CHEMISTRY

BOOKS - BETTER CHOICE PUBLICATION

SOLUTIONS

Question Bank 2 1 Types Of Solutions

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

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2. Given an example each of solid in gas and liquid in gas solution

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3. What is meant by gas in gas solutions ? Give two examples .

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4. What is meant by solid in solid solutions ?

Give two examples

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5. What is meant by liquid in liquid solutions ?

Give two examples

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Question Bank 2 2 Expressing Concentrations Of Solutions

1. Define

Mole fraction


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2. Define the following terms

Molality


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3. Define the following terms

Molarity

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4. Define

Mass percentage

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5. Define

Parts per million

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6. When molality of a solution becomes equal to its molarity ?

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7. Why does the molality of a solution remain unchanged with temperature ?

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8. What is the effect of temperature on the molality of a solution

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9. Define molality and molarity . Why is molality preffered over molarity?

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10. Out of 1M (aq) and 1 m (aq) solutions, which is more concentrated and why

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11. Why is one molar solution more concentrated than one molal solutions ?

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12. Write two differences between molarity and molality

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Question Bank 2 3 Solubility

1. Define saturated and unsaturated solutions

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2. Define solubility. Name the factors on which solubility of a solute in a solvent depends.

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3. State Henry's law and mention its some important applications.

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4. What is the effect of temperature on solubility of a gas n a liquid ?

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

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

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7. Ethanol is an organic compound yet it is freely miscible with water.Explain.

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8. Carbon tetrachloride and water are immissible while ethyl alcohol and water are

missible in all proportions .Correlate this behaviour with the molecular structures of these compounds

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Question Bank 2 4 Vapour Pressure Of Liquid Solutions

1. (a) Define vapour pressure

(b) Explain why vapour pressure of a solvent

lowered by the addition of non-volatile solute ?

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2. Why the vapour pressure of saline solutions is lower than that of pure water ?

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3. Why the vapour pressure of a solution of glucose in water is lower than of pure water

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4. State and explain :

Raoult's law for volatile solute.

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5. State and explain :

Raoult's law for non-volatile solute.

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6. What are limitations of Raoult's law

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7. Why petrol evaporate faster than water ?

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8. Why is the vapour pressure of a solvent lowered on the addition of non-volatile solute into it ?

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9. Write similarity between Raoult's law and Henry's law

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Question Bank 2 5 Ideal And Non Ideal Solutions

1. Mention three characteristics of ideal solutions . What cause deviation from ideal

behaviour ? Discuss the + ve deviation from ideal behaviour for ilquid pairs

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2. Define Ideal and non-ideal solution. Give examples each of ideal and non-ideal solutions .

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3. Explain different types of non-ideal solutions. What is the cause of positive and negative deviations ?

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4. Write differences between ideal and non-ideal solutions.

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5. What type of deviation is shown by a mixture of benzene and ethyl alcohol . Explain it .

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6. What type of deviations is shown by a mixture of ethyl alcohol and cyclohexane. Explain it

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7. What type of deviation is shown by a mixture of acetone and chloroform . Explain

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8. Write two differences between solution and emulsion.

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9. What are Azeotropes ?

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10. Define Azeotropic mixture. Give one example.

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11. What are the differences between minimum boiling azeotropes and maximum boiling azeotropes ?

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Question Bank 2 6 Colligative Properties And Determination Of Molar Mass

1. What are colligative properties ? Name four such properties.

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2. Show that relative lowering in vapour pressure is a colligative property

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3. Derive the relationship between the relative lowering of Vapour pressure and the mole fractions of the non volatile solute

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4. Derive the relationship between the relative lowering of Vapour pressure and the mole fractions of the non volatile solute

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5. How will you calculate the molecular mass of a solute with the help of relative lowering in vapour pressure of a solution of a non volatile solute?

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6. Define boiling point and find out expression for the molecular mass of non -volatile solute from the elevation of boiling point.

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7. Define molar elevation constant.

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8. How will you show that elevation in boiling point is a colligative property?

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9. Explain depression in freezing point. How depression in freezing point can be used to

find molar mass of a non-volatile solute

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10. Define molar depression constant

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11. How will you show that depression in freezing point is a colligative property?

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12. How will you show that depression in freezing point is a colligative property?

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13. The boiling point increases and freezing point decreases when sodium chloride is added to water. Why ?

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14. Sodium chloride solution freezes at lower temparature than water but boils at higher temparature than water . Explain.

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15. Out of 1 M urea and 1M KCl solution, which has higher freezing point?

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16. What are antifreeze solutions ?

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17. In cold concentries, a solution of water and ethylene glycol is used as coolant in an automobile engine radiator instead of water. Explain

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

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19. What is de-icing agent ? How does it function ?

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20. Define osmosis. What is the difference between osmosis and diffusion ?

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21. What is Osmotic pressure?

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22. Why determination of osmotic pressure is preffered for finding molecular mass of macro-

molecules?

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23. Show that osmotic pressure is a colligative property?

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24. What is a semi-permeable membrane ?

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25. What are isotonic,hypertonic and hypotonic solutions.

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26. Derive the relationship to find the condition for isotonic solutions.

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27. STATEMENT - 1 : When dried fruits and vegetables are placed in water, they slowly get swollen.

STATEMENT - 2 : It happens due to the phenomenon of osmosis.

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28. A poled egg when dipped in water swells while is saturated brine solution it shrinks. Explain

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Question Bank 2 7 Abnormal Molar Mass

1. Why is great care is taken in intravenous injection to have comparable concentration of solutions to be injected to that of blood plasma /

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2. What do you mean by abnormal molecular mass ? Why do we gets abnormal molecular masses from colligative properties

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3. Define van't Hoff factor . What is its importance? How does it account for abnormal molecular masses?

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4. The van't Hoff factor i for an electrolyte which undergoes dissociation and association in solvents respectively are:

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5. Why is osmotic pressure of 1 M solution of NaCl approximately double than that of 1 M solution of sugar ?

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6. What are abnormal molecular masses ? Why does a solute show abnormal molecular mass in a solution ?

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7. Under what conditions Van't Hoff factor , i is eaual to unity

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8. Under what conditions Van't Hoff factor , i less than one

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9. Under what conditions Van't Hoff factor , i more than one

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10. Out of NaCl and $BaCl_2$ aqueous solutions, which shows more depression in freezing point and Why ?

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11. Out of NaCl and $BaCl_2$ aqueous solutions, which shows more relative lowering of vapour pressure and why ?

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12. Out of NaCl and $BaCl_2$ aqueous solutions which shows more elevation in boiling point and Why ?

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13. What is the size of particles of solutions ?

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Numerical Problems Pseb 2008

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

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2. 18g of glucose , $C_6H_{12}O_6$ (Molar mass=180g mol^{-1}) is dissolved in 1000g (1kg) of water in a sauce pan . At what temparature will water boil at 1.013 bar? K_b for water is 0.52K kg

mol^{-1} . Water boils at 373.15K at 1.013bar pressure.

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3. How much ethly alcohol must be added to 1.0 L of water so that solution will not freeze at -4° ? ($K_f = 1.86^{\circ}C/m$)

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4. Benzene and toluene form nearly ideal solution . At 313 K the vapour pressure of benzene and toluene are 160 mm and 60 mm of Hg respectively. Calculate the total pressure of the solution made by mixing their equal masses at 313 K.

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5. At 293 K, ethyl acetate has vapour pressure of 72.8 torr ethyl proprionatr has vapour

pressure of 27 . 7 torr. Assuming their mixture to obey Raoult's law determine the vapour pressure of the mixture containing 25 g ethyl acetate and 50 g of ethyl propomoate

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6. Benzene and toluene form nearly ideal solution. At a certain temperature the vapour pressure of pure benzene and toluene are 150 and 50 torr. respectively. Calculate the vapour

pressure of solution containing equal weights of benzene and toluene at this temperature .

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Numerical Problems Pseb 2009

1. At 298 K the vapour pressure of pure benzene C_6H_6 is 0.256 bar and vapour pressure of pure toluene, C_6H_8 is 0.925 bar. If the mole fraction of benzene in solution is 0 . 40 , find the total vapour pressure of solution.

Also find the mole fraction of toluene in vapour phase

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2. 2g of benzoic acid (C_6H_5COOH) is dissolved in 25g of benzene show depression in freezing point equal to 1.62K. Molar depression constant for benzene, K_f=4.9K $kgmol^{-1}$. What is percentage association of acid if it forms a dimer in solution?

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3. Vapour pressure of chlolfom $(CHCI_3)$ and dichloromethane (CH_2CI_2) at 298 K are 200 mm Hg and 415 mm Hg respectively. Calculate the vapour pressure of the solution prespared by miximng 25 g of $CHCI_3$ and 45 g of CH_2CI_2 at 298 K. Also find the mole fraction of CHI_3 in the vapour phase .

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4. 5 . 0 g of phenol dissolved in 250 g of benzene shows a depression in freezing point equal to $0.70^{\circ}C$. What is the percentage association of phenol ? (K_f for benzene = 5.12 K kg.MOL^{-1})

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5. The vapour pressure of ethanol and methanol are 44.5 and 88.7 mm of Hg at 298 K. An ideal solution is formed at the same

temperature by mixing 60 g of ethanol and 40 g methanol. Calculate the total vapour pressure of the solution and the mole fraction of methanol in the vapour phase.

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6. 1 . 5 of Ba $(NO_3)_2$ dissolved in 100 g of water shows a depression in freezing point equal to $0.28^\circ C$. What is the percentage dissociation of the salt ? (K_f for water = 1 . 86 K/m and molar mass of Ba $(NO_3)_2$ = 261.)

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7. Addition of 0.643g of a compound to 43.95g of benzene lowers the freezing point from 5.51° C to 5.03° C. If K_f for benzene is 5.12K kg mol^{-1} , calculate the molar mass of the compound.

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8. Boiling point of benzene is 353.23 K . When 1 . 80 g of non-volatile solute was dissolved in

90 g of benzene the boiling point is raised to 354. 11 K? Calculate molar mass of solute . (K_b for benzene is 2 . 53 K kg mol^{-1})

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9. 200 cm^3 of an aqueous solution of a protein contains 1.26g of the protein . The osmotic pressure of such a solution at 300K is found to be 2.7×10^{-3} bar. Calculate the molar mass of the protein (R=0.083 L bar $mol^{-1}K^{-1}$)

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10. 4 . 0 g of NaOH are contained in one decilitre of a solution. Calculate the molarity and molality of this solution .

(Density of solution $= 1.038 gmL^{-1}$)

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11. At some temperature the vapour pressure of pure benzene, C_6H_6 is 0 . 256 bar and vapour pressure of toluene, $C_6H_5CH_3$ is 0 . 0

925 bar, if the mole fraction of toluene in a solution is 0 . 60

(i) What is the total vapour pressure of the solution ?

(ii) Calculate the composition of the vapour phase in terms of mole fraction.

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12. Calculate molarity and molality of solution prepared by mixing equal volumes of $30\ \%$ by mass of H_2SO_4 (density = 1 .218 g mL^{-1}) and

$70\,\%$ by mass of H_2SO_4 (density $= 1.610 gmL^{-1}$)

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13. Vapour pressure of chlolfom $(CHCI_3)$ and dichloromethane (CH_2CI_2) at 298 K are 200 mm Hg and 415 mm Hg respectively. Calculate the vapour pressure of the solution prespared by miximng 25 g of $CHCI_3$ and 45 g of CH_2CI_2 at 298 K. Also find the mole fraction of CHI_3 in the vapour phase .

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14. Vapour pressure of chlolfom $(CHCI_3)$ and dichloromethane (CH_2CI_2) at 298 K are 200 mm Hg and 415 mm Hg respectively. Calculate the vapour pressure of the solution prespared by miximng 25 g of $CHCI_3$ and 45 g of CH_2CI_2 at 298 K. Also find the mole fraction of CHI_3 in the vapour phase .

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15. The density of $10\,\%$ by mass of KCl solution in water is $1.06 gm L^{-1}$. Calculate molarity and molality of the solution

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16. The vapour pressure of ethanol and methanol are 44.5 and 88.7 mm of Hg at 298 K. An ideal solution is formed at the same temperature by mixing 60 g of ethanol and 40 g methanol. Calculate the total vapour

pressure of the solution and the mole fraction of methanol in the vapour phase.

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17. 18 g of a compound is dissolved in 10 kg of water so that the resulting solution freezes at $-8^{\circ}C$. If K_f for water = 1 . 86 K/m . Calculate the molecular mass of the compound

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18. 35 g of compound is added in 1 kg of water so that the resulting solution freezes at -10° C . If K_f for water = 1. 86 K/m . Calculate the molecular mass of the compound

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19. 70 g of glucose and 40 g of NaCl are dissolved in 900 g of water, calculate the mole fraction of each component?

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20. In winter, the normal temperature in Dharmshala is -8° C Is a $30\,\%$ by mass of an aqueous solution of ethylene glycol (molar mass = 62) suitable for car radiator . K_f for water is 1 . 86 K/m

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21. Calculate mole fraction of ethanol and water in a sample of rectified spirit which contains 92% ethanol by mass.

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22. In winter, the normal temperature in Kashmir valley is -12° C . Is a $25\,\%$ by mass of an aqueous solution of ethylene glycol (molar mass = 62) suitable for car radiator . K_f for water is $1.\,86 Km^{-1}$

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Numerical Problems Pseb 2011

1. A sugar syrup of weight 214.2g contains 34.2g of sugar $(C_{12}H_{22}O_{11})$. Calculate (i) Molality and (ii) Mole fraction of sugar in syrup.

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2. In winter, the normal temperature in a Himalayan's valley was found to be -10° C . Is a $30\,\%$ by mass of an aqueous solutions of ethylene glycol (molar mass = 62) suitable for car radiator ? K_f for water is $1.\,86Km^{-1}$

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3. If 1 .71 g of sugar (molar mass = 342) are dissolved in $500cm^3$ of solution at 300 K, what will be its osmotic pressure ?

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4. 19.5 g of CH_2FCOOH is dissolved in 500 g of water. The depression in the freezing point of water observed is 1.0° C. Calculate the van't

Hoff factor and dissociation constant of fluoroacetic acid.

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5. Calculate mole fraction of ethanol and water in a sample of rectified spirit which contains 92% ethanol by mass.

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6. Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at 25° C, assuming that it is completely dissociated.

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7. 2g of benzoic acid (C_6H_5COOH) is dissolved in 25g of benzene show depression in freezing point equal to 1.62K. Molar depression constant for benzene, K_f=4.9K

$kgmol^{-1}$. What is percentage association of acid if it forms a dimer in solution?

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

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9. Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 in 2 litre of water at 25° C, assuming that it is completely dissociated.

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10. 19.5 g of CH_2FCOOH is dissolved in 500 g of water. The depression in the freezing point of water observed is 1.0° C. Calculate the

van't Hoff factor and dissociation constant of fluoroacetic acid.

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11. The density of 10% by mass of KCI solution in water is $1.06 gmL^{-1}$. Calculate molarity and molality of the solution

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12. Concentrated H_2SO_4 has a density 1 . 9 g/mL and is $99\,\%\,H_2SO_4$ by mass. Calculate the molarity of the acid

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13. Commercially available HCl contains 38% HCl by mass. Calculate molarity of solution if the density is 1.19 g/mol.

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Numerical Problems Pseb 2012

1. A solution contains non volatile solute of molecular mass M_2. Which of the following can be used to claculate the molecular mass of solute in terms of osmotic pressure ?

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2. Find the molarity and molality of a 67% solution of HNO_3 by weight . The density of

the solution is 1.50 4 g/ cc and the molecular mass of nitric acid is 63

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3. A solution of 12.5 g of non electrolyte solute in 175 g of water gave an elevation of 0 . 70 K in boiling point . Calculate the molecular mass of solute . The molal elevation constant for water is, K_b = 0 . 52 K/m

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4. Find the molarity and molality of a 37% solution of HCI by weight . The density of the solution is 1 19 g/cc. and the molec lar mass of hydrochloric acid is 36. 5

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5. 200 cm^3 of an aqueous solution of a protein contains 1.26g of the protein . The osmotic pressure of such a solution at 300K is found to be 2.7×10^{-3} bar. Calculate the molar

mass of the protein (R=0.083 L bar $mol^{-1}K^{-1}$

)

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6. Find the molarity and molality of a 67% solution of HNO_3 by weight . The density of the solution is 1.50 4 g/ cc and the molecular mass of nitric acid is 63

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Numerical Problems Pseb 2013

1. A solution of glycerol $(C_3H_8O_3)$ in water as prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100 . 42° C. What mass of glycerol was dissolved to make the solution ? K_b for H_2O = 0 . 512 K kg mol^{-1}

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

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3. 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at $-0.34^{\circ}C$. What is them

molar ass of the substance ? (K_f for water = 1.

86 K kg mol^{-1})

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4. The boiling point of Benzene (C_6H_6) is 353.23 K. When 1 . 80 g of a non - volatile solute was dissolved in 90 g of C_6H_6 the boiling point is raised to 354 . 11 K. Calculate the molar mass of solute .

(Given K_b for benzene is 2 . 53 K kg mol^{-1})

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5. Calculate the molal elevation constant of water $(K_b = ?)$. Given that 0 . 1 molar aquous solution of a substance boiled at 100.052° C

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Numerical Problems Pseb 2014

1. Calculate the temperature at which a solution containing 54 gms of glucose

$(C_6H_{12}O_6)$ in 250 gms of water will freeze. K_f for water .

$(1.\ 86Kkgmol^{-1})$

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2. 1.00g of a non-electrolyte solute dissolved in 50g of benzene lowered the freezing point of benzene by 0.40K. The freezing point depression constant of benzene is 5.12K mol^{-1} . Find the molar mass of the solute.

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Numerical Problems Pseb 2015

1. Commercially available sample of sulphuric acid is 15% H_2SO_4 by weight (density=1.10g mL^{-1}) . Calculate the molarity of the solution.

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Numerical Problems Pseb 2016

1. 10g of non-volatile solute when dissolved in 100g of benzene raises its boiling point by 1° C. What is the molecular mass of the solute. (k_b for benzene=2.53 K kg mol^{-1})

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2. 45g of ethylene glycol ($C_2H_6O_2$) is mixed with 600g of water. Calculate

The freezing point depression

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3. 45g of ethylene glycol ($C_2H_6O_2$) is mixed with 600g of water. Calculate

The freezing point depression

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4. Boiling point of benzene is 353.23 K . When 1 . 80 g of non-volatile solute was dissolved in 90 g of benzene the boiling point is raised to 354. 11 K? Calculate molar mass of solute .

(K_b for benzene is 2 . 53 K kg mol^{-1})

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

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