch Video Solution

72. 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

73. 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

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

Watch Video Solution

75. 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

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

Watch Video Solution

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

Watch Video Solution

78. (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?

Watch Video Solution

79. (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?

Watch Video Solution

80. (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?

Watch Video Solution

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

Watch Video Solution

82. 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

83. What is "semipermeble membrane"?

Watch Video Solution

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

Watch Video Solution

85. Explain the terms ideal and non-idealsolution in the light of forces of interactions operating between molecules in liquid solutions.

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Exercise Part Ii Descriptive Questions Short Answer Questions

1. (a) Differentiate between molarity and molality in a solution. What is the effect of temperature change on molarity and molality in a solution? . (b) What would be the molar mass of a compound if 6.21 g of it dissolved in 24.0g of chloroform from a solution tharhas a boiling point of $68.04^{\circ}C$. The boiling point of pure chloroform is $61.7^{\circ}C$ and the boiling point elevation constant, K_b for chloroform is $3.63^{\circ}C/m$.

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2. Differentiate between molality and molarity of a solution . What is the effect of change in temperature of a solution on its molality and molarity ?

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3. Explain the term mass fraction and mole fraction.

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4. State Raoult's law. State the factors responsible for deviations from this law. Illustrate deviations with suitable examples.

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5. Explain the terms ideal and non-idealsolution in the light of forces of interactions operating between molecules in liquid solutions.

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6. Using Raoult's law how could you distinguish between ideal and non-ideal solutions ?

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7. How can you justify the observation that the V.P. of solution of a non-volatile solute in a given solvent is less than that of pure solvent. Also state the law concerning the observation.

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8. Give any two examples of each type of liquid solutions showing positive and negative deviations.

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9. State Raoult's law. Explain from it why the vapour pressure of a solution is always less than that of a pure solvent.

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10. Write two differences between ideal and non-ideal solutions.

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11. Give important differences between solutions showing positive and negative deviations.

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12. What are azeotropes ? Write two differences between maximum boiling and minimum boiling azeotropes.

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13. Define the term colligative property. Name four colligative properies.

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14. Define vapour pressure of a liquid. What happens to the vapour pressure when (a) volatile solute dissolves in the liquid and (b) the dissolved solute is non-volatile.

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15. Show that relative lowering of vapour pressure is a colligative property.

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16. With the help of suitable diagrams, illustrate the two types of on-ideal solutions.

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17. How does a non-ideal solution differ from an ideal solution ? When does the positive deviation occur from ideality?

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

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19. Define elevation in boiling point and show that it is a colligative property.

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20. Illustrate elevation in boiling point with the help of vapour pressure-temperature curve of a solution. Show that elevation in boiling point is a colligative property.

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21. If ΔT is the elevation in boiling point of a solvent and m is the number of moles of the solute per kilogram of solute, what is the relationship between ΔT and m?

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22. Draw the vapour pressure curve explaining depression in freezing point.

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23. Derive a formula determining molecular mass from depression in freezing point.

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24. What is osmosis ? What is the difference between osmosis and diffusion?

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25. Name two inorganic compounds which can be used as semipermeable membranes. Describe briefly the preparation of cupric ferrocyanide membrane.

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26. What is meant by semipermeable membrane ? Give one example each for natural and artificial membrane.

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27. Derive a formula for determining molecular mass from osmotic pressure.

Watch Video Solution

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

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29. Derive van't Hoff's equation for dilute solution.

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30. (a) What is van't Hoff factor? What types of values can it have if in forming the solution the solute molecules undergo

(i) Dissociation ?

(ii) Assoication ?

(b) How many mL of a 0.1 M HCl solution are required to react completely with 1 g of a mixture of Na_2CO_3 and Na_2HCO_3 containing equimolar amounts of both ?

(Molar mass : $Na_2CO_3 = 106g$, $NaHCO_3 = 84g$)

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31. Show graphically that the freezing point of a liquid will be depressed when a non-volatile solute is dissolved in it.

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32. Show graphically how the vapour pressures of a solvent and a solution in it of non-volatile solute change with temperature. Show on this graph the boiling points of the solvent and the solution. Which is higher and why?

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33. Why do we get abnormal molecular masses of the substances using colligative properties of solutions only sometimes ? What are the natures of these abnormalities?

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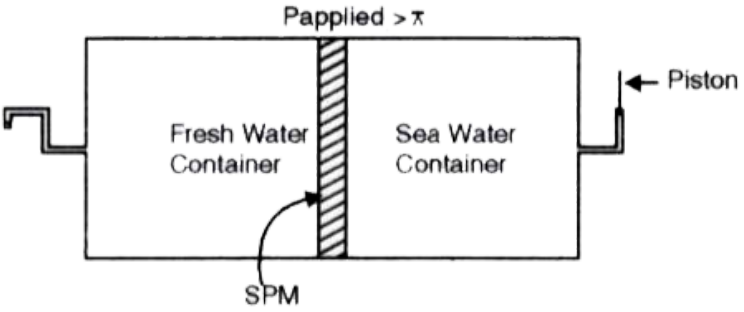
34. Given below is a sketch of a plant for carrying out a process.



(i) Name the process occuring in the above plant.

(ii) To which container does the net flow of solvent takes place?

(iii) Name one SPM which can be used in this plant.

(iv) Give one practical use of the plant.

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Exercise Part Ii Descriptive Questions Long Answer Questions

1. Define the terms:

(i) Molarity (ii) Molality (iii) Normality (iv) Mole fraction (v) ppm

Which out of these are affected by changes in temperature ?

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2. State and explain Raoult's law. Show graphically the variation of total V.P. over a mixture of two volatile liquids with the composition of the mixture.

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3. Give any two limitations of Raoult's law.

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4. What are the conditions necessary to show ideal behaviour of solution.

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5. Why is one molar aqueous solution more concentrated than one molal solution ?

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6. Mixing acetone and chloroform occurs with reduction in volume and is exothermic process. What changes will occur in the vapour pressure ? Explain.

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7. Show that the relative lowering of vapour pressure is given by.

$$\frac{p^0 - p}{p^0} = \frac{W_2 / M_2}{W_1 / M_1 + W_2 / M_2}$$

where W and W_2 are the weights and M_1 and M_2 are the molecular weights of solvent and solute respectively, p^0 is the vapour pressure of pure solvent and p that of solution.

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

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9. Under what conditions non-ideal solutions show positive deviations?

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10. The boiling point of a solution gets raised on dissolution of non-volatile solute. Explain how this property is used for finding the molecular mass of the solute ?

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11. What is depression in freezing point ? How will you find the molecular weight of a substance with its help? Why do we get abnormal molecular mass from depression in freezing points ?

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12. Osmotic pressure of a solution is

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13. Differentiate between :

Diffusion and Osmosis

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14. Explain the osmosis and osmotic pressure. How is a semipermeable membrane prepared ? How is osmotic pressure determined

experimentally?

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15. Which method is the best method for determining the mol. wt. of polymers?

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16. Derive van't Hoff's equation for the concentration dependence of the osmotic pressure of a non-volatile solute.

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17. What are isotonic solutions ?

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18. Give the biological significance of osmosis.

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19. What are the conditions under which abnormal molecular weights are obtained from colligative properties of:

(i) non-electrolytes

(ii) electrolytes?

What is meant by van't Hoff factor?

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20. Write an explanatory note on abnormal molecular masses from colligative properties.

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21. Explain why the molecular weight of KCl determined by the depression in the freezing point method does not agree with its correct theoretical molecular weight. What do you expect is its molecular weight as determined by the experiment ?

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Isc Examination Questions Part I Objective Questions

1. Fill in the blanks choosing appropriate word/words from those given in the brackets :

(inversely, more, less, directly, ideal, Raoult's, non-ideal, do not)

The ..... of the boiling point of a solvent by the addition of a solute is ..... proportional to the molality of the solution.

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2. Fill in the blanks choosing appropriate word/words from those given in the brackets :

(inversely, more, less, directly, ideal, Raoult's, non-ideal, do not)

The ..... pressure of an aqueous soluton of 0.1 M cane sugar is ..... than that of the pure water.

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3. Fill in the blanks choosing appropriate word/words from those given in the brackets :

(inversely, more, less, directly, ideal, Raoult's, non-ideal, do not)

Solutions which strictly obey ..... law are called . solutions.

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4. Fill in the blanks choosing appropriate word/words from those given in the brackets :

(inversely, more, less, directly, ideal, Raoult's, non-ideal, do not)

The van't Hoff factor of acetic acid solution is ..... than one and the value of normal colligative property is ..... than the observed colligative property of this solution.

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5. Fill in the blanks choosing appropriate word/words from those given in the brackets :

(inversely, more, less, directly, ideal, Raoult's, non-ideal, do not)

Ideal solutions obey ..... law and they ..... form azeotropic mixtures.

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6. Correct the following Statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Freezing point of a solution is directly proportional to its molality.

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7. Correct the following Statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Osmotic pressure and $\underline{\text{boiling point}}$ are colligative properties.

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8. Correct the following Statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Molarity of a solution is $\underline{\text{independent of temperature}}$.

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9. Correct the following Statements by changing the underlined part of the sentence. (Do not change the whole sentence):

Water boils $\underline{\text{below } 100^{\circ}C}$ by the addition of NaCl.

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10.

(i)	cottrell's	(a)	K kg mol^{-1}
(ii)	Elevation of boiling point.	(b)	Raoult's law
(iii)	Dilute solution	(c)	Osmotic pressure
(iv)	Colligative property	(d)	Ebullioscopic method
(v)	Molal depression constant	(e)	Relative lowering of vapour pressu

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Isc Examination Questions Part I Objective Questions Choose The Correct Alternative

1. The relative lowering of vapour pressure of a solvent by the addition of a solute is :

1) proportional to the molarity of the solution

2) proportional to the molality of the solution

3) equal to the mole fraction of the solute

4) equal to the mole fraction of the solvent.

A. proportional to the molarity of the solution

B. proportional to the molality of the solution

C. equal to the mole fraction of the solute

D. equal to the mole fraction of the solvent.

Answer: C

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2. The lowest freezing point of 0.1 M aqueous solution is of:

A. K_2SO_4

B. NaCl

C. Urea

D. Glucose

Answer: A

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3. The solubility of a gas varies directly with pressure of the gas is based upon :

1) Raoult's Law

2) Henry's law

3) Nernst's Distribution law

4) None of these

A. Raoult's Law

B. Henry's law

C. Nernst's Distribution law

D. None of these

Answer: B

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4. The molecular weight of sodium chloride determined by measuring the osmotic pressure of its aqueous solution is

1) double the theoretical value

2) same as the theoretical value

3) half the theoretical value

4) three times the theoretical value

A. double the theoretical value

B. same as the theoretical value

C. half the theoretical value

D. three times the theoretical value

Answer: C

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5. For a dissociated solute in solution, the value of van't Hoff factor is :

1) zero

2) one

3) greater than one

4) less than one

A. zero

B. one

C. greater than one

D. less than one

Answer: C

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6. Out of following solutions, the one having the highest boiling point will be:

A. 0.1 M NaCl

B. $0.1MBaCl_2$

C. $0.1MKNO_3$

D. $0.1MK_4\left[Fe(CN)_6\right]$

Answer: D

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7. Of the following terms used for denoting concentration of a solution, the one which does not get affected by temperature is

A. Molarity

B. Molality

C. Normality

D. Formality

Answer: B

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8. The molal freezing points constant of water is 1.86 K kg mol^{-1}. Therefore, the freezing point of 0.1 M NaCl in water is expected to be

1) $-1.86^{\circ}C$

2) $-0.372^{\circ}C$

3) $-0.186^{\circ} C$

4) $+0.372^{\circ} C$

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

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

C. $-0.186^{\circ} C$

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

Answer: B

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Isc Examination Questions Part Ii Descriptive Questions

1. What is a colligative properrty ? Give two examples.

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2. Arrange the following solutions in increasing order of their osmotic pressures .

(i)34.2 g/litre surcrose

(ii)60 g/litre of urea

(iii)90 g/litre of glucose

(iv)58.5 g/litre of sodium chloride

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3. The molecular weights of sodium chloride and glucose are determined by the depression of freezing point method. As compared to their theoretical molecular weights, what will be their observed molecular weights when determined by the above method ? Justify your answer.

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4. Answer the question

Which of the following solutions will have a lower vapour pressure and

why?

(1) A 5% solution of cane sugar $(C_{12}H_{22}O_{11})$

(2) A 5% solution of urea (NH_2CONH_2)

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5. The elevation of boiling point produced by dilute equimolal solutions of three substances are in the order A $>$ glucose $>$ B Suggest a reason for this observation.

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6. The osmotic pressure of 0.25 M urea solution is 2.67 atm. What will be the osmotic pressure of a 0.25 M solution of potassium sulfate?

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7. $0 \cdot 1$ M urea solution shows less depression in freezing point than $0 \cdot 1 MMgCl_2$ solution. Explain.

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8. A solution is prepared by dissolving three moles of glucose in one litre of water and a solution Y is prepared by dissolving 1.5 moles of sodium chloride in one litre of water. Will the osmotic pressure of X be higher, lower or equal to that of Y? Give a reason for your answer.

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9. Define cryoscopic constant.

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10. Define Raoult's law for the elevation of boiling point of a solution.

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11. Two liquids A and B form type II non-ideal solution which shows a minimum in its temperature-molefraction plot (T-X diagram). Can the two liquids be completely separated by fractional distillation?

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Isc Examination Questions Part Ii Descriptive Questions Numerical Problems

1. The osmotic pressure of 0.01 molar solution of an electrolyte is found to be 0.65 atm at $27^{\circ} C$. Calculate the van.t Hoff factor. What conclusion can you draw about the molecular state of the solute in the solution?

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2. 46 gms of ethyl alcohol is dissolved in 18 gms of water. Calculate the mole fraction of ethyl alcohol. (At. wt of C = 12, 0 = 16, H= 1).

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3. A solution of lactose containing 8.45 g of lactose in 100g of water has a vapour pressure of 4.559 mm of Hg at $0^{\circ} C$. If the vapour pressure of pure water is 4.579 of Hg, calculate the molecular weight of lactose.

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4. A solution of urea in water has a boiling point of $100 \cdot 18^{\circ} C$. Calculate the freezing point of the solution.(K for water is $1 \cdot 86 \ \mathrm{K\,kg} \ mol^{-1}$ and K_b for water is $0 \cdot 512 \ \mathrm{K\,kg} \ mol^{-l}$).

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5. Ethylene glycol is used as an antifreeze agent. Calculate the amount of ethylene glycol to be added to 4 kg of water to prevent it from freezing at $-6^{\circ} C$.

$\left(K_f \ \text{ for } \ H_2O = 1 \cdot 85 K \mathrm{mole}^{-1} kg\right)$

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6. The freezing point of a solution containing $0 \cdot 3$ gms of acetic acid in 30 gms of benzene is lowered by $0 \cdot 45K$. Calculate the van't Hoff factor. $\left(At.\ wt.\ of C = 12, H = 1, 0 = 16, K_f \text{ for benzene } = 5.12 \text{ K kg mole}^{-}\right.$).

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7. A 2 molal solution of sodium chloride in water causes an elevation in the boiling point of water by $1 \cdot 88K$. What is the value of van't Hoff factor? What does it signify ? $\left[K_b = 0 \cdot 52 \text{ K kg } mol^{-1}\right]$

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8. What will be the vapour pressure of a solution containing 5 moles of sucrose $(C_{12}H_{22}O_{11})$ in 1 kg of water, if the vapour pressure of pure water is $4 \cdot 57$ mm of Hg ? $[C = 12, H = 1, 0 = 16]$

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9. If 1.71 g of sugar (molar mass = 342) are dissolved in 500 mL of an aqueous solution at 300 K. What will be its osmotic pressure?

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10. 0.70 g of an organic compound when dissolved in 32 g of acetone produces an elevation of 0.25°C in the boiling point. Calculate the molecular mass of organic compound. $\left(K_b \text{ for acetone} = 1.72 \text{ K kg mol}^{-1}\right)$.

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11. A solution containing 0.5 g of KCl dissolved in 100 g of water and freezes at $-0.24^\circ C$. Calculate the degree of dissociation of the salt. (K_f for water $=1.86^\circ C$. [Atomic weight K = 39, Cl = 35.5]

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12. A 10% solution of sucrose (molar mass 342) is isotonic with 1.754% solution of urea. Calculate the molecular mass of urea.

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13. The molecular weight of an organic compound is 58 g mol^{-1}. What will be the boiling point of a solution containing 48 g of the solute in 1200 g of water?

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14. What will be the value of van't Hoff factor (i) of benzoic acid if it dimerises in aqueous solution ? How will the experimental molecular weight vary as compared to the normal molecular weight?

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Multiple Choice Questions

1. The number of moles of solute present in 1000 gm of the solvent is known as:

A. Molarity

B. Molality

C. Normality

D. Mole fraction

Answer: B

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2. The solubility of a gas varies directly with pressure of the gas is based upon :

1) Raoult's Law

2) Henry's law

3) Nernst's Distribution law

4) None of these

A. Raoult's law

B. Henry's law

C. Nernst's distribution law

D. None of these

Answer: B

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3. Of the following terms used for denoting concentration of a solution, the one which does not get affected by temperature is

A. Molarity

B. Normality

C. Molality

D. Formality

Answer: C

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4. The term homogenous mixtures signify that:

A. Both composition and properties are uniform throughout the mixture.

B. Its properties are uniform throughout the mixture.

C. Its composition is uniform throughout the mixture.

D. Neither composition nor properties are uniform throughout the mixture

Answer: A

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5. Determination of correct molecular mass from Raoult's law is applicable to :

A. An electrolyte in solution

B. A non-electrolyte in dilute solution

C. A non-electrolyte in conc. Solution

D. An electrolyte in a liquid solvent

Answer: B

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6. Molecular weight of non-volatile solute can be determined by:

A. Victor-Mayer's method

B. Graham's law of diffusion

C. Gay Lussac's law

D. Raoult's law

Answer: D

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7. The relative lowering in vapour pressure is proportional to the ratio of number of

A. Solute molecules to solvent molecules

B. Solvent molecules to solute molecules

C. Solute molecules to the total number of molecules in solution

D. Solvent molecules to the total number of molecules in solution

Answer: C

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8. The osmotic pressure of a solution can be increased by

A. Increasing the volume

B. Increasing the number of solute molecules

C. Decreasing the temperature

D. Removing semipermeable membrane

Answer: B

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9. Sprinkling of salt helps in clearing the snow covered roads in hills. The phenomenon involved in the process is:

A. Lowering in vapour pressure of snow

B. Depression in freezing point of snow

C. Melting of ice due to increase in temperature by putting salt

D. Increase in freezing point of snow

Answer: B

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10. The elevation in boiling point for 13.44 g of $CuCl_2$ dissolved in 1 kg of water as solvent will be $\left(K_b = -0.52 Km^{-1}, \text{molar mass of} CuCl_2 = 134.4 gmol^{-1}\right)$

A. 0.16

B. 0.05

C. 0.1

D. 0.2

Answer: A

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11. 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

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12. 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.

A. 1.78×10^{-3}

B. 17.43

C. 0.114

D. 2.814

Answer: A

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13. Which of the following condition is not satisfied by an ideal solution?

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

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

C. Raoult's Law is obeyed

D. Formation of an azeotropic mixture

Answer: D

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14. The unit of ebillioscopic constant is

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

B. mol kgK^{-1} or K^{-1}(molality)

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

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

Answer: A

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15. The liquid pair benzene-toluene shows

A. Positive deviation from Raoult's law

B. Negative deviation from Raoult's law.

C. Practically no deviation from Raoult's law

D. Irregular deviation from Raoult's law.

Answer: C

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16. Which of the following is not a colligative property?

A. Depression in freezing point

B. Elevation in boiling point

C. Osmotic pressure

D. Modification of refractive index

Answer: D

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17. Which of the following 0.1M aqueous solution will have the lowest freezing point?

A. Potassium sulphate

B. Sodium chloride

C. Urea

D. Solvent molecules to the total number of molecules in solution

Answer: A

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

A. $NaCl > BaCl_2 >$ Glucose

B. $BaCl_2 > NaCl >$ Glucose

C. Glucose $> NaCl > BaCl_2$

D. $NaCl >$ Glucose $> BaCl_2$

Answer: B

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19. The osmotic pressure of a dilute solution is given by

A. $P = P_0 x$

B. $\pi V = nRT$

C. $\pi = VRT$

D. None of these

Answer: B

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20. Which solution is isotonic to the blood?

A. 0.75% by weight of NaCl approximately

B. 0.99% by weight of NaCl approximately

C. 0.90% by weight of NaCl approximately

D. None of these

Answer: C

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21. Colligative properties depend on:

A. The nature of solute particles in solution

B. The number of solute particles in solution

C. The nature of solute and solvent particles

D. The physical properties of solute particles in solution

Answer: B

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22. If 5.85 gms of NaCl ar dissolved in 90 gms of water, the mole fraction of NaCl is

A. 0.2632

B. 0.0102

C. 0.0196

D. 0.1045

Answer: C

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23. Solutions which distil without any change in composition and temperature are called:

A. Ideal

B. Super saturated

C. Azeotropic mixture

D. Isotonic

Answer: C

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Multiple Choice Questions Fill In The Blanks

1. Relative lowering of vapour pressure, osmotic Pressure of a solution and elevation in boiling points are ..... properties. Osmosis is the passage of ..... through a semipermeable membrane from a solution of ..... towards a solution of ..... Osmotic pressure is equivalent to mechanical pressure which must be applied on ..... to prevent osmosis.

A. Colligative, solvent, lower concentration, higher concentration, solution.

B. Colligative, solution, lower concentration, higher concentration, solvent.

C. Colligative, solvent, higher concentration, lower concentration, solution.

D. Colligative, solution, higher concentration, lower concentration, solution.

Answer: A

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2. Molality of the solution is number of moles of the solute in ..... kg of .....An aqueous solution of sugar boils ..... $100^{\circ}C$ and freezes..... 0° C .

A. Solvent below, above, one

B. One, solvent, above, below

C. Above, solvent, one, below

D. One, below, above, solvent

Answer: B

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3. Solutions which strictly obey ..... law are called ..... solutions. If the vapour pressure of non-ideal solution is ..... than predicted by Raoult's

law then it shows positive deviation and if it is..... than predicted by Raoult's law then it shows negative deviation

A. Ideal, Raoult's, lower, higher

B. Higher, Raoult's, ideal, lower

C. Raoult's, ideal, higher, lower

D. Raoult's, lower, higher, ideal

Answer: C

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4. A solution which does not obey Raoult's law at all range of concentration is called .....A solution which distills without change in composition is called..... Ideal solutions obey ..... law and they ..... form azeotropic mixtures.

A. Non-Ideal, Azeotrope, Raoult's, do not

B. Azeotrope, Raoult's, Non-Ideal, do not

C. Raoult's, Non-Ideal, do not, Azeotrope

D. Non-Ideal, Raoult's, Azeotrope, do not

Answer: A

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5. For sodium chloride solution, van't Hoff factor is ..... When solvent starts flowing from ..... into ..... through semipermeable membrane, the phenomenon is termed as reverse osmosis. Relative lowering of vapour pressure is equal to the mole fraction of the.....

A. solvent, solution, Greater than 1, Solute

B. Solute, solution, solvent, Greater than 1

C. Greater than 1, solute, solvent, solution

D. Greater than 1, solution, solvent, Solute

Answer: D

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6. ..... is an example of positive deviation The number of moles of the solute per kilogram of solvent..... The properties which depends upon amount of solute and not upon the nature of solute are called..... A type of liquid mixture having a definite composition and boiling like a pure liquid.....

A. Ethanol, molality, Colligative property, azoetrope

B. Azoetrope, molality, Ethanol, colligative property

C. Molality, ethanol, azoetrope, colligative property

D. Colligative property, ethanol, azeotrope, Molality

Answer: A

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7. The minimum excess pressure that has to be applied on the solution to prevent the entry of the solvent into the solution through semipermeable membrane is called as ..... The unit of molal depression constant is ..... The relative lowering in vapour pressure is proportional to the ratio of number of..... Solutions having same osmotic pressure are called as.....

A. Atmospheric pressure, ppm, hypertonic solution, Solute molecules to the total number of solvent

B. Atmospheric pressure, K kg mol^{-1} , Solute molecules to the total number of molecules in solution, hypertonic solution

C. Osmotic Pressure, K kg mol^{-1} Solute molecules to the total number of molecules in solution, isotonic solution

D. Osmotic Pressure, ppm, Solute molecules to the total number of solvent, hypertonic solution

Answer: C

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Multiple Choice Questions Match The Following

1. Match the columns:

Column I	Column II
A Mass percentage	(p) Medicine and pharmacy
B Mass by volume	(q) Concentration of pollutants in water
C ppm	(r) Industrial chemical application
D Volume percentage	(s) Liquid solutions

(a) A-(q), B-(p), C-(s), D-(r)

(b) A-(r), B-(p), C-(q), D-(s)

(c) A-(r), B-(q), C-(s), D-(p)

(d) A-(s), B-(r), C-(p), D-(q)

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2. Match the columns:

Column I	Column II
1 Molal depression constant	(p) Henry's law
2 Colligative property	(q) Osmotic pressure
3 Dilute solution	(r) Relative lowering of vapour pressure
4 Elevation of boiling point	(s) K kg mol^{-1}
5 Solubility of gas in liquid	(t) Colligative property

(a) 1-(s), 2-(r), 3-(q), 4-(t), 5-(p)

(b) 1-(r), 2-(t), 3-(s), 4-(q), 5-(p)

(c) 1-(p), 2-(q), 3-(t), 4-(s), 5-(r)

(d) 1-(q), 2-(p), 3-(r), 4-(t), 5-(s)

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3. Match the columns:

	Column I	Column II
1	Colligative property	(p) Raoult's law
2	Dilute solution	(q) Osmotic pressure
3	Cottrell's	(r) Ebullioscopic constant
4	Temperature	(s) Solutions having same osmotic pressure
5	Isotonic solution	(t) Intensive property

(a) 1-(p), 2-(t), 3-(r), 4-(s), 5-(q)

(b) 1-(t), 2-(q), 3-(s), 4-(p), 5-(r)

(c) 1-(q), 2-(p), 3-(r), 4-(t), 5-(s)

(d) 1-(r), 2-(t), 3-(q), 4-(s), 5-(p)

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Multiple Choice Questions Numerical Based Questions

1. 46 gms of ethyl alcohol is dissolved in 18 gms of water. Calculate the mole fraction of ethyl alcohol. (At. wt of C= 12, O=16, H=1).

A. 0.7

B. 0.8

C. 0.2

D. 0.5

Answer: D

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2. The osmotic pressure of 0.01 molar solution of an electrolyte is found to be 0.65 atm at $27^{\circ}C$. Calculate the van't Hoff factor. What conclusion can you draw about the molecular state of the solute in the solution?

A. 2.149

B. 2.639

C. 2.224

D. 1.169

Answer: B

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3. A solution of urea in water has a boiling point of $100.18^{\circ}C$. Calculate the freezing point of the solution.

A. $-0.4539^{\circ}C$

B. $-0.6539^{\circ}C$

C. $-0.4859^{\circ}C$

D. $-0.5539^{\circ}C$

Answer: B

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4. Ethylene glycol is used as an antifreeze agent. Calculate the amount of ethylene glycol to be added to 4 kg of water to prevent it from freezing at

$-6^{\circ}C.$

A. 844.32g

B. 804.32g

C. 741.5 g

D. 835.6 g

Answer: B

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5. What will be the vapour pressure of a solution containing 5 mole of sucrose $(C_{12}H_{22}O_{11})$ in 1 kg of water, if the vapour pressure of pure water is 4.57 mm of Hg ? (C = 12, H = 1, O=16]

A. 4.192 mm of Hg

B. 4.369 mm of Hg

C. 4.572 mm of Hg

D. 4.489 mm of Hg

Answer: A

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6. The boiling point of pure water is 373 K. Calculate the boiling point of an aqueous solution containing 18 g of glucose (MW=180) in 100 g of water. Molal elevation constant of water is 0.52 K kg mol^{-1} .

A. 373.52K

B. 287.52K

C. 397.56 K

D. 483.52K

Answer: A

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7. A solution to be used in a hand lotion is prepared by mixing 90 g of water, 9.2 g ethyl alcohol and 18.4 g of glycerol $(C_3H_8O_3)$. Calculate the mole fraction of glycerol present in it.

A. 0.045

B. 0.039

C. 0.048

D. 0.037

Answer: D

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8. 75.2 g of C_6H_5OH (Phenol) is dissolved in a solvent of K_f = 14. If the depression in freezing point is 7 K, then find the % of phenol that dimerises.

A. 0.35

B. 0.45

C. 0.7

D. 0.65

Answer: C

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9. The freezing point of a solution containing 0.3 gms of acetic acid in 30 gms of benzene is lowered by 0.45 K. Calculate the van't Hoff factor.

A. 0.5273

B. 0.6845

C. 0.4656

D. 0.5942

Answer: A

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10. A solution of lactose containing 8.45 g of lactose in 100 g of water has a vapour pressure of 4.559 mm of Hg at $0^{\circ}C$. If the vapour pressure of pure water is 4.579 mm of Hg, calculate the molecular weight of lactose.

A. 348

B. 485

C. 582

D. 372

Answer: A

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11. The osmotic pressure of a dilute aqueous solution of a compound X containing 0.12 g/L is twice the osmotic pressure of a dilute aqueous solution of another compound Y containing 0:18 g/L. What is the ratio of the molecular weight of X to that of Y? Both X and Y remain in molecular form in solution.

A. $4:1$

B. $5:1$

C. $2:1$

D. $3:1$

Answer: D

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12. An aqueous solution containing one gram of urea (molecular weight = 60) boils at $100.25^{\circ}C$. The same solution freezes at $-0.894^{\circ}C$. The aqueous solution containing 3 gram of glucose (Molecular weight =180) in the same volume of solution:

What is the boiling point of glucose ?

A. $100.75^{\circ}C$

B. $100.50^{\circ}C$

C. $100.25^{\circ}C$

D. $100.08^\circ C$

Answer: C

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13. A solution of sucrose (molecular weight 342g mol^{-1}) has been prepared by dissolving 68.4g of sucrose in 1000 g of water.

The freezing point of the solution obtained will be:

A. $-0.52^\circ C$

B. $+0.52^\circ C$

C. $-0.372^\circ C$

D. $+0.372^\circ C$

Answer: C

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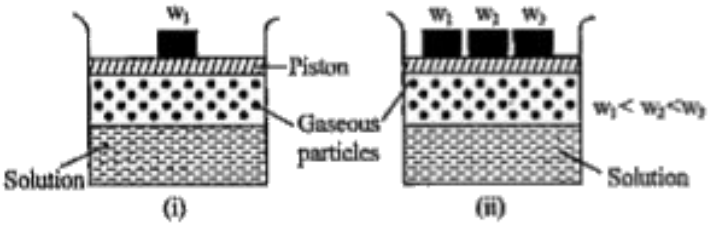
Multiple Choice Questions Structure Based Questions

1. Consider the two figures given below.



Which one of the following statements regarding the experiment is true?

A. The solubility of a gas remains unaffected by change in weights.

B. The solubility of a gas is equal in both beakers.

C. The solubility of a gas in beaker (i) is less than that in beaker (ii).

D. The solubility of a gas in liquid in beaker (i) is greater than that in beaker (ii).

Answer: C

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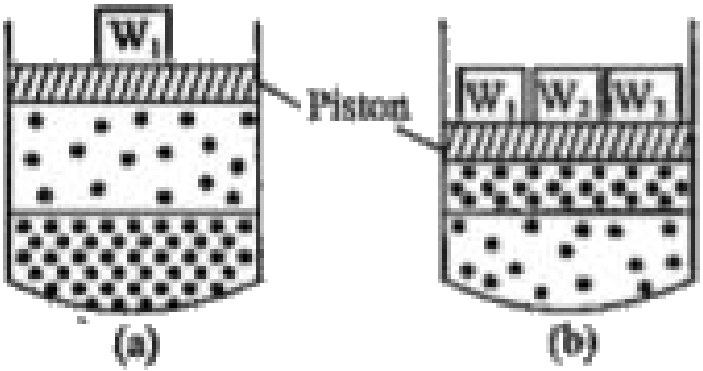
2. On the basis of the figure given below which one of the following is not true?



A. Rate at which gaseous particles are striking the solution to enter it, increases.

B. Rate at which gaseous particles are striking the solution to enter it, decreases.

C. In figure (b) on compressing the gas number of gaseous particles per unit volume over the solution increases.

D. In figure (a) assuming the state of dynamic equilibrium rate of gaseous particles entering and leaving the solution phase is same.

Answer: C

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3. At high altitudes the partial pressure of oxygen is less than that at the ground level. This leads to the,

A. Low concentrations of oxygen in the blood and tissues.

B. High concentrations of oxygen in the blood and tissues.

C. Release of dissolved gases and formation of bubbles of nitrogen in the blood.

D. Thickening of blood and tissues.

Answer: A

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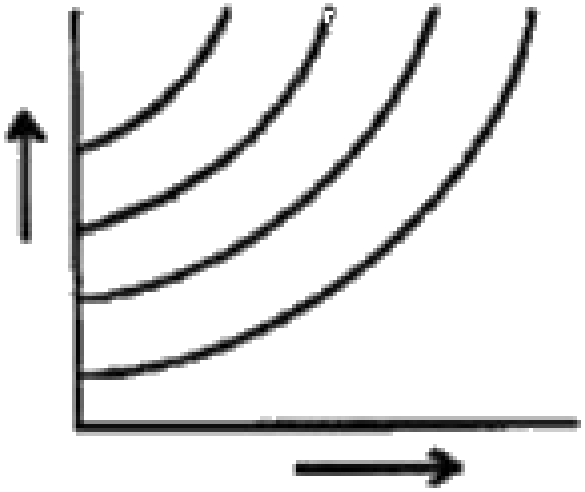
4. The given graph shows the vapour pressure temperature curves for some liquids.



Liquids A, B, C and Drespectively are,

A. Ethyl alcohol, acetone, diethyl ether, water

B. Water, ethyl alcohol, acetone, diethyl ether

C. Acetone, ethyl alcohol, diethyl ether, water

D. Diethyl ether, acetone, ethyl alcohol, water

Answer: D

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Multiple Choice Questions Assertion And Reason Based Questions

1. Assertion: The concentration of pollutants in water or atmosphere is often expressed in terms of ppm.

Reason: Concentration in parts per million can be expressed as mass to mass, volume to volume and mass to volume

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: B

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2. Assertion: 0.1 M solution of KCI has greater osmotic pressure than 0.1 M solution of glucose at same temperature.

Reason: In solution, KCl dissociates to produce more number of particles.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: A

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3. Assertion: When a solution is separated from the pure solvent by a semi-permeable membrane, the solvent molecules pass through it from

pure solvent side to the solution side.

Reason: Diffusion of solvent occurs from a region of high concentration solution to a region of low concentration solution.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: C

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4. Assertion: In solution, amalgam of mercury with sodium is an example of solid solutions.

Reason: Mercury is solvent and sodium is solute in the solution.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: C

View Text Solution

5. Assertion: Molarity of a solution in liquid state changes with temperature.

Reason: The volume of a solution changes with change in temperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: A

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6. Assertion: Pressure have any effect on solubility of solids in liquids.

Reason: Solids and liquids are not incompressible.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: A

View Text Solution

7. Assertion: Elevation in boiling point is a colligative property.

Reason: Elevation in boiling point is directly proportional to molarity.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: C

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8. Assertion: Azeotropic mixtures are not formed only by non-ideal solutions and they may have boiling points either greater than both the components or less than both the components.

Reason: The composition of the vapour phase is same as that of the liquid phase of an azeotropic mixture.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: B

View Text Solution

9. Assertion: At equilibrium, vapour phase will not be always rich in component which is more volatile.

Reason: The composition of vapour phase in equilibrium with the solution is determined by the partial pressures of the components.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: D

View Text Solution

10. Assertion: An ideal solution obeys Henry's law.

Reason: In an ideal solution, solute-solute as well as solvent solvent interactions are not similar to solute-solvent interaction.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

Answer: D

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