



# CHEMISTRY

## BOOKS - MODERN PUBLICATION

### SOLUTIONS

#### Exercise

1. A liquid is in equilibrium with its vapours at its boiling point. On the average the molecules in the two phases have equal:

A. potential energy

B. total energy

C. kinetic energy

D. intermolecular forces

**Answer: C**



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**2. In the case of osmosis, solvent molecules move from:**

A. higher vapour pressure to lower vapour pressure

B. higher concentration to lower concentration

C. lower vapour pressure to higher vapour pressure

D. higher osmotic pressure to lower osmotic pressure

**Answer: A**



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3. If molecular interaction between two different liquid molecules are stronger than the molecular interactions between the pure liquid molecules, the mixture is expected to show:

A. positive deviations

B. negative deviations

C. no deviations

D. positive as well as negative deviations

**Answer: B**



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4. The ratio of the value of any colligative property for KCl solution to that of sugar solution is:

A. 1

B. 0.5

C. 2

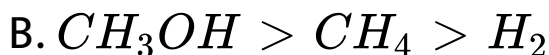
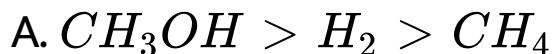
D. 4

**Answer: C**



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5. On the basis of intermolecular forces predict the correct order of decreasing boiling to that of sugar solution is:



**Answer: B**



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6. If the temperature increases from  $0^{\circ}C$  to  $50^{\circ}C$  at atmospheric pressure, which of the following processes is expected to take place more in case of liquids ?

A. fusion

B. vaporisation

C. solubilization

D. none

**Answer: B**



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7. The reverse of fusion is freezing and it is:

A. endothermic

B. exothermic

C. neither exothermic nor endothermic

D. may be exothermic or endothermic



**Answer: B**



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8. The most suitable method for the determination of molecular weight of oxyhaemoglobin, a compound of high molecular weight is:

A. Osmotic pressure method

B. Vapour pressure lowering method

C. Elevation of boiling point method

D. none

**Answer: A**

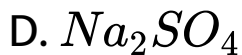
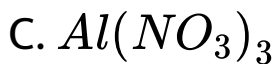


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9. Which salt may show the same value of van't Hoff factor (i) as that of  $K_4Fe(CN)_6$  in very dilute solution state ?

A.  $Al_2(SO_4)_3$

B.  $NaCl$



**Answer: A**



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**10.** The lubricating action of an oil is more if it possess:

A. High vapour pressure

B. Low vapour pressure

C. High surface tension

D. High density

**Answer: B**



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**11.** Which solution will show the maximum vapour pressure at 300 K ?

A. 1 M  $NaCl$

B. 1 M  $CaCl_2$

C. 1 M  $CH_3COOH$

D. 1 M  $C_{12}H_{22}O_{11}$

**Answer: D**



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**12.** The van't Hoff factor (i) for a dilute aqueous solution of glucose is:

A. Zero

B. 1

C. 1.5

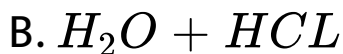
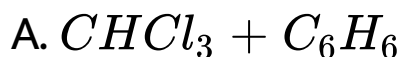
D. 2

**Answer: B**



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**13.** Which pair shows a contractions in volume on mixing ?





D. all

**Answer: D**



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**14.** If  $P_0$  and  $P_\delta$  are the vapour pressure of solvent and solution respectively and  $N_1$  and  $N_2$  are the mole of solute and solvent then:

A.  $(P_0 - P_\delta)/P_0 = N_1/(N_1 + N_2)$

B.  $(P_0 - P_8) / p_s = (N_1) / N_2$

C.  $P_s = P_0 \cdot N_2 / (N_1 + N_2)$

D. ALL

**Answer: D**



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**15.** Which characterises the weak intermolecular forces of attraction in a liquid ?

A. High boiling point



B. High vapour pressure

C. High critical temperature

D. High heat of vaporisation

**Answer: B**



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**16.** The phenomenon in which cells are swelled up and then burst if placed in hypotonic solutions is called:

A. Plasmolysis

B. Haemolysis

C. Exosmosis

D. none

**Answer: B**



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**17.** The phenomenon in which cells are swelled up and then burst if placed in hypotonic solutions is called:

A. Plasmolysis

B. Haemolysis

C. Endosmosis

D. NONE

**Answer: A**



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**18.** Equimolal solutions will have the same elevation in boiling point, provided they do not show:

A. Electrolysis

B. Association

C. Dissociation

D. Association or dissociation

**Answer: D**



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**19.** The depression in f.p.t. is directly proportional to:

A. Normality

B. Molality

C. Molarity

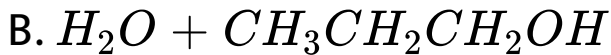
D. NONE

**Answer: B**



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**20.** Pick out the combination which show positive deviations from Raoult.s law:



D. All are correct

**Answer: D**



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**21.** If mole fraction of the solvent in a solution decreases then:

A. Vapour pressure of solution increases

B. B.P. decreases

C. Osmotic pressure increases

D. All are correct

**Answer: C**



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**22.** In which of the following the van.t Hoff Factor (i) is equal to one ?

A.  $NaCl$

B.  $KNO_3$

C. UREA

D. ALL

**Answer: C**



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



A. An azeotropic mixture

B. An eutectic formation

C. That the liquids are immiscible with One  
another

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

**Answer: A**



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24. When the vapour pressure of solutions of two liquids are less than those expected from ideal solutions, they are said to show:

A. Positive deviations from ideal behaviour

B. Negative deviations from ideal behaviour

C. Positive deviations for lower concentrations and negative deviations for higher concentration

D. NONE

**Answer: B**



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**25.** The natural semipermeable membrane is:

A. Gelatinous  $Cu_2Fe(CN)_6$

B. gelatinous  $Ca_3(PO_4)_2$

C. plant cell

D. phenol layer

**Answer: C**



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26. The osmotic pressure of a solution increases if,

A. Temperature is lowered

B. Volume is increase

C. Number of solute molecules is increased

D. none

**Answer: C**



27. Just after slow crystallisation the solution in contact with the crystal is:

- A. Dilute
- B. Unsaturated
- C. Saturated
- D. Super saturated

**Answer: D**



**28.** The van't Hoff factor (i) for a dilute solution of  $K_3[Fe(CN)_6]$  is:

A. 10

B. 4

C. 5

D. 0.25

**Answer: B**



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29. Which of the following 0.1 M aqueous solutions will have the lowest freezing point :

A. Potassium sulphate

B. Sodium chloride

C. urea

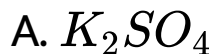
D. glucose

**Answer: A**

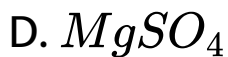


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30. Which compound corresponds van.t Hoff factor (i) to be equal to 2 in dilute solution?



C. sugar



**Answer: D**



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**31.** The plant cells will shrink when placed in

A. water

B. A hypotonic solution

C. A hypertonic solution

D. An isotonic solution

**Answer: C**



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32. A solution of sulphuric acid in water exhibits:

A. Negative deviations from Raoult's law

B. Positive deviations from Raoult's law

Modern's

C. Ideal properties

D. The applicability of Henry's law

**Answer: A**



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**33.** A substance will be deliquescent if its vapour pressure is:

A. Equal to the atmospheric pressure

B. Equal to that of water vapour in the air

C. Greater than that of water vapour in the  
air

D. Lesser than that of water vapour in the  
air

**Answer: D**



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**34.** The process of getting freshwater from sea water is known as:

A. osmosis

B. filtration

C. diffusion

D. reverse osmosis

**Answer: D**



**35.** Saturated solution of NaCl on heating becomes:

- A. Super 'saturated
- B. Unsaturated
- C. Remains saturated
- D. none

**Answer: B**



**36.** A super saturated solution is a metastable state of solution in which solute concentration:

A. Is equal to the solubility of that substance in water

B. Exceeds its solubility

C. Less than its solubility

D. Continuously chang

**Answer: B**



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37. The molal cryoscopic constant for water is:

A.  $1.86 \text{ K molality}^{-1}$

B.  $5.26 \text{ K molality}^{-1}$

C.  $55.5 \text{ K molality}^{-1}$

D.  $0.52 \text{ K molality}^{-1}$

**Answer: A**



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**38.** An aqueous solution is heated until it begins to boil. The atmospheric pressure is 760 mm of Hg. The boiling temperature will be:

A.  $100^{\circ}\text{C}$

B.  $\text{gt}100^{\circ}\text{C}$

C.  $\text{lt}100^{\circ}\text{C}$

D. None

**Answer: B**



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**39.** The spontaneous movement of solute particles from a more concentrated solution to less concentrated solution is called:

- A. Osmosis
- B. diffusion
- C. Plasmolysis
- D. fusion

**Answer: B**



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40. At a suitable pressure near the freezing point of ice, there exists:

A. Only ice

B. Ice and water

C. Ice and steam

D. Ice, water and steam, all existing side by side

**Answer: D**



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41. With increase of altitude, the boiling point of water \_\_\_\_\_(increase,decreases,remains same)



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42. Solutions having same osmotic pressure are called \_\_\_\_\_



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**43.** On adding a solute, freezing point of solution \_\_\_\_\_ .



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**44.** On adding a solute, boiling point of solution \_\_\_\_\_ .



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**45.** On adding a solute, osmotic pressure \_\_\_\_\_



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46. On adding a solute, vapour pressure \_\_\_\_\_



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47.  $Cl_4$  is \_\_\_\_\_ in water.



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**48.** When temperature increases vapour pressure of liquid –



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**49.** Solubility of a gas in liquid, \_\_\_\_\_ with rise of temperature .



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50. At the boiling point of a liquid its vapour pressure is equal to \_\_\_\_\_.



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51. Polar solutes are \_\_\_\_\_ in non-polar solvents

.



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52. Colligative properties are inversely proportional to \_\_\_\_\_



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53. Van't Hoff law of osmotic pressure of dilute solution is expressed as \_\_\_\_\_



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54. Van't Hoff factor (i) in terms of molar mass is expressed as \_\_\_\_\_



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55. On adding a solute, vapour pressure increases .(true/false)



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**56.** The sum of mole fractions of all components is in a three component system is three.SAY TRUE/FALSE



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**57.** Solubility of a gas in liquid, increases with rise of temperature .



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**58.** At the boiling point of liquid its vapour pressure is greater than atmospheric pressure . Is it true or false?



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**59.** For non-electrolytic solution, the value of van't Hoff factor,  $i = \text{zero}$  SAY TRUE/FALSE



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60. Give two sets of examples of non-ideal solutions showing positive deviation.



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61. Write expressions of  $\Delta_{mix} H$  and  $\Delta_{mix} V$  of non-ideal solution showing negative deviation.



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**62.** What type of deviation is shown by the mixture of acetone and chloroform (or acetone + aniline) where reduction in volume takes place ?



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**63.** Name the solution of two liquids, which boil at constant temperature and can distil over without change in composition



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



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**65.** What are two solutions called when they have same osmotic pressure



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**66.** How is human blood is related to saline water (0.91%) of sodium chloride solution?



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**67.** What is the solution called, when it has lower osmotic pressure as compared to that of another solution ?



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**68.** Name a large scale use of reverse osmosis



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**69.** How is the value of a colligative property related to molecular mass of non-electrolytic solute like urea ?



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70. What is term assigned to the value of elevation in boiling point of a solution containing 1 gm-mole of solute dissolved in 1000 g of solvent ?



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71. What is the ratio of normal molecular mass to observed molecular mass called ?



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72. What is value of van't Hoff factor  $T$  for acetic acid (or benzoic acid) ?



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73. When will be the value of vant Hoff factor greater than one?



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74. What is the value of van't Hoff factor for the non-electrolytic solution?



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75. What is the value of van't Hoff factor for the electrolyte of type  $AB_2$  (i.e.,  $CaCl_2$ ) or  $A_2B$  (i.e.,  $K_2SO_4$ ) ?



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



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**77.** Under what condition van't Hoff factor  $i$  is less than one.



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78. What would be the value of van't Hoff's factor for a dilute solution of  $K_2SO_4$  in water ?



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79. What is the freezing point of water at 1 atmospheric pressure in kelvin scales ?



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80. What Is the molarity of 1.5  $NHNO_3$  ?



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81. What are the units of molality ?



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82. Write the units of molarity.



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**83.** What is the molality of a solution containing 0.2 mol of solute dissolved in 5 kg of solvent ?



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**84.** Which law gives the relationship between the mass ( $m$ ) of the gas dissolved in a given volume of liquid at a constant temperature and the pressure ( $p$ ) of the gas.



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**85.** What is the effect of pressure on the solubility of a gas ?



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**86.** What is the effect of temperature on the solubility, if the substance dissolves in water with liberation of heat ?



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**87.** Between hydrogen and helium which is more soluble in water ?



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**88.** Between hydrogen and helium which one has higher value of Henry's law of gas constant ?



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**89.** Give two examples of solid substances, whose solubility increases with rise in temperature



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**90.** What is the effect of pressure on the solubility of a solid ?



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**91.** What is the term assigned to the pressure exerted by the vapours on the surface of liquid in equilibrium at a given temperature ?



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**92.** Which law gives the quantitative relationship between partial pressures  $p_1$  or  $p_2$  and mole fractions  $x_1$  or  $x_2$  of two volatile liquid components of a liquid-liquid solutions ?





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**93.** What is the term assigned to the solutions, Which obey Raoult's law over entire range of concentration ?



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**94.** How is vapour pressure ( $p_1$ ) of a solution of a nonvolatile solid in liquid related to the mole fraction ( $x_1$ ) of the solvent ?



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**95.** Write the expression of Raoult's law for vapour pressure of solution containing non-volatile solid in liquid.



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**96.** For an ideal solution of liquid in liquid give two expressions for enthalpy of mixing  $\Delta(\text{mix}H)$  and volume of mixing  $\Delta(\text{mix}V)$ .



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**97.** Give two sets of examples of liquid-liquid ideal solutions.



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**98.** How can the vapour pressures of two liquids of a non-ideal solution be expressed ?



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**99.** What type of deviation from Raoult's law is shown, if A.....B interactions in solutions are weaker than A.....A and B.....B interactions ?



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**100.** What type of change takes place when suger is dissolved in a cup of tea ?



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**101.** Out of 1M urea solution or 1M glucose solution, which will have higher boiling point ?



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**102.** What is the value of Van't Hoff factor  $i$  for  $K_4[Fe(CN)_6]$  aqueous solution assuming complete ionisation ?



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**103.** Name the component present in small quantity in a binary solution



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**104.** Name the component present in large quantity in binary solution



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**105.** Which type of solution an alloy is ?



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**106.** Which type of solution an amalgam is ?



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**107.** Give one example of solid in gas and liquid in gas solution?



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**108.** Which unit of concentration is used when the solute is present in trace quantities ?



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**109.** What is the sum of mole fractions of all components in a given solution ?



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**110.** Name two concentration units which do not change with temperature.



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**111.** Which concentration term is expressed as the number of moles of solute dissolved per 1000 ml (or 1 litre) of solution ?



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**112.** Which concentration term is expressed as the number of moles of solute dissolved per 1000 g (or 1 kg) of the solvent ?



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**113.** What is the relationship between depression in freezing point of a solution and molecular mass of the solute ?



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**114.** In which type of liquid, an ionic solid will go into solution ?



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**115.** At 313 K, the vapour pressure of methanol and ethanol solution is expressed as:  $p = 123x + 132$  mm Hg where  $X$  is equal to mole fraction of methanol. What is vapour pressure of pure ethanol at this temperature ?



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**116.** Why cannot water be separated completely from ethanol by fractional distillation ?



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



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**118.** Camphor is used as solvent to determine molecular weight of non-volatile solute by Rast method because. For camphor:



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**119.** State Henry's law.



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**120.** Define mole fraction .







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**121.** Calculate the molarity when 73 grams of HCl is dissolved in water to make 1500 ml solution.



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**122.** What do you understand by osmotic pressure ?



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**123.** Define molality. 29.25 gms of NaCl are present in 529.25 gms of solution . Find out the molality .



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**124.** 5.85 g of NaCl is dissolved in 90 g water what is the mole fraction of NaCl ?



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**125.** Compare the osmotic pressures following two solutions at the same temperature :(i) 1 M Glucose solution (ii) 1 M Urea solution.



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**126.** Arrange the following in increasing order of their vapour pressure at room temperature. (Water, salt solution in water, alcohol – water solution)



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**127.** How does the vapour pressure of a liquid change with intermolecular force of attraction ?



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**128.** What is freezing point of a liquid ?



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**129.** What is Osmotic pressure ?



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**130.** What is ebullioscopic constant ?



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**131.** Between sea water and pure water, which boils at a higher temperature ?



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**132.** Define osmosis.



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**133.** 15 gm of a substance dissolved in 150 gms of water produces a depression of  $-1.2^{\circ}\text{C}$  in the freezing point . Calculation the Mol. Wt. of the solid (  $K_f$  for water is  $1.86\text{ K kg mol}^{-1}$  )



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**134.** What is the relationship between depression in freezing point of a solution and molecular mass of the solute ?



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**135.** What is condition of reverse osmosis?



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**136.** Name the properties which depend only on the solute particles.



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**137.** Under what condition van't Hoff factor  $i$  is less than one.



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**138.** Find the value of van't Hoff factor for the binary ( $n = 2$ ) electrolyte of the type AB such as *KCl*.



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**139.** Why is molality considered better for expressing concentration of solution than molarity?



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**140.** Define Raoult's law for binary solutions.



**Watch Video Solution**

**141.** What are isonotic solutions ?



**Watch Video Solution**

**142.** What is reverse osmosis ?



**Watch Video Solution**

**143.** What is ebullioscopic constant ?



**Watch Video Solution**

**144.** Define Van't Hoff factor.



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**145.** What is hypotonic solution ?



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**146.** Define Henry's law about solubility of a gas in a liquid.



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**147.** At the same temperature, hydrogen is more soluble in water than helium. Which of them will have a higher value of  $K_H$  and why ?



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**148.** Which will have higher boiling point : 0.1 M  $NaCl$  or 0.1 M  $BaCl_2$  in water ? Explain.



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**149.** Why does the use of pressure cooker reduce the cooking time ?



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**150.** Define azeotropic mixture.



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



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



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**153.** What happens when blood is placed in pure water ?



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**154.** If  $K_f$  for water is  $1.86^\circ \text{C}/\text{m}$ , explain why 1 m  $\text{NaCl}$  in water does not have a freezing point equal to  $-1.86^\circ \text{C}$  but equal to  $-3.72^\circ \text{C}$ .



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**155.** Why is the boiling point of a solution always higher than that of a pure solvent ?



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**156.** Distinguish between diffusion and osmosis.



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**157.** Define Van't Hoff factor.



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**158.** Concentrated nitric acid used in the laboratory work is 68% nitric acid by mass in aqueous solution. What should be molarity of such sample of the acid if the density of solution is  $1.504 \text{ g mL}^{-1}$  ?



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**159.** What role does the molecular interactions play in solution of alcohol and water ?



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**160.** The vapour pressure of water is 12.3 kPa at 300 K. Calculate the vapour pressure of one molal solution of non-volatile solute in water.



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



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**162.** A 1.00 molal aqueous solution of trichloroacetic acid ( $CCl_3COOH$ ) is heated to its boiling point. The solution has the boiling point of  $100.18^\circ\text{C}$ . Determine the van't Hoff factor for trichloroacetic acid.

$$K_b = 0.512 \text{ K kg/mol}$$



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**163.** How will you determine the molecular mass of a substance from osmotic pressure ?



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**164.** Give two limitations of Raoult's law.



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**165.** Sodium chloride solution freezes at a lower temperature but boils at a higher

temperature than water. Explain.



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**166.** What are antifreeze solutions ? Which substance is commonly used as antifreeze ?



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**167.** A solution is made by dissolving 30 g of a non-volatile solute in 90 g of water. It has a vapour pressure of 2.8 k Pa at 298 K. At 298 K,

vapour pressure of pure water is 3.64 kPa.

Calculate the molar mass of the solute.



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**168.** Calculate the temperature at which a solution containing 54 g of glucose ( $C_6H_{12}O_6$ ) in 250 g of water will freeze. ( $K_f$  for water =  $1.86 \text{ K mol}^{-1} \text{ kg}$ ).



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**169.** Calculate the amount of KCl which must be added to 1 kg of water so that the freezing point is depressed by 2K. ( $K_f$  for water = 1.86 K kg mol<sup>-1</sup>).



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**170.** State Raoult's law. How is the molecular mass of a solute determined from lowering of vapour pressure measurement ?



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**171.** A solution contains 72% water and 28% methyl alcohol. Calculate the mole fraction of each component in the solution.



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**172.** State Henry's law correlating the pressure of a gas and its solubility in a solvent and mention its two applications ?



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**173.**  $H_2S$  a toxic gas with rotten egg like smell, is used for qualitative analysis. If the solubility of  $H_2S$  in water at S.T.P. is 0.195. Calculate Henry's law constant.



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**174.** How would you justify that the relative lowering in vapour pressure is a colligative property ?



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**175.** What type of deviations (positive or negative) from an ideal solution will be shown by the solution of cyclohexane and ethanol ?



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**176.** Heptane and octane form ideal solution. At 373 K, the vapour pressures of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure

of a mixture of 26.0g of heptane and 35 g of octane ?



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**177.** What do you mean by depression in freezing point? Show that depression in freezing point is a colligative property.



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



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**179.** 2g of benzoic acid ( $C_6H_5COOH$ ) dissolved in 25 g of benzene shows a depression in freezing point equal to 1.62 K. Molar depression constant for benzene is 4.9 K kg  $mol^{-1}$ . What is the percentage association of acid if it forms double molecules (dimer) in solution ?



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**180.** Distinguish between diffusion and osmosis.



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**181.** Define Van't Hoff laws of Osmotic pressure.



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**182.** Define the terms osmosis and osmotic pressure. What is the advantage of using

osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions ?



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**183.** What are ideal and non-ideal solutions ?  
What types of non-idealities are exhibited by cyclohexane-ethanol mixtures ? Give reasons for your answer.



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**184.** Why do we sometimes get abnormal molecular masses of the substance by using colligative properties of the solution ? State the factors with suitable example which bring abnormality in the results thus obtained.



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**185.** Explain elevation in boiling point of a solution with the help of vapour pressure temperature diagram. How will you determine the molecular mass of solute from it?





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