CHEMISTRY

BOOKS - OSWAAL PUBLICATION CHEMISTRY (KANNADA ENGLISH)

SOLUTIONS

Topic I Types Of Solutions Expression Of Concentration Of Solutions Of Solids In Liquids Solubility Of Gases In Liquids Solid Solutions Very Short Answer Type Questions

1. At a given temperature and pressure nitrogen gas is more soluble in water than helium gas. Which one of them has higher value of K_H ?

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2. Define the term 'molarity'.

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3. State Henry's law.

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4. Name any one concentration dependent of temperature.

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5. What is the effect of increase in pressure on the solubility of a gas in a liquid ?

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6. Define mole fraction.

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7. Differentiate between molality and molarity of a solution ?

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8. How does molarity varies with temperature?

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9. Name any two compounds which can be used as semipermeable membrane.

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10. $CaCl_2$ is used to clear snow from roads on hill stations, explain.

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Topic I Types Of Solutions Expression Of Concentration Of Solutions Of Solids In Liquids Solubility Of Gases In Liquids Solid Solutions Short Answer Tye Questions

1. What happens to the solubility of a gas in a liquid with increase in temperature ?

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2. A 4% solution of non-volatile solute is isotonic with 0.702% urea solution Calculate the molar mass of the non-volatile solute. (Mola.r mass of urea = 60 g mol^{-1})

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

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4. The partial pressure of ethane over a solution containing 6.56×10^{-2} g of ethane is 1 bar. If the solution contains 5.0×10^{-2} g of ethane, then what will be the partial pressure of the gas?

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5. State Henry's law and mention two ofil8important applications.

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Topic I Types Of Solutions Expression Of Concentration Of Solutions Of Solids In Liquids Solubility Of Gases In Liquids Solid Solutions Long

Answer Type Questions I

1. If the density of some lake water is 1.2.5 g mL^{-1} and contains 92 g of Na^{+} ions per kg of water, calculate the molality of Na^{+} ions in the lake.

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2. Concentrated nitric acid used in laboratory work is 68% nitric add by aqueous solution. What should be the molarity of such a sample of the add lf the density of the solution is 1.504 g mL^{-1} ?

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3. A solution is obtained by mixing 300 g of 25% solution and 400 g of 40% solution by mus. Calculate the moss per centage of the resulting solution.

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

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5. Define molarity and molality.

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6. Define Molefraction and Mass percentage.

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Topic 2 Vapour Pressure Raoult S Law Ideal And Non Ideal Solutions Very Short Answer Type Questions

1. On mixing equal volumes of acetone and ethanol, what type of deviation from Raoult' s low is expected ?

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2. Mention th.e enthalpy of mixing (Δ_{mix}) value to form an ideal solution.

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3. Write the matflematical form of Ra.oult' s law of relative lowering of vapour pressure.

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4. ΔG^0 value for the formation of A_2O and B_2O are - 827 kJ and - 540 kJ. Which one of them is more stable ?

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5. Predict the sign of Δ S for the following process : $H_2O_{(g)} \rightarrow H_2O_{(l)}$

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6. What is an ideal solution ?

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7. What happens to change in entropy when water is converted into ice ?

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8. Components of a non-idea) binary solution cannot be completely separated by fracti.o.nal distillation. Why?

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9. Some liquids on mixing form 'azeotropes'. Wh.at are 'azeotropes' ?

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10. What type of intermolecular attractive Interaction exists in the pair of methanol and acetone ?

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11. State Raoult's law of a binary solution for two volatile liquid components.

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Topic 2 Vapour Pressure Raoult S Law Ideal And Non Ideal Solutions Short Answer Type Questions

1. Give two general characteristics of an ideal solution of two liquids.

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2. Write two differences between ideal and non-ideal solution

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3. State Raoult' s law for a soluti.on of 2 volatile liquids. Give an example for liquid mixture that show negative deviation from Raoult's law.

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4. Define "lowering of vapour pressure". Give equation for Raoult' s law of relative lowering of vapour pressure.

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5. Give two conditions for the positive deviation of non-ideal solutions.

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6. Give one example for non-ideal solution showing positive deviation and non-ideal solution showing negative deviation.

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7. The vapour pressure of a solution cont.aning 10 g of a non-electrolyte in 200 g of water at a particular temperature is 2985 Pa. The

vapour pressure of pure water at that temperature is 3000 Pa. Calculate the molecular mass of the solute.

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8. Mention any two differences between ideal and non-ideal solutions.

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

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10. State Raoult's l.iw for the solution containing voLttile components. Wh.it is the simi.Ltrity between Raoult's law and Henry's law?

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11. State Rioult's Ltw. How is It formul.ited for solutions of non-volatile solutes ?

Derive expression for Rioult's law when the solute is non-volatile.

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12. The putial pressure of ethane over a saturated solution containing 6.56 $\times 10^{-2}$ g of ethane is 1 bar.if the solution contains 5.0 $\times 10^{-2}$ g of ethane, then what will be the partial pressure of the gas ?

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Topic 2 Vapour Pressure Raoult S Law Ideal And Non Ideal Solutions Long Answr Type Questions I

1. A stream of dry air was passed through a bulb containing a solution of 7.5 g of a compound dissolved in 75 g of water and then through another bulb containing pure water. The loss of mass in the first bulb

was 2.81 g and in the second bulb was 0.054 g. Calculate the molecular mass of the compound.

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2. A solution containing 30 g of non-volatile solute exactly in 90 g of water has a vapour pressure of 2.8 kPa at 298 K. Further 18 g of water is added to this solution. The new vapour pressure becomes 2.9 kPa at 298 K. Calculate

(i) The molecular mass of solute and

(ii) vapour pressure of water at 298K

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3. If N_2 gas is bubbled through water at 293 K, how many of millimoles of N_2 gas would dissolve in 1 litre of water 7 Assume that N_1 exerls a partial pressure of 0.987 bar. Given that Henry's law constant for N_2 at 293 K is 76.48 K bar.

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Topic 3 Colligative Properties Determination Of Molar Mass Abnormal Molar Mass Van T Hoff Factor Very Short Answer Type Questions

1. What is the effect of rise in temperature on the solubility of gases in liquids?

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2. Define osmotic pressure.

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3. Define Van't Hoff's factor.

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4. What are isotonic solutions?

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5. Name a colligative property.

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6. What does the Van't Hoff factor for a solute in a solvent account for

?

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7. What is the value of Van't Hoff's factor (i) for K_2SO_4?

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8. Define the term colligative property.

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9. Write the expression relating solubility and solubility product of AB_2 type salts.

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10. Write mathematical expression for Vant Hoff Boyle's law ?

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11. State Van't Hoff-Boyle's law.

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12. Give reason equimolar solutions of sodium chloride and glucose do not have the same osmotic pressure.

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13. Define "lowering of vapour pressure". Give equation for Raoult' s law of relative lowering of vapour pressure.

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14. Between 2M glucose solution and 1M glucose solution which one has a lower freezing point ?

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15. What is a reverse osmosis? How it used in desalination of sea water?

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16. Explain boiling point of elevation constant for a solvent or Ebullioscoplc constant.

	Boiling point (°C)	K_b
X	100	0·68
Y	27	0·53
Z	253	0·98

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Topic 3 Colligative Properties Determination Of Molar Mass Abnormal Molar Mass Van T Hoff Factor Short Answer Type Questions

1. Define isotonic solution. What happens when the blood cell is dipped in a solution containing more than normal saline concentration?

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2. What is reverse osmosis ? Mention any one of its use.

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3. The vapour pressure of ether (mol. mass = 74) is 60 kPa at 293 K. If 3g of a compound A is dissolved in 50 g of ether at this tempenture, the vapour pressure falls to 56.8 kPa. Calculate molecular mass of A.

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4. Mention four colligative properties.

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5. Calculate the mass of compound (molar mass = 256 g mol^{-1}) to be dissolved in 75 g of benzene to lower its freezing point by 0.48 $K\left(K_f = 5.12 \quad \mathrm{K\ kg\ } mol^{-1}\right)$.

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6. 18 g of glucose, $C_6H_{12}O_6$ (Molar Maas=180 g mol^1) is dissolved in 1 kg of water in a sauce pan. Al what temperature will this solution boil ? (K_b for water = 0.52 K kg mol^{-1}, boiling point of pure water = 373.15 K)

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7. A 1.00 molar .aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.18 $^\circ$C. Determine the Van't Hoff factor for trichloroacetic acid. $\left(K_b \text{for water} = 0.512 \text{kg mol}^{-1}\right)$.

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8. What mass of NaCl must be dissolved in 65.0 g of water for lowering the freezing point of water by $7.50^\circ C$? The freezing point depression

constant $\left(K_f\right)$ for water is 1.86° C/m. Assume Van't Hoff factor for NaCL is 1.87 (molar mass of NaCl = 58.5 g)

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9. A solution prepared by dissolving 1.25 g of oil of winter green (methyl s.ilicylate) in 99.0 g of benzene has a boiling po . int of 80.31° C , Determine the molar mass of this compound. (B.P. of pure benzene = 80.10° C and K_b for benzene = $2.53^\circ C \quad \mathrm{Kg} \quad mol^{-1}$)

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10. A decimolar solution of potassium ferrocyanlde $K_4\left[Fe(CN)_6\right]$ is 50% dissociated at 3001K. Calculate the value of Van't Hoff factor for postuslum ferrocyanide.

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11. What type of intermolecular attraction exists in each of the following pair of compounds :

(i) n-hexane and n-octane ,

(ii) methanol and acetone.

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Topic 3 Colligative Properties Determination Of Molar Mass Abnormal Molar Mass Van T Hoff Factor Long Answer Type Questions I

1. The boiling point of benzene is 353.23 K when 1.80 g of a non-volatile, non-ionising solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of solute.

[Given K_b for benzene = 2.53 K kg mol^{-1}]

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2. Acetone boils at 56.38°C and a solution of 1.41 g of an organic compound in 20 g of acetone boils at 56.88°C. Calculate the molar mass of the organic compound (Given k_b for acetone = 1.67 k kg/ mol).

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3. Calculate the osmotic pressure of 0.05% urea solution in water at 20°C. Given R = 0.0821 atm $mol^{-1}K^{-1}$. Molar mass of urea = 60 g mol^{-1} .

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4. A solution containing 18g of non - volatile non - electrolyte solute is dissolved in 200g of water freezes at 272.07K. Calculate the molecular mass of solute. Given $K_f = 1.86kg/mol$ and freezing point of water = 273K

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5. On dissolving 2.34g of non-electrolyte solute in 40g of benzene, the boiling point of solution was higher than benzene by 0.81K. Kb value for benzene is 2.53 K $kgmol^{-1}$ .Calculate the molar mass of solute. [Molar mass of benzene is 78 $gmol^{-1}$]

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6. Determine the osmotic pressure of a solution prepa.red by diHolving 2.5 $\times 10^{-2}$ g of a solution 2I. Of water at 25° C, assuming that it is completely dissociated.

$\left(R = 0.0821 \ \ \mathrm{L\,atm\,K^{-1}mol^{-1}}, \ \ \text{molar mass of} K_2SO_4 = 174g \ \ \mathrm{mol^{-1}}\right.$

)

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7. 1.0 g of non - electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.4 K. Find the molar mass of the solute. [Given : Freezing point depression constant of benzene = 5.12 K. kg mol].

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8. A solution of glycerol $(C_3H_8O_3)$ in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100.42° C while pure water boils at 100° C. What mass of glycerol was dissolved to make the solution ? $\left(K_b \text{for water} = 0.512 K \text{kg mol}^{-1}\right)$

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

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10. At 25° C , the saturated vapour pressure of water is 3.165 k Pa (23.75 mm Hg). Find the saturated vapour pressure of a 5% aqueous solution of urea (carbamide) at the same temperature.

(Molar mass of urea = 60.05 g mol^{-1})

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

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12. What mass of ethylene glycol (molar mass = 62.0 g mol^{-1}) must be added to 5.50 kg of water to lower the freezing point of water from

$0^{\circ} C$ to -10.0° C ?

$\left(K_f \text{for water} \quad = 1.86k \ \ \text{kg mol}^{-1}\right)$

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13. 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at - 0.34° C. what is molar mass of the substance ? $\left(K_f \ \ \text{for water} \quad = 1.86kkg \ \ \text{mol}^{-1}\right)$

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14. Vapour pressure of chloroform $(CHCl_3)$ and dichloromethane (CH_2Cl_2) at 298 K and 200 mm Hg and 415 mm Hg respectively (i) calculate the vapour pressure of the solution prepared by mixing 25·5 g of $CHCl_3$ and 40 g ef CH_2Cl_2 at 298 K and (ii) mole fraction of each component in vapour phase.

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15. At a given temperature and pressure nitrogen gas is more soluble in water than helium gas. Which one of them has higher value of K_H ?

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16. Match the following if molecular masses of X, Y, Z are same

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17. At 10° C, the average osmotic pressure of blood is 8.8 atm. Find the concentration of the various constituents in the blood. Assuming that the concentration is the same as the molarity. Find the freezing point of the solution $\left(K_f \text{ for water } = 1.86K \text{ kg mol}^{-1}\right)$

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Topic 3 Colligative Properties Determination Of Molar Mass Abnormal Molar Mass Van T Hoff Factor Long Answer Type Questions Ii

1. (a) Define the following terms :

(i) Molarity

(ii) Molal elevation constant(K_b)

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

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2. (a) What type of deviation is shown by a mixture of ethanol and acetone 7 Give reason.

(b) A solution of glucose (molar mass = 180 g mol^{-1}) in water is labelled as 10% (by mass). What would be the molallty and molarity of the 90lution ? (Density of solution = 1.2 g mL^{-1}.)

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

(b) What is meant by +ve and -ve deviations from Raoult's law and how is the sign of H solution related to +ve and -ve deviations from Raoult's law ?

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4. (a) A 5% solution (by mass) of cane - sugar in water has freezing point of 271 K. Calculate the frttzing point of 5% solution (by mass) of glucose in water if the freezing point of pure water is 273.15 K. [Molecular masses : Glucose $C_6H_{12}O_6$: 180 amu, Cane - sugar

$C_{12}H_{12}O_{11}$: 342 amu]

(b) State Henry's law and mention two of its important applications.

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5. (a) Define the following terms :

(i) Ideal solution

(ii) Azeotrope

(iii) Osmotic pressure

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

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

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6. 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at - 0.34° C. what is molar mass of the substance ? $\left(K_f \text{ for water } = 1.86 kkg \text{ mol}^{-1}\right)$

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7. Define the terms osmosis and osmotic pressutt. Is the osmotic pressure of a solution a colligative property ? Explain.

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8. Calculate the boiling point of a solution prepared by adding 15.00 g of NaCl to 250.0 g of water. (K_b, for water 0.512 K. kg mol^{-1}, molar mus of NaCl = 58.44g)

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

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10. What would be the molar mass of a compound if I 6.21 g of it dissolved in 24 .0 g of chloroform form a solution that has a bolling point of $68.04^{\circ}C$. The bolling point of pure chloroform is $61.7^{\circ}C$ and the boiling point elevation constant, K_b for chloroform is 3.63° C/m.

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11. What is Van't Hoff factor ? What possible values can it have If the solute molecules undergo dissociation?

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12. An aqueous solution containing 12.48 g of barium chloride in 1.0 kg of water boils at 373.08321K. Calculate the d.egree of dissociation of barium I chloride. (Given K_b, of $H_2O = 0.52Km^{-1}$, molar mass of Ba $CI_2 = 208.34gmol^{-1}$]

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13. List any four factors on which the colligative properties of a solution depend.

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14. Calculate the bolling point of one mole aqueous solution (density 1.06 g cm^{-3}) of KBr.

(Given : K_b, for $H_2O = 0.52$K kg mol^{-1}, Atomic mass : K =39 , Br = 80]

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15. Explain why a solution of chloroform and acetone shows negative deviation from Raoult's law.

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16. Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20 g of phenol in 1.0 kg of benzene has its freezing point lowered by 0.69 K. Calculate the fraction of phenol that has dimerised.

[Given : K_f for benzene = 5.1 Km^{-1}]

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17. What is Van't Hoff factor ? Under what conditions Van't Hoff factor is

(i) > 1

(ii) =1

< 1. Explain .

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18. What will happen to the boiling point of a solution if mass of the solute dissolved is doubled and that of the solvent taken is halved ?

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