CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

SOLUTIONS (GENERAL AND COLLIGATIVE PROPERTIES)

Solved Example

1. Calculate the masses of cane sugar and water required to prepare 250g of 20% can sugar solution.

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2. Calculate the molarity of the following solution:

(a) 4g of caustic soda is dissolved in 200mL of the solution.

(b) 5.3 g of anhydrous sodium carbonate is dissolved in100 mL of solution.

(c) 0.365 g of pure HCl gas is dissolved in 50 mL of solution.

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3. The density of a solution containing 13% by mass of sulphuric acid is $1.09g/mL$. Calculate the molarity and normality of the solution

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

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5. Calculate the quantity of sodium carbonate (anhydrous) required to prepare 250mL $\frac{M}{10}$ solution.

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6. 214.2 gram of sugar syrup contains 34.2 gram of sugar. Caluculate (i) molality of the solution and (ii) mole fraction of the sugar in the syrup-

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7. A solution contains $410.3g\ H_2SO_4$ per litre of the solution at $20^\circ C$. If the density $= 1.243gmL^{-1}$, what will be its molality and molarity?

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

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9. The density of $3M$ sodium of thiosulphate solution $(Na_2S_2O_3)$ is $1.25gmL^{-1}$. Calculate

a. The precentage by weight of sodium thiosulphate.

b. The mole fraction of sodium thiosulphate.

c. The molalities of $Na^{\oplus}$ and $S_2O_3^{2-}$ ions.

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10. A solution is prepared by dissolving 5.64g of flucose in 60g of water. Calculate the following :

(i) mass percent of each of glucose and water

(ii) molality of the solution

(iii) mole fraction of each of glucose and water.

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

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12. The mole fraction of CH_3OH in an aqueous solution is 0.02 and its density is $0.994gcm^{-3}$. Determine its molarity and molality.

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13. Calculate the concentration of NaOH solution g/mL, which has the same normality as that of a solution of HCl of concentration 0.04 g/mL.

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14. How many Na^{+} ions are present in 50mL of a 0.5 M solution of $NaCl$?

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15. Reaction $2Br^{-}_{(aq.)} + Cl_{2(aq.)} \rightarrow 2Cl^{-}_{(aq.)} + Br_{2(aq.)}$, is used for commercial preparation of bromine from its salts. Suppose we have $50mL$ of a $0.060M$ solution of $NaBr$. What volume of a $0.050M$ solution of Cl_2 is needed to react completely with the Br ?

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16. Calculate the molarity, molality and mole fraction of ethyl alcohol in a solution of total volume 95 mL prepared by adding 50 mL of ethyl alcohol (density $= 0.789mL^{-1}$) to 50 mL water (density $= 1.00gmL^{-1}$).

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17. Calculate the concentration of CO_2 in a soft drink that is bottled with a partial pressure of CO_2 of 4 atm over the liquid at $25^{\circ}C$. The Henry's law constant for CO_2 in water at $25^{\circ}C$ is $3.1 \times 10^{-2}\text{mol/litre-atm}$.

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

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

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

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21. An aqueous solution containing 28% by mass of liquid A $(mol. mass = 140)$ has a vapour pressure of $160mm$ at $30^{\circ} C$. Find the vapour pressure of the pure liquid A. (The vapour pressure of the water at $30^{\circ} C$ is $150mm$.)

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22. Heptane and octane form ideal solution. At $373K$, the vapour pressure of the two liquids are $105.2kPa$ and $46.8kPa$ respectively. What will be the vapour pressure, in bar, of a mixture of $25g$ of heptane and $35g$ of octane?

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23. Calculate the vapour pressure lowering caused by addition of $50g$ of sucrose (molecular mass $= 342)$ to $500g$ of water if the vapour pressure of pure water at $25^{\circ} C$ is $23.8mmHg$.

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

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25. A solution containing $30g$ of a nonvolatile solute in exactly $90g$ water has a vapour pressure of $21.85mmHg$ at $25^{\circ} C$. Further $18g$ of water is then added to the solution. The resulting solution has vapour pressure of $22.18mmHg$ at $25^{\circ} C$. calculate (a) molar mass of the solute, and (b) vapour pressure of water at $25^{\circ} C$.

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

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27. A current of dry air was bubbled through a bulb containing 26.66g of an organic compound in 200g of water, then through a bulb at the same temperature, containing water and finally through a tube containing anhydrous calcium chloride. The loss of mass in bulb containing water was 0.087g and gain in mass of the calcium chloride tube was 2.036g. Calcium the molecular mass of the organic substance.

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28. The vapour pressure of an aqueous solution of glucose is $750mm$ of Hg at $373K$. Calculate molality and mole fraction of solute.

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

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30. $10g$ of glucose (molar mass 180) and $20g$ of sucrose (molar mass 342) are dissolved in $100g$ of water. What will be the vapour pressure of the resultant solution if the vapour pressure of water is $30mmHg$?

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31. Calculate the vapour pressure of an aqueous solution of 1.0 molal glucose solution at $100^\circ C$.

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32. The vapour pressure of pure benzene at 50° is $268mm$ of Hg. How many moles of non-volatile solute per mole of benzene are required to prepare a solution of benzene having a vapour pressure of $16.0mm$ of Hg at $50^\circ C$?

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33. On dissolving 10.8g glucose (m.wt = 180) in 240g of water, its boiling point increases by $0.13^\circ C$. Calculate the molecular elevation constant of water.

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34. A solution of 2.5g of non-volatile solid in 100g benzene is boiled at $0.42^\circ C$ higher than the boiling point of pure benzene. Calculate the molecular mass of the substance. Molal elevation constant of benzene is 2.67K kg mol^{-1}.

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35. The molal elevation constant for water is $0.56 Kkgmol^{-1}$. Calculate the boiling point of a solution made by dissolving 6.0g of urea (NH_2CONH_2) in 200g of water.

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36. By dissolving $13.6g$ of a substance in $20g$ of water, the freezing point decreased by $3.7^\circ C$. Calculate the molecular mass of the substance. (Molal depression constant for water $= 1.863 Kkgmol^{-1}$)

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37. On dissolving $0.25g$of a non-volatile substance in$30mL$ benzene $\left(density0.8gmL^{-1}\right)$, its freezing point decreases by $0.25^{\circ}C$. Calculate the molecular mass of non-volatile substance $\left(K_f = 5.1Kkgmol^{-1}\right)$.

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38. A solution of 1.25g of a certain non-volatile substance in 20g of water freezes at 271.94K. Calculate the molecular mass of the solute $\left(K_f = 1.86 \ \text{ K kg mol}^{-1}\right)$.

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

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40. $1.355g$ of a substance dissolved in $55g$of CH_3COOH produced a depression in the freezing point of $0.618^\circ C$. Calculate the molecular weight of the substance $\left(K_f = 3.85\right)$

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41. An aqueous solution of a non-volatile solute boils at $100.17^\circ C$. At what temperature will the solution freeze? (Given: $K_b = 0.512$ and $K_f = 1.86$)

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42. $18g$ of glucose $(C_6H_{12}O_6)$ is dissolved in $1kg$ of water in a saucepan. At what temperature will the water boil (at 1 atm) ? K_b for water is $0.52Kkgmol^{-1}$.

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43. A solution of urea in water has boiling point of $100.15^{\circ}C$. Calculate the freezing point of the same solution if K_f and K_b for water are $1.87Kkgmol^{-1}$ and $0.52Kkgmol^{-1}$, respectively.

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44. In a cold climate water gets frozen causing damage to radiator of a car. Ethylene glycol is used as an anifreezing agent. Calculate the amount of ethylene glycol to be added to $4kg$ of water to prevent it from freezing at -6° . (K_f for water = $1.85kgmol^{-1}$)

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45. A solution containing 0.2563g of naphthalene (molecular mass = 128) in 50g of carbon tetrachloride yields a boiling point elevation of $0.201^{\circ}C$ while a solution of 0.6216g of an unknown solute in the same mass of the solvent gives a boiling point elevation of $0.647^\circ C$. Find the molecular mass of the unknown solute.

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46. $200cm^3$ of an aqueous solution contains 1.26g of a polymer. The osmotic pressure of such solution at 300K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the polymer.

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47. A solution is prepared by dissolving $1.08g$ of human serum albumin, a protein obtained from blood plasma, in $50cm^3$ of aqueous solution. The solution has an osmotic pressure of $5.85mmHg$ at $298K$.

a. What is the molar mass of albumin ?

b. What is the height of water column placed in solution ?

$d_{(H_2O)} = 1gcm^{-3}$

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48. Calculate osmotic pressure of 5% solution of cane sugar (sucrose) at $15^\circ C$.

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49. The solution containing $10g$ of an organic compound per litre showed an osmotic pressure of $1.18atm$ at $0^\circ C$. Calculate the molecular mass of the compound "(R=0.0821 litre atm per degree per mol)"

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50. The osmotic pressure of a solution containing 30g of a substance in 1 litre solution at $20^\circ C$ is 3.2 atmosphere. Calculate the value of S. The molecular mass of solute is 228.

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51. What is the volume of solution containing 1g mole of sugar that will give rise to an osmotic pressure of 1atmosphere at $0^\circ C$?

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52. Find the osmotic pressure M/20 solution of urea at $27^\circ C\left(S = 0.0821 litatm K^{-1} mol^{-1}\right)$

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53. The osmotic pressure of a solution of an organic substance containing 18g in one litre of solution at 293K is $2.414 \times 10^5 Nm^{-2}$. Find the molecular mass of the substance if $S = 8.3 JK^{-1}$ per mol.

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

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55. Phenol associates in benzene to certain extent to form a dimer. A solution containing $20 \times 10^{-3} kg$ of phenol in $1.0 kg$ of benzene hs its freezing point depressed by $0.69 K$. Calculate the fraction of phenol that has dimerized. (K_f for benzene is $5.12 K kg mol^{-1}$).

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56. The freezing point depression of $0.001 m K_x \left[Fe(CN)_6\right]$ is $7.10 \times 10^{-3} K$. Determine the value of x. Given, $K_f = 1.86 K kg \text{mol}^{-1}$ for water.

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57. An M/10 solution of potassium ferrocyanide is 46% dissociated at $300K$. What will be its osmotic pressure?

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58. A 0.5% aqueous solution of KCl was found to freeze at $-0.24^\circ C$. Calculate the Van,t Hoff factor and degree of dissociation of the solute at this concentration. (K_f for water =$1.86Kkgmol$^(-1)`)

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

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

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60. 50g of a saturated aqueous solution of potassium chloride at $30^{\circ} C$ is evaporated to dryness, when 13.2 g of dry KCl was obtained. Calculate the solubility of KCl in water at $30^{\circ} C$.

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61. How much copper sulphate will be required to saturate 100g of a dilute aqueous solution of $CuSO_4$ at $25^{\circ} C$ if 10g of the dilute solution leave on evaporation and drying 1.2g of anhydrous $CuSO_4$? The solubility of $CuSO_4$ in water at $25^{\circ} C$ is 25.

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MISC Examples

1. Calculate the freezing point of an aqueous soltuion of non-electrolyte having an osmotic pressure $2.0 atm$ at $300K$. $(K'_f = 1.86 K mol^{-1} kg$ and $S = 0.0821$ litre atm $K^{-1} mol^{-1})$

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2. Calcualate the amount of $NaCl$ which must be added to $100g$ water so that the freezing point, depressed by $2K$. For water K_f =$1.86Kkgmol^{-1}$.

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3. The degree of dissociation of $Ca(NO_3)_2$ in a dilute solution containing 14g of the salt per 200g of water at $100^\circ C$ is 70%. If the vapour pressure of water is 760 mm, calculate the vapour pressure of solution.

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4. Calculate osmotic pressure of a solution obtained by mixing $100mL$ of 3.4% solution "(weight/volume)" of urea "(molecular weight 60)" and $100mL$ of 1.6% solution "(weight/volume)" of cane sugar "(molecular weight 342)" at $20^\circ C$.

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5. Calculate the normal boiling point of a sample of sea water found to contain3.5% of $NaCl$ and 0.13% of $MgCl_2$ by mass. The normal boiling of point of water is $100^\circ C$ and $K_b(\text{water}) = 0.51 Kkgmol^{-1}$. Assume that both the salts are completely ionised.

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6. A solution of a non-volatile solute in water has a boiling point of 375.3K. Calculate the vapour pressure of water above this solution at 338K. Given, p_0 (water) = 0.2467 atm at 338K and K_b for water = 0.52.

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7. Sea water is 3.5% by mass of a salt and has a density $1.04 gcm^{-3}$ at $293K$.Assuming the salt to be sodium chloride ,calculate the osmotic pressure of sea water.Assume complete ionisation of the salt-

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8. Molality of a solution in aqueous medium is 0.8.Calculate its more fraction and the percentage by mass of solute if molar mass ofsolute is 60

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9. Calculate the boiling point of a solution containing $0.61g$ of benzoic acid in $50g$ of carbon disulphide assuming 84% dimerization of the acid. The boiling point and K_b of CS_2 are $46.2^\circ C$ and $2.3kgmol^{-1}$.

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

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11. A solution of a non-volatile solute in water freezes at $-0.30^{\circ}C$. The vapour pressure of pure water at $298K$ is $23.51mmHg$ and K_f for water is $1.86degree/molal$. Calculate the vapour pressure of this solution at $298K$.

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12. xg of non-electrolytic compound (molar mass =200) is dissolved in $1.0L$ of $0.05MNaCl$ solution. The osmotic pressure of this solution is found to be $4.92atm$ at $27^{\circ}C$. Calculate the value of x. Assume complete dissociation of $NaCl$ and ideal behaviour of this solution.

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

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

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15. $1.4g$ of acetone dissolved in $100g$ of benzene gave a solution which freezes at $277.12K$. Pure benzene freezes at $278.4K.2.8$ of solid (A) dissolved in $100g$ of benzene gave a solution which froze at $277.76K$. Calculate the molecular mass of (A).

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

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17. The osmotic pressure of a solution is $1.3atm$. The density of solution is $1.3gcm^{-3}$. Calculate the osmotic pressure rise. ($1atm = 76cmHg$, $d_{Hg} = 13.6gcm^{-3}$)

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18. (a) $10g$ of a certain non-volatile solute were dissolved in $100g$ water at $20^\circ C$. The vapour pressure was lowered from $17.3555mm$ to $17.2350mm$, calculate m. wt. of solute.

(b) The vapour pressure of pure water at $25^\circ C$ is $23.62mm$. What will be the vapour pressure of a solution of $1.5g$ of urea in $50g$ of water?

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19. Match the boiling point with K_b for x,y and z, if molecular weight of x,y and z are same.

	$b.pt.$	K_b
x	100	0.68
y	27	0.53
z	253	0.98

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20. When $1.22gC_6H_5COOH$ is added into two solvents, the following data of ΔT_b and K_b are obtained:

i. In $100gCH_3COCH_3$,$\Delta T_b = 0.17$,$K_b = 1.7kgKmol^{-1}$.

ii. In $100g$ benzene,$\Delta T_b = 0.13$ and $K_b = 2.6kgKmol^{-1}$.

Find out the molecular weight of C_6H_5COOH in both cases and interpret the results.

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21. How much C_2H_5OH should be added to 1 litre H_2O so that it will not freeze at $-20^\circ C$?

$K_f = 1.86^\circ C / m.$

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

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23. There is KI and sucrose solution with 0.1 M concentration, if the osmotic pressure of KI and sucorse solution is 0.465 atm and 0.245 atm respectively. Then find the van't Hoff factor of KI and its degree of dissociation.

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24. 102% solution of glycerine and 2% solution of glucose are isotonic. Molecular mass of glucose is 180 then find out the molecular mass of glycerine.

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

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

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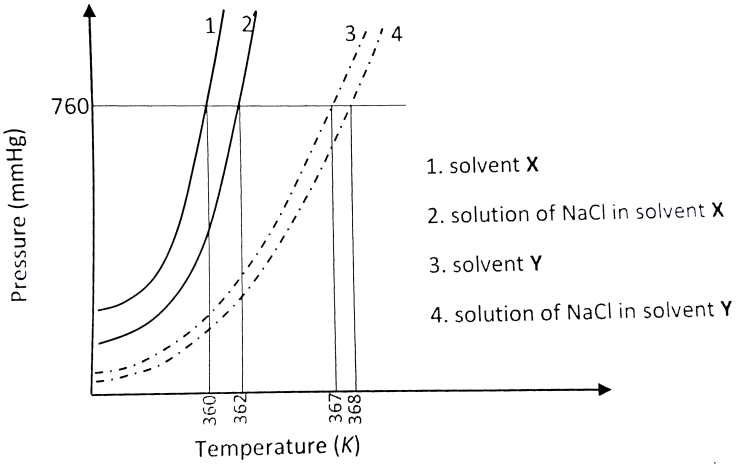
26. The plot given below shows $P-T$ curves (where P is the pressure and T is the temperature) for two solvents X and Y and isomolal solutions of NaCl in these solvents. NaCl completely dissociates in both the solvents.



On addition of equal number of moles of a non-volatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is three times that of solvent Y. Solute S is known to undergo dimerization in these solvents. If the degree of dimerization is 0.7 in solvent Y, the degree of dimerization in solvent X is ____.

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Illustrations

1. 0.5 M of H_2SO_4 is diluted from 1 litre to 10 litre, normality of resulting solution is

A. 1 N

B. 0.1 N

C. 10 N

D. 11 N

Answer: B

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2. Molar solution means 1 mole of solute present in

A. 1000g of solvent

B. 1 litre of solvent

C. 1 litre of solution

D. 1000g of solution

Answer: C

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3. The molarity of a solution containing 50g of NaCl in 500g of a solution and having a density of $0.936 \text{g} / \text{cm}^3$ is :

A. 1.5 M

B. 1.6 M

C. 1.8 M

D. 1.2 M

Answer: B

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4. 20 mL of 0.5 M HCl is mixed with 30 mL of 0.3 M HCl, the molarity of the resulting solution is :

A. 0.8 M

B. 0.53 M

C. 0.38 M

D. 0.83 M

Answer: C

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5. How many Na^{+} ions are present in 50mL of a 0.5 M solution of $NaCl$?

A. 0.125 mol , 7.32 g

B. 7.32 mol , 0.125 g

C. 0.125 mol, 0.125 g

D. 7.32 mol , 7.32 g

Answer: A

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

A. 1.14 mol kg^{-1}

B. 3.28 mol kg^{-1}

C. 2.28 mol kg^{-1}

D. 0.44 mol kg^{-1}

Answer: C

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7. The hardness of water sample containing $0 \cdot 002$ mole of magnesium sulphate dissolved in a litre of water is expressed as

A. 20 ppm

B. 200 ppm

C. 2000 ppm

D. 120 ppm

Answer: B

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8. The density $(\text{in} gmL^{-1})$ of a $3.60M$ sulphuric acid solution that is $29\% \ H_2SO_4$ (Molar mass $= 98gmol^{-1}$) by mass will be:

A. 1.45

B. 1.64

C. 1.88

D. 1.22

Answer: D

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9. 1 litre solution containing 490 g of sulphuric acid is diluted to 10 litre with water. What is the normality of the resulting solution ?

A. 0.5 N

B. 1.0 N

C. 5.0 N

D. 10.0 N

Answer: B

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10. 250 mL of a Na_2CO_3 solution contains $2.65g$ of $Na_2CO_3.10mL$ of this solution is added to xml of water is obtain $0.001MNa_2CO_3$ solution. The value of x is :

A. 1000

B. 990

C. 9990

D. 90

Answer: B

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11. The volumes of two HCl solution A $(0.5M)$ and $B(0.1M)$ to be mixed for preparing 2 L of 0.2 M HCl are

A. 0.5 L of A + 1.5 L of B

B. 1.5 L of A + 0.5 L of B

C. 1 L of A + 1 L of B

D. 0.75 L of A + 1.25 L of B

Answer: A

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12. Mole fraction of component A in vapour phase is χ_1 and that of component A in liquid mixture is χ_2, then (p_A°)= vapour pressure of pure A, p_B° = vapour pressure of pure B), the total vapour pressure of liquid mixture is

A. $p_A^0 \frac{x_2}{x_1}$

B. $p_A^0 \frac{x_1}{x_2}$

C. $p_B^0 \frac{x_1}{x_2}$

D. $p_B^0 \frac{x_2}{x_1}$

Answer: A

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13. Vapour pressure of pure $A\left(p_A^\circ\right) = 100$ mm Hg

Vapour pressure of pure $B\left(p_B^\circ\right) = 150$ mm Hg

2 mol of liquid A and 3 mol of liquid B are mixed to form an ideal solution.

The vapour pressure of solution will be:

A. 135 mm

B. 130 mm

C. 140 mm

D. 145 mm

Answer: B

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14. The vapour pressure of a certain pure liquid A at 298 K is 40 mbar. When a solution of B is prepared in A at the same temperature, the vapour pressure is found to be 32 mbar. The mole fraction of A in the solution is

A. 0.5

B. 0.2

C. 0.1

D. 0.8

Answer: D

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15. $100mL$ of liquid A and $25mL$ of liquid B are mixed to form a solution of volume $125mL$. Then the solution is

A. ideal

B. non-ideal with positive deviation

C. non-ideal with negative deviation

D. cannot be predicted

Answer: A

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16. The vapour pressure of pure benzene at $88^\circ C$ is $957mm$ and that of toluene at the same temperature is $379.5mm$. The composition of benzene-toluene mixture boiling at $88^\circ C$ will be

A. $x_{\text{benzene}} = 0.66, x_{\text{toluene}} = 0.34$

B. $x_{\text{benzene}} = 0.34, x_{\text{toluene}} = 0.66$

C. $x_{\text{benzene}} = x_{\text{tolulene}} = 0.5$

D. $x_{\text{benzene}} = 0.75, x_{\text{toluene}} = 0.25$

Answer: A

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17. At $25^\circ C$, the total pressure of an ideal solution obtained by mixing 3 mole of A and 2 mole of B, is 184 torr. What is the vapour pressure (in torr) of pure B at the same temperature (Vapour pressure of pure A at $25^\circ C$ is 200 torr) ?

A. 180

B. 160

C. 16

D. 100

Answer: B

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18. The mass of glucose that would be dissolved in 50g of water in order to produce the same lowering of vapour pressure as is produced by dissolving 1g of urea in the same quantity of water is :

A. 1g

B. 3g

C. 6g

D. 18g

Answer: B

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19. The vapour pressure of pure benzene and toluene are 160 and 60 mm Hg respectively. The mole fraction of benzene in vapour phase in contact with equimolar solution of benzene and toluene is :

A. 0.073

B. 0.027

C. 0.27

D. 0.73

Answer: D

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20. The vapour pressure of water at $23^\circ C$ is 19.8 mm. 0.1 mole glucose is dissolved in 178.2g of water. What is the vapour pressure (in mm) of the resultant solution ?

A. 19

B. 19.602

C. 19.402

D. 19.202

Answer: B

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21. What is the vapour pressure of the solution containting 34.2g of sucrose per 100g of water at $25^{\circ}C$? The vapour pressure of water at $25^{\circ}C$ is 23.75 mm.

A. 20.3 mm

B. 23.10 mm

C. unpredictable

D. 23.33 mm

Answer: D

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22. The lowering of vapour pressure due to a solute in a $1m$ aqueous solution at $100^\circ C$ is

A. 13.44 mm Hg

B. 14.12 mm Hg

C. 31.2 mm Hg

D. 35.2 mm Hg

Answer: A

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

.

A. 20g

B. 30g

C. 10g

D. 40g

Answer: C

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24. 3g urea is dissolved in 45g of water. The relative lowering of vapour pressure is :

A. 0.05

B. 0.04

C. 0.02

D. 0.01

Answer: C

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25. When 25g of a non-volatile solute is dissolved in 100g of water, the vapour pressure is lowered by 0.225 mm. If the vapour pressure of water at $25^\circ C$ is 17.5 mm, what is the molecular mass of solute ?

A. 206

B. 302

C. 318

D. 276

Answer: C

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26. Calculate the molal depression constant of a solvent which has freezing point $16.6^\circ C$ and latent heat of fusion 180.75J g^{-1} :

A. 2.68

B. 3.86

C. 4.68

D. 2.86

Answer: B

Watch Video Solution

27. The elevation in boiling point, when 13.44g of freshly prepared $CuCl_2$ are added to one kilogram of water, is [Some useful data, $K_b(H_2O) = 0.52\text{kg K mol}^{-1}, \text{mol.wt. of CuCl}_2 = 134.4gm\Big]$

A. 0.05

B. 0.10

C. 0.16

D. 0.20

Answer: C

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28. A solution containing 7g of a solute (molar mass 210g mol^{-1}) in 350g of acetone raised the boiling point of acetone from $56^{\circ}C$ to $56.3^{\circ}C$. The value of ebullioscope contant of acetone in K kg bol^{-1} is :

A. 2.66

B. 3.15

C. 4.12

D. 2.86

Answer: B

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29. The normal boiling point of toluene is $110.7^{\circ}C$ and its boiling point elevation constant $3.32 \text{ K kg mol}^{-1}$. The enthalpy of vaporization of toluene is nearly :

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30. An aqueous solution freezes at $-0.186^{\circ} C\left(K_f = 1.86^{\circ}\ ,K_b = 0.512^{\circ}\right.$. What is the elevation in boiling point?

A. 0.186

B. 0.512

C. $\frac{0.512}{1.86}$

D. 0.0512

Answer: D

Watch Video Solution

31. The amount of urea to be dissolved in 500 cc of water $\left(K_f = 1.86\right)$ to produce a depresssion of $0.186^{\circ} C$ in the freezing point is :

A. 9g

B. 6g

C. 3g

D. 0.3g

Answer: C

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32. What should be the freezing point of aqueous solution containing $17g$ of $C_2H(5)OH$ is $1000g$ of water (K_f for water $=1.86 degkgmol^{-1}$)?

A. $-0.69^\circ C$

B. $0.34^\circ C$

C. $0.0^\circ C$

D. $-0.34^\circ C$

Answer: A

Watch Video Solution

33. 6g of non-volatile, non-electrolyte x dissolved in 100g of water freezes $-0.93^{\circ}C$. The molar mass of x in g mol^{-1} is :

$\left(K_f \text{of} H_2O = 1.86\text{K kg mol}^{-1}\right)$

A. 60

B. 140

C. 180

D. 120

Answer: D

Watch Video Solution

34. The mass of ascorbic acid $(C_6H_8O_6)$ to be dissolved in 100g of acetic acid to lower its freezing point by $1.5^{\circ}C$ in g is : (K_f for acetic acid is $4.0 \text{ K kg mol}^{-1}$)

A. 17.6

B. 8.8

C. 6.6

D. 13.2

Answer: C

Watch Video Solution

35. Find out the osmotic pressure of 0.25 M aqueous solution of urea at $27^{\circ}C\left(R = 0.082 \text{ litre atm K}^{-1}\text{mol}^{-1}, R = 1.987\text{cal K}^{-1}\text{mol}^{-1}\right)$

A. 6.157 atm

B. 0.615 atm

C. 0.0615 atm

D. 61.5 atm

Answer: A

Watch Video Solution

36. Two solutions of glucose have osmotic pressure 1.5 and $2.5 atm$,respectively. $1L$ of first solution is mixed with $2L$of second solution. The osmotic pressure of the resultant solution will be

a.$2.62 atm$, b.$6.12 atm$,c.$3.26 atm$, d.$2.16 atm$

A. 1.62 atm

B. 6.12 atm

C. 1.26 atm

D. 2.16 atm

Answer: D

Watch Video Solution

37. $18 g$ glucose and $6 g$ urea are dissolved in $1 L$ aqueous solution at $27^{\circ} C$. The osmotic pressure of the solution will be a.$8.826atm$, b.$4.926atm$,c.$2.92atm$, d.$4.42atm$

A. 3.826 atm

B. 4.926 atm

C. 2.92 atm

D. 9.42 atm

Answer: B

Watch Video Solution

38. A solution containing $10gperdm^3$ of urea (mol.wt. $= 60gmol^{-1}$) is isotonic with a 5% (mass//vol.) of a non-volatile solute. The molecular mass of non-volatile solute is:

A. 250 g mol^{-1}

B. 300 g mol^{-1}

C. 350 g mol^{-1}

D. 200 g mol^{-1}

Answer: B

Watch Video Solution

39. The osomotic pressure of a solution at $0^{\circ} C$ is $4 atm$. What will be its osmotic pressure at $546 K$ under similar conditions?

a.$4atm$, b.$9atm$,c.$8atm$, d.$6atm$

A. 4 atm

B. 2 atm

C. 8 atm

D. 1 atm

Answer: C

Watch Video Solution

40. The temperature at which 10% aqeous solution $\left(\frac{W}{V}\right)$ of glucose will exhibit the osmotic pressure of 16.4 atm, is : $\left(R = 0.082 \text{dm}^2 \text{atm K}^{-1} \text{mol}^{-1}\right)$

A. $360^\circ C$

B. 180 K

C. 90 K

D. 360 K

Answer: D

Watch Video Solution

41. $0.002 molar$ solutiion of $NaCl$ having degree of dissociation of 90% at $27^\circ C$ has osmotic pressure equal to

a.0.94 bar , b.9.4 bar , c.0.094 bar , d.9.4×10^{-4} bar

A. 0.94 bar

B. 9.4 bar

C. 0.094 bar

D. 9.4×10^{-4} bar

Answer: C

Watch Video Solution

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42. A $0.2 molal$ solution of KCl freezes at $-0.68^{\circ} C$. If K_f for H_2O is 1.86, the degree of dissociation of KCl is

a.85% , b.83% , c. 65% , d. 90%

A. 0.75

B. 0.83

C. 0.65

D. 0.92

Answer: B

Watch Video Solution

43. A certain substance A tetramerizes in water to the extent of 80%. A solution of $2.5g$ of A in $100g$ of water lowers the freezing point by $0.3^\circ C$. The molar mass of A is

a.120 , b.61 ,c.60 ,d.62

A. 122

B. 31

C. 244

D. 62

Answer: D

Watch Video Solution

44. The Van't Hoff factor of Hg_2Cl_2 in its aqueous solution will be (Hg_2Cl_2 is 80% ionized in the solution)

a.1.6 , b.2.6 ,c.3.6 ,d.4.6

A. 1.6

B. 2.6

C. 3.6

D. 4.6

Answer: B

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45. $0.1M$ aqueous solution of $MgCl_2$ at $300K$ is $4.92atm$. What will be the percentage ionination of the salt?

a.49% , b. 59% ,c.79% d. 69%

A. 0.49

B. 0.29

C. 0.39

D. 0.69

Answer: A

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46. Which of the following solutions will exhibit highest boiling point?

A. 0.01 M Na_2SO_4

B. 0.01 M KNO_3

C. 0.015 M urea

D. 0.015 M glucose

Answer: A

Watch Video Solution

47. 12.25g of $CH_3CH_2CHClCOOH$ ia added to 250g of water to make a solution. If the dissociation constant of above acid is 1.44×10^{-3}, the depression in freezing point of water in $.^{\circ} C$ is : (K_f for water is $1.86 \text{K kg mol}^{-1}$)

A. 1.789

B. 0.394

C. 1.183

D. 0.592

Answer: A

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Practice Problem

1. 15g of methyl alcohol is present in 100 mL of solution. If the density of solution is 0.96g mL^{-1}, calculate the mass percentage of methyl alcohol in solution.

Watch Video Solution

2. A solution is prepared by dissolving 15g of cane sugar in 60g warer. Coompute the mass per cent of each component of solution.

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3. The density of the solution of a salt X is $1.15 \mathrm{g\,mL}^{-1}$. 20 mL of the solution when completely evaporated gave a residue of 4.6g of the salt. Calculate the mass percentage of the solute in solution.

Watch Video Solution

4. (a) 5.85g of NaCl is dissolved in 200mL of water. What will be the molarity of this solution ?

(b) Calculate the molarity of the solution obtained by dissolving 20.6g NaBr in 500mL of water.

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5. The density of a solution containing 40% by mass of HCl is 1.2 g/mL. Calculate the molarity of the solution.

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

Watch Video Solution

7. A mixture of alcohol and water contains 54% water by mass. Calculate the mole fraction of alcohol in this solution.

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8. What amount of oxalic acid is required to prepare 250 mL 0.1 N solution (Given : molecular mass of oxalic acid = 126) ?

Watch Video Solution

9. 7.45g of potassium chloride is dissolved in 100g of water. What will be the molality of the solution ?

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10. A solution contains 35% water, 50% ethanoic acid and 25% ethanol by mass. Compute the mole fraction of each component.

Watch Video Solution

11. Find the amount of 98% pure Na_2CO_3 required to prepare 5 litres of 2N solution.

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12. What will be the final concentration of solution when $2.0\text{litre of}3.0M$ sugar solution and $3.0\text{lite of}2.5M$ sugar solutions are mixed? If the solution is now diluted to 10litre what molarity will it have?

Watch Video Solution

13. If 20.0 mL of 0.1 M calcium chloride and 60mL of 0.2 M $CaCl_2$ are mixed, what will be the molarity of the final solution ?

Watch Video Solution

14. Calculate the molarity of each of the ions in a solution when 3.0 litre of 4.0 M NaCl and 4.0 litre of 2.0 M $CoCl_2$ are mixed and diluted to 10 litre.

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

Watch Video Solution

16. Calculate the molarity of each ion in solution after 2.0 litre of 3.0 M $AgNO_3$ is mixed with 3.0 litre of 1.0 M $BaCl_2$.

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17. The density of a 10.0% by mass of KCl solution in water is 1.06 g/mL. Calculate molarity, molality and mole fraction of KCl in the solution.

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18. Calculate the molality and mole fraction of the solute in an aqueous solution containing 6g of urea per 500g of water (Mol. Mass of urea = 60)

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19. Molarity of H_2SO_4 is 0.8 M and its density is $1.06gcm^{-3}$. What will be concentration of the solution in terms of molality and mole fraction ?

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

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21. How many kilograms of wet $NaOH$ containing 12% water are required to prepare 60 litre of 0.50 N solution ?

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22. In an experiment, 18.0 g of mannitol was dissolved in 100 water. The vapour pressure of solution at $20^{\circ}C$ was 17.226 mm of mercury. Calculate the molecular mass of mannitol. The vapour pressure of water at $20^{\circ}C$ is 17.535 mm of mercury.

Watch Video Solution

23. The vapour pressure of water at $20^{\circ}C$ is 17.53 mm. Calculate the vapour pressure of a solution at $20^{\circ}C$ containing 6g of urea in 100g of water (molecular mass of urea = 60)

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24. The vapour pressure of ether (molecular mass = 74) is 442 mm Hg at 293 K. If 3g of a compound A are dissolved in 50g of ether at this temperature, the vapour pressure falls to 426 mm Hg. Calculate the molecular mass of A assuming that the solution of A is very dilute.

Watch Video Solution

25. 18.2 g of urea is dissolved in 100g of water at $50^\circ C$. The lowering of vapour pressure produced is 5 mm Hg. Calculate the molecular mass of urea. The vapour pressure of water at $50^\circ C$ is 92 mm Hg.

Watch Video Solution

26. Calculate the vapour pressure of a solution at $100^\circ C$ containing 3g of cane sugar in 33g of water.(Atwt.C =12,h=1,O=16)

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

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28. At $25^{\circ} C$, the vapour pressure of pure benzene is 100 torr, while that of pure ethyl alcohol is 44 torr. Assuming ideal behaviour, calculate the vapour pressure at $25^{\circ} C$ of a solution which contains 10g of each substance.

Watch Video Solution

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

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30. 10g of a certain non-volatile solute was dissolved in 100g of water at $20^{\circ} C$. The vapour pressure was lowered in 100g of water at $20^{\circ} C$. The vapour pressure was lowered from 17.3555 to 17.235 mm. Calculate the molecular mass of the solute.

Watch Video Solution

31. 0.534 g of solute is dissolved in 15g of water then freezing point temperature changes from $0^{\circ} C$ to $-1.57^{\circ} C$. Molal depression constant of water, $k_f = 1.85 K kg mol^{-1}$. Find out :

(i) Molal concentration

(ii) Molecular mass of solute.

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32. The addition of $0.643g$ of a compound to $50mL$ of benzene (density 0.879 g mL^{-1}) lowers the freezing point from 5.51 to $5.03^{\circ} C$. If K_f for benzene is 5.12, calculate the molecular weight of the compound.

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33. A solution made by dissolving 0.32 of a new compound in 25g of water has freezing point $-0.201^{\circ} C$.the molecular mass of the new compound.

Watch Video Solution

34. Calculate the freezing point and the boiling point at 1 atmosphere of a solution containing 20g cane sugar (molecular mass 343) and 150g water.

Given : $K_b = 0.513 \text{ and } K_f = 1.86.$

Watch Video Solution

35. When $36.0g$ of a non -volatile, non-electrolyte solution an empirical formula CH_2O is dissolved inn$1.20Kg$ of water. The solution freezes at $-0.93^\circ C$. What is the no. of oxygen atoms present per molecule of solute? K_f of $H_2O = 1.86Kkgmol^{-1}$, Freezing point of $H_2O = 273K$

Watch Video Solution

36. In winter, the normal temperature in Kullu valley was found to be $-11^\circ C$. Is a 28% (by mass) aqueous solution of ethylene glycol suitable for a car radiator ?

K_f for water $= 1.86\text{K kg mol}^{-1}$.

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37. If latent heat of fusion of ice is 80 cals per g at 0°, calculate molal depression constant for water.

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38. A solution containing 7.5g of urea (molecular mass = 60) in 1kg of water freezes at the same temperature as another solution containing 15g of solute 'A' in the same amount of water. Calculate molar mass of 'A'.

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39. Calculate the osmotic pressure of a decinormal solution of NaCl which is ionised to 80% at $27^\circ C$.

Watch Video Solution

40. What is the volume of a solution containing 2g mole of sugar that will give rise to an osmotic pressure of 1 atmosphere a STP ?

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41. If the osmotic pressure of 5g per litre solution of compound at $27^{\circ}C$ is 0.025 atm, calculate the molecular mass of the compound.

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42. The osmotic pressure of blood is $7.65atm$ at $37^{\circ}C$. How much glucose should be used per litre for an intravenous injection that is to have the same osmatic pressure as blood?

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43. 10g of cane sugar (molecular mass = 342) in $1 \times 10^{-3} m^3$ of solution produces an osmotic pressure of $6.68 \times 10^4 Nm^{-2}$ at 273 K. Calculate the value of S in SI units.

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44. A 250 mL water solution containing 48 g of sucrose (molecular mass $= 342$) at 300 K is separated from pure water by means of a semipermeable membrane. What pressure must be applied on solution as to prevent osmosis ?

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45. What would be the osmotic pressure of 0.05 M solution of sucorse at $5^\circ C$? Find out the concentration of a solution of glucose which would be isotonic with this solution of sucrose. (Molecular mass of sucrose = 342, Molecular mass of glucose = 180)

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

48. A 5% solution of glucose is isotonic with 1.1 % solution of KCl at $30^{\circ}C$. Calculate the degree of ionisation of KCl.

Watch Video Solution

49. What should be the osmotic pressure of a solution of urea in water at $30^\circ C$ which has boiling point 0.052 K higher than pure water ? Assume molarity and molality to be the same. K_b for water is $0.52 \text{Kg kg mol}^{-1}$

Watch Video Solution

50. 4.0g of substance A dissolved in 100g H_2O depressed the freezing point of water by $0.1^\circ C$ while 4.0g of another substance B depressed the freezing point by $0.2^\circ C$. Which one has higher molecular mass and what is the relation ?

Watch Video Solution

51. A solution containing 28 g of phosphorus in 315 g $CS_2(b.\ p.\ 46.3^\circ C)$ boils at $47.98^\circ C$. If K_b for CS_2 is 2.34 K kg mol^{-1} . The formula of phosphorus is (at , mass of P = 31).

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52. A solution of two volatile liquids A and B obeys Raoult's law. At a certain temperature it is found that when the pressure above the mixture in equilibrium is 402.5 mm of Hg, the mole fraction of A in the vapour is 0.35 and in the liquid it is 0.65. What are the vapour pressures of two liquids at this temperature ?

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

Watch Video Solution

54. At 293.2K, the density of a 60% aqueous solution of methanol is 0.8946 g/mL. Calculate volume of 1 mole of the solution.

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55. 1.2 kg ethylene glycol $\begin{pmatrix} CH_2OH \\ | \\ CH_2OH \end{pmatrix}$ was added in a car radiator containing 9 litre water. The freezing of water as just prevented when car was running in the Himalayan valley at temperature $-4^\circ C$. Sudden thunderstorm in the valley lowered the temperature to $-6^\circ C$. Calculate the amount of ice separated.

Watch Video Solution

56. 2g mixture of glucose and sucrose is dissolved in 1 litre water at 298K to develop osmotic pressure of 0.207 atm. Calculate percentage composition of glucose and sucrose by mole as well as by mass.

Watch Video Solution

57. If benzoic acid (mol. Mass = 122) is associated into double molecules when dissolved in benzene and the osmotic pressure of a solution of 5g of benzoic acid in 100 mL benzene is 5.73 atm at $10^{\circ}C$, what is the percentage association of benzoic acid ?

Watch Video Solution

58. 0.1 formal soluton of NaCl is found to be isotonic with 1.10% solution of urea. Calculate the apparent degree of ionization of NaCl.

Watch Video Solution

59. The vapour pressure of water at $100^{\circ}C$ is 760 mm. What will be the vapour pressure at $95^{\circ}C$? The latent heat of water at this temperature range is 548 cal/g.

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60. Calculate the increase in vapour pressure of water per atmosphere rise in external pressure at $10^{\circ}C$. The vapour pressure of water at $10^{\circ}C$

and 1 atm is equal to 9.2 mm.

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61. An aqueous solution of H_2SP_4 has density 1.84 g/mL. Solution containso 98% H_2SO_4 by mass. Calculate :

(i) molarity of solution

(ii) overall molarity of solution

(iii) molar volume

(iv) specific volume

(v) relative, decrease in vapour pressure with respect to water, assuming H_2SO_4 as non-electrolyte at his high concentration.

Watch Video Solution

62. You are given two sample of HCl with molarity 0.341 and 0.143 , volume of each sample being 1 litre. What will be the maximum volume of 0.243 M HCl that can be obtained mixing the given samples in the following two conditions ?

(i) When water is added for dilution

(ii) When no water is added.

Watch Video Solution

63. What is the vapour pressure of a solution of glucose which has an osmotic pressure of 3 atmosphere at $20^\circ C$? The vapour pressure of water at $20^\circ C$ is 17.39 mm. Consider the density of solution equal to that of solvent.

Watch Video Solution

64. The osmotic pressure of an aquoeus solution of a non-electrolyte is 18.8 atm at $15^\circ C$. What will be the vapour pressure of this solution at $100^\circ C$ (Density of water at $100^\circ C \approx 1g/cc$) ?

Watch Video Solution

65. Calculate the osmotic pressure at $25^{\circ}C$ of a solution containing 1g of glucose and 1g of sucrose in 1 litre of solution.

If it were not known that the solute was a mixture of glucose and sucrose, what would be the molecular weight of solute corresponding to the calculated osmotic pressure ?

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66. 100 mL aqueous solution of glucose with osmotic pressure 1.2 atm at $25^{\circ}C$ is mixed with 300 mL aqueous solution of urea at 2.4 atm at $25^{\circ}C$. Calculate the osmotic pressure of mixture.

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Set-1 (Level-A)

1. A solution is defined as a :

A. homogeneous mixture of two or more substances

B. heterogeneous mixture of two or more substances

C. homogeneous mixture of liquid and soild components only

D. homogeneous mixture consisting of water as one of the components

Answer: A

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2. Ideal solution is formed when its components :

A. have zero heat of mixing only

B. have zero volume change on mixing only

C. have zero heat of mixing and zero volume change

D. can be converted into gases

Answer: C

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3. Solution distilled without change in composition at a temperature is called

A. amporphous

B. azeotropic mixture

C. supersaturated

D. ideal

Answer: B

Watch Video Solution

4. Azeotropic mixtures are

A. mixture of two solids

B. those which boil at different temperatures

C. those which can be fractionally distilled

D. constant boiling mixtures

Answer: D

Watch Video Solution

5. The solubility of a gas in a liquid is directly proportional to the pressure of the gas. This statement is :

A. Raoult's law

B. Henry's law

C. van't Hoff law

D. none of these

Answer: B

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6. Which of the following is not correct for an ideal solution ?

A. Raoult's law is obeyed for entire concentration range and temperatures

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

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

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

Answer: D

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7. Solubility of a gas in a liquid solvent increases with

A. increase in temperature

B. reduction of gas pressure

C. decrease in temperature and increase of gas pressure

D. amount of liquid taken

Answer: C

Watch Video Solution

8. Saturated solution of NaCl on heating becomes :

A. supersaturated

B. unsaturated

C. remains saturated

D. none of these

Answer: B

Watch Video Solution

9. A supersaturates solution is a metastable state of solution in which solute concentration:

A. is equal to the solubility of the substance in solvent

B. is less than the solubility

C. exceeds the solubility

D. continuously changes

Answer: C

Watch Video Solution

10. When a crystal of a solute is introduced into a supersaturated solution of the solute :

A. the solute dissolves

B. the solution becomes unsaturated

C. the solution remains supersaturated

D. the excess of solute crystallises out

Answer: D

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11. An electrolyte dissolves in water if :

A. lattice energy is less than hydration energy

B. lattice energy is greater than hydration energy

C. lattice energy is equal to hydration energy

D. dissolution in endothermic

Answer: A

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12. The solubility of a substance is defined as the amount of solute in grams :

A. present in 100g of the solvent

B. present in 100g of the solution

C. present in 100 mL of the solution

D. present in 1 litre of the solution

Answer: A

Watch Video Solution

13. Which of the following will form an ideal solution ?

A. C_2H_5OH and water

B. HNO_3 and water

C. $CHCl_3 \text{ and } CH_3COCH_3$

D. $C_6H_6 \text{ and } C_6H_5CH_3$

Answer: D

Watch Video Solution

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

A. $C_6H_6 \text{ and } C_6H_5CH_3$

B. $C\,\hat{}\,H_6 \text{ and } CCl_4$

C. $ChCl_3 \text{ and } C_2H_3OH$

D. $CHCl_3 \text{ and } CH_3COCH_3$

Answer: C

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15. Which of the following shows negative deviation from Raoult's law?

A. $CHCl_3$ and acetone

B. $C_6H_6 \text{ and } C_2H_5OH$

C. $C_6H_5CH_3 \text{ and } C_6H_6$

D. $C_6H_6 \text{ and } CCl_4$

Answer: A

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16. An azeotropic solution of two liquids has a boiling point lower than either of them when it:

A. it is saturated

B. it does not deviate from Raoult's law

C. it show negative deviation from Raoult's law

D. it shows positive deviation from Raoult's law

Answer: D

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17. A maxima or minima obtained in the temperature composition curve of a mixture of two liquids indicates:

A. an azetropic mixture

B. an eutectic formation

C. that the liquids are immiscible with on another

D. that the liquids are partially miscible at the maximum or minimum

Answer: A

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18. Which one of the following is not an ideal solution?

A. $C_6H_6 \text{ and } C_6H_5CH_3$

B. $C_2H_5Cl \text{ and } C_2H_5OH$

C. $C_6H_5Cl \text{ and } C_6H_5Br$

D. $C_2H_5Br \text{ and } C_2H_5I$

Answer: B

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19. Which of the following solution pairs can be separated by fractional distillation ?

A. Water-HNO_3

B. Water-HCl

C. Benzene-toluene

D. C_2H_5OH-water

Answer: C

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20. When two liquids A and B are mixed, their boiling points become greater than both of them. The mixture is :

A. ideal solution

B. non-ideal solution with negative deviation from Raoult's law

C. non-ideal solution with positive deviation from Raoult's law

D. normal solution

Answer: B

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21. The azetrophic mixture of water (b.pt. $100^\circ C$) and HCl (b.pt. $85^\circ C$) boils at $108.5^\circ C$. What this mixture is distilled, it is possible to obtain :

A. pure HCl

B. pure water

C. pure water as well as HCl

D. neither HCl nor H_2O in their pure states

Answer: D

View Text Solution

22. Pressure cooker reduces cooking time because :

A. the heat is more evenly distributed inside the cooker

B. a large flame is used

C. boiling point of water is elevated

D. whole matter is converted into steam

Answer: C

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23. A molal solution is one that contains one mole of a solute in

A. 1000 g of the solvent

B. one litre of the solution

C. one litre of the solvent

D. 22.4 litre of the solution

Answer: A

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24. In which mode of expression, the concentration of a solution remains independent of temperature?

A. Normality

B. Molality

C. Molarity

D. Formality

Answer: B

Watch Video Solution

25. An aqueous solution of glucose was prepared by dissolving 18g of glucose in 90g of water. The relative lowering in vapour pressure is

A. 6

B. 0.2

C. 5.1

D. 0.02

Answer: D

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26. If 18 g of glucose is present in 1000 g of solvent, the solution is said to be

A. 1 molar

B. 0.1 molar

C. 0.5 molal

D. 0.1 molal

Answer: D

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27. The molarity of pure water is

A. 100 M

B. 55.6 M

C. 5- M

D. 18 M

Answer: B

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28. Mole fraction of the solute in a 1 molal aqueous solution is :

A. 1.77

B. 0.177

C. 0.0177

D. 0.0344

Answer: C

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29. Mole fraction of $C_3H_5(OH)_3$ in a solution of $36g$ of water and $46g$ of glycerine is:

A. 0.46

B. 0.36

C.

D. 0.20

Answer: C

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30. H_2O_3 solution used for hair bleachingm is sold as a solution approximately 5.0 g H_2O_2 per 100 mL of the solution. The molecular mass of H_2O_2 is 34. The molarity of this solution approximately :

A. 0.15 M

B. 1.5 M

C. 3.0 M

D. 3.4 M

Answer: B

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31. The number of moles of solute per kg of a solvent is called its :

A. molarity

B. normality

C. mole fraction

D. molality

Answer: D

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32. 1000 gram aqueous solution of $CaCO_3$ contains 10 gram of carbonate. Concentration of solution is:

A. 10 ppm

B. 100 ppm

C. 1000 ppm

D. 10000 ppm

Answer: D

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33. A solution of $CaCl_2$ is 0.5 mol/litre , then the moles of chloride ion in 500 mL will be :

A. 0.5

B. 0.25

C. 1.0

D. 0.75

Answer: B

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34. What is the normality of 1 M H_3PO_4 solution ?

A. 0.5 N

B. 1.0 N

C. 2.0 N

D. 3.0 N

Answer: D

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35. The molarity of a 0.2 N Na_2CO_3 solution will be :

A. 0.05 M

B. 0.2 M

C. 0.1 M

D. 0.4 M

Answer: C

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36. Colligative properties of the solution depend upon :

A. nature of the solution

B. nature of the solvent

C. number of solute particles

D. number of mole of solvent

Answer: C

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37. Which of the following is a colligative property ?

A. Surface tension

B. Osmotic pressure

C. Optical rotation

D. Viscosity

Answer: B

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38. Which os not a colligative property ?

A. Osmotic pressure

B. Lowering in vapour pressure

C. Depression in freezing point

D. Optical activity

Answer: D

Watch Video Solution

39. Colligative properties are applicable to :

A. ideal dilute solutions

B. concentrated solutions

C. non-ideal solutions

D. all of these

Answer: A

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40. On mixing, heptane and octane form an ideal solution. At $373K$ the vapour pressure of the two liquid components (heptane and octane) are $105kPa$ and kPa respectively. Vapour pressure of the solution obtained by mixing 25.0 of heptane and $35g$ of octane will be (molar mass of heptane $= 100gmol^{-1}$ and of octane $= 114gmol^{-1}$):-

A. 96.2 kPa

B. 144.5 kPa

C. 72 kPa

D. 36.1 kPa

Answer: C

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41. The vapour pressure of water at room temperature is 30 mm of Hg. If the mole fraction of the water is 0.9, the vapour pressure of the solution will be :

A. 30 mm of Hg

B. 24 mm of Hg

C. 21 mm of Hg

D. 27 mm of Hg

Answer: D

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42. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300K. The vapour pressure of propyl alcohol is 200 mm. if the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

A. 360

B. 350

C. 300

D. 700

Answer: B

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43. The vapour pressure of a dilute aqueous solution of glucose is 750 mm of mercury at 373 K . The mole fraction of solute is :

A. $\frac{1}{10}$

B. $\frac{1}{76}$

C. $\frac{1}{35}$

D. $\frac{1}{76}$

Answer: D

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

A. 14 torr

B. 56 torr

C. 140 torr

D. 70 torr

Answer: C

Watch Video Solution

45. The vapour pressure of water at room temperature is 23.8 mm Hg. The vapour pressure of an aqueous solution of sucrose with mole fraction 0.1 is equal to :

A. 23.9 mm Hg

B. 242 mm Hg

C. 21.42 mm Hg

D. 31.44 mm Hg

Answer: C

Watch Video Solution

46. The vapour pressure of pure liquid A is 10 torr and at the same temperature when 1 g solid B is dissolved in 20g of A , its vapour pressure is reduced to9.0torr . If the molecular mass of A is 200amu , then the molecular mass of B is

A. 100 amu

B. 90 amu

C. 75 amu

D. 120 amu

Answer: B

Watch Video Solution

47. If the various terms in the following expressions have usual meanings, the van't Hoff factor 'i' cannot be calculated by which of the following expression ?

A. $\pi V = \sqrt{inRT}$

B. $\Delta T_f = i \times K_f \times m$

C. $\Delta T_b = i \times K_b \times m$

D. $\dfrac{P^o_{\text{solvent}} - P_{\text{solution}}}{P^o_{\text{solvent}}} = i\left[\dfrac{n}{N+n}\right]$

Answer: A

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48. Semipermeable membrane is that which permits the passage of :

A. solute molecules only

B. solvent molecules only

C. solvent and solute molecules both

D. neither solute nor solvent molecules

Answer: B

Watch Video Solution

49. Which inorganic precipitate acts as semipermeable membrane ?

A. Calcium sulphate

B. Barium oxalate

C. Nickel phosphate

D. Copper ferrocyanide

Answer: D

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50. During osmosis, flow of water through a semipermeable membrane is:

A. from solution having higher concentration only

B. from both sides of semipermeable membrane with equal flow rates

C. from both sides of semipermeable membrane with unequal flow rates

D. from solution having lower concentration only

Answer: D

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51. The osmotic pressure of a solution of benzoic acid dissolved in benzene is less than expected because:

A. benzoic acid is organic solute

B. benzoic acid has higher molar mass than benzene

C. benzoic acid gets associated in benzene

D. benzoic acid gets dissociated in benzene

Answer: C

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52. Blood cells do not shrink in blood because blood is

A. hypertonic

B. isotonic

C. equimolar

D. hypotonic

Answer: B

Watch Video Solution

53. A gas 'X' is dissolved in water at 2 bar pressure. Its mole fraction is 0.02 in solution. The mole fraction water when the pressure of gas is doubled at the same temperature is :

A. 0.04

B. 0.98

C. 0.96

D. 0.02

Answer: C

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54. The osmotic pressure of solution increases if :

A. increasing the temperature of the solution

B. decreasing the temperature of the solution

C. increasing the volume of the vessel

D. diluting the solution

Answer: A

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55. The osmotic pressure of a 5% solution of cane sugar (molecular mass 342) at $15^{\circ}C$ is :

A. 3.46 atm

B. 3.64 atm

C. 4.0 atm

D. 2.45 atm

Answer: A

Watch Video Solution

56. A solution has an osmotic pressure of 0.821 atm at 300 K. Its concentration would be :

A. 0.66 M

B. 0.32 M

C. 0.066 M

D. 0.03 M

Answer: D

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57. If 3g of glucose (molecular mass 180) is dissolved in 60g of water at $15^\circ C$, then the osmotic pressure of this solution will be :

A. 0.34 atm

B. 0.65 atm

C. 6.57 atm

D. 5.57 atm

Answer: C

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58. Two solutions of KNO_3 and CH_3COOH are prepared separately. The molarity of both is $0.1M$ and osmotic pressure is P_1 and P_2, respectively.

The correct relationship between the osmotic pressure is

A. $P_1 = P_2$

B. $P_2 > P_1$

C. $\frac{P_1}{P_1 + P_2} = \frac{P_2}{P_1 + P_2}$

D. $P_1 > P_2$

Answer: D

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

A. 1.5 P

B. P

C. 0.5 P

D. 0.75 P

Answer: A

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60. 1 molar solution of a non-volatile and non-electrolyte compound will produce an osmotic pressure â€¦.. At $0^\circ C$

A. 1 atm

B. 44.8 atm

C. 0.5 atm

D. 0.75 atm

Answer: D

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61. If 0.1 N solution of glucose and 0.1 M urea solution are placed on two sides of a semipermeable membrane to equal heights, then it will be correct to say that :

A. there will be no net movement across the membrane

B. glucose will flow towards urea solution

C. urea will flow towards glucose solution

D. water will flow from urea solution towards glucose solution

Answer: A

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62. Which solution will exert highest osmotic pressure ?

A. 1 M glucose solution

B. 1 M urea solution

C. 1 M alum solution

D. 1 M NaCl solution

Answer: C

Watch Video Solution

63. Which is the correct relation between osmotic pressure of 0.1 M NaCl solution and 0.1 M Na_2SO_4 solution ?

A. The osmotic pressure of Na_2SO_4 is less than NaCl solution

B. The osmotic pressure of Na_2SO_4 is more than NaCl solution

C. Both have same osmotic pressure

D. None of the above

Answer: B

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64. A 0.6% urea solution would be isotonic with :

A. 0.1 M glucose solution

B. 0.1 M KCl solution

C. 0.6% glucose solution

D. 0.6% NaCl solution

Answer: C

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65. Which of the following aqueus solution has highest freezing point ?

A. 0.1 molal $Al_2(SO_4 \_ (3))$

B. 0.1 molal $BaCl_2$

C. 0.1 molal $AlCl_3$

D. 0.1 molal NH_4Cl

Answer: D

Watch Video Solution

66. The following solutions have equal concentrations. Which one will show minimum osmotic pressure ?

A. $BaCl_2$

B. $AgNO_3$

C. Na_2SO_4

D. $(NH_4)_3PO_4$

Answer: B

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67. A solution of substance containing 1.05 g per 100 mL was found to be isotonic with 3% glucose solution . The molecular mass of the substance is :

A. 31.5

B. 6.3

C. 630

D. 63

Answer: D

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68. The order of osmotic prssure of equimolar solutions of $BaCl_2, NaCl$ and glucose will be:

A. glucose $>$ NaCl $> BaCl_2$

B. $BaCl_2 >$ NaCl $>$ glucose

C. NaCl $> BaCl_2 >$ glucose

D. NaCl $>$ glucose $> BaCl_2$

Answer: B

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69. At $25^\circ C$, the highest osmotic pressure is exhibited by 0.1 M solution of :

A. $CaCl_2$

B. KCl

C. glucose

D. urea

Answer: A

Watch Video Solution

70. The plant cell will shrink when placed in :

A. water

B. a hypotonic solution

C. a hypertonic solution

D. an isotonic solution

Answer: C

Watch Video Solution

71. The osmotic pressure of a solution at 273 K is 2.5 atm. Its osmotic pressure at 546 K under similar conditions will be :

A. 0.5 atm

B. 1.0 atm

C. 2.5 atm

D. 5.0 atm

Answer: D

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72. Which one of the following pairs of solutions will be expected to be isotonic under the same temperature ?

A. 0.1 M urea and 0.1 M NaCl

B. 0.1 M urea and 0.2 M $MgCl_2$

C. 0.1 M NaCl and M Na_2SO_4

D. $0.1MCa(NO_3)_2$ and $0.1MNa_2SO_4$

Answer: D

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73. An aqueous solution of methanol in water has vapour pressure:

A. less than that of water

B. equal to that of water

C. more than that of water

D. equal to that os methanol

Answer: A

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74. An aqueous solution is 1 molal in KI. Which change will cause the vapour pressure of the solution to increase ?

A. Addition of NaCl

B. Assition of Na_2SO_4

C. Addition of 1 molal KI

D. Addition of water

Answer: D

View Text Solution

75. A solution of urea contains 8.6 g per litre. It is isotonic with 5% solution of a non-volatile solute. The molecular mass of the solute will be :

A. 349

B. 34.9

C. 3490

D. 861

Answer: A

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76. The hard shell of an egg was dissolved in HCl. The egg was then placed in a concentrated solution of NaCl. What will happen ?

A. The egg will shrink

B. The egg wil swell

C. The egg will become harder

D. There will be hardly any visible change

Answer: A

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77. The molal elevation constant is the ratio of the elevation in boiling point to :

A. molarity

B. molality

C. mole fraction of solute

D. mole fraction of solvent

Answer: B

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78. In cold countries, ethylene glycol is added to water in the radiators of cars during winters. It results in:

A. reducing viscosity

B. reducing specific heat

C. reducing freezing point

D. reducing boiling point

Answer: C

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

A. relative lowering in vapour pressure

B. osmotic pressure

C. elevation in boiling point

D. depression in freezing point

Answer: B

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80. Ebullioscopy is concerned with :

A. osmotic pressure of a solution

B. elevation of boiling point of a solution

C. depression in freezing point of a solution

D. relative lowering in vapour pressure of a solution

Answer: B

Watch Video Solution

81. Cryoscopy is concerned with :

A. osmotic pressure of a solution

B. elevation of boiling point of a solution

C. depression in freezing point of a solution

D. relative lowering in vapour pressure of a solution

Answer: C

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82. Molecular mass of non-volatile solute can be determined by :

A. Cryoscopic method

B. Victor-Meyer's method

C. Graham's method

D. Duma's method

Answer: A

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83. Beckmann's thermometer measures :

A. boiling point of the solution

B. freezing point of the solution

C. any temperature

D. elevation in boiling point or depression in freezing point

Answer: D

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84. The freezing point of 1% of lead nitrate solution in water will be :

A. $2^\circ C$

B. $1^\circ C$

C. $0^\circ C$

D. below $0^\circ C$

Answer: D

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85. A solution of 1.25g of a certain non-volatile substance in 20g of water freezes at 271.94K. Calculate the molecular mass of the solute $\left(K_f = 1.86 \text{ K kg mol}^{-1}\right)$.

A. 207.8

B. 179.79

C. 209.6

D. 109.5

Answer: D

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86. The freezing point order of the solution of glucose is :

A. $10\% > 3\% > 2\% > 1\%$

B. $1\% > 2\% > 3\% > 10\%$

C. $1\% > 3\% > 10\% > 2\%$

D. $10\% > 1\% > 3\% > 2\%$

Answer: B

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87. Which one of the following solutions has the highest b.pt ?

A. $0.1 M NaCl$

B. 0.1 M urea

C. 0.1 M $BaCl_2$

D. 0.1 M glucose

Answer: C

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88. The freezing point of 1 molal $NaCl$ solution assuming $NaCl$ to be 100% dissociated in water is:

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

B. $-3.72^{\circ}C$

C. $+1.86^{\circ}C$

D. $+3.72^{\circ}C$

Answer: B

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89. The freezing point among the following equimolal aqueous solutions will be highest for

A. $C_6H_5NH_3Cl$

B. $Ca(NO_3)_2$

C. $La(NO_3)_3$

D. $C_6H_{12}O_6$ (glucose)

Answer: D

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90. Elevation in boiling point was $0.52^\circ C$ when 6 g of a compound X was dissolved in 100 g of water. Molecular weight of X is (K_b of water is $5.2^\circ C$ per 100 g of water)

A. 120

B. 60

C. 600

D. 180

Answer: B

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91. The molal freezing point for water is $1.86^{\circ} Cmol^{-1}$. If 342g of cane sugar is dissolved in 1000 mL of water, the solution will freeze at

A. $1.86^{\circ} C$

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

C. $-3.92^{\circ} C$

D. $3.92^{\circ} C$

Answer: B

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92. The molal elevation constant of water is 0.51. The boiling point of 0.1 molal aqueous NaCl solution is nearly :

A. $100.05^{\circ} C$

B. $100.1^{\circ} C$

C. $100.2^{\circ} C$

D. $101.0^\circ C$

Answer: B

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93. The molal elevation of an unknown solution is equal to the molal elevation of 0.1 M solution of urea. The concentration of unknown solution is :

A. 1M

B. 0.01 M

C. 0.1 M

D. none of these

Answer: C

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94. Benzoic acid dissolved in benzene shows a molecular weight of:

A. 122

B. 61

C. 244

D. 366

Answer: C

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95. If the observed and normal osmotic pressures of a KCl solution are 5.85 and 3.20 atm, the degree of dissociation of KCl is :

A. 1

B. 0.082

C. 0.82

D. 0.28

Answer: C

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96. The van't Hoff factor of a 0.005 M aqueous solution of KCl is 1.95. The degree of ionisation of KCl is :

A. 0.95

B. 0.97

C. 0.94

D. 0.96

Answer: A

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97. If the observed and normal osmotic pressure of 1% NaCl solution are 5.7 and 3.0 atm, the degree of dissociation of NaCl is :

A. 0.9

B. 1.0

C. 0.57

D. 0.3

Answer: A

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98. Which one of the following salts would have the same value of the van't Hoff factor as that of $K_3Fe(CN)_6$?

A. $Al_2(SO_4)_3$

B. NaCl

C. Na_2SO_4

D. $Al(NO_3)_3$

Answer: D

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99. Equimolal solutions A and B show depression in freezing point in the ratio $2:1$. A remains in the normal state in solution. B will be

A. normal

B. associated

C. hydrolysed

D. dissociated

Answer: B

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100. The values of observed and calculated molecular weights of calcium nitrate are respectively 65.6 and 164. The degree of dissociation of calcium nitrate will be:

A. 0.25

B. 0.50

C. 0.60

D. 0.75

Answer: D

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101. A solution containing 3.3g of a substance in 125g of benzne (b.pt = $80^{\circ}C$) boils at $80.66^{\circ}C$. If K_b for benzene is 3.28K kg mol^{-1} the molecular mass of the substance will be :

A. 130.20

B. 129.20

C. 132.20

D. 131.20

Answer: D

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102. The elevation in boiling point of a solution of 10g of a binary electrolyte (molecular mass 100) in 100g of water is ΔT_b. The value of K_b for water is :

A. $\frac{\Delta T_b}{2}$

B. 10

C. $10\Delta T_b$

D. $\frac{\Delta T_b}{10}$

Answer: A

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103. The freezing point depression constant for water is $-1.86^\circ Cm^{-1}$. if $5.00gNa_2SO_4$is dissolved in $45.0gH_2O$,the freezing point is changed by $-3.82^\circ C$,Calculate the van't Hoff factor for Na_2SO_4

A. 0.381

B. 2.05

C. 2.63

D. 3.11

Answer: C

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104. Equal volumes of M/20 urea solution and M/20 glucose solution are mixed. The mixture will have osmotic pressure :

A. equal to either of the solution

B. less than either of the solution

C. higher than either of the solution

D. zero

Answer: A

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105. Assuming the salts to be unionised in solution, which of the following has highest osmotic pressure ?

A. 1% CsCl

B. 1% RbCl

C. 1% KCl

D. 1% NaCl

Answer: D

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106. Pure benzne freezes at $5.3^\circ C$. A solution of 0.223g of phenyl acetic acid $(C_6H_5CH_2COOH)$ in 4.4g of benzene $\left(K_f = 5.12\text{K kg mol}^{-1}\right)$ freezes at $4.47^\circ C$. From the observation one can conclude that :

A. phenyl acetic acid exists as such in benzene

B. phenyl acetic acid undergoes partial ionization in benzene

C. phenyl acetic acid undergoes complete ionization in benzene

D. phenyl acetic acid dimerizes in benzene

Answer: D

View Text Solution

107. The movement of solvent molecules from higher concentration to lower concentration through semipermeable membrane under pressure is termed :

A. osmosis

B. reverse osmosis

C. dialysis

D. diffusion

Answer: B

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108. During depression of freezing point in a solution, the following are in equilibrium:

A. liquid solvent and solid solvent

B. liquid solute and solid solvent

C. liquid solute and solid solute

D. liquid solvent and solid solute

Answer: A

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109. The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to :

A. ionisation of benzoic acid

B. dimerization of benzoic acid

C. trimerization of benzoic acid

D. solvation of benzoic acid

Answer: B

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110. 0.15g of a subatance dissolved in 15g of solvent boiled at a temperature higher at 0.216° than that of the pure solvent. Calculate the molecular weight of the substance. Molal elecation constant for the solvent is $2.16^{\circ}C$

A. 1.01

B. 10

C. 10.1

D. 100

Answer: D

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111. The vapour pressure of pure benzene at a certain temperature is $640mm$ of Hg. A non-volatile non-electrolyte solid weighing $2.175g$ added $39.0g$ of benzene. The vapour pressure of the solution is $600mm$ of Hg. What is the molecular weight of solid substance?

A. 49.50

B. 59.6

C. 69.5

D. 79.8

Answer: C

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112. A 5% (w/V) solution of cane sugar (molecular mass = 342) is isotonic with 1% (w/V) solution of a subtance X. The molecular mass of X is :

A. 34.2

B. 171.2

C. 68.4

D. 136.8

Answer: C

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

A. 0.8

B. 0.6

C. 0.4

D. 0.2

Answer: B

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114. Ethylene glycol is used as an antifreeze in a cold cliamate Mass of ethylene glycol which should be added to 4 kg for water to prevent it from freezing at $-6^{\circ}C$ will be (K_f for water =$1.86Kkgmol^{-1}$ and molar mass of ethylene glycol =$62gmol^{-1}$)

A. 304.6 g

B. 804.32 g

C. 204.3 g

D. 400.00 g

Answer: B

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115. A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution ?

A. The solution formed is an ideal solution

B. The solution is non-ideal, showing positive deviation from Raoult's law

C. The solution is non-ideal, showing negative deviation from Raoult's law

D. n-heptane shows positive deviation, while ethanol shows negative deviation from Raoult's law.

Answer: B

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116. X is a non-volatile solute and Y is volatile solvent. The following vapour pressures are obtained by dissolving X in Y

$X/molL^{-1}$	$Y/mmHg$
0.1	P_1
0.25	P_2
0.01	P_3

The correct order of vapour pressure is :

A. $P_1 < P_2 < P_3$

B. $P_3 < P_2 < P_1$

C. $P_3 < P_1 < P_2$

D. $P_2 < P_1 < P_3$

Answer: D

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117. $12.2gm$ benzoic acid $(M = 122)$ in $100gH_2O$ has elevation of boiling point of $0.27^\circ C, K_b = 0.54K$ kg/mole. If there is $100\,\%$ dimerization the no.of molecules of benzoic acid in associated sate is:

A. 1

B. 2

C. 3

D. 4

Answer: B

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118. For $[CrCl_3 . xNH_3]$, elevation in boiling point of one molal solution is double of one molal solution of glucose , hence x is if complex is 100% ionised :

A. 4

B. 5

C. 6

D. 3

Answer: A

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

A. Glycerol

B. Methanol

C. Both are equal

D. None of these

Answer: B

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120. Two liquids A and B have $P_A^0 : P_B^0 = 1 : 3$ at a certain temperature. If the mole fraction ratio of $x_A : x_B = 1 : 3$, the mole fraction of A in vapour in equilibrium with the solution at a given temperature is :

A. 0.1

B. 0.2

C. 0.5

D. 1.0

Answer: A

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121. Relationship between osmotic pressure at 273 K when 1% glucose (π_1), 1% urea (π_2), 81% sucrose (π_3) are dissolved in 1 litre of water :

A. $\pi_1 > \pi_2 > \pi_3$

B. $\pi_2 > \pi_1 > \pi_3$

C. $\pi_3 > \pi_1 > \pi_2$

D. $\pi_1 = \pi_2 = \pi_3$

Answer: B

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122. Which of the following property indicates weak intermolecular forces of attraction in liquid ?

A. High heat of vaporization

B. High vapour pressure

C. High critical temperature

D. High boiling point

Answer: B

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123. One mole of non-volatile solute is dissolved in two mole of water. The vapour pressure of the solution relative to that of water is:

A. $2/3$

B. $1/3$

C. $3/2$

D. $1/2$

Answer: A

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124. The highest temperature at which vapour pressure of a liquid can be measured is :

A. critical temperature

B. inversion temperature

C. critical solu. Temperature

D. b.pt of liquid

Answer: D

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125. The expression relating molality (m) and mole fraction (x_2) of solute in a solution is :

A. $x_2 = \frac{mM_1}{1 + mM_1}$

B. $x_2 = \frac{mM_1}{1 - mM_1}$

C. $x_2 = \frac{1 + mM_1}{mM_1}$

D. $x_2 = \frac{1 - mM_1}{mM_1}$

Answer: A

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126. The degree of dissociation (α) of a weak electrolyte A_xB_y is related to van't Hoff factor (i) by the expression

A. $\alpha = \frac{x+y+1}{i-1}$

B. $\alpha = \frac{i-1}{x+y-1}$

C. $\alpha = \frac{i-1}{x+y+1}$

D. $\alpha = \frac{x+y-1}{i-1}$

Answer: B

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127. The best and accurate method for determining osmotic pressure is :

A. negative pressure method

B. Berkeley and Hartley method

C. Morse and Frazer method

D. Preffer's method

Answer: B

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128. If all the following four compounds were sold at the same price, which would be cheapest for preparing an antifreeze solution for a car radiator ?

A. CH_3OH

B. C_2H_5OH

C. $C_2H_5(OH)_2$

D. $C_3H_5(OH)_3$

Answer: A

View Text Solution

129. What is the osmotic pressure of the solution obtained by mixing $300cm^3$ of 2% (mass-volume) solution of urea with $300cm^3$ of 3.43 % solution of sucrose of $20^\circ C$?

$\left(R = 0.082\text{L atm K}^{-1}\text{mol}^{-1}\right)$

A. 5 atm

B. 5.2 atm

C. 2.6 atm

D. 4.5 atm

Answer: B

View Text Solution

130. A solution of 1 molal concentration of a solute will have maximum boiling point elevation when the solvent is :

A. ethyl alcohol

B. acetone

C. benzene

D. chloroform

Answer: C

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131. Isotonic solutions have :

A. same boiling point

B. same vapour pressure

C. same melting point

D. same osmotic pressure

Answer: D

Watch Video Solution

132. The depressions in freezing point for 1 M urea, 1 M glucose and 1M NaCl are in the ration :

A. $1:2:3$

B. $3:2:2$

C. $1:1:2$

D. none of these

Answer: C

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133. An aqueous solution of $6.3g$ oxalic acid dihydrate is made up to $250mL$. The volume of $0.1NNaOH$ required to completely neutralise $10mL$ of this solution is

A. 40 mL

B. 20 mL

C. 10 mL

D. 4 mL

Answer: A

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134. The vapour pressure of pure liquid solvent A is $0.80 atm$. When a non-volatile substance B is added to the solvent, its vapour pressure drops to $0.60 atm$, the mole fraction of component B in the solution is

A. 0.25

B. 0.50

C. 0.75

D. 0.90

Answer: A

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135. An aqueous solution of sucrose, $C_{12}H_{22}O_{11}$, containing 23.2g/L has an osmotic pressure of 2.38 atmosphere at $17^{\circ}C$, For an aqueous solution of glucose, $C_6H_{12}O_6$, to be isotonic with this solution, it would have :

A. 34.3 g/L

B. 17.1 g/L

C. 18.0 g/L

D. 36.0 g/L of glucose

Answer: C

View Text Solution

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136. The molal b.pt constant for water is $0.513^{\circ}C\text{kg mol}^{-1}$. When 0.1 mole of sugar is dissolved in 200g of water, the solution boils under a pressure of 1 atm at :

A. $100.513^\circ C$

B. $100.0513^\circ C$

C. $100.256^\circ C$

D. $101.025^\circ C$

Answer: C

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137. The correct expression relating molality (m), molarity (M), density of solution (d) and molar mass (M_2) of solute is :

A. $m = \dfrac{M}{d + MM_2}$

B. $m = \dfrac{M}{d - MM_2}$

C. $m = \dfrac{d + MM_2}{M}$

D. $m = \dfrac{d - MM_2}{M}$

Answer: B

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138. The expression relating mole fraction of solute (x_2) and molarity (M) of the solution is :

(where ρ is the density of solution and M_1 and M_2 are the molar masses of solvent and solute, respectively.)

A. $x_2 = \frac{MM_1}{M(M_1 - M_2) + \rho}$

B. $x_2 = \frac{MM_1}{M(M_1 - M_2) - \rho}$

C. $x_2 = \frac{M(M_1 - M_2) + \rho}{MM_1}$

D. $x_2 = \frac{M(M_1 - M_2) - \rho}{MM_1}$

Answer: A

View Text Solution

139. The boiling point of a solution of 0.11 of a substance in 15g of ether was found to be $0.1^{\circ}C$ higher than that of pure ether. The molecular weight of the substance will be $(K_b = 2.16)$:

A. 148

B. 158

C. 168

D. 178

Answer: B

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140. 2.5 litre of 1 M NaOH solution are mixed with another 3 litre of 0.5 M NaOH solution Then the molarity of the resulting

A. 0.80 M

B. 1.0 M

C. 0.73 M

D. 0.50 M

Answer: C

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141. In mixture A and B ,components show -ve deviations as:

A. $\Delta V_{\text{mix}} > 0$

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

C. A -B interaction is weaker than A - A and B - B interactions

D. none of the above reasons is correct

Answer: B

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142. A solution contains non-volatile solute of molecular mass M_2 which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure?

(m_2 =mass of solute,V=volume of solution,π =osmotic pressure)

A. $M_2 = \frac{m_2}{\pi} VRT$

B. $M_2 = \left(\frac{m_2}{V}\right)\frac{RT}{\pi}$

C. $M_2 = \left(\frac{m_2}{V}\right)\pi RT$

D. $M_2 = \left(\frac{m_2}{V}\right)\frac{\pi}{RT}$

Answer: B

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143. 0.6g of an organic compound when dissolved in 21.7 g water freezes at 272.187 K. The molar mass of the organic compound is close to :

(K_f of warer is 1.86 deg/molality , freezing point is 273 K)

A. 61 g mol^{-1}

B. 63 g mol^{-1}

C. 65 g mol^{-1}

D. 67 g mol^{-1}

Answer: B

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144. Osmotic pressure of a urea solution at $10^{\circ} C$ is 500 mm. Osmotic pressure of the solution become 105.3 mm. When it is diluted and temperature raised to $25^{\circ} C$.The extent of dilution is

A. 8 times

B. 5 times

C. 4 times

D. 7 times

Answer: B

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145. The average osmotic pressure of human blood is 7.8 bar at $37^{\circ}C$. What is the concentration of an aqueous$NaCl$solution that could be used in the blood stream ?

A. 0.15 mol/L

B. 0.30 mol/L

C. 0.45 mol/L

D. 0.60 mol/L

Answer: B

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146. Camphor is often used in molecular mass determination because

A. it is readily available

B. it has very high cryoscopic constant

C. it is volatile

D. it is a solvent for organic susbtances

Answer: B

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147. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.010 M solution of glucose at same temperature. The apparent degree of dissociation fo Na_2SO_4 is

A. 0.25

B. 0.5

C. 0.75

D. 0.85

Answer: C

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148. Which of the following liquid pairs shows a positive deviation from Raoult's law?

A. Water-hydrochloric acid

B. Benzene-methanol

C. Water-nitric acid

D. Acetone-chloroform

Answer: B

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149. Which one of the following statements is false ?

A. Raolt's law states that vapour pressure of a component over a solution is proportional to mole fraction.

B. The osmotic pressure (π) of a solution is given by the reation $\pi = MRT$ where M is molarity of the solution

C. The correct order of osmotic pressure of 0.01 M aqueous solution of each component is :

$BaCl_2 > KCl > CH_3COOH > \text{Sucrose}$

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

Answer: D

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

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

A. $-0.372^\circ C$

B. $-0.520^\circ C$

C. $+0.372^\circ C$

D. $-0.570^\circ C$

Answer: A

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151. Which of the following is incorrect ?

A. Relative lowering of vapour pressure is independent of the nature of the solute and the solvent

B. The vapour pressure is a colligative property

C. Vapour pressure of a solution is lower than that of the solvent

D. The relative lowering of vapour pressure is directly proportional to the original pressure

Answer: D

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152. Calculate the molal depression constant of a solvent which has

a. Freezing point $16.6^{\circ} C$ and latent heat of fusion $180.75 J g^{-1}$.

b. Freezing point $20.0^{\circ} C$ and latent heat of fusion $200.00 J g^{-1}$.

A. 2.68

B. 3.86

C. 4.68

D. 2.86

Answer: B

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153. If for the sucrose solution elevation in boiling point is $0.1^{\circ} C$then what will be the boiling point of NaCl solution for same molal concentration

A. $0.1^{\circ} C$

B. $0.2^\circ C$

C. $0.08^\circ C$

D. $0.01^\circ C$

Answer: B

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154. Which has minimum osmotic pressure ?

A. 200 mL of 2 M NaCl solution

B. 200 mL of 1 M glucose solution

C. 200 mL of 2 M urea solution

D. All have same

Answer: B

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155. Solution A contains 7 g/L of $MgCl_2$ and solution B contains 7 g/L of NaCl. At room temperature, the osmotic pressure of :

A. solution A is greater than B

B. both have same osmotic pressure

C. solution B is greater than A

D. can't determine

Answer: A

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156. The van't Hoff factor for $BaCl_2$ at 0.01 M concentration is 1.98. The percentage dissociation of $BaCl_2$ at this concentration is :

A. 49

B. 69

C. 89

D. 98

Answer: A

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157. Equimolar solutions in the same solvent have-

A. same boiling point but different freezing points

B. same freezing point but different boiling points

C. same freezing and boiling points

D. different freezing and boiling points

Answer: D

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158. After adding non-volatile solute, freezing point of water decreases to $-0.186^\circ C$. Calculate ΔT_b if :

$K_f = 1.86 \text{K kg mol}^{-1}$ and $K_b = 0.521 \text{K kg mol}^{-1}$

A. 1.86

B. 0.521

C. 0.0186

D. 0.0521

Answer: D

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159. The osmotic pressure of a solution of benzoic acid dissolved in benzene is less than expected because:

A. benzoic acid is an organic solute

B. benzoic acid has higher molar mass than benzene

C. benzoic acid gets associated in benzene

D. benzoic acid gets dissociated in benzene

Answer: C

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

A. 271 K

B. 273.15 K

C. 269.07 K

D. 277.23 K

Answer: C

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161. $18g$ of glucose $(C_6H_{12}O_6)$ is added to $178.2g$ of water. The vapour pressure of water for this aqueous solution at $100^\circ C$ is-

A. 759 torr

B. 7.60 torr

C. 76 torr

D. 752.4 torr

Answer: D

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162. Depression in freezing point is 6K for NaCl solution. If K_f for water is 1.86K kg mol^{-1}, amount of NaCl dissolved in 1kg water is :

A. 3.42

B. 1.62

C. 3.24

D. 1.71

Answer: B

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163. Observe the following observations :

$\pi_{obs} =$ observed colligative property

$\pi_{cal} =$ theoretical colligative property assuming normal behaviour of solute

van't Hoff factor (i) is given by :

A. $i = \pi_{obs} \times \pi_{cal}$

B. $i = \pi_{obs} + \pi_{cal}$

C. $i = \pi_{obs} - \pi_{cal}$

D. $i = \frac{\pi_{obs}}{\pi_{cal}}$

Answer: D

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164. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass $= 60gmol^{-1}$) in the same solvent. If the densities of both the solutions are assumed to be equal to $1.0gcm^{-3}$, molar mass of the substance will be:

A. 210.0 g mol^{-1}

B. 90.0 g mol^{-1}

C. 115.0 g mol^{-1}

D. 105 g mol^{-1}

Answer: A

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165. Concentrated aqueous sulphuric acid is $98\% H_2SO_4$ by mass and has a density of $1.80gmL^{-1}$. Volume of acid required to make one litre of

$0.1 M H_2SO_4$ solution is:

A. 16.65 mL

B. 22.20 mL

C. 5.55 mL

D. 11.10 mL

Answer: C

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166. If the vapour pressure of pure A and pure B at 298 K are 60 and 15 torr respectively, what would be the mole fraction of A in vapour phase (at this temperature) in a solution that contains 20 mole per cent of A in the (A + B) binary mixture in liquid phase ?

A. 0.2

B. 0.3

C. 0.5

D. 0.7

Answer: C

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167. When 20 g of naphthoic acid $(C_{11}H_8O_2)$ is dissolved in 50 g of benzene $(K_f = 1.72 K \text{kg} mol^{-1})$, a freezing point depression of 2K is observed . The van't Hoff factor (i) is :

A. 0.5

B. 1

C. 2

D. 3

Answer: A

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168. At $80^\circ C$ the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at $80^\circ C$ and 1 atm pressure, the amount of 'A' in the mixture is (1 atm $= 760mmHg$)

A. 50 mol per cent

B. 52 mole per cent

C. 34 mole per cent

D. 48 mol percent

Answer: A

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169. The vapour pressure of water at 20° is $17.5mmHg$. If $18g$ of glucose $(C_6H_{12}O_6)$ is added to $178.2g$ of water at $20^\circ C$, the vapour pressure of the resulting solution will be

A. 17.325 mm Hg

B. 17.675 mm Hg

C. 15.75 mm Hg

D. 16.5 mm Hg

Answer: A

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170. Which of the following can be measured by the Oswald-Walker dynamic method ?

A. Vapour pressure of the solvent

B. Relative lowering of vapour pressure

C. Lowering of vapour pressure

D. all of the above

Answer: B

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171. Cryoscopic constant is the depression in freezing point produced by :

A. 1% solution

B. 1 molar solution

C. 1 molal solution

D. 1 N solution

Answer: C

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172. Which among the following gas will greatly deviate from Henry's law in water ?

A. H_2

B. N_2

C. CH_4

D. CO_2

Answer: D

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173. Vapour pressure increases with increase in :

A. concentration of solution containing non-volatile solute

B. temperature upto boiling point

C. temperature upto triple point

D. altitude of the concerned place of boiling

Answer: B

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174. When mercuric iodide is added to the aqueous solution of potassium iodide, then:

A. freezing point id raised

B. freezing point is lowered

C. freezing point does not change

D. boiling point is raised

Answer: A

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175. The Henry's law constant for the solubility of N_2 gas in water at $298K$ is $1.0 \times 10^5 atm$. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at $298K$ and $5atm$. Pressure is:

A. 4×10^{-4}

B. 4×10^{-5}

C. 5×10^{-4}

D. 4×10^{-6}

Answer: A

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176. A $0.002M$ aqueous solution of an ionic compound $[Co(NH_3)_5(NO_2)]Cl$ freezes at $-0.00732^\circ C$. Find the number of moles of ions which 1 mole of ionic compound produces of being dissolved in water. $(K_f = -1.86^\circ C/m)$.

A. 1

B. 2

C. 3

D. 4

Answer: B

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177. A solution is separated from pure solvent by a semipermeable membrane at 298 K. The difference in the height of the solution and the solvent is 0.9 m. If K_f and freezing point of the solvent are $30Kkgmol^{-1}$ and 250.3 K, respectively, the temperature which the solution freezes is : (Assume density of solution be 1 g/cc)

A. 250.10 K

B. 250.25 K

C. 250.20 K

D. 250.05 K

Answer: C

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178. Dissolving $120g$ of urea $(Mw = 60)$ in $1000g$ of water gave a solution of density $1.15gmL^{-1}$. The molarity of solution is:

A. 1.78 M

B. 2.00 M

C. 2.05 M

D. 2.22 M

Answer: C

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179. The freezing point (in $.^\circ C$) of a solution containing $0.1g$ of $K_3[Fe(CN)_6]$ (Mol. wt. 329) in $100g$ of water $(K_f = 1.86Kkgmol^{-1})$ is :

A. -2.3×10^{-2}

B. -5.7×10^{-2}

C. -5.7×10^{-3}

D. -1.2×10^{-2}

Answer: A

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180. A solution of $CaCl_2$ was prepared by dissolving 0.0112g in 1 kg of distilled water (molar mass of $Ca = 41 gmol^{-1}$ and $Cl = 35.5 gmol^{-1}$). The freezing point constant of water is 2K kg mol^{-1}. The depression in the freezing point of the solution is :

A. 0.0002

B. 0.002

C. 0.003

D. 0.0006

Answer: D

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181. For a dilute solution containing 2.5g of a non-volatile non-electrolyte solute in 100g of water, the elevation in boiling point at 1 atm pressure is $2^{\circ}\mathrm{C}$. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is (take K_b=0.76 K kg mol^{-1})

A. 724

B. 740

C. 736

D. 718

Answer: A

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182. K_f for water is $1.86 K kg mol^{-1}$. IF your automobile radiator holds $1.0 kg$ of water, how many grams of ethylene glycol $(C_2H_6O_2)$ must you add to get the freezing point of the solution lowered to $-2.8^\circ C$?

A. 72g

B. 93g

C. 39g

D. 27g

Answer: B

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183. The molarity of a solution obtained by mixing 750 mL of 0.5 M HCl with 250 mL of 2 M HCl will be

A. 1.75 M

B. 0.975 M

C. 0.875 M

D. 1.00 M

Answer: C

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184. Consider separate solutions of $0.500MC_2H_5OH(aq)$, $0.100MMg_3(PO_4)(aq)$,$0.250MKBr(aq)$, and $0.125MNa_3PO_4(aq)$ at $25^\circ C$. Which statement is true about these solutions, assuming all salts to be strong electrolytes?

A. 0.125 M $Na_3PO_4(aq)$ has the highest osmotic pressure

B. 0.500 M $C_2H_5OH(aq)$ has the highest osmotic pressure

C. They all have some osmotic pressure

D. 0.100 M $Mg_3(PO_4)_2(aq)$ has the highest osmotic pressure

Answer: C

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185. The vapour pressure of acetone at $20^{\circ} C$ is 185 torr. When $1.2g$ of non-volatile substance was dissolved in $100g$ of acetone at $20^{\circ} C$ its vapour pressure was 183 torr. The moalr mass $\left(gmol^{-1}\right)$ of the substance is:

A. 488

B. 32

C. 64

D. 128

Answer: C

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186. $18g$ glucose $(C_6H_{12}O_6)$ is added to $178.2g$ water. The vapour pressure of water (in torr) for this aqueous solution is:

A. 7.6

B. 76.0

C. 752.4

D. 759.0

Answer: C

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187. The freezing point of benzene decreases by $0.45^{\circ}C$ when $0.2g$ of acetic acid is added to $20g$ of benzene. IF acetic acid associates to form a dimer in benzene, percentage association of acetic acid in benzene will be $\left(K_f \text{for benzene} = 5.12Kkgmol^{-1}\right)$

A. 74.6%

B. 94.6%

C. 64.6%

D. 80.4%

Answer: B

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188. An isotonic solution with produce an osmotic pressure of 10 atm measured against pure water at $37^{\circ}C$. How many grams of NaCl must be dissolved in one litre of water to produce isotonic solution.

A. 11.46 g

B. 0.196 g

C. 9.01 g

D. 10 g

Answer: A

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189. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point ?

A. $[Co(H_2O)_5Cl]Cl_2. H_2O$

B. $[Co(H_2O)_4Cl_2]Cl.2H_2O$

C. $[Co(H_2O)_3Cl_3].3H_2O$

D. $[Co(H_2O)_6]Cl_3$

Answer: C

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190. If CO_2 gas having a partial pressure of 1.67 bar is bubbled through 1 L water at 298 K, the amount of CO_2 dissolved in water in $\mathrm{g\,L}^{-1}$ is approximately :

(Herny's law constant of $CO_2$is 1.67 k bar at 298 K)

A. 24.42

B. 12.21

C. 2.44

D. 1.22

Answer: C

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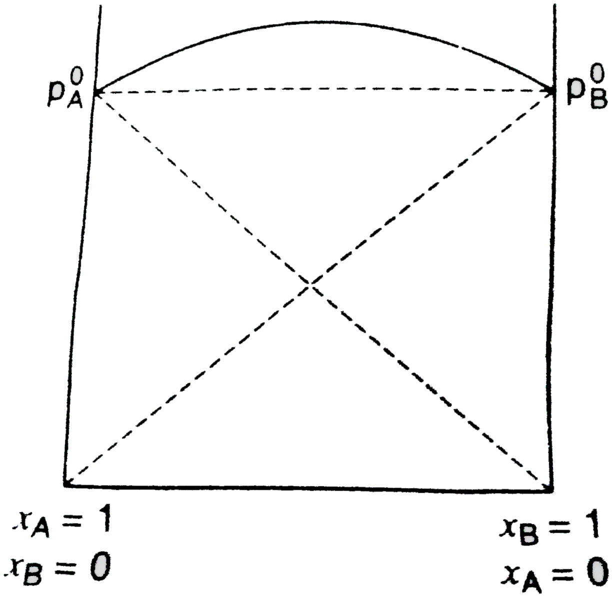
Set-2 (Level-A)

1. The given graph indicates :



A. (+) deviation

B. (-) deviation

C. no deviation

D. none of these

Answer: A

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2. Which is the correct statement ?

A. Minimum boiling azeotropic mixture boils at temperature lower than either of the two pure components.

B. Maximum boiling azeotropic mixture boils at temperature higher than either of the two pure components.

C. Minimum boiling azeotropic mixture shows (+)ve deviation

D. Maximum boiling azetropic mixture shows (-)ve deviation.

Answer: A::B::C::D

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3. A certain non-volatile substance (non-electrolyte) contains 40%C, 6.7%H, 53.3 % O. An aqueous solution containing 5% by mass of the solute boils at $100.15^\circ C$. Molecular formula of the compound is :

A. CH_2O

B. $C_2H_4O_2$

C. $C_6H_{12}O_6$

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

Answer: C

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4. A difference between diffusion and osmosis is

A. a semipermeable membrane is required for osmosis while diffusion require no semipermeable membrane

B. in osmosis the movement of molecules is only in one direction whereas in diffusion movement is on both sides.

C. in osmosis only the solvent moves while in diffusion solute and solvent both move

D. none of the above

Answer: A::B::C

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5. For a non-volatile solute

A. vapour pressure of solute is zero

B. vapour pressure of solution = vapour pressure of pure solvent

C. vapour pressure of solution = vapour pressure of solvent in solution

D. all of the above

Answer: A::C

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6. In which of the following cases does osmosis take place if the solutions are separated by a semipermeable membrane ?

A. 0.1 M NaCl and 0.2 M glucose

B. 0.1 M sucrose and 0.1 M fructose

C. $0.05MK_4\left[Fe(CN)_6\right]$ and $0.1MCaCl_2$

D. $10^{-3}MCaCl_2$ and $1.5\times10^{-3}MNaCl$

Answer: C

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7. Match the following :

	Solute (equimolar)		π(OP)ratio
(i)	Urea, glucose, fructose	(A)	1 : 0.8 : 1
(ii)	$NaCl, mgCl_2, K_2SO_4$	(B)	1 : 2 : 3
(iii)	$Al_2(SO_4)_3, Na_3PO_4, K_4Fe(CN_6)$	(C)	1 : 1 : 1
(iv)	Glucose, NaCl, $CaCl_2$	(D)	2 : 3 : 3

A.

(i)	(ii)	(iii)	(iv)
A	B	C	D

B.

(i)	(ii)	(iii)	(iv)
B	D	C	A

C.

(i)	(ii)	(iii)	(iv)
D	B	A	C

D.

(i)	(ii)	(iii)	(iv)
C	D	A	B

Answer: D

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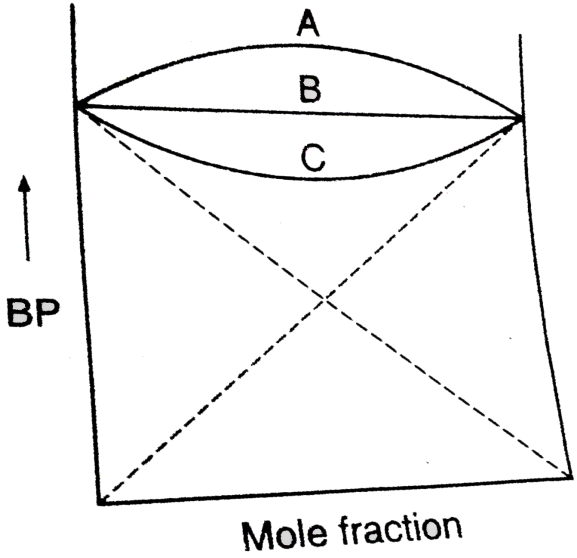
8. Match the following graph :



A (i) (+) deviation

B (ii) Ideal ltbvrgt C (iii)(-) deviation.

A. (A) (i),(B) (ii), (C) (iii)

B. (A) (iiii), (B) (ii), (C) (i)

C. (A) (ii), (B) (iii), (C) (i)

D. none of the above

Answer: B

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9. Vapour pressure of methyl alcohol and ethyl alcohol solutions is represented by $P = 115x_A + 140$ where $x_A$is the mole fraction of methyl alcohol. The value of $\lim_{x_A \to 0} \frac{P_B^0}{x_B}$ is:

A. 255

B. 115

C. 140

D. 135

Answer: C

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10. To $10mL$ of $1MBaCl_2$ solution $5mL$ of $0.5MK_2SO_4$ is added. $BaSO_4$ is precipitated out. What will happen?

A. F.pt is increased

B. B.pt is increased

C. F.pt is lowered

D. B.pt. is lowered

Answer: B::C

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11. Which is a dimensionless quantity ?

A. Mole fraction

B. Molality

C. % by wt. of solvent

D. % by wt of solution

Answer: A::C::D

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12. Which of the following concentration terms is/are independent of temperature ?

A. Molarity

B. Molarity and mole fraction

C. Mole fraction and molality

D. Molality and normality

Answer: C

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13. In the depression of freezing point experiment, it is found that the:

A. the vapour pressure of the solution is less than that of pure solvent

B. the vapour pressure of solution is more than that of pure solvent

C. only solute molecules solidify at the freezing point

D. only solvent molecules solidify at the freezing point

Answer: A::D

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14. Which of the following is/are correct for a solution of a particular concentrations ?

A. Molarity is always less than molality

B. Formality is equivalent to molarity

C. Mole fraction is equivalent to mass fraction

D. Normality of H_2SO_4 solution is double than its molarity.

Answer: B::D

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15. Effect of adding a non-volatie solute to a solvent is"

A. to lower the vapour pressure

B. to increase its freezing point

C. to increase its boiling point

D. to decrease its osmotic pressure

Answer: A::C

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16. Which of the following form/s an ideal solution ?

A. Ethyl bromide + ethyl iodide

B. Ethyl alcohol + water

C. Chloroform + benzene

D. Benzene + tolulene

Answer: A::D

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17. Osmotic pressure of a solution is :

A. directly proportional to the molar concentration of the solution

B. inversely proportional to the molecular weight of the solute

C. inversely proportional to the temperature

D. directly proportional to the volume of the solution

Answer: A::D

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18. Which of the following is/are true ?

A. For the same solution, elevation in boiling point = depression in freezing point

B. van't Hoff factor for a dilute solution of $BaCl_2$ is 3.

C. Elevation in boiling point is due to increase in vapour pressure

D. Depression in freezing point is due to decrease in vapour pressure

Answer: B::D

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19. In the following questions, more than one of the answers given may be correct. Select correct answer and mark it according to the code :

A solution containing components A and B exhibits positive deviation from Raoult's law only when

(1) $\Delta V_{\text{mixing}} = +ve$

(2) $\Delta H_{\text{mixing}} = -ve$

(3) A - B attraction forces $< A - A$ and $B - B$ attraction forces

(4) A - B attraction forces $> A - A$ and $B - B$ attraction forces.

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 3 are correct

D. 1 and 3 are correct

Answer: D

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20. Consider the following statements in respect of an ideal solution :

1. Raoult's law is valid for an ideal solution over the whole concentration range

2. Enthalpy of mixing is zero, i.e., $\Delta H_{\text{mix}} = 0$

3. Volume of mixing is not zero, i.e., $\Delta V_{\text{mix}} \neq 0$

4. The components of ideal solution cannot be separated by fractional distillation

Which of the statements given above is/are correct ?

A. 3 and 4

B. 1 and 4

C. 1 and 2

D. 2 and 3

Answer: C

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21. Consider the following :

At constant pressure, boiling point of a solution is greater than the boiling point of its pure liquid solvent because

1. Solute is non-electrolyte

2. Solute is involatile

3. Chemical potential of solvent in solution is less than the chemical potential of solvent in its pure state at constant pressure

Which of the above are correct ?

A. 1,2 and 3

B. 1 and 2 only

C. 1 and 3 only

D. 2 and 3 only

Answer: D

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22. Which values can be obtained from the information represented by the vapour pressure curve of a liquid ?

1. Normal boiling point

2. Normal freezing point

3. Enthalpy of vaporisation

A. 1 only

B. 1 and 2 only

C. 1 and 3 only

D. 1,2 and 3

Answer: B

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Level-B

1. Three solution of HCl having normalities 12 N, 6N and 2 N are mixed to obtain a solution of 4 N normality. Which among the following volume ratio is correct for the above three components ?

A. $1:1:5$

B. $1:2:6$

C. $2:1:9$

D. $1:2:4$

Answer: B

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2. 6.8 g H_2O_2 is dissolved in 224 mL solution. This solution will be labelled as:

A. $0.224V$

B. $20V$

C. 5 V

D. 10 V

Answer: D

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3. A solution weighing a g has molality b. The molecular mass of solute if the mass of solute is c g, will be:

A. $\frac{c}{b} \times \frac{1000}{(a-c)}$

B. $\frac{b}{a} \times \frac{1000}{(a-b)}$

C. $\frac{b}{c} \times \frac{1000}{(a-c)}$

D. $\frac{c}{a} \times \frac{1000}{(b-a)}$

Answer: A

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4. Two solution of H_2SO_4 of molarities x and y are mixed in the ratio of $V_1mL : V_2mL$ to form a solution of molarity M_1. If they are mixed in the ratio of $V_2mL : V_1mL$, they form a solution of molarity M_2. Given $V_1 / V_2 = \frac{x}{y} > 1$ and $\frac{M_1}{M_2} = \frac{5}{4}$, then $x : y$ is

A. $2 : 1$

B. $4 : 1$

C. $1 : 2$

D. $3 : 1$

Answer: A

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5. You are given 500 mL of 2 N HCl and 500 mL of 5 N HCl. What will be the maximum of 3 M HCl that you can make from these two solution?

A. 250 mL

B. 750 mL

C. 500 mL

D. 1000 mL

Answer: B

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6. The mole fraction of a given sample of I_2 in C_6H_6 is 0.2. The molality of I_2 in C_6H_6 is:

A. 0.32

B. 3.2

C. 0.032

D. 0.48

Answer: B

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7. A 15 - volume sample of an H_2O_2 solution is equivalent to:

A. $5.30N$

B. $1.77N$

C. $2.68N$

D. 7.50 N`

Answer: C

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8. If P_A is the vapour pressure of a pure liquid A and the mole fraction of A in the mixture of two liquids A and B is x, the parial vapour pressure of A is:

A. $(1-x)P_A$

B. xP_A

C. $\frac{x}{(1-x)}P_A$

D. $\frac{1-x}{x}P_A$

Answer: B

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9. A difference between diffusion and osmosis is

A. a semipermeable membrane is required for osmosis while diffusion requires no semipermeable membrane

B. in osmosis, movement of molecules is in one direction whereas in diffusion, the movement is on both side

C. in osmosis only the solvent moves while in diffusion solute and solvent both move

D. all of the above

Answer: D

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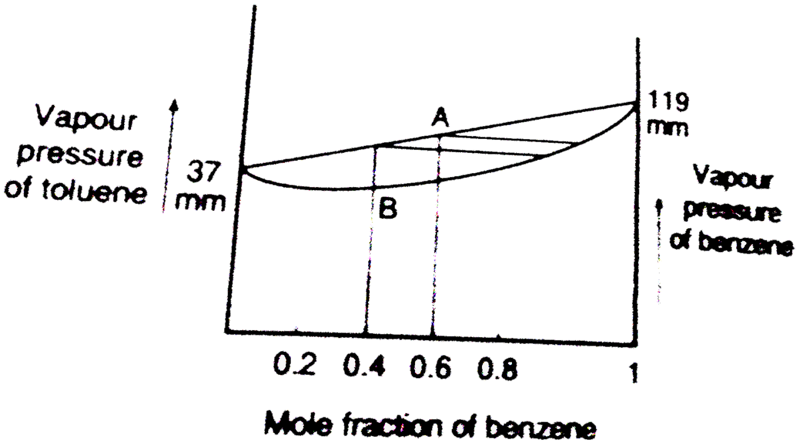
10.



Choose the correct option:

A. A' represents vapour composition and 'B' the liquid composition

B. A' as well as 'B' represent liquid composition

C. Both 'A' and 'B' represent vapour composition

D. A' represents liquid composition and 'B' the vapour composition

Answer: C

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11. Insulin $(C_2H_{10}O_5)_n$ is dissolved in a suitable solvent and the osmotic pressure (π) of solutions of various concentrations $\left(g/cm^3\right)C$ is measured at $20^\circ C$. The slope of a plot of π against C is found to be 4.65×10^{-3}. The molecular weight of insulin is:

A. 4.8×10^5

B. 9×10^5

C. 3×10^5

D. 5.17×10^6

Answer: D

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12. Solubility of deliquescent substances in water is generally:

A. high

B. low

C. moderate

D. cannot be predicted

Answer: A

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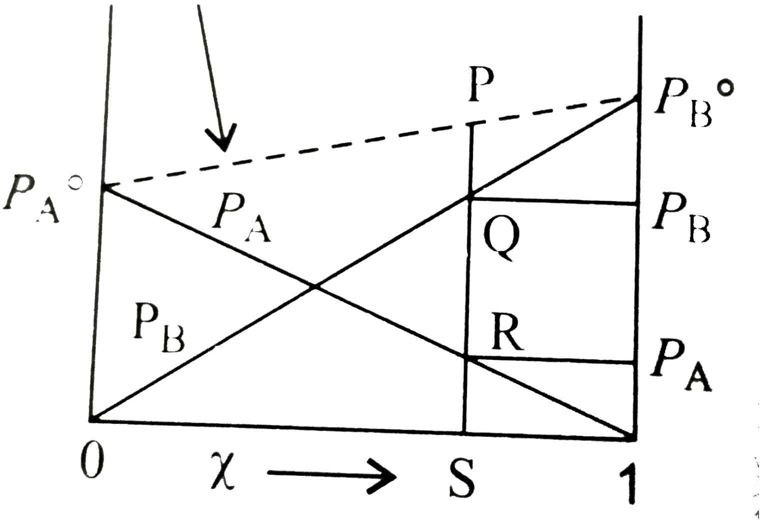
13. Consider the follwing vapour pressure composition graph. SP is equal to:

a. $PQ + RS$m , b. $PQ + QR$, c. $SR + SQ$, d. PQ + QR + RS



A. $PQ + RS$

B. $PQ + QR + RS$

C. $SR + SQ$

D. $PQ + QR$

Answer: C

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14. Y g of non-volatile organic substance of molecular mass M is dissolved in 250 g benzene . Molal elevation constant of benzene is K_b . Elevation in its boiling point is given by :

A. $\frac{M}{K_b y}$

B. $\frac{4K_b y}{M}$

C. $\frac{K_b y}{4M}$

D. $\frac{K_b y}{M}$

Answer: B

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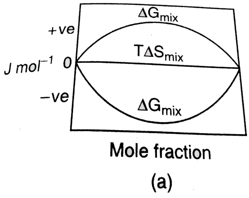
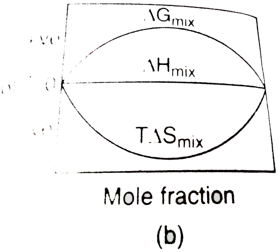
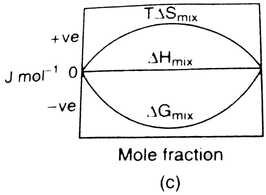
15. Which of the following represents correcty the changes in thermodynamic properties during the formation of 1 mole of an ideal binary solution :



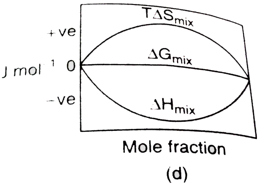
A.



B.



C.



D.

Answer: C

16. A solute forms a pentamer when dissolved in a solvent. The van't Hoff factors 'I' for the solute will be :

A. 0.2

B. 0.8

C. 0.5

D. 0.6

Answer: A

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17. What is the molarity of HCl in a solution prepared by dissolving 5.5 g HCl in 200 g ethanol if the density of the solution is 0.79 gmL^{-1}?

A. 21 M

B. $0.58M$

C. $6 \times 10^{-4}M$

D. 1.7 M

Answer: B

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18. Which statement about the composition of vapour over an ideal $1:1$ molar mixture of benzene and toluene is correct ? Assume the temperature is constant at $25^{\circ}C$

Vapour pressure data $(25^{\circ}C)$:

Benzene	$75mmHg$
Toluene	$22mmHg$

A. The vapour will contain higher precentage of benzene

B. The vapour will contain higher precentage of toluene

C. The vapour will contain equal amount of benzene and toluene

D. Not enough information is given to make a prediction

Answer: B

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19. When $1.20g$ of sulphur is melted with $15.00g$ of naphthalene, the solution freezes at $77.2^{\circ}C$. What is the moalr mass of this from of sulphur. Data for Napthalene

Melting point, m.p $80^{\circ}C$

Freezing point depression constant, $k_f = 6.80^{\circ}Cm^{-1}$

A. $180gmol^{-1}$

B. $190gmol^{-1}$

C. $260gmol^{-1}$

D. $450gmol^{-1}$

Answer: B

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20. Which of the following concentration factors can be calculated if the mole fraction and density of an aqueous solution of HCl are known ?

A. 1 only

B. 3 only

C. 1 and 2 only

D. 1, 2 and 3

Answer: D

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21. The vapour pressure of a liquid in a closed container depends on:

(1) temperature of liquid (2) quantity of liquid (3) surface area of the liquid

A. 1 only

B. 2 only

C. 1 and 3 only

D. 1, 2 and 3

Answer: A

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22. A solution prepared by dissolving a 2.50 g sample of an unknown compound dissolved in 34.0 g on benzene , C_6H_6 , boils $1.38^\circ C$ higher than pure benzene . Which expression gives the molar mass of the unknown compound ?

A. $2.53 \times \frac{2.50}{1.38}$

B. $1.38 \times \frac{34}{2.53} \times 2.50$

C. $2.5 \times 10^3 \times \frac{2.53}{34} \times \frac{1}{1.38}$

D. $2.50 \times 10^3 \times \frac{1.38}{34} \times 2.53$

Answer: C

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23. If liquids A and B from an ideal solution

A. the free energy of mixing is zero

B. the free energy as well as entropy of mixing are zero

C. enthalpy of mixing is zero

D. the entropy of mixing is zero

Answer: C

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24. Solute A is a ternary electrolyte and solute B is a non-electrolyte. If 0.1 M solution of B produces an osmotic pressure of 2P at temperature 3T K then 0.05 M solution of A at T K will produce an osmotic pressure of:

A. P

B. $1.5P$

C. 2P

D. 10 P

Answer: A

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25. Which of the following behaviours is true for an ideal binary liquid solution?

A. Plot of $P_{\text{total}} vs y_A$ (mole fraction of A in vapour) is linear

B. Plot of $P_{\text{total}} vs y_B$ is linear

C. Plot of $1/P_{\text{total}} vs y_A$ is linear

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

Answer: C

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26. Total Vapour pressure of mixture of 1molA$\left(p_A^0 = 150\text{torr}\right)$and 2molB $\left(p_B^0 = 240\text{torr}\right)$is 200torr. In this case

A. there is positive deviation from Raoult's law

B. there is negative deviation from Raoult's law

C. there is no deviation from Raoult's law

D. molecular masses of A and B are also required for calculating the deviation

Answer: B

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27. A compound MX_2has observed and normal molar masses $65.6 \text{ and } 164$respectively .Calculated the apparent degree of ionization of MX_2:

A. 0.75

B. 0.85

C. 0.65

D. 0.25

Answer: A

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28. Compound $PdCl_4. 6H_2O$ is a hydrated complex, 1 molal aqueous solution of it has freezing point 269.28 K. Assuming 100% ionization of complex, calculate the molecular formula of the complex (K_f for water = 1.86 K mol^{-1})

A. $[Pd(H_2O)_6]Cl_4$

B. $[Pd(H_2O)_4Cl_2]Cl_2.2H_2O$

C. $[Pd(H_2O)_3Cl_3]Cl. 3H_2O$

D. $[Pd(H_2O)_2Cl_4].4H_2O$

Answer: C

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29. Insulin is dissolved in suitable solvent and the osmotic pressure (π) of solution of various concentration (g / cm^3) C is measured at $27^\circ C$. The slope of plot of π against C is found to be 4.1×10^{-3}. The molecular mass of inulin is:

A. 6×10^6

B. 3×10^6

C. 6×10^3

D. 3×10^3

Answer: A

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30. pH of a $0.1M$ monobasic acid is found to be 2. Hence, its osmotic pressure at a given temperature T K is

A. 0.1 RT

B. 0.11 RT

C. 1.1 RT

D. 0.01 RT

Answer: B

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31. Calculate the amount of ice that will separate out on cooling containing $50g$of ethylene glycol in $200g$ of water to $-9.3^{\circ}C\left(K_f\right.$ for water =$1.86Kmol^{-1}kg$)

A. 38.71 g

B. 38.71 mg

C. 42 g

D. 42 mg

Answer: A

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32. 2 moles each of liquids A and B are dissolved to form an ideal solution. What will be the mole fraction of B in the vapour phases ?

$p_A^\circ = 120 \text{ torr } , p_B^\circ = 80$ torr

A. $1/4$

B. $1/2$

C. $3/5$

D. $2/5$

Answer: D

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33. Lowering of vapour pressure due to a solute in 1 molal aqueous solution at $100^{\circ} C$ is

a.$13.44 mmHg$,b. $14.14 mmHg$,c.$13.2 mmHg$,d. $35.2 mmHg$

A. 13.44 mm Hg

B. 14.12 mm Hg

C. 31.2 mm Hg

D. 35.2 mm Hg

Answer: A

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34. The temperature at which molarity of pure water is equal to its molality is :

A. 273 K

B. 298 K

C. 277 K

D. None of these

Answer: C

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35. Isopiestic solution have:

A. same vapour

B. pressure

C. same osmotic pressure

D. same freezing point

Answer: A

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36. Molarity and molality of a solution of caustic soda are respectively $11.12M$ and $94.12m$ The density of the solution is

A. $0.556gmL^{-1}$

B. $5.56gmL^{-1}$

C. $55.6gmL^{-1}$

D. None of these

Answer: A

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37. Which of the following aqueous solution shas osmotic presseure nearest to that of an equimolar solution of $K_4[Fe(CN)_6]$

A. Na_2SO_4

B. $BaCl_2$

C. $Al_2(SO_4)_3$

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

Answer: C

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38. Equal mass of a soute are dissolved in equal mass of two solvents A and B and formed very dilute solution. The relative lowering of vapour pressure for the solution B has twice the relative lowering of vapour pressure for the solution A. If $m_A \text{and} M_B$ are the molecules mass of solventds A and B respectively, then :

A. $M_A = M_B$

B. $M_A = M_B / 2$

C. $M_A = 4M_B$

D. $M_A = 2M_B$

Answer: B

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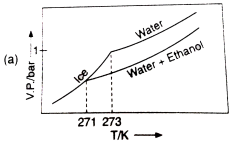
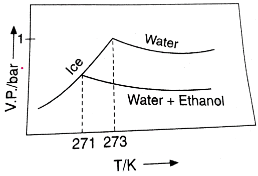
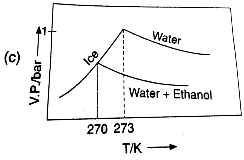
39. Pure water freezes at 273 K and 1 bar. The addition of 34.5 g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as 2 K $kgmol^{-1}$. The figures shown below represent plots of vapour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is$46gmol^{-1}$ Among the following, the option representing change in the freezing point is



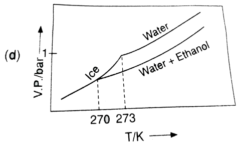
A.



B.



C.



D.

Answer: D

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40. Consider the following solutions:

I.1 M sucrose , II. 1 M KCl

III.1 M benzoic acid in benzene

IV.$1M(NH_3)_3PO_4$

Which of the following is/are true?

A. All solutions are isotonic

B. III is hypotonic of I, II and IV

C. I, II and III are hypertonic of IV

D. IV is hypertonic of I, II and III

Answer: B::C::D

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41. The osmotic pressure of a solution depends on

A. nature of solute

B. nature of solvent

C. temperature

D. molar concentration of solute

Answer: C::D

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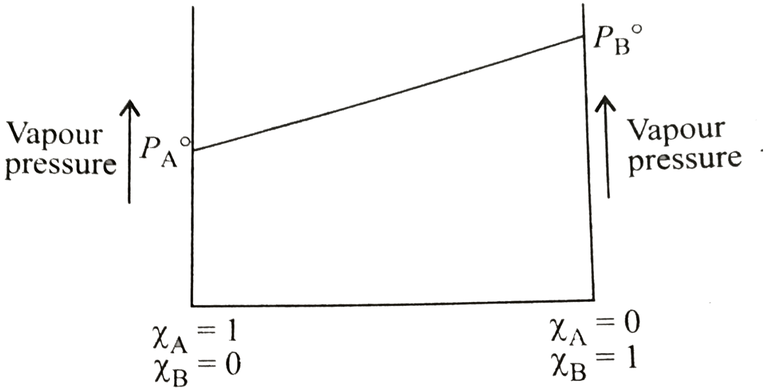
42. The following is a graph plotted between the vapour pressure of two volatile liquids against their respective mole fractions. Which of the following statements is/are correct?



A. When $x_A = 1$ and $x_B = 0$, then $p = p_A^0$

B. When $x_B = 1$ and $x_A = 0$, then $p = p_B^0$

C. When $x_A = 1$ and $x_B = 0$, then $p < p_B^0$

D. When $x_B = 1$ and $x_A = 0$, then $p > p_A^0$

Answer: A::B

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43. Which of the following combinations are correct for a binary solution, in which the solute as well as solvent are liquid?

A. C_6H_6 and $C_6H_5CH_3, \Delta H_{\text{sol}} > 0, \Delta V_{\text{sol}} = 0$

B. $CH_3 - \overset{\overset{O}{||}}{C} - CH_3$ and $CHCl_3, \Delta H_{\text{sol}} < 0, \Delta V_{\text{sol}} < 0$

C. H_2O and $HCl, \Delta H_{\text{sol}} > 0, \Delta V_{\text{sol}} < 0$

D. H_2O and $C_2H_5OH, \Delta H_{\text{sol}} > 0, \Delta V_{\text{sol}} > 0$

Answer: B::D

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44. A solution containing 0.1g of a non-volatile organic substance P (molecular mass 100) in 100g of benzene raises the boiling point of benzene by $0.2^\circ C$, while a solution containing 0.1 g of another non-volatile substance Q in the same amount of benzene raises the boiling point of benzene by $0.4^\circ C$. What is the ratio of molecular masses of P and Q ?

A. $1:2$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: B

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45. Consider 0.1 M solutions of two solutes X and Y. The solute X behaves as univalent electrolyte, while the solute Y dimerises in solution. Select correct statement(s) regarding these solutions:

A. 1,2,3

B. 2,3,4

C. 1,2,4

D. 1,3,4

Answer: A

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46. For a given value of degree of dissociation, which of the following have correct Van't Hoff factor?

A. $NaCl \qquad i = 2 + \alpha$

B. $Ca(NO_3)_2 \qquad i = 1 + 2\alpha$

C. $K_4[Fe)CN)_5] \qquad i = 1 + 4\alpha$

D. $(NH_3)_3PO_4 \qquad i = 3 + \alpha$

Answer: B::C

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47. 1 mol benzene $(P^\circ \_ (\text{benzene}) = 42mm)$ and 2 mol toluence $(P^\circ \_ (\text{toluene}) = 36mm)$ will have

A. total vapour pressure 38 mm

B. mole fraction of vapours of benzene above liquid mixture is 7/19

C. positive deviation from Raoult's law

D. negative deviation from Raoult's law

Answer: A::B

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48. The decrease in freezing point of an aqueous solution of a substance is 1.395 K and that in the freezing point of a benzene solution of the same substance is 1.28 K. The substance :

A. dissociates in aqueous solution as well as in the benzene solution

B. forms complexes in the solution

C. associates in the benzenem solution

D. dissociates in the aqueous solution and not in the benzene solution

Answer: C::D

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49. The vapour pressure of water at T (K) is 20 mm Hg. The following solution are prepared at T (K) :

I. 6g of urea (mol. Wt = 60) is dissolved in 178.2g of water

II. 0.01 mole glucose is dissolved in 179.82 g of water

III. 53g of Na_2CO_3 (mo. wt. 106) is dissolved in 179.1g of water

Identify the correct order in which the vapour pressures of solutions increases :

A. III,I,II

B. II,III,I

C. I,II,III

D. I,III,II

Answer: A

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50. Consider lowering of vapour pressure (Δp), elevation in boiling point (ΔT_b) and depression in freezing point (ΔT_f) of a solvent for the same molar concentration of each of the following three solutes :

1. $BaCl_2$

2. $NaCl$

3. $MgCl_2$

Which of the following is/are the correct sequence ?

A. $\Delta p : 3 < 2 < 1$

B. $\Delta T_b : 1 > 2 > 3$

C. $\Delta T_f : 3 < 2 < 1$

D. None of these

Answer: D

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51. Benzene and naphthalene form an ideal solution at room temperature. For this process,the true statement(s) is (are)

A. ΔG is positive

B. ΔS_{system} is positive

C. $\Delta S_{\text{surroundings}} = 0$

D. $\Delta H = 0$

Answer: B::C::D

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52. Mixture (s) showing positive deviation from Raoult's law at $35^{\circ} C$ is (are)

A. carbon tetrachloride + methanol

B. carbon disulphide + acetone

C. benzene + tolulene

D. phenol + aniline

Answer: A::B

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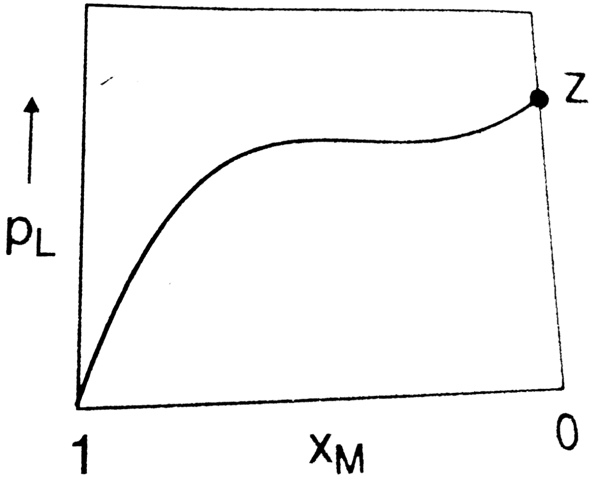
53. For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown in the following figure, Here x_L and x_M represent mole fraction of L and M, respectively in the solution, the correct statement(s) applicable to this system is (are) :



A. Attractive intramolecular interactions between L-L in pure liquid L and M-M in pure liquid M are stronger than those between L-M when mixed in solution

B. The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $x_L \to 0$

C. The point Z represents vapour pressure of pure liquid L and Raoult's law is obeyed when $x_L \to 1$

D. The point Z represents vapour pressure of pure liquid M and Raoult's is law is obeyed from $x_L = 0$ to $x_L = 1$

Answer: A::C

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Assertion-Reason

1. Assertion (A): The dissolution of gases in water is always an endothermic process.

Reason (R) : The dissolution of gases in water proceed with a negative value of ΔS.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: D

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2. Assertion (A): Water boiling at $100^{\circ}C$ at 1 atmospheric pressure in a beaker is not at equilibrium.

Reason (R): If refers to an open system.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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3. (A) : A solution which contains one gram equivalent of solute pre litre of the solution is called a normal solution

(R) : A normal solution means a solution in which the solute does not associate or dissociate.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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4. Assertion (A): The sum of mole fractions of all the component of a solution is unity.

Reason (R): The mole fraction is a temperature dependent quantity.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

Watch Video Solution

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

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

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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6. Statement - The vapour pressure of $0.1M$ sugar solution is more than that of $0.1M$ potassium chloride solution.

Explanation- Lowering of vapour pressure is directly proportional to the number of species present in the solution.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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7. Assertion (A): Non-ideal solutions form azeotropic mixture.

Reason (R): The boiling point of an azeotropic mixture is only higher than boiling points of both components.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

Watch Video Solution

8. (A) : One molar solution is always more concentrated than one molal solution

(R) : The amount of solvent in 1 M and 1m aqueous solution is not equal.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: D

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9. Assertion (A): Camphor is used as a solvent in the determination of the molecular mass of naphthalene and anthracene.

Reason (R): camphor has high molal elevation constant.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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

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

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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11. (A) : Molarity of 0.02 N solution of HNO_3 is 0.02 M

(R) : Molarity and normality of a soltuion are never equal.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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12. Assertion (A): Larger the value of cryoscopic constant of the solvent, lesser will be the freezing point of the solution.

Reason (R): Depression in the freezing point depends on the nature of the solvent.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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

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

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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14. Assertion (A): Henry's law and Raoult's law are not independent, i.e., one can be derived from the other.

Reason (R): The partial pressure is directly proportional to the mole fraction of the concerned species for ideal solutions.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: B

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15. Statement - The water pouch of instant cold pack for treating athletic injuries breakes when squeezed and NH_4NO_3 dissolves lowering the temperature.

Explanation - Addition of non-volatile solute into solvent results into depression of freezing point of solvent.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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16. (A) : In a pressure cooker, the water is brought to boil. The cooker is then removed from the stove. Now on removing the lid of pressure cooker, the water starts boiling again

(R) : The impurities in water bring down its boiling point.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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17. Each question contains STATEMENT-I(Assertion) and STATEMENT-2(Reason).the statement carefully and mark the correct answer accoring to the instrution given below:

STATEMENT - 1 : An increase in surface area increases the rate of evaporation.

STATEMENT - 2 : Stronger the intermolecular attaction force, faster is the rate of evaporation at a given temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: C

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18. Each question contains STATEMENT-I(Assertion) and STATEMENT-2(Reason).the statement carefully and mark the correct answer accoring to the instrution given below:

STATEMENT - 1 : An ideal solution obeys Raoult's law.

STATEMENT - 2 : In an ideal solution, solute-solvent as well as solvent-solvent, interactions are similar to solute - solvent interactions.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A)

B. If both (A) and (R) are correct but (R) is not correct explanation for (A)

C. If (A) is correct but (R) is incorrect

D. If (A) is incorrect but (R) is correct

Answer: A

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Matrix

1.

	Set-I		Set-II
(A)	10 vol H_2O_2	1.	Perhydrol
(B)	20 vol H_2O_2	2.	$5.358N$
(C)	30 vol H_2O_2	3.	$1.785N$
(D)	100 vol H_2O_2	4.	$3.30\,\%$

The correct match is :

A. A-4, B -3, C-2, D-1

B. A-1, B-2, C-3, D-4

C. A-1, B-3, C-2, D-4

D. A-4, B-2, C-3, D-1

Answer: A::B::C::D

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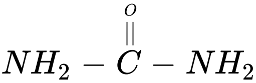
2. [A] Match the solutes in Column-I with th van't Hoff factors in Column-II

:

	Column-I		Column-II
(a)	$K_4\left[Fe(CN)_6\right]$	(p)	$1+\alpha$
(b)	$Al_2(SO_4)_3$	(q)	Greater than 1
(c)	 $NH_2-\overset{O}{\overset{\|}{C}}-NH_2$	(r)	$(1+4\alpha)$
(d)	$CaCl_2$	(s)	1

$\alpha =$ Degree of ionization.

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3. [B] Match the solutions in Column-I with their nature in Column-II :

	Column-I		Column-II
(a)	Benzene + toluene	(p)	Non-ideal solution
(b)	Ethanol + water	(q)	Ideal solution
(c)	Benzene + chloroform	(r)	$\Delta H_{\text{mix}} > 0$
(d)	Carbon tetrachloride + chloroform	(s)	$\Delta H_{\text{mixing}} = 0$

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4. [C] Match the solutions in Column-I with their nature in Column-II :

	Column-I		Column-II
(a)	n-hexane + n heptane	(p)	Can be perfectly separated by distillatio
(b)	Acetone + chloroform	(q)	Maximum boiling azeotrope
(c)	Acetone + aniline	(r)	Cannot be perfectly separated by distill
(d)	Ethanol + water	(s)	Nearly ideal

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5. [D] Match the solutions in Column-I in Column-I with their osmotic properties in Column-II :

	Column-I		Column-II
(a)	$S_1 : 0.1M$ glucose, $S_2 0.1M$ urea	(p)	S_1 and S_2 are isotonic
(b)	$S_1 : 0.1M$ NaCl, $S_2 : 0.1M Na_2SO_4$	(q)	No migration of solvent a
(c)	$S_1 : 0.1$ NaCl, $S_2 = 0.1MKCl$	(r)	S_1 is hypertonic to S_2
(d)	$S_1 : 0.1MCuSO_4$, $S_2 : 0.1M$ sucorse	(s)	S_1 is hypotonic to S_2

[Note : Assume that the electrolytes are completely ionised.

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6. [E] Match the solutions in Column-I with their colligative properties in Column-II :

	Column-I		Column-II
(a)	$0.1MCa_3(PO_4)_2$	(p)	Solution with highest boiling point
(b)	$0.1MNaCl$	(q)	Solution with van't Hoff factor greater than 1
(c)	$0.1M$ glucose	(r)	Solution with lowest osmotic pressure
(d)	$0.1MCaCl_2$	(s)	Solution with lowest freezing point

[Note : Assume that the electrolytes are completely ionised.]

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7. [F] Match the concentration terms of List-I with their informations in List-II :

	List-I		List-II
(a)	Molarity	(p)	Number of gram formula mass of solute di
(b)	Molality	(q)	Number of moles of solute dissolved per kg
(c)	Formality	(r)	Depends on temperature
(d)	Strength of solution	(s)	Number of moles of solute dissolved per lit

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8. [G] Match the salts in Column-I with the ratio of van't Hoff factor in Column-II :

(, Column-I, , Column-II), ((a), Glucose, fructose, sucrose, (p), $1:2:3$), ((b

((d), Urea, KCl, $CaCl_2$, (s), $1:1:1$)

[Note : Assume that the electrolytes are completely ionised.

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9. [H] Match the following :

	List-I		List-II
A.	Azeotrope	(I)	$\Delta T_b = i k_b m$
B.	Henry's law	(II)	$p = k_H x$
C.	Cryoscopic consant	(III)	$\Delta T_f / m$
D.	van't Hoff factor	(IV)	Deviation from Raoult's law
		(V)	$\pi = cRT$

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Integer

1. 0.1 M $K_4[Fe(CN)_6]$ is 50% ionised in aqueous medium. What will be its van't Hoff factor ?

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2. Osmotic pressure of a solution at 300 K is 73.8 atm. Assuming non-electrolytic solute, the molarity of solution will be :

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3. If Hg_2Cl_2 is 100% ionised, then find out its van't Hoff factor.

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4. Molal lowering of vapour presure of liquid is 1.008 mm Hg at $25^{\circ}C$ in very dilute solution. The vapour pressure of liquid at $25^{\circ}C$ is $x \times 10$ mm Hg. The value of x is (molecular mass of liquid is 18 g mol^{-1})

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5. $29.2\,\%\,(w/w)HCl$ stock, solution has a density of $1.25gmL^{-1}$. The molecular weight of HCl is $36.5gmol^{-1}$. The volume (mL) of stock solution required to prepare a $200mL$ solution of $0.4MHCl$ is :

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6. MX_2 dissociates into M^{2+} and $X^{\ominus}$ ion in an aqueous solution, with a degree of dissociation (α) of 0.5. The ratio of the observed depression of freezing point of the aqueous solution to the value of the depression of freezing point in absence of ionic dissociation is

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7. A compound H_2X with molar mass of $80g$ is dissolved in a solvent having density of $0.4gmL^{-1}$. Assuming no change in volume upon dissolution, the molality of a 3.2 molar solution is

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8. If the freezing point of a 0.01 molal aqueous solution of a cobalt (III) chloride-ammonia complex (which behaves as a strong electrolyte) is $-0.0558^{\circ}C$, the number of chloride (s) in the coordination sphere of the complex if $\left[K_f \text{ of water } = 1.86Kkgmol^{-1}\right]$

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9. The mole fraction of a solute in a solutions is 0.1. At $298K$ molarity of this solution is the same as its molality. Density of this solution at 298 K is $2.0gcm^{-3}$. The ratio of the molecular weights of the solute and solvent, $\frac{MW_{\text{solute}}}{MW_{\text{solvent}}}$ is

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Comprehension

1. A $1.24M$ aqueous solution of KI has density of $1.15gcm^{-3}$.

Answer the following questions about this solution:

The percentage composition of solute in the solution is

A. 17.89

B. 27.89

C. 37.89

D. 47.89

Answer: A

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2. A $1.24M$ aqueous solution of KI has density of $1.15gcm^{-3}$.

Answer the following questions about this solution:

The molality of this solution will be

A. 2.61

B. 1.31

C. 4.12

D. 3.12

Answer: B

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3. A $1.24M$ aqueous solution of KI has density of $1.15gcm^{-3}$.

Answer the following questions about this solution:

What is the freezing point of the solution if KI is completely dissociated in the solution?

A. $-4.87^{\circ}C$

B. $-3.22^{\circ}C$

C. $-1.22^{\circ}C$

D. None of these

Answer: A

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4. A $1.24M$ aqueous solution of KI has density of $1.15gcm^{-3}$.

Answer the following questions about this solution:

The experimental freezing point of the solution is $-4.46^{\circ}C$.

What percentage of KI is dissociated?

A. 0.82

B. 0.9

C. 0.83

D. None

Answer: C

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5. A $1.24M$ aqueous solution of KI has density of $1.15gcm^{-3}$.

Answer the following questions about this solution:

The normality of the solution is

A. 0.62

B. 1.24

C. 2.48

D. 3.72

Answer: B

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6. The electrolyte solutions show abnormal colligative porperties.To account for this effect we define a quantity called the Van't Hoff factor given by

$$i = \frac{\text{Actual number of particles in solution after dissociation}}{\text{Number of formula units initially dissolved in solution}}$$

$i = 1(\text{for non-electrolytes})$

$i > 1(\text{for electrolytes, undergoing dissociation})$

$i < 1(\text{for solutes, undergoing association})$

Answer the following questions:

Benzoic acid undergoes dimerization in bezene solution. The Van't Hoff factor i for the solutions is

A. $i = 1 - \alpha$

B. $i = 1 + \alpha$

C. $i = 1 - \frac{\alpha}{2}$

D. $i=1+\frac{\alpha}{2}$

Answer: C

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7. The electrolyte solutions show abnormal colligative porperties.To account for this effect we define a quantity called the Van't Hoff factor given by

$$i=\frac{\text{Actual number of particles in solution after dissociation}}{\text{Number of formula units initially dissolved in solution}}$$

$i=1(\text{for non-electrolytes})$

$i>1(\text{for electrolytes, undergoing dissociation})$

$i<1(\text{for solutes, undergoing association})$

Answer the following questions:

certain substances trimerize when dissolved in a solvent A. The Van't Hoff factor i for the solutions is

A. 1

B. $1/3$

C. 3

D. unpredictable

Answer: B

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$i = 1(\text{for non-electrolytes})$

$i > 1(\text{for electrolytes, undergoing dissociation})$

$i < 1(\text{for solutes, undergoing association})$

Answer the following questions:

For a solution of a non-electrolyte in water, the Van't Hoff factor is

A. always equal to 0

B. ≤ 1

C. always equal to 2

D. > 1 but < 2

Answer: B

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$$i = 1(\text{for non-electrolytes})$$

$$i > 1(\text{for electrolytes, undergoing dissociation})$$

$$i < 1(\text{for solutes, undergoing association})$$

Answer the following questions:

$0.1MK_4\left[Fe(CN)_6\right]$ is 60% ionized. What will be its Van't Hoff factor?

A. 1.4

B. 2.4

C. 3.4

D. 4.4

Answer: C

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10. The electrolyte solutions show abnormal colligative porperties.To account for this effect we define a quantity called the Van't Hoff factor given by

$$i = \frac{\text{Actual number of particles in solution after dissociation}}{\text{Number of formula units initially dissolved in solution}}$$

$i = 1(\text{for non-electrolytes})$

$i > 1(\text{for electrolytes, undergoing dissociation})$

$i < 1(\text{for solutes, undergoing association})$

Answer the following questions:

A solution of benzoic acid is dissolved in benzene such that it undergoes molecular association and its molar mass apporaches 244. The benzoic molecules will exist as

A. dimer

B. monomer

C. tetramer

D. trimer

Answer: A

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11. The colligative properties of electrolytes require a slightly different approach than the one used for the colligative properties of non-electrolytes. The electrolytes dissociate into ions in a solution. It is the number fo solute particles that determines the colligative properties of a solution. The electrolyte solutions, therefore, show abnormal colligative properties. To account for this effect we define a quantity called the van't Hoff factor, given by :

$$i = \frac{\text{Actual number of particles in solution after dissociation}}{\text{NUmber of formula units initially dissolved in solution}}$$

$i = 1$ (for non-electrolytes) ,

$i > 1$ (for electrolytes, undergoing dissociation)

$i < 1$ (for solutes, undergoing association).

The molare mass of the solute sodium hydroxide obtained from the measurement of the osmotic pressure of its aqueous solution at $27^{\circ} C$ is 25g mol^{-1}. Therefore, its dissociation percentage in this solution is :

A. 75

B. 60

C. 80

D. 70

Answer: B

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12. The osomotic pressure π depends on the molar concentration of the solution $(\pi = CRT)$. If two solutions are of equal solute concentration and, hence, have the same omotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism for transporting water upward in the plants. Answer the following questions:

A plant cell shrinks when it is kept in:

A. hypotonic solution

B. hypertonic solution

C. isotonic solution

D. pure water

Answer: B

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13. The osomotic pressure π depends on the molar concentration of the solution $(\pi = CRT)$. If two solutions are of equal solute concentration and, hence, have the same omotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism for transporting water upward in the plants. Answer the following questions:

What would be the percent strength of solution of urea that would be isotonic with 4.5% solution of glucose?

A. 4.5%

B. 13.5%

C. 1.5%

D. 9%

Answer: C

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14. The osmotic pressure π depends on the molar concentration of the solution $(\pi = CRT)$. If two solutions are of equal solute concentration and, hence, have the same omotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism for transporting water upward in the plants. Answer the following questions:

The glucose solution to be injected into the bloodstream and the blood itself should have the same.

A. molarity

B. vapour pressure

C. osmotic pressure

D. viscosity

Answer: C

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15. The osomotic pressure π depends on the molar concentration of the solution $(\pi = CRT)$. If two solutions are of equal solute concentration and, hence, have the same omotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism for transporting water upward in the plants. Answer the following questions:

Isotonic solutions have same

A. density

B. molarity

C. molality

D. mole fraction

Answer: B

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16. The osomotic pressure π depends on the molar concentration of the solution $(\pi = CRT)$. If two solutions are of equal solute concentration and, hence, have the same omotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

Osmosis is the major mechanism for transporting water upward in the plants. Answer the following questions:

Osmotic rise of a solution depends on

A. density

B. temperature

C. nature of solvent

D. none of these

Answer: A::B

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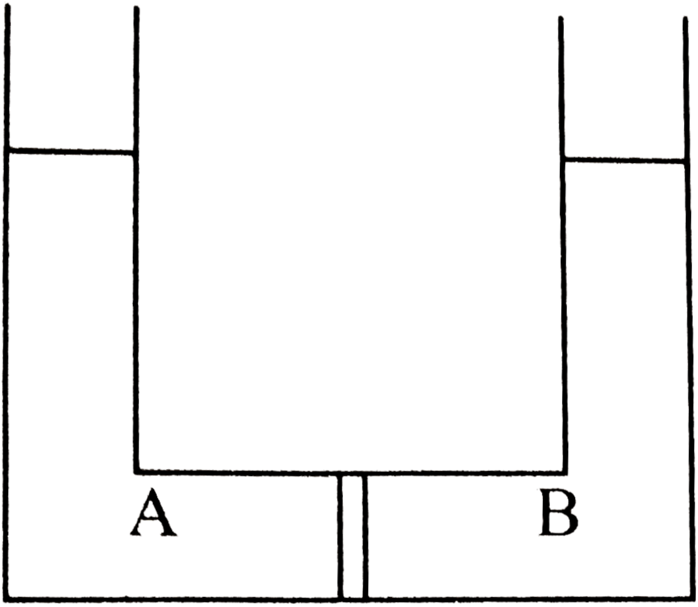

17.

Compartment A and B have the following combinations of solution:

	A	B
1	$0.1MKCl$	$0.2MKCl$
2	$0.1\,\%\,(m/V)NaCl$	$10\,\%\,(m/V)NaCl$
3	$18gL^{-1}$glucose	$34.2gL^{-1}$sucrose
3	$20\,\%\,(m/V)$glucose	$10\,\%\,(m/V)$glucose

The solutions in which compartment B is hypertonic.

A. 1 only

B. 3 only

C. 4 only

D. 2 only

Answer: B

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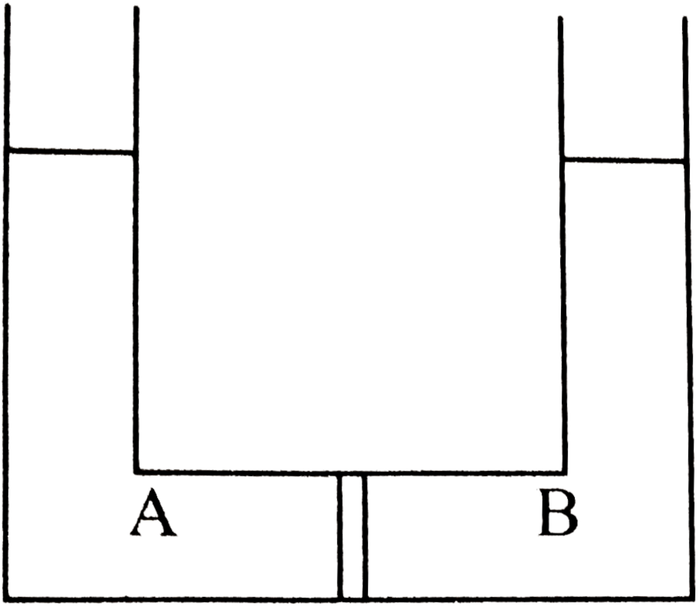


18.

Compartment A and B have the following combinations of solution:

	A	B
1	$0.1MKCl$	$0.2MKCl$
2	$0.1\%(m/V)NaCl$	$10\%(m/V)NaCl$
3	$18gL^{-1}$glucose	$34.2gL^{-1}$sucrose
3	$20\%(m/V)$glucose	$10\%(m/V)$glucose

The solutions in which compartment B is hypertonic.

A. 1,2

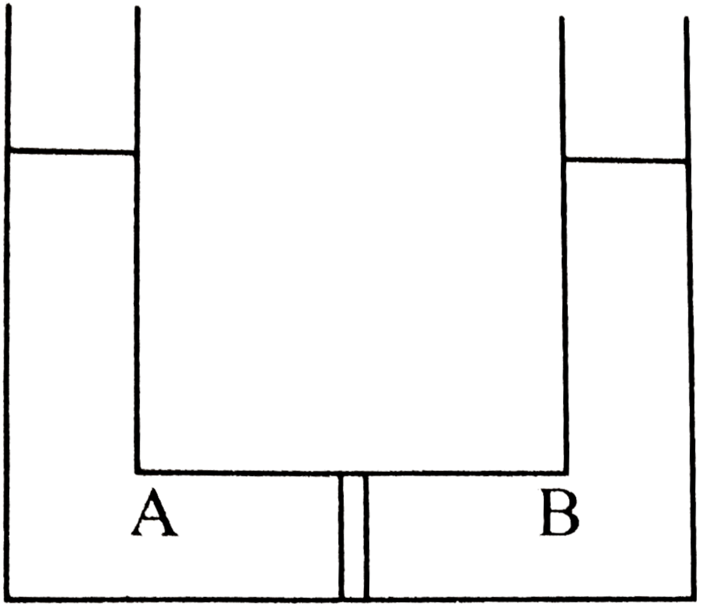
B. 2,3

C. 3,4

D. 1,4

Answer: A

Watch Video Solution



19.

Compartment A and B have the following combinations of solution:

	A	B
1	$0.1MKCl$	$0.2MKCl$
2	$0.1\%(m/V)NaCl$	$10\%(m/V)NaCl$
3	$18gL^{-1}$glucose	$34.2gL^{-1}$sucrose
3	$20\%(m/V)$glucose	$10\%(m/V)$glucose

Indicate the solution(s) in which compartment B will show an increases in volume.

A. 1

B. 2

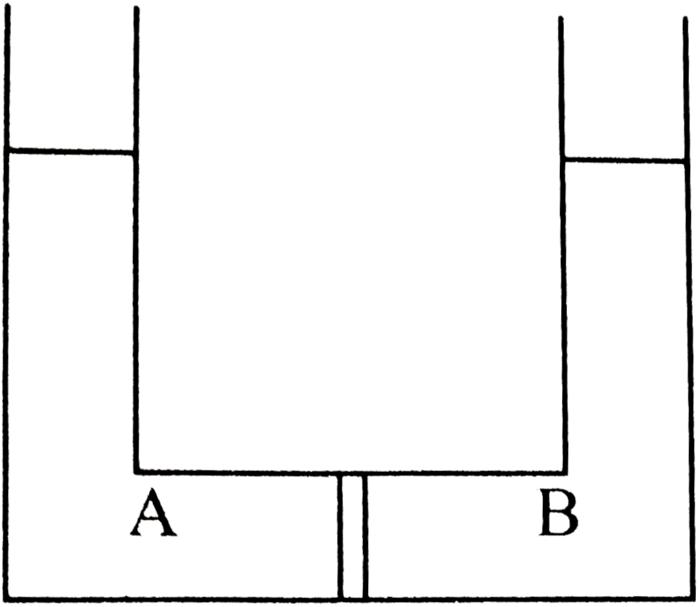
C. 3

D. 4

Answer: D

Watch Video Solution

20.



Compartment A and B have the following combinations of solution:

	A	B
1	$0.1MKCl$	$0.2MKCl$
2	$0.1\%(m/V)NaCl$	$10\%(m/V)NaCl$
3	$18gL^{-1}$glucose	$34.2gL^{-1}$sucrose
3	$20\%(m/V)$glucose	$10\%(m/V)$glucose

Indicate the solution(s) in which compartment B will show an increases in volume.

A. 1,2,4

B. 1,2

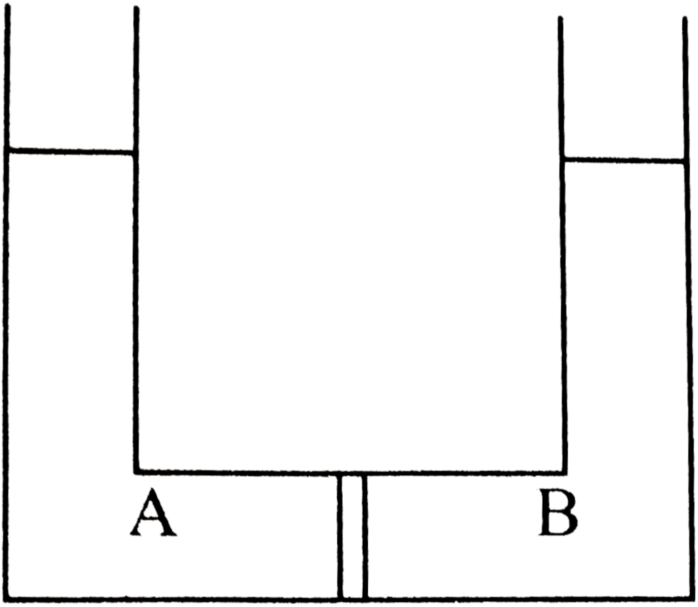
C. 2,3

D. 3,4

Answer: B

Watch Video Solution

21.



Compartment A and B have the following combinations of solution:

	A	B
1	$0.1MKCl$	$0.2MKCl$
2	$0.1\%(m/V)NaCl$	$10\%(m/V)NaCl$
3	$18gL^{-1}$glucose	$34.2gL^{-1}$sucrose
3	$20\%(m/V)$glucose	$10\%(m/V)$glucose

The solution in which there will be no change in the level of the solution in the compartment A and B is.

A. 1

B. 2

C. 3

D. 4

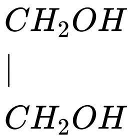
Answer: C

Watch Video Solution

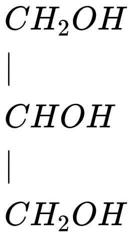
22. The boiling point elevation and freezing point depression of solutions have a number of partical applications. Ethylene glycol $(CH_2OH - CH_2OH)$ is used in automobile radiatiors as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has low vapour pressure. We can also use glycerol as an antifreeze. In order for the boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at $65^\circ C$, is sometimes used as an antifreeze in automobile radiators.

Which of the following is a better reagent for depression in freezing point but not for elevation in boiling point?

A. CH_3OH

B. 

$$\begin{array}{l} CH_2OH \\ | \\ CH_2OH \end{array}$$

C. 

$$\begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$$

D. $C_6H_{12}O_6$

Answer: A

Watch Video Solution

23. The boiling point elevation and freezing point depression of solutions have a number of partical applications. Ethylene glycol $(CH_2OH - CH_2OH)$ is used in automobile radiatiors as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has low vapour pressure. We can also use glycerol as an antifreeze. In order for the boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at $65^\circ C$, is sometimes used as an antifreeze in automobile radiators.

$124g$ each of the two reagents glycol and glycerol are added in $5kg$ of water of the radiators in two cars. Which of the following statements is wrong?

A. Both will act as antifreeze

B. Glycol will be better

C. Glycerol is better because its molar mass is greater than glycol

D. Glycol is more volatile than glycerol

Answer: C

Watch Video Solution

24. The boiling point elevation and freezing point depression of solutions have a number of partical applications. Ethylene glycol $(CH_2OH - CH_2OH)$ is used in automobile radiatiors as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has low vapour pressure. We can also use glycerol as an antifreeze. In order for the boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at $65^\circ C$, is sometimes used as an antifreeze in automobile radiators.

$620g$ glycol is added to $4kg$ water in the radiator of car. What amount of ice will separate out at $-6^\circ C$?

A. 800g

B. 900g

C. 600g

D. 1000 g

Answer: B

Watch Video Solution

25. The boiling point elevation and freezing point depression of solutions have a number of partical applications. Ethylene glycol $(CH_2OH - CH_2OH)$ is used in automobile radiatiors as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has low vapour pressure. We can also use glycerol as an antifreeze. In order for the boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at $65^{\circ} C$, is sometimes used as an antifreeze in automobile radiators.

If the cost of glycerol, glycol, and methanol is same, then the sequence of economy to use these compounds as antifreeze will be

A. glycerol $>$ glycol $>$ methanol

B. methanol $>$ glycol $>$ glycerol

C. methanol = glycol = glycerol

D. methanol $>$ glycol $<$ glycerol

Answer: B

Watch Video Solution

26. The boiling point elevation and freezing point depression of solutions have a number of partical applications. Ethylene glycol $(CH_2OH - CH_2OH)$ is used in automobile radiatiors as an antifreeze because it lowers the freezing point of the coolant. The same substance also helps to prevent the radiator coolant from boiling away by elevating the boiling point. Ethylene glycol has low vapour pressure. We can also use glycerol as an antifreeze. In order for the boiling point elevation to occur, the solute must be non-volatile, but no such restriction applies to freezing point depression. For example, methanol (CH_3OH), a fairly volatile liquid that boils only at $65^\circ C$, is sometimes used as an antifreeze in automobile radiators.

Which of the following is a better reagent for depression in freezing point but not for elevation in boiling point?

A. CH_3OH

B. C_2H_5OH

C. Glycol

D. Glycerol

Answer: A

Watch Video Solution

27. The solution which boil at constant temperature like a pure liquid and possess same composition in liquid as well as vapour state are called azeotropes. The components of azetropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of an azeotrope is never equal to the boiling points of any of the components of the azeotrope.

Answer the following question:

The azeotropic solutions of two miscible liquids

A. can be separated by simple distillation

B. may show positive or negative deviation form Raoult's law

C. are supersaturated

D. behave like single pure component and boil at a fixed temperature

Answer: B::D

Watch Video Solution

28. The solution which boil at constant temperature like a pure liquid and possess same composition in liquid as well as vapour state are called azeotropes. The components of azetropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of an azeotrope is never equal to the boiling points of any of the components of the azeotrope.

Answer the following question:

Solutions which distill without any change in composition or temperature are called

A. saturated

B. supersaturated

C. ideal

D. azeotrope

Answer: D

Watch Video Solution

29. The solution which boil at constant temperature like a pure liquid and possess same composition in liquid as well as vapour state are called azeotropes. The components of azetropes cannot be separated by

fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of an azeotrope is never equal to the boiling points of any of the components of the azeotrope.

Answer the following question:

The azeotropic mixture of water and HCl boils at $108.5^\circ C$. This solution is

A. ideal

B. non-ideal with positive deviation

C. non-ideal with negative deviation

D. cannot be predicted

Answer: C

Watch Video Solution

30. The solution which boil at constant temperature like a pure liquid and possess same composition in liquid as well as vapour state are called azeotropes. The components of azetropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of an azeotrope is never equal to the boiling points of any of the components of the azeotrope.

Answer the following question:

$100mL$ of liquid A and $50mL$ of liquid B are mixed to form $138mL$ solution. It is

A. ideal solution

B. high boiling azetrope

C. low boiling azeotrope

D. none of these

Answer: B

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31. The solution which boil at constant temperature like a pure liquid and possess same composition in liquid as well as vapour state are called azeotropes. The components of azetropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of an azeotrope is never equal to the boiling points of any of the components of the azeotrope.

Answer the following question:

The azeotropic solutions of two miscible liquids

Which among the following combinations is a maximum boiling azeotrope?

A. $H_2O + CH_3OH$

B. $CCl_4 + CHCl_3$

C. $(CH_3)_2CO + C_2H_5OH$

D. $H_2O + HNO_3$

Answer: D

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32. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of its examples is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. Thus moel fraction of ethanol in the mixture is 0.9.

Given: Freezing point depression constant of water

$\left(K_f^{\text{water}}\right) = 1.86 Kkgmol^{-1}$

Freezing point depression constant of ethanol

$\left(K_f^{\text{ethanol}}\right) = 2.0 Kkgmol^{-1}$

Boiling point elevation constant of water

$\left(K_b^{\text{water}}\right) = 0.52 K kg mol^{-1}$

Boiling point elevation constant of ethanol

$\left(K_b^{\text{ethanol}}\right) = 1.2 K kg mol^{-1}$

Standard freezing point of water $= 273 K$

Standard freezing point of ethanol $= 155.7 K$

Standard boiling point of water $= 373 K$

Standard boiling point of ethanol $= 351.5 K$

vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40 mmHg$

Molecualr weight of water $= 18 g mol^{-1}$

Molecular weight of ethanol $= 46 g mol^{-1}$

In asweering the following questions, consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

The freezing point of the solution M is :

A. 268.7 K

B. 268.5 K

C. 234.2 K

D. 150.9 K

Answer: D

Watch Video Solution

33. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of its examples is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. Thus moel fraction of ethanol in the mixture is 0.9.

Given: Freezing point depression constant of water

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

Freezing point depression constant of ethanol

$$\left(K_f^{\text{ethanol}}\right) = 2.0 K kg mol^{-1}$$

Boiling point elevation constant of water

$$\left(K_b^{\text{water}}\right) = 0.52 K kg mol^{-1}$$

Boiling point elevation constant of ethanol

$\left(K_b^{\text{ethanol}}\right) = 1.2 K kg mol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethanol $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40 mmHg$

Molecualr weight of water $= 18 gmol^{-1}$

Molecular weight of ethanol $= 46 gmol^{-1}$

In asweering the following questions, consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

The vapour pressure of the solution M is:

A. 39.3 mm Hg

B. 36.0 mm Hg

C. 29.5 mm Hg

D. 28.8 mm Hg

Answer: B

Watch Video Solution

34. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogenous solution. These are called colligative properties. Application of colligative properties are very useful in day-to-day life. One of its example is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9.

Given : Freezing point depression constant of water $\left(K_f^{\text{water}}\right) = 1.86K\text{mol}^{-1}$

Freezing point depression constant of ethanol $\left(K_f^{\text{ethonal}}\right) = 2.0Kkg\text{mol}^{-1}$

Boiling point elevation constant of water $\left(K_b^{\text{water}}\right) = 0.52Kkg\text{mol}^{-1}$

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethonal}}\right) = 1.2Kkgmol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethonal $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

Vapour pressure of pure water $= 32.8mmHg$

Vapour pressure of pure ethonal $= 40mmHg$

Molecular weight of water $= 18g\text{mol}^{-1}$

Molecular weight of ethonal $= 45g\text{mol}^{-1}$

In answering the following questions, consider the solution to be ideal ideal solutions and solutes to be non-volatile and non-dissociative.

Water is added to the solution M such lthat the molecules fraction of water in t he solution becomes 0.9. The boiling point of this solution is :

A. 380.4 K

B. 376.2 K

C. 375.5 K

D. 354.7 K

Answer: B

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Self Assessment

1. The relative lowering of vapour pressure of an aqueous solution containing a non-volatile solute, is 0.0125. The molality of the solution is

A. 0.70

B. 0.50

C. 0.90

D. 0.80

Answer: A

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2. If the elevation in boiling point of a solution of 10 g of solute (molecular weight = 100) in 100 g of water is ΔT_b, the ebullioscopic constant of water is

A. 10

B. $100T_b$

C. ΔT_b

D. $\frac{\Delta T_b}{10}$

Answer: C

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3. Which one of the following aqueous solutions will exhibit highest boiling point ?

A. $0.1MKNO_3$

B. $0.1MNa_3PO_4$

C. $0.1MBaCl_2$

D. $10.1MK_2SO_4$

Answer: B

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4. A solution containing $10 gper dm^3$ of urea (mol.wt. $= 60 gmol^{-1}$) is isotonic with a 5% (mass//vol.) of a non-volatile solute. The molecular mass of non-volatile solute is:

A. 300 g mol^{-1}

B. 350 g mol^{-1}

C. 200 g mol^{-1}

D. 250 g mol^{-1}

Answer: A

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5. The molarity of 5 molal aqueous solution of NaOH having density 1.2g/cc is :

A. 5 M

B. 4.1 M

C. 6 M

D. 8 M

Answer: A

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6. The value of osmotic pressure does no depend on :

A. concentration of solution

B. van't Hoff factor

C. temperature

D. structure of solute particles

Answer: D

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7. Henry's law constants for O_2 and N_2 are :

$k_{O_2} = 3.3 \times 10^7 m k_{N_2} = 6.51 \times 10^7$

Calculate the ratio of $\frac{x_{O_2}}{x_{N_2}}$, i.e., the ratio of mole fractions of O_2 and N_2 dissolved in water at $25^\circ C$ from air :

A. 0.62

B. 0.92

C. 0.42

D. 0.52

Answer: D

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8. The molal lowering of vapor pressure for H_2O at $100^\circ C$ is

A. 13.68 mm

B. 46 mm

C. 65 mm

D. 13.68 cm

Answer: A

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9. USP ethanol in aqueous solution is containing 95% ethanol by volume. At $20^{\circ} C$, pure ethanol has a density of 0.789 g/mL and USP ethanol density 0.813 g/mL. What is the mass percentage of ethanol in USP ethanol ?

A. 46%

B. 90%

C. 86%

D. 93.3%

Answer: D

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10. A solution of 7.45 g KCl in 1000 mL shows osmotic pressure of 4.68 atm at 300K. Calculate the percentage dissociation of KCl :

A. 70%

B. 80%

C. 90%

D. 10%

Answer: C

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11. The mass of glucose that would be dissolved in 50g of water in order to produce the same lowering of vapour pressure as is produced by dissolving 1g of urea in the same quantity of water is :

A. 1 g

B. 3 g

C. 6 g

D. 18 g

Answer: B

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12. Consider the following aqueous solutions and assume 100% ionisation in electrolytes :

I. $0.1m$ urea

II. 0.04 m $Al_2(SO_4)_3$

III. 0.05 m $CaCl_2$

IV. 0.005 m $NaCl$

The correct statement regarding the above solutions is :

A. freezing point will be lowest for solution I

B. freezing point will be highest for solution IV

C. boiling point will be highest for solution IV

D. vapour pressure will be highest for solution II

Answer: B

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13. K_2HgI_4 is $50\,\%$ ionised in aqueous solution. Which of the following are correct ?

A. $n = 7$

B. $n = 3$

C. $i = 2$

D. $i = 4$

Answer: B::C

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14. Henry's law is invalid for gases like :

A. CO_2

B. SO_2

C. HCl

D. N_2

Answer: A::B::C

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15. The azetropic mixture of two liquids :

A. boils at constant temperature

B. can be separated by simple distillation

C. is super saturated

D. deviates from Raoult's law

Answer: A::D

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16. Cryoscopic constant of a liquid depends on :

A. the latent heat of fusion of solvent

B. the freezing point of solvent

C. the concentration of solution

D. the melting point of solute

Answer: A::B

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17. Which of the following is/are influenced by the temperature ?

A. Freezing point

B. Boiling point

C. Vapour pressure

D. Osmotic pressure

Answer: C::D

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18. Statement-1 : Solubility of ionic compounds in water depends on both the lattice energy and the hydration energy.

Statement-2 : Ionic compounds dissolve in water when their hydration energy exceeds the lattice energy.

A. Statement-1 is true , statement-2 is true , statement-2 is a correct explanation for statement-1

B. Statement-1 is true , statement-2 is true , statement-2 is not a correct explanation for statement-1

C. Statement-1 is true , statement-2 is false

D. Statement-1 is false , statement-2 is true

Answer: A

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19. Each question contains STATEMENT-I(Assertion) and STATEMENT-2(Reason).the statement carefully and mark the correct answer accoring to the instrution given below:

STATEMENT - 1 : Isotonic solutions must have the same molal concentration.

STATEMENT - 2 : Solution which have the same osmotic pressure are known as isotonic solution.

A. Statement-1 is true , statement-2 is true , statement-2 is a correct explanation for statement-1

B. Statement-1 is true , statement-2 is true , statement-2 is not a correct explanation for statement-1

C. Statement-1 is true , statement-2 is false

D. Statement-1 is false , statement-2 is true

Answer: D

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20. Statement-1 : The vapour pressure of 0.1 M Hg_2Cl_2 is equal to 0.1 M $AlCl_3$ solution

Statement-2 : 0.1 $AlCl_3$ and 0.1 Hg_2Cl_2 give different numbers of ions in a solution.

A. Statement-1 is true , statement-2 is true , statement-2 is a correct explanation for statement-2

B. Statement-1 is true , statement-2 is true , statement-2 is not a correct explanation for statement-2

C. Statement-1 is true , statement-2 is false

D. Statement-1 is false , statement-2 is true

Answer: D

View Text Solution

21. Each question contains STATEMENT-I(Assertion) and STATEMENT-2(Reason).the statement carefully and mark the correct answer accoring to the instrution given below:

STATEMENT - 1 : Elevation in boiling point will be high if the molal elevation constant of the liquid is high.

STATEMENT - 2 : Elevation in boiling point is a colligative property.

A. Statement-1 is true , statement-2 is true , statement-2 is a correct explanation for statement-3

B. Statement-1 is true , statement-2 is true , statement-2 is not a correct explanation for statement-3

C. Statement-1 is true , statement-2 is false

D. Statement-1 is false , statement-2 is true

Answer: B

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22. Statement-1 : Ethylene glycol is used as antifreeze for the radiator of a car

Statement-2 : Ethylene glycol dissolves in water with the help of hydrogen bond and it lowers the freezing point.

A. Statement-1 is true , statement-2 is true , statement-2 is a correct explanation for statement-4

B. Statement-1 is true , statement-2 is true , statement-2 is not a correct explanation for statement-4

C. Statement-1 is true , statement-2 is false

D. Statement-1 is false , statement-2 is true

Answer: A

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23. Match the Column-I with Column-II

	Column-I		Column-II
(a)	$CCl_4 + CHCl_3$	(p)	Raoult's law
(b)	$C_6H_6 + H_2O$	(q)	Nearly ideal solution
(c)	$p_A \propto x_A$	(r)	Negative deviation from Raoult's law
(d)	$p_A < p_A^0 x_A$	(s)	Positive deviation from Raoult's law

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24. Match the Column-I with Column-II :

	Column-I (Species completely ionised)		Column-II (van't Hoff factor)
(a)	Hg_2Cl_2	(p)	5
(b)	$K_3\left[Fe(CN)_6\right]$	(q)	4
(c)	$Ca_3(PO_4)_2$	(r)	1
(d)	glucose	(s)	3

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25. Match the Column-I with Column-II :

	Column-I		Column-II
(a)	Mole fraction	(p)	mol kg^{-1}
(b)	Molality	(q)	Depends on temperature
(c)	Molarity	(r)	Unitless
(d)	Normality	(s)	Independent of temperature

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26. The van't Hoff factor 'i' for the species $\left[Fe(H_2O)_2(CN)_2Cl_2\right].NO_3.2H_2O$ is :

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27. The ratio of the value of any colligative property of KCl solution to that for sugar is nearly 'x' times for water as solvent and same molality. What will be the value of 'x' ?

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28. How many moles of $CaCl_2(i = 2.47)$ dissolved in 2.5 litre water such that its osmotic pressure is 72.91 atm at $27^\circ C$?

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29. An antifreeze solution is prepared for a laboratory experiment. In this solution 222.6g of ethylene glycol is dissolved in 200g of water. The density of resultant solution was found to be 1.072g mL^{-1}. Molal depression constant of water is $1.86 \text{ K kg mol}^{-1}$ and molar mass of ethylene glycol $(C_2H_6O_2)$ is 62 g mol^{-1}.

Molality of solution is :

A. 17.95

B. 0.1795

C. 1.795

D. 5.197

Answer: A

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30. An antifreeze solution is prepared for a laboratory experiment. In this solution 222.6g of ethylene glycol is dissolved in 200g of water. The density of resultant solution was found to be 1.072g mL^{-1}. Molal depression constant of water is $1.86\text{ K kg mol}^{-1}$ and molar mass of ethylene glycol $(C_2H_6O_2)$ is 62 g mol^{-1}.

Molarity of solution is :

A. 0.911

B. 9.11

C. 17.95

D. 1.795

Answer: B

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31. An antifreeze solution is prepared for a laboratory experiment. In this solution 222.6g of ethylene glycol is dissolved in 200g of water. The density of resultant solution was found to be $1.072 \mathrm{g\,mL}^{-1}$. Molal depression constant of water is $1.86\ \mathrm{K\ kg\ mol}^{-1}$ and molar mass of ethylene glycol $(C_2H_6O_2)$ is $62\ \mathrm{g\ mol}^{-1}$.

Freezing point of the solution will be :

A. $-17.387^\circ C$

B. $-33.387^\circ C$

C. $-3.38^\circ C$

D. $-0.338^\circ C$

Answer: B

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