CHEMISTRY

BOOKS - KUMAR PRAKASHAN KENDRA CHEMISTRY (GUJRATI ENGLISH)

SOLUTIONS

Example

1. Calculate the mole fraction of ethylene glycol $(C_2H_6O_2)$ in a solution containing 20% of $C_2H_6O_2$ by mass.

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2. Calculate the molarity of a solution containing 5g of NaOH in 450 mL solution.

3. Calculate molality of 2.5 g of ethanoic acid (CH_3COOH) in 75 g of benzene.

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

5. Vapour pressure of chloroform $(CHCl_3)$ and dichloromeane (CH_2Cl_2) at 298 K are 200 mm Hg and 415 mm Hg respectively.

(i) Calculate the vapour pressure of the solution prepared by mixing 25.5

g of $CHCl_3$ and 40 g of CH_2Cl_2 at 298 K and,

(ii) Mole fractions of each component in vapour phase.

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

7. 18 g glucose, $C_6H_{12}O_6$, is dissolved in 1 kg of water in saucepan. At what temperasture will water boil at 1.013 bar ? K_b for water is 0.52 K kg mol^{-1}.

8. The boiling point of benzene is 353.23 K. When 1.80 g of a non - volatile solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. K_b for benzene is 2.53 K kg mol^{-1}.

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9. 45 g of ethylene glycol $(C_2H_6O_2)$ is mixed with 600 g of water. Calculate (a) the freezing point depression and (b) the freezing point of the solution.

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10. 1.00 g of a non - electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. The freezing point depression constnat of benzene is $5.12 K kgmol^{-1}$. Find the molar mass of the solute.

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11. $200cm^3$ of an aqueous solution of a protein contains 1.26 g of the protein. The osmotic pressure of such a solution at 300 K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein.

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12. 2 g 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 dimer in solution ?

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13. 0.6 mL of acetic acid (CH_3COOH), having density $1.06 gmL^{-1}$, is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was $0.0205°C$. Calculate the van't Hoff factor and the dissociation constant of acid.

Section A Questions

1. Explain types of solution on the basis of physical states of solute and solvent with suitable examples.

2. What is the mean of concentration of solution ? Discuss different types of concentration of solutions ?

3. Explain % V/V in brief.

4. Explain % w/V and % w/w in brief.

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5. Explain parts per million in brief.

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6. What is mole fraction ? Explain in brief.

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7. Explain molarity and molality in short.

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8. What is solubility ? Explain solubility of solid solute in liquid solvent.

9. Explain solubility of solution formed by gaseoius solute and liquid solvent.

10. Write and explain Henry's law. Also write its application.

11. Derive an equation for solution which shows relation between total pressure and mole fraction of volatile solute and volatile solvent and explain it by plotting graph.

12. Explain "Solubility of gaseous solute and vapour pressure of liquid solution follows Henry's and Raoult's law".

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13. Explain vapour pressure of solutions of solids in liquids.

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14. Explain ideal solution.

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15. What are non ideal solutions ? Explain non ideal solutions with positive deviation and those with negative deviation.

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16. What is azeotropes ? Explain their types.

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17. What are colligative properties ?

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18. Write Raoult's law for non - volatile solute and volatile solvent and explain it.

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19. What is elevation in boiling point ? Explain.

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20. What is molal elevation ? Explain.

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21. What is depression of freezing point ? Explain.

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22. What is molal depression constant (K_f) ? Derive equation relating K_f with molar mass of solute.

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23. What is semi permeable membrane ? Give examples.

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24. Explain : What is osmosis ? Give example.

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25. What is osmotic pressure ? Explain and derive equation.

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26. Which method is most suitable to determine molecular mass of polymer ?

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27. Explain isotonic solutions.

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28. Explain reverse osmosis and purification of water.

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29. Explain abnormal molar masses. Also explain association and dissociation of solute.

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30. Explain van't Hoff factor.

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Section A Questions Self Practice Questions

1. Given examples of gaseous solute and solvent.

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2. Given physical state of solution of camphor as solute and N_2 gas as solute.

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3. German silver is a mixture or which metals ?

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4. Bronze is a mixture of which metals ?

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5. What is meant by binary solution ?

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6. Write meaning of 10% aqueous solution (by weight) of glucose.

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7. Write formula for percentage by weight.

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8. When is the unit of ppm used ?

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9. In which branch of science is the unit % w/V used ?

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10. What is molarity ?

11. What is solubility ?

12. What is saturated solution ?

13. What is dissolution ?

14. Give Le Chatelier's law ?

15. Write Henry's law.

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16. Write Dalton's law for the partial presure.

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17. Write formula which relationship between total pressure of solution and mole fraction.

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18. What is vapour pressure ?

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19. Graph between vapour pressure and mole fraction of solvent is ....

20. Give example of ideal solution.

21. What is non - ideal solution ?

22. Write examples of azeotropes.

23. What is positive deviation ?

24. Give value for ΔH and ΔV for ideal solution.

25. What are colligative properties ?

26. Give name of colligative properties.

27. What is boiling point ?

28. Give unit for molal elevation in voiling point.

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29. Give formula for boiling constant.

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30. Find out relation between freezing point and fusion enthalpy of solvent.

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31. Write formula which shows the relation between boiling point and evaporation enthalpy of solvent.

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32. Write value of i for K_2SO_4.

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33. Write value of i for $K_4[Fe(CN)_6]$.

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34. What is association ?

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35. What is dissociation ?

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36. Write formula for van't Hoff factor.

37. What is abnormal molar mass ?

Section A Questions Try Yourself

1. If 5.85 gm of NaCl is dissolved in 90 gm of water, then find out the mole fraction of NaCl.

2. Find out mole fraction of methanol in 5.2 m solution of methanol.

3. Find out mole fraction of glycerine, in solution of 46 gm of glycerine and 36 gm water.

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4. If 6.022×10^{23} atoms are present in 100 mL of urea solution then find out the molarity of urea solution.

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5. Find out molarity of solution when 0.01 mole substance is dissolved in its 10 mL aqueous solutions.

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6. Find out the molality of solution formed by dissolving 29.22 g of NaCl in 2.00 kg of water.

7. Find out the molality of solution prepared by dissolving 2.89 g of NaCl in 0.159 litre of water. Density is 1.00 gm/mL.

8. How many milimoles of CO_2 gas will dissolve when CO_2 gas is passed in 900 mL water at 298 K temperature ? [The value of K_H is 6.02×10^{-4} bar and partial pressure of CO_2 gas is 2×10^{-8} bar.]

9. How many milimoles of nitrogen dissolve when nitrogen is passed in 1 litre water at 293 K temperature ? [The value of K_H is 7.648×10^4 bar and partial pressure of N_2 gas is 0.987 bar.]

10. Calculate K_H when 2 milimoles of O_2 dissolve in 540 mL of water at $27°C$ temperature. $\left(P_{O_2} = 2 \times 10^{-8} \text{ bar}\right)$

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11. The vapour pressure of benzene and toluene are 0.9 and 0.85 respectively. Calculate vapour pressure of solvent in solution prepared by dissolving 7.8 gm benzene in 180 gm of toluene.

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12. The vapour pressure of ethanol and methanol at 298 K is 44.5 mm and 88.7 mm respectively. At same temperature, if ideal solution is prepared by mixing 60 gm of ethanol and 40 gm of methanol. Then find out mole fraction of methanol in vapour state.

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13. For two volatile liquid A and B if the vapour pressure ratio of $P^0_A : P^0_B = 1:2$ and $X_A : X_B = 1:2$, then find out mole fraction of component A in vapour state ?

14. Mole of Chlorobenzene and bromo benzene is 0.1 and 0.2 respectively. The vapour pressure of chlorobenzene and bromo benzen is 0.350 bar and 0.500 bar respectively. So find out total vapour pressure of solution prepared by mixing of chlorobenzene and bromo benzene.

15. Calculate freezing point of solution prepared by dissolving 1.8 gm glucose in 500 gm water. K_f value for solvent is 1.8 K kg mol^{-1}.

16. If freezing point of 5% w/w aqueous solution of sucrose has 271 K and pure water has freezing point of 273.15 K then calculate freezing point of 5% w/w aqueous solution of glucose.

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17. When 0.01 mol sodium sulphate is dissolve in 1 kg of water then complete ionization of solution is observed. Find decrease in freezing point of such solution. $\left(K_f = 1.86 \ \text{K kg mol}^{-1} \right)$

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18. The aqueous solution of urea has freezing point $-0.6°C$. To prepare such solution how much gram of urea is needed to dissolve in 3 kg of water ? (M = 60 gm/mol) $\left(K_f = 1.5°C \ \text{kg mol}^{-1} \right)$.

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19. Calculate osmotic pressure of solution which is prepared by dissolving 1.75 gm glucose in 150 mL of solution at $17°C$.

20. At which temperature 0.006 % w/V urea solution has osmotic pressure 0.0246 atmosphere ?

21. If 5% sugar solution is isotomic with 1% solution of unknown substance, then find out molecular mass of unknown substance.

22. Find out osmotic pressure of 12 % w/V KCl solution at $27°C$.

23. Find out osmotic pressure of 0.2 M solution of glucose at 300 K.

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24. If solution have osmotic pressure of 0.82 bar at $27°C$, then find out concentration of such solution ?

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25. When 1.0 gm of KCl is dissolved in 200 gm water, the decrease in freezing point of such solution is 0.24 K, calculate Van't Hoff factor (i) for such solution. K_f of water = 1.86 K kg / mol.

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26. If solution prepared by adding 6.1 gm of benzoic acid in 500 gm benzene is freeze at $-0.290°C$. Then find out association percentage ? (

K_f of water $= 5.52° K$ kg/mol.)

27. 3×10^{-3} kg acetic acid is added into $500 cm^3$ water. If dissociation of acetic acid is 23% then find out depression in freezing ? K_f of water = 1.86 K kg / mol and density = 0.997 gm cm^{-3}.

28. 1.7920 gm K_2SO_4 is present in 1000 mL of solution. If such solution have osmotic pressure of 0.680 bar at $26° C$ then find out van't Hoff factor value.

29. When 1.5 gm phenol is disolved in 100 gm of toluene, decrease in freezing point is 0.56 K is observed. If its association is dimeric in nature,

then find out percentage of association. $\left[K_f = 4 \ \text{K kg mol}^{-1}\right]$.

Section B Intex Questions And Answers

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

2. Calculate the mole fraction of benzene in solution containing 30% by mass in carbontetrachloride.

3. Calculate the molarity of each of the following solutions :

30 g of $Co(NO_3)_2.6H_2O$ in 4.3 L of solution

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4. Calculate the molarity of each of the following solutions :

30 mL of 0.5 M H_2SO_4 diluted to 500 mL.

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

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

7. H_2S, a toxic gas with rotten egg like smell, is used for the qualitative analysis. If the solubility of H_2S in water at STP is 0.195 m, calculate Henry's law constant.

8. Henry's law constant for CO_2 in water is 1.67×108 Pa at 298 K. Calculate the quantity of CO_2 in 500 mL of soda water when packed under 2.5 atm CO_2 presure at 298 K.

9. The vapour pressure of pure liquids A and B are 450 and 700 mm Hg respectively, at 350 K. Find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg. Also find the composition of the vapour phase.

10. Vapour presure of pure water at 298 K is 23.8 mm Hg. 50 g of urea (NH_2CONH_2) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and its relative lowering.

11. Boiling point of water at 750 mm Hg is $99.63°\,C$. How sucrose is to be added to 500 g of water such that it boils at $100°\,C$. Molal elevation constant for water is 0.52 K kg mol^{-1}.

12. Calculate the mass of ascorbic acid (Vitamin $C, C_6H_8O_6$) to be dissolved in 75 g g of acetic acid to lower its melting point by $1.5°\,C$, $\left[K_f = 3.9 \quad K\,kg\,mol^{-1}\right]$.

13. Calculate the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of polymer of molar mass 185,000 in 450 mL of water at $37° C$.

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Section C Textual Exercise

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

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2. Given an example of solid solution in which the solute is a gas.

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3. Define the terms :

Mole fraction

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4. Define the terms :

Molality

▶ **Watch Video Solution**

5. Define the terms :

Molarity

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6. Define the terms :

Mass percentage.

7. Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution 1.504 gm L^{-1} is ?

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

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

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

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

12. A sample of drinking water was found to be severely contaminated with chloroform $(CHCl_3)$ supposed to be a carcinogen. The level of contamination was 15 ppm (by mass) :

(i) Express this in percent by mass.

(ii) Determine the molality of chloroform in the water sample.

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

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

15. State Henry's law and mention some important applications.

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

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17. What is meant by positive and negative deviations from Raoult's law and how is the sign of Δ_{Sol} H related to positive and negative deviations from Raoult's law ?

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

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19. Heptane and octane form an ideal solution. At 373 K, the vapour pressure of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure of a mixture of 26.0 g of heptane and 25 g of octane ?

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20. The vapour pressure of water is 12.3 kPa at 300 K. Calculate vapour pressure of 1 molal solution of a non - voltaile solute in it.

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

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22. 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 then added to the solution and the new vapour pressure becomes 2.9 kPa at 298 K. Calculate :

(i) Molar mass of the solute.

(ii) Vapour pressure of water at 298 K.

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

24. Two elements A and B form compounds having formula AB_2 and AB_4. When dissolved in 20 g of benzene (C_6H_6), 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 K kg mol^{-1}. Calculate atomic masses of A and B.

25. At $27°C$ temperature, 36 gm glucose is in 1 litre aqueous solution has $\pi = 4.98$ bar. Find out concentration if $\pi = 1.52$ bar at same temperature.

26. Suggest the most important type of intermolecular attractive interaction in the following pairs :

(i) n - hexane and n - octane

(ii) I_2 and CCl_4

(iii) $NaClO_4$ and water

(iv) Methanol and acetone

(v) Acetonitrile (CH_3CN) and acetone (C_3H_6O).

27. Based on solute - solvent interactions, arrange the following in order of increasing solubility in n - octane and explain. Cyclohexane, KCl, CH_3OH, CH_3CN.

28. Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water ?

(i) Phenol

(ii) Toluene

(iii) Formic acid

(iv) Ethlene glycol

(v) Chloroform

(vi) Pentanol.

29. If the density of some lake water $1.25 gmol^{-1}$ is and contains 92 g of Na^+ ions per kg of water, calculate the molality of Na^+ ions in the lake.

30. If the solubility product of CuS is 6×10^{-15}, calculate the maximum molarity of CuS in aqueous solution.

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

32. Nalophene $(C_{19}H_{21}NO_3)$, similar to morphine, is used to combat withdrawal symptoms in narcotic users. Dose of nalorphene generally

given is 1.5 mg. Calculate the mass of 1.5×10^{-3} m aqueous solution required for the above dose.

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

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34. The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid increases in the order given above. Explain briefly.

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35. Calculate the depression in the freezing point of water when 10 g of $CH_3CH_2CHClCOOH$ is added to 250 g of water.

$K_a = 1.4 \times 10^{-3}$, $K_f = 1.86$ K kg mol^{-1}.

36. 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.

37. 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.

38. Henry's law constant for the molality of methane in benzene at 298 K is 4.27×10^5. Calculate the solubility of methane in benzene at 298 K

under 760 mm Hg.

39. 100 g of liquid A (molar mass 140 g mol^{-1}) was dissolved in 1000 g of liuquid B (molar mass 180 g mol^{-1}). The vapour pressure of pure liquid B was found to be 500 torr. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution if the total vapour pressure of the solution is 475 Torr.

40. Vapour pressure of pure acetone and chloroform at 328 K are 741.8 mm Hg and 632.8 mm Hg respectively. Assuming that they form ideal solution over the entire range of composition, plot P_{total}, $P_{chloroform}$, and $P_{acetone}$ as a function of $x_{acetone}$. The experimental data observed for different compositions of mixture is :

$100xx_{\text{acetone}}$	0	11.8	23.4	36.0	50.8	58.2	64.5	72.1
$P_{\text{acetone}}/mmHg$	0	54.9	110.1	202.4	322.7	405.9	454.1	521
$P_{\text{chloroform}}/mmHg$	632.8	548.1	469.4	359.7	257.7	193.6	161.2	120

From the question, we have the following data.

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41. Benzene and toluene form ideal solution over the entire range of composition. The vapour pressure of pure benzene and toluene at 300 K are 50.71 mm Hg and 32.06 mm Hg respectively. Calculate the mole fraction of benzene in vapour phase if 80 g of benzene is mixed with 100 g of toluene.

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42. The air is a mixture of a number of gases. The major components are oxygen and nitrogen with approximate proportion of 20% is to 79 % by volume at 298 K. The water is in equilibrium with air at a pressure of 10 atm. At 298 K if the Henry's law constants for oxygen and nbitrogen are

3.30×10^7 and 6.51×10^7 respectively, calculate the composition of these gases in water.

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43. Determine the amount of $CaCl_2(i = 2.47)$ dissolved in 2.5 litre of waster such that its osmotic pressure is 0.75 atm $27°C$ at.

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44. 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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Section D Ncert Exemplar Solution Multiple Choice Questions

1. Which of the following units is useful in relating concentration of solution with its vapour pressure ?

A. Mole fraction

B. Parts per million

C. Mass percentage

D. Molality

Answer: A

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2. On dissolving sugar in water at room temperature solution feels cool to touch. Under which of the following cases dissolution of sugar will be most rapid ?

A. Sugar crystals in cold water.

B. Sugar crystals in hot water.

C. Powdered sugar in cold water.

D. Powdered sugar in hot water

Answer: D

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3. At equilibrium the rate of dissolution of a solution solute in a volatile liquid solvent is ......

A. Less than the rate of crystallisation

B. Greater than the rate of crystallisation

C. Equal to the rate of crystallisation

D. Zero

Answer: C

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4. A beaker contains a solution of substance 'A'. Precipitations of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is ....

    A. Saturated

    B. Super saturated

    C. Unsaturated

    D. Concentrated

Answer: B

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5. Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon .....

    A. Temperature

    B. Nature of solute

C. Pressure

D. Nature of solvent

Answer: C

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6. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to ....

A. Low temperature

B. Low atmospheric pressure

C. High atmospheric pressure

D. Both low temperature and high atmospheric pressure

Answer: B

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7. Considering the formation, breaking and strength of hydrogen bond, predict which of the following mixtures will show a positive deviation from Raoult's law ?

A. Methanol and acetone

B. Chaloroform and acetone.

C. Nitric acid and water

D. Phenol and aniline.

Answer: A

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8. Colligative properties depend on ....

A. The nature of the solute particles dissolved in solution.

B. The number of solute particles in solution.

C. The physical properties of the solute particles dissolved in solution.

D. The nature of solvent particles.

Answer: B

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

A. 1.0 M NaOH

B. $1.0MNa_2SO_4$

C. $1.0MNH_4NO_3$

D. $1.0MKNO_3$

Answer: B

10. The unit of ebulioscopic constant is ....

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

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

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

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

Answer: A

11. In comparison to a 0.01 M solution of glucose, the depression in freezing point of a 0.01 M $MgCl_2$ solution is ....

A. the same

B. about twice

C. about three times

D. about six times

Answer: C

12. An unripe mango placed in a concentrated salt solution to prepare pickle, shrivels because .....

    A. it gains water due to osmosis.

    B. it loses water due to reverse osmosis.

    C. it gains water due to reverse osmosis.

    D. it loses water due to osmosis.

Answer: D

13. At a given temperature, osmotic pressure of a concentrated solution of a substance ....

A. is higher than that at a dilute solution.

B. is lower than that of a dilute solution.

C. is same as that of a dilute solution.

D. cannot be compared with osmotic pressure of dilute solution.

Answer: A

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14. Which of the following statements is false ?

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

B. The osmotic pressure of a solution is given by the equation $\pi = CRT$ (where C is the molarity of the solution).

C. Decreasing order of osmotic pressure for 0.01 M aqueous solutions of barium chloride, potassium chloride, acetic acid and sucrose is

$$BaCl_2 > KCl > CH_3COOH > \text{ sucrose.}$$

D. According to Raoult's law, the vapour pressure exerted by a volatile

component of a solution is directly proportional to its mole fraction

in the solution.

Answer: A

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

are ......

A. 2, 2 and 2

B. 2, 2 and 3

C. 1, 1 and 2

D. 1, 1 and 1

Answer: B

16. Which of the following statements is false ?

A. Units of atmospheric pressure and osmotic pressure are the same.

B. In reverse osmosis, solvent molecules move through a semipermeable membrane from a region of lower concentration of solute to a region of higher concentration.

C. The value of molal depression constant depends on nature of solvent.

D. Relative lowering of vapour pressure, is a dimensionless quantity.

Answer: B

17. Value of Henry's constant K_H ....

A. Increases wiuth increase in temperature.

B. Decreases with increase in temperature.

C. Remains constant.

D. First increases then decreases.

Answer: A

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18. The value of Henry's constant K_H is ....

A. Greater for gases with higher solubility.

B. Greater for gases with lower solubility.

C. Constant for all gases.

D. Not related to the solubility of gases.

Answer: B

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19. Consider the Figure and mark the correct option.
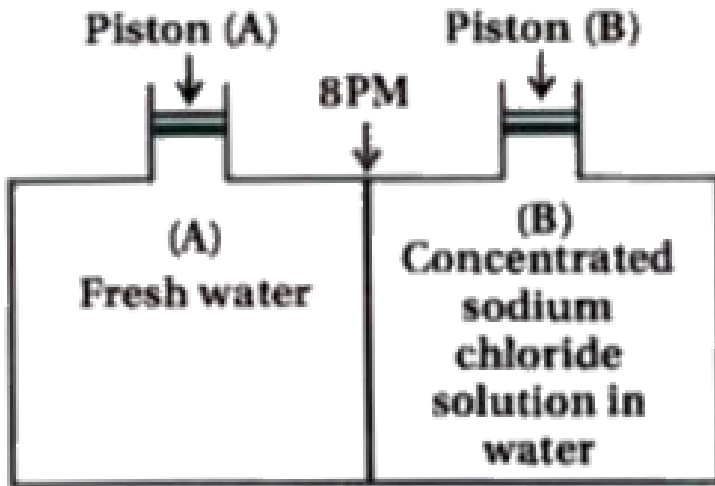
A. Water will move from side (A) to side (B) if a presure lower than

osmotic pressure is applied on piston (B).

B. Water will move from side (B) to side (A) if a presure greater than

osmotic presure is applied on piston (B).

C. Water will move from side (B) to side (A) if a pressure equal to

osmotic pressure is applied on piston (B).

D. Water will move from side (A) to side (B) if pressure equal to osmotic pressure is applied on piston (A).

Answer: B

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

A. $i_A < i_B < i_C$

B. $i_A > i_B > i_C$

C. $i_A = i_B = i_C$

D. $i_A < i_B > i_C$

Answer: A

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

Information :

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

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

(iii) In chloroform and acetone mixture A - A or B - B type intermolecular interactions are weaker than A - B type interactions.

   A. Solution (ii) and (iii) will follow Raoult's law.

   B. Solution (i) will follow Raoult's law.

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

   D. Solution (iii) will show positive deviation from Raoult's klaw.

Answer: B

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22. Two beakers of capacity 500 mL were taken. One of these beakersm labelled as "A", was filled with 400 mL water whereas the beaker labelled "B" was filled with 400 mL of 2 M solution of NaCl. At the same temperature both the bekers were place in closed containers of same material and same capacity as shown in Fig. At a given temperature, which of the following statement is correct about the vapour pressure of pure water and that of NaCl solution.
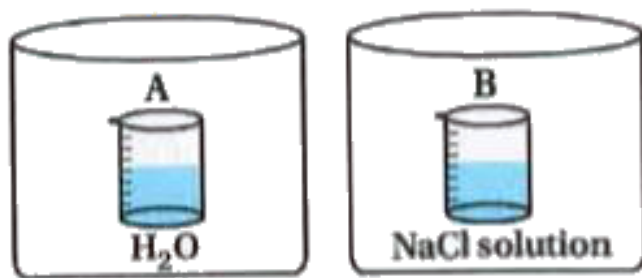
A. Vapour pressure in container (A) is more than that in container (B).

B. Vapour pressure in container (A) is less than that in container (B).

C. Vapour pressure is equal in both the containers.

D. Vapour pressure in container (B) is twice the vapoure in container (A).

Answer: A

23. If two liquids A and B from minimum boiling azeotrope at some specific composition then ......

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

B. Vapour presure of solution increases because more number of molecules of liquids A and B can escape from the solution.

C. Vapour pressure of solution decreases because less number of molecules of only one of the liquids escape from the solution.

D. A-B interactions are weaker than those between A-A or B-B.

Answer: D

24. 4 L of 0.02 M aqueous solution of NaCl was diluted by adding one litre of water. The molality of the resultant solution is ......

A. 0.004

B. 0.008

C. 0.012

D. 0.016

Answer: D

25. On the basis of information given below mark the correct option. Information : On adding acetone to methanol some of the hydrogen bonds between methanol molecules break.

A. At specific composition methanol - acetone mixture will form minimum boiling azeotrope and will show positive deviation from Raoult's law.

B. At specific composition methanol - acetone mixture forms maximum boiling azeotrope and will show positive deviation from Raoult's law.

C. At specific composition methanol - acetone mixture will form minimum boiling azeotrope and will show negative deviation from Raoult's law.

D. At specific composition methanol - acetone mixture will form maximum boiling azeotrope and will show negative deviation from Raoult's law.

Answer: A

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26. K_H value for $Ar_{(g)}, CO_{2(g)}, HCHO_{(g)}$ and $CH_{4(g)}$ are 40.39, 1.67, 1.83×10^{-5} and 0.413 respectively. Arrange these gases in the order of their increasing solubility.

A. $HCHO < CH_4 < CO_2 < Ar$

B. $HCHO < CO_2 < CH_4 < Ar$

C. $Ar < CO_2 < CH_4 < HCHO$

D. $Ar < CH_4 < CO_2 < HCHO$
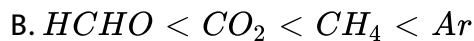
Answer: D

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27. Which of the following factor(s) affect the solubility of a gaseous solute in the fixed volume of liquid solvent ?

(a) nature of solute

(b) temperature

(c) pressure

A. (a) and (c) at constant T

B. (a) and (b) at constant P

C. (b) and (c) only

D. (c) only

28. Intermolecular forces between two benzene molecules are nearly of same strength as those between two toluene molecules. For a mixture of benzene and toluene, which of the following are not true ?

A. $\Delta_{mix} H = $ zero

B. $D_{mix} V = $ zero

C. These will form minimum boiling azeotrope.

D. These will not form ideal solution.

29. Relative lowering of vapour pressure is a colligative property because ....

A. It depends on the concentration of a non - electrolyte solute in solution and does not depend on the nature of the solute molecules.

B. It depends on number of particles of electrolyte solute in solution and does not depend on the nature of the solute particles.

C. It depends on the concentration of a non - electrolyte solute in solution as well as on the nature of the solute molecules.

D. It depends on the concentration of an electrolyte or non - electrolyte solute in solution as well as on the nature of solute molecules.

Answer: A::B

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30. Van't Hoff factor i is given the expression ....

A. $i = \dfrac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$

B. $i = \dfrac{\text{Abnormal molar mass}}{\text{Normal molar mass}}$

C. $i = \dfrac{\text{Observed colligative property}}{\text{Calculated colligative property}}$

D. $i = \dfrac{\text{Calculated colligative property}}{\text{Observed colligative property}}$

Answer: A::C

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31. Isotonic solutions must have the same ....

A. Solute

B. Density

C. Elevation in boiling point

D. Depression in freezing point

Answer: C::D

32. Which of the following binary mixtures will have same composition in liquid and vapour phase ?

    A. Benzene - Toluene

    B. Water - Nitric acid

    C. Water - Ethanol

    D. n - Hexane - n - Heptane

Answer: B::C

33. What is isotonic solution ?

A. Solute and solvent both are same.

B. Osmotic pressure is same.

C. Solute and solvent may or may not be same.

D. Solute is always same solvent mat be different.
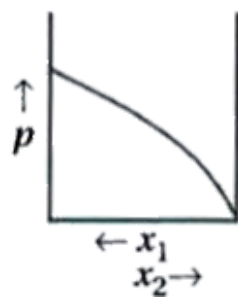
Answer: B::C

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34. For a binary ideal liquid solution, the variation in total vapour pressure versus composition of solution is given by which of the curves ?
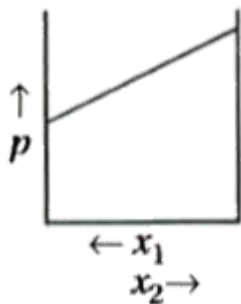
A.
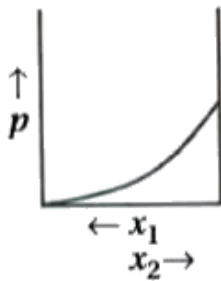
B.

C.
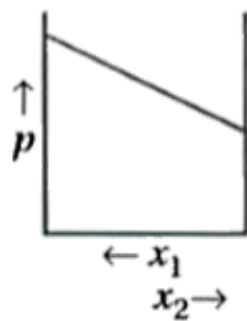
D.

Answer: A::D

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35. Colligativeproperties are observed when ....

    A. A nonvolatile solid is dissolved in a volatile liquid.

    B. A nonvolatile liquid is dissolved in an other volatile liquid.

    C. A gas is dissolved in nonvolatile liquid.

    D. A volatile liquid is dissolved in an other volatile liquid.

Answer: A::B

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Section D Ncert Exemplar Solution Short Answer Type Questions

1. Components of a binary mixture of two liquids A and B were being separated by distillation. After some time separation of components stopped and composition of vapour phase became same as that of liquid phase. Both the components started coming in the distillate. Explain why this happened.

2. Explain why on addition of 1 mol of NaCl to 1 litre of water, the boiling point of water increases, while addition of 1 mol of methyl alcohol to one litre of water decreases its boiling point.

3. Explain the solubility rule "like dissolves like" in terms of inter - molecular forces that exist in solutions.

4. Concentration terms such as mass percentage, ppm mole fraction and molality are independent of temperature, however molarity is a function of temperature. Explain.

5. What is the significance of Henry's Law constant K_H ?

6. Why are aquatic species more confortable in cold water in comparison to warm water ?

7. Explain the following phenomena with the help of Henry's law.

(i) Painful condition known as bends.

(ii) Feeling of weakness and discomfort in breathing at high altitude.

8. Why soda water bottle kept at room temperature fizzes on opening ?

9. Why is the vapour pressure of an aqueous solution of glucose lower than that of water ?

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10. How does sprinkling of salt help in clearing the snow - convered roads in hilly areas ? Explain the phenomenon involved in the process.

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11. What is semi permeable membrane ? Give examples.

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12. Give example of a material used for making semipermeable membrane for carrying out reverse osmosis.

Section D Ncert Exemplar Solution Matching The Columns

1. Match the items given in Column - I and Column - II.

	Column - I		Column - II
(A)	Saturated solution	(1)	Solution having same osmotic pressure at
(B)	Binarysolution	(2)	A solution whose osmotic pressure is less
(C)	Isotonic solution	(3)	Solution with two components.
(D)	Hypotonic solution	(4)	A solution which contains maximum amo
(E)	Solid solution	(5)	A solution whose osmotic pressure is mor
(F)	Hypertonic solution	(6)	A solution in solid phase.

2. Match the items given in Column - I with the type of solutions given in Column - II.

	Column - I		Column - II
(A)	Soda water	(1)	A solution of gas in solid.
(B)	Sugar solution	(2)	A solution of gas in gas.
(C)	German silver	(3)	A solution of solid in liquid.
(D)	Air	(4)	A solution of solid in solid.
(E)	Hydrogen gas in palladium	(5)	A solution of gas in liquid
		(6)	A solution of liquid in solid.

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3. Match the laws given in Column - I with express ions given in Column - II

	Column - I		Column - II
(A)	Raoult's law	(1)	$\Delta T_f = K_f . m$
(B)	Henry's law	(2)	$\pi = CRT$
(C)	Elevation of boiling point	(3)	$p = p_1^0 x_1 + p_2^0 x_2$
(D)	Depression in freezing point	(4)	$\Delta T_b = K_b . m$
(E)	Osmotic pressure	(5)	$p = K_H . x$

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4. Match the terms given in Column - I with express ions given in Column - II.

Column - I			Column - II
(A)	Mass percentage	(1)	$\dfrac{\text{Number of moles the solute component}}{\text{Volume of solution in litre}}$
(B)	Volume percentage	(2)	$\dfrac{\text{Number of moles a component}}{\text{Total number all components}}$
(C)	Mole fraction	(3)	$\dfrac{\text{Volume of the solute in solution}}{\text{Total volume of solution}} \times 100$
(D)	Molality	(4)	$\dfrac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$
(E)	Molarity	(5)	$\dfrac{\text{Number of moles of the solute}}{\text{Mass of solvent in kilograms}}$

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

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

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

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2. Assertion : When methyl alcohol is added to water, boiling point of water increases.

Reason : When a volatile solute is added to a volatile solvent elevation in boiling point is observed.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: D

3. Assertion : When NaCl is added to water a depression in freezing point

is observed.

Reason : The lowering of vapour pressure of a solution causes depression

in the freezing point.

A. Assertion and reason both are correct statements and reason is

correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not

correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

4. Assertion : When a solution is separated from the pure solvent by a semipermeable membrane, the solvent molecules pass through it from pure solvent side to the solution side.

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

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: B

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1. Using Raoult's law explain how the total vapour pressure over the solution is related to mole fraction of components in the following solutions.

(a) $CHCl_{3(l)}$

(b) $CH_2Cl_{2(l)}$
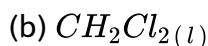
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2. Explain the terms ideal and non - ideal solutions in the light of forces of interactions operating between molecules in liquid solutions.

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3. Why is it not possible to obtain pure ethanol by fractional distillation ? What general name is given to binary mixtures which show deviation

from Raoult's law and whose components cannot be separated by fractional distillation ? How many types of such mixtures are there ?

4. When kept in water, raisin swells in size. Name and explain the phenomenon involved with the help of a diagram. Give three applications of the phenomenon.

5. Discus biological and industrial importance of osmosis.

6. How can you remove the hard calcium carbonate layer of the egg without damaging its semi - permeable membrane ? Can this egg be

inserted into a bottle with a narrow neck without distorting its shape ?

Explain the process involved.

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7. Why is the mass determined by measuring a colligative property in case

of some solutes abnormal ? Discuss it with the help of Van't Hoff factor.

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Section E Multiple Choice Questions Mcqs

1. Which of the following substance has highest solubility in water ?

A. Ethanol

B. Ethylene glycol

C. Glycerine

D. Propanol

Answer: C

2. On increasing temperature, the value of Henry's constant ....

    A. decreases

    B. increases

    C. Remains constant.

    D. uncertain

Answer: B

3. 0.5 M glucose solution is iso-osmotic with which of the following solutions ?

A. 0.10 M NaCl

B. 0.05 NaCl

C. 0.25 M NaCl

D. 1 M NaCl

Answer: C

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4. The real vapour pressure for non ideal solution is .... Than by Raoult's law.

A. more

B. less

C. equal

D. (A) and (B) both

Answer: D

5. The total pressure for volatile components A and B is 0.02 bar at equilibrium. If the mole fractions at component A is 0.2, then, what will be the partial pressure of component B ?

    A. 0.02 bar

    B. 0.04 bar

    C. 0.016 bar

    D. 0.2 bar

Answer: C

6. Soda water is of which type solution ?

    A. Solid solution

B. Liquid solution

C. Gaseous solution

D. None of these

Answer: B

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7. Which of the following is non aqueous solvent ?

A. Benzene

B. Ether

C. CCl_4

D. All of these

Answer: D

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8. Pickup the correct formula of potash alum.

A. $K_2SO_4.\ Al_2(SO_4)_3.24H_2O$

B. $K_2SO_4.\ Al_2(SO_4)_2.24H_2O$

C. $K_2SO_4.\ Al_2(SO_4)_3.12H_2O$

D. $K_2SO_4.\ Al(SO_4)_3.12H_2O$
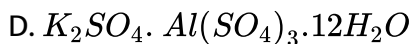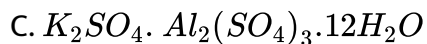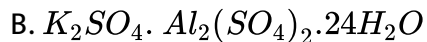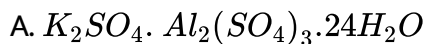
Answer: A

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9. Formality unit is used in which scientific field ?

A. Pharmacy

B. Medical

C. Agriculture

D. (A) and (B) both

Answer: D

---

10. What is the nature of graph of mole fraction of gaseous solute and its partial pressure ?

    A. Straight line

    B. Perabola

    C. Zigzag line

    D. None of these

Answer: A

---

11. 1 ppm = ... Mass of solute in 1 litre solution.

A. 10^{-3} gram

B. 10^{-4} gram

C. 10^{-6} gram

D. 10^{-2} gram

Answer: A

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12. What is the use of Henry's law ?

A. In preparation of cold drinks

B. Inbiochemical processes

C. In the idustry

D. All of these

Answer: D

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13. Which of the following statement is wrong ?

A. K_H increase with increase in temperature.

B. With increase in temperature, the solubility of gaseous solute in

liquid decrease.

C. K_H remains constant with change in temperature.

D. $p \propto X$

Answer: C

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14. Which are the affecting factors on the vapour pressure ?

A. The nature of liquid

B. Temperature

C. (A) and (B) both

D. None of these

Answer: C

15. According to Raoult's law, for which system of solution, the vapour pressure of both i.e., solute and solvent will be proportional to their mole fraction ?

A. Both are volatile

B. Solute is volatile, solvent is non volatile
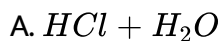
C. Both are monvolatile

D. Solute is nonvolatile, solvent is volatile

Answer: A

16. Which of the following pair is of non ideal solution ?

A. $HCl + H_2O$

B. $HNO_3 + H_2O$

C. $C_6H_5OH + C_6H_5NH_2$
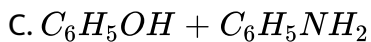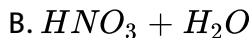
D. All of these

Answer: D

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17. The solution which do not obey the Raoult's law over the entire range of concentration is called which solution ?

A. Ideal

B. Non Ideal

C. True Solution

D. (B) and (C) both

Answer: D

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18. Which is not a natural semi permeable membrane ?

A. Plant celwall

B. Urinary bladder

C. Cellophane paper

D. None of these

Answer: C

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19. Which relation is true, if molecular weight of solute is x and its weight is y ?

A. $x = \left(\dfrac{y}{v}\right)\dfrac{RT}{\pi}$

B. $y = \left(\dfrac{x}{y}\right)\dfrac{RT}{\pi}$

C. $x = \left(\dfrac{v}{y}\right)\dfrac{RT}{\pi}$

D. $x = \left(\dfrac{y}{v}\right)\dfrac{R\pi}{T}$

Answer: A

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20. To produce difference between freezing point and boiling point of a solution by $105.0°\,C$, how much sucrose should be dissolved in 100 gm of water ? $\left(K_f = 1.86°\,C,\ kgmol^{-1}\ \text{and}\ K_b = 0.151°\,Ckgmol^{-1}\right)$

A. 72 gm

B. 34.2 gm

C. 342 gm

D. 460 gm

Answer: A

21. At 273 K temperature, if 10 gm glucose (p_1), 10 gm urea (p_2) and 10 gm sucrose (p_3) is dissolved in 250 mL of water, then what is the correct relation of osmotic pressure for them ?

A. $p_1 > p_2 > p_3$

B. $p_3 > p_2 > p_1$

C. $p_2 > p_1 > p_3$

D. $p_2 > p_3 > p_1$

Answer: C

22. If osmotic pressure of an aqueous solution of sucrose having concentration of 34.2 gm/litre at $17°C$ is 2.38 atmosphere, then .... gm / mL glucose is isotonic with solution.

A. 34.2

B. 17.1

C. 36.0

D. 18.0

Answer: D

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23. To prepare solution of certain substance, 300 gm is used for 25% solution and 400 gm for 40% solution, then what is the mass percentage of solute present in this solution mixture ?

A. 33.57

B. 66.43

C. 87.23

D. 19.24

Answer: A

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24. 20% aqueous $FeCl_3$ solution has density of 1.1 gm/mL then molar concentration of this solution is ....

A. 0.028

B. 1.357

C. 0.163

D. 1.47

Answer: B

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25. Give mole fraction of solute present in 1.00 m aqueous solution.

A. 0.177

B. 0.00177

C. 0.0177

D. 0.034

Answer: C

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26. Find out molarity of NO_3^- ions in solution when mixing 2 litre 3 M $AgNO_3$ solution with 3 litre 1 M $BaCl_2$ solution.

A. 1.2 M

B. 0.1 M

C. 0.5 M

D. 0.4 M

Answer: A

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27. Which equimolal concentrated solution has highest freezing point ?

A. Glucose

B. $La(NO_3)_3$

C. $Ca(NO_3)_2$

D. Vinegar

Answer: A

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28. Brass is mixture of ...... metals.

A. Zn, Ni

B. Cu, Sn

C. Cu, Zn

D. Cu, Zn, Ni

Answer: C

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29. Bronze is mixture of .... metals.

A. Cu, Sn

B. Cu, Zn

C. Zn, Sn

D. Cu, Pb

Answer: A

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30. .... ppm of F^- ion in water can stop decay of teeth.

A. 1.5

B. 1

C. 0.5

D. 2

Answer: B

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31. German silver is a alloy of ...... metal.

A. Zn, Sn, Ni

B. Cu, Sn, Ni

C. Zn, Cu, Pb

D. Cu, Zn, Ni

Answer: D

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32. .... ppm concentration of flouride ion causes a stain of teeth.

A. 1.5

B. 1

C. 0.5

D. 2

Answer: A

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33. At certain temperature, vapour pressure of pure element A and B has 108 and 36 torr respectively. If solution has equal mole of A and B elements, then vapour pressure of solution is ....

A. 144 torr

B. 72 torr

C. 90 torr

D. 125 torr

Answer: B

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34. Four solution of K_2SO_4 possess concentration of 0.1 m, 0.001 m and 0.0001 m respectively. So among which solution has highest van't hoff factor ?

A. 0.0001 m

B. 0.001 m

C. 0.01 m

D. 0.1 m

Answer: A

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35. Osmotic pressure of aqueous solution of urea is 500 mm at 283 K. If its temperature is maintained at 298 K, then on how much dilution its osmotic pressure would be 105.3 mm ?

A. 10 times

B. 5 times

C. 2.5 times

D. 4 times

Answer: B

36. Which of the following aqueous solution has same osmotic pressure ?

(i) 0.1 M NaCl solution

(ii) 0.1 M glucose solution

(iii) 0.6 gm urea in 100 mL solution

(iv) 1.0 gm non - volatile solute (x) in 50 mL solution. (Molecular Mass of x = 200)

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

    B. (ii), (iii), (iv)

    C. (i), (ii), (iv)

    D. (i), (iii), (iv)

Answer: B

37. .... solution has highest freezing point.

A. $1mK_4[Fe(CN)_6]$
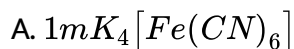
B. 1 m NaCl

C. 1 m glucose

D. 1 m KCl

Answer: C

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38. If non ideal solution is prepared by mixing 30 mL $CHCl_3$ and 50 mL Acetone, then volume of solution is ....

A. $>$ 80 mL

B. $<$ 80 mL

C. $=$ 80 mL

D. $\geq$ 80 mL

Answer: B

---

39. Density of solution prepared by dissolving 120 gm urea in 1000 gm water is 1.15 gm/mL then find out molarity of solution is ....

A. 0.50 M

B. 1.78 M

C. 1.02 M

D. 2.05 M

Answer: D

---

40. If 25 gram of Na_2SO_4 is dissolved in 10^3 kilogram solution, then concentration will be ....

A. 25 ppm

B. 0.25 ppm

C. 250 ppm

D. 2.5 ppm

Answer: A

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41. How much gram of acid should be present in 100 mL volume of solution to obtain decimolar solution having 200 gm/mole molecular mass of diabasic acid ?

A. 20 gm

B. 1 gm

C. 2 gm

D. 10 gm

Answer: C

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42. If 6.022×10^{20} molecules are present in 100 mL urea solution, then find out the concentration of urea solution.

A. 0.01 M

B. 0.001 M

C. 0.2 M

D. 0.1 M

Answer: A

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43. Find out mlarity of solution on addition of 200 mL of water in 500 mL of 0.2 M solution.

A. 0.501 M

B. 0.02847 M

C. 0.709 M

D. 0.1428 M

Answer: D

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44. Increase in boiling point is solution .... prepared by dissolving 13.44

gm $CuCl_2$ in 1 kg of water. ($K_b = 0.52$ kg mol^{-1} and molecular mass of

$CuCl_2 = 134.4$ gm/mole)

A. 0.05

B. 0.1

C. 0.16

D. 0.92

Answer: C

Section E Assertion And Reason Type

1. Assertion (A) : For ideal solution ΔH_{mix} and ΔV_{mix} are always zero.

Reason (R) : Intermolecular attractive forces in solution is same as liquid.

A. Assertion and reason both are correct statements and reason is

correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not

correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

2. Assertion (A) : As the pressure on water increased it's freezing point decreases.

Reason (R) : Density of water at 273 K is maximum.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: C

3. Assertion (A) : Pressure cooker reduces time for cooking.

Reason (R) : In pressure cooker boiling point get increased.

A. Assertion and reason both are correct statements and reason is
   correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not
   correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: B

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4. Assertion (A) : 0.1 M urea solution is iso-osmotic with 0.1 M NaCl
solution.

Reason (R) : Urea and NaCl had same concentration.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Both assertion and reason are false.

Answer: D

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5. Assertion (A) : NaCl is used for removing snow from roads.

Reason (R) : NaCl decreases the freezing point of water.

A. Assertion and reason both are correct statements and reason is correct explanation for assertion.

B. Assertion and reason both are correct statements but reason is not

correct explanation for assertion.

C. Assertion is correct statement but reason is wrong statement.

D. Assertion and reason both are incorrect statements.

Answer: A

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Section E Mcqs Asked In Competitive Exam

1. The molal depreesion constant of water is $1.86° C/m$. Then find out the freezing point of 0.1 m NaCl solution.

A. $-1.86° C$

B. $0.372° C$

C. $-0.372° C$

D. $-0.186° C$

Answer: C

---

2. What will be equal for the isotonic solution at constant temperature ?

   A. Density

   B. Normality

   C. Molar concentration

   D. Volume

Answer: C

---

3. The solution of 6.8 gram non-ionic substance in 100 ram water is freezed at $-0.93°C$. What is the molar mass of unknown substance ? $\left(K_f = 1.86\right)$

A. 34

B. 136

C. 68

D. 13.6

Answer: B

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4. The solution of 1 gram urea boils at $100.25° C$, At what temperature the same volume solution of 3 gram glucose will boil ?

A. $100° C$

B. $100.5° C$

C. $100.25° C$

D. $100.75° C$

Answer: C

5. Which of the following having maximum boiling point ?

A. 1.1 M glucose solution

B. $1.1MNa_2SO_4$ solution

C. 1.1 M KCl solution

D. $1.1MC_6H_{12}O_6$ solution

Answer: B

6. What is the concentration of NO_3^- ion on mixing equal volume solution of 0.1 M $AgNO_3$ and 0.2 M NaCl ?

A. 0.1 M

B. 0.15 M

C. 0.2 M

D. 0.05 M

Answer: D

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7. How much methanol should be added to water, to make 150 mL. 2 M solution of CH_3OH ?

A. 9.6 gram

B. 2.4 gram

C. 9.6×10^3 gram

D. 4.3×10^2 gram

Answer: A

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8. Which of the following having same Van't Hoff factor as that of $K_3[Fe(CN)_6]$?

A. $Al_2(SO_4)_3$

B. K_2SO_4

C. $Al(NO_3)_3$

D. KCl
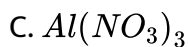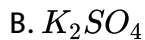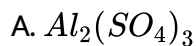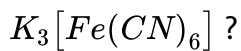
Answer: C

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9. What will be tha Van't Hoff factor i for the 0.1 M ideal solution ?
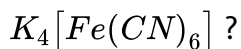
A. 0.1

B. Zero

C. 10

D. 1

Answer: D

10. Which of the following having same Van't Hoff factor as $K_4[Fe(CN)_6]$?

A. $Al_2(SO_4)_3$

B. NaCl

C. $Al(NO_3)_3$

D. Na_2SO_4
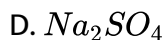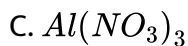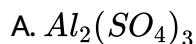
Answer: A

11. What is the mole fraction of NaCl, when solution is prepared by dissolving 5.85 gram NaCl in 90 gram of water ?

A. 0.2

B. 0.1

C. 0.01

D. 0.0196

Answer: D

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12. The concentration of an aqueous solution of glucose is 10% W/V. How much solution is required to dissolve 1 mole glucose ?

A. 18 litre

B. 9 litre

C. 0.9 litre

D. 1.8 litre

Answer: D

13. What will be the same in the isotonic solution at same temperasture ?

A. Size

B. N

C. M

D. Mole fraction

Answer: C::D

14. What will be the osmotic pressure of 5% W/V sugar solution of $150°C$ temperature ?

A. 5.07 atmosphere

B. 5.70 atmosphere

C. 7.5 atmosphere

D. 3.55 atmosphere

Answer: A

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15. The boiling point of water at 760 mm pressure is 373 K. The vapour pressure of water at 298 K is 23 mm. If the vaporisation enthalpy is 40.656 KJ/mole, then what will be boiling point of water at 23 mm. pressure ?

A. 250 K

B. 298 K

C. 51.6 K

D. 12.5 K

Answer: B

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16. What is the molarity of a solution prepared by dissolving 7.1 gram Na_2SO_4 in 100 mL. water ?

A. 0.5 M

B. 2 M

C. 0.2 M

D. 0.05 M

Answer: A

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17. What is the vapour pressure of the solution prepared by dissolving 0.5 gram substance (Molecular weight 65) in 100 mL CCl_4 ? The vapour pressure of CCl_4 is 143 mm. density of CC_4 is 1.58.

A. 143.99 mm

B. 94.39 mm

C. 141.97 mm

D. 199.34 mm

Answer: C

18. Show the relation between the osmotic pressure of the solutions prepared in 1 liter water by dissolving 10 gram glucose (P_1), 10 gram urea (P_2) and 10 gram Sucrose, (P_3) respectively.

A. $P_2 > P_1 > P_3$

B. $P_2 > P_3 > P_1$

C. $P_1 > P_2 > P_3$

D. $P_3 > P_2 > P_1$

Answer: A

19. The mole fraction of solute is 0.2 at that time the decrease in vapoure pressure is 10 mm. If the decrease in vapour pressure is 20 mm, then what will be the mole fraction of solute ?

A. 0.2

B. 0.4

C. 0.6

D. 0.8

Answer: B

20. 5% sucrose solution is isotonic with 1% 'X' solution. What will be the molecular weight of 'X' ?

A. 343 gram/mole

B. 180 gram/mole

C. 68.4 gram/mole

D. 171 gram/mole

Answer: C

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21. How much water should be added to 2% W/V, 5 liter NaOH solution so as to make its concentration to 0.5 N ?

A. 5 lit

B. 2.5 lit

C. 1 lit

D. No need to add water

Answer: D

1. What will be the osmotic pressure of the solution prepared by dissolving 1.75 gram sucrose in 50 mL. solution at $17°C$ temperature ?

A. 0.406

B. 8.12

C. 0.822

D. 0.0406

Answer: C

2. 25 mL $Ba(OH)_2$ solution is neutralized by 35 mL 0.1 M HCl, what will be molarity of $Ba(OH)_2$ solution ?

A. 0.42

B. 0.21

C. 0.07

D. 0.14

Answer: C

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3. 25 mL $Ba(OH)_2$ solution is neutralized by 35 mL 0.1 M HCl, what will be molarity of $Ba(OH)_2$ solution ?

A. 0.14

B. 0.28

C. 0.35

D. 0.07

Answer: D

4. The degree of ionization of 0.2 m weak acid HX is 0.3. If the K_f for water = 1.85. What will be the freezing point of solution ?

A. $-0.360°C$

B. $-0.206°C$

C. $+0.480°C$

D. $-0.480°C$

Answer: D

5. Which of the following having the higherst boiling point ?

A. $0.01MNa_2SO_4$

B. 0.015 M Sucrose

C. 0.015 M Glucose

D. $0.01 M NaNO_3$

Answer: A

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6. The partial pressure ratio $P_A^\circ : P_B^\circ$ for the two volatile liquid A and B and $P_A^\circ : P_B^\circ = 1:2$ and mole ratio is $X_A : X_B = 1:2$. What is the mole fraction of A ?

A. 0.33

B. 0.25

C. 0.20

D. 0.52

Answer: C

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7. The vapour pressure of benzene is 75 mm and that of toluene is 22 m at $20°C$ temperature. The solution prepared by mixing 78 gram benzene and 46 gram toulene then, what will be the partial pressure of benzene in the mixture ?

A. 25

B. 50

C. 100

D. 75

Answer: B

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8. What is the molality of 2.05 molar aqueous solution of acetic acid ? The density of solution is 1.02 gram/mL.

A. 1.14 M

B. 3.28 M

C. 2.28 M

D. 0.44 M

Answer: C

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9. The freezing point of 5% W/W solution of sucrose is 271 K. The freezing point of pure water is 273.15 K. What will be the freezing point of 5% W/W Glucose solution ?

A. 271.2 K

B. 273.15 K

C. 269.07 K

D. 277.23 K

Answer: C

10. What will be the vapour pressure of solution prepasred by dissolving 18 gram Glucose to 178.2 gram water ?

  A. 759.00 mm

  B. 7.60 mm

  C. 76.00 mm

  D. 752.40 mm

Answer: D

11. What will be the vapour pressure of the solution of 18 gram glucose dissolve in 178.2 gram water at $100°C$ temp. ?

  A. 706.4 mm

B. 752.4 mm

C. 750 mm

D. 760 mm

Answer: B

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12. How much H_2SO_4 is required to prepare 0.1 M 1 liter H_2SO_4 solution ? The density of 98% W/W H_2SO_4 is 1.80 gm/mL.

A. 22.20 mL

B. 5.55 mL

C. 11.10 mL

D. 16.65 mL

Answer: B

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13. 1.5 % Urea solution and 5.25% unknown substance's solutions are isotonic. The density of both the solutions are $1gm/cm^3$ then what is the molecular weight of unknown substance ?

    A. 90.0 gram/mole

    B. 115.0 gram/mole

    C. 1050.0 gram/mole

    D. 210.0 gram/mole

Answer: D

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14. The vapour pressure of mixture of ethanol and propanol is 290 mm at 300 K temp. If the vapour pressure of propanol is 200 mm at 300 K temp. and the mole fraction of ethanol is 0.6, then what will be the vapour pressure of ethanol at 300 K temp. ?

A. 350 mm

B. 300 mm

C. 700 mm

D. 360 mm

Answer: A

15. 1.5 % Urea solution and 5.25% unknown substance's solutions are isotonic. The density of both the solutions are $1gm/cm^3$ then what is the molecular weight of unknown substance ?

A. 104

B. 210

C. 88

D. 120

Answer: B

---

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

A. $90 gmol^{-1}$

B. $115 gmol^{-1}$

C. $105 gmol^{-1}$

D. $210 gmol^{-1}$

Answer: D

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

A. 0.5

B. 1

C. 2

D. 3

Answer: A

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18. The vapour pressure of mixture of ethanol and propanol is 290 mm at 300 K temp. If the vapour pressure of propanol is 200 mm at 300 K temp. and the mole fraction of ethanol is 0.6, then what will be the vapour pressure of ethanol at 300 K temp. ?

A. 350 mm

B. 300 mm

C. 700 mm

D. 360 mm

Answer: A

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19. The vapour pressure of pure liquid A and B are 520 mm and 1000 mm respectively at $80°C$ temp. If the solution of A and B is boil at $80°C$ temp. and I at pressure, what will be the % of A in the mixture ?

A. $52\,\%$

B. $34\,\%$

C. $48\,\%$

D. $50\,\%$

Answer: D

20. At 353 K, the vapour pressure of pure liquid A and B are 520 mm and 1000 mm respectively. If a mixture of solutions of A and B boils at 353 K and 1 bar pressure, the mole percent of A in mixture is ...... (1 bar = 760 mm)

A. 52 %

B. 34 %

C. 48 %

D. 50 %

Answer: D

21. The freezing point of 0.01 M KCl solution is $-2°C$. If $BaCl_2$ is completely ionized, what is the freezing point of 0.01 M $BaCl_2$ solution ?

    A. $-3°C$

    B. $+3°C$

    C. $-2°C$

    D. $-4°C$

Answer: A

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22. The vapour pressure of water is 17.5 mm at $20°C$ temp. what is the vapour pressure of solution $20°C$ prepared by dissolving 18 gram glucose in to 178.2 gram water at $20°C$ temp. ?

    A. 17.675 mm

    B. 15.750 mm

C. 16.500 mm

D. 17.325 mm

Answer: D

23. Two liquids A and B form an ideal solution. At $300K$, the vapour pressure of a solution containing $1mol$ of A and $3mol$ of B is $550mmHg$. At the same temperature, if $1mol$ more of B is added to this solution, the vapour pressure of the solution increases by $10mmHg$. Determine the vapour pressure of A and B in their pure states.
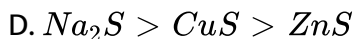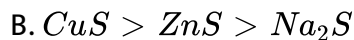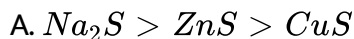
A. 500 and 600

B. 200 and 300

C. 300 and 400

D. 400 and 600

Answer: D

24. Identify the correct order of solubility in aqueous medium :

A. $Na_2S > ZnS > CuS$

B. $CuS > ZnS > Na_2S$

C. $ZnS > Na_2S > CuS$

D. $Na_2S > CuS > ZnS$

Answer: A

25. Consider separate solutions of 0.500 M $C_2H_5OH_{(aq)}$, $0.100 M Mg_3(PO_4)_{2(aq)}$, $0.250 M KBr_{(aq)}$ and $0.125 M Na_3PO_{4(aq)}$ at $25°C$. Which statement is true about these solutions, assuming all salts to be strong electrolytes ?

A. $0.125 M Na_3 PO_{4(aq)}$ has the highest osmotic pressure.

B. $0.500 M C_2 H_5 OH_{(aq)}$ has the highest osmotic pressure.

C. They all have the same osmotic pressure.

D. $0.100 M Mg_3 (PO_4)_{2(aq)}$ has the highest osmotic pressure.
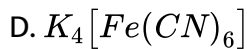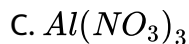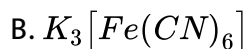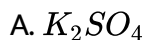
Answer: C

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26. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression ?

A. KCl

B. $C_6 H_{12} O_6$

C. $Al_2 (SO_4)_3$

D. $K_2 SO_4$

Answer: C

27. Which of the following electrolytes has the same value of van't Hoff's factor (i) as that of $Al_2(SO_4)_3$ (if all are 100% ionised) ?

A. K_2SO_4

B. $K_3[Fe(CN)_6]$

C. $Al(NO_3)_3$

D. $K_4[Fe(CN)_6]$

Answer: D

28. The boiling point of 0.2 mol kg^{-1} solution of X in water is greater than equimolal solution of Y in water. Which one of the following statements is true in this case ?

A. X is undergoing dissociation in water.

B. Molecular mass of X is greater than the molecular mass of Y.

C. Molecular mass of X is less than the molecular mass of Y.

D. Y is undergoing dissociation in water while X undergoes no change.

Answer: A

29. Which one is not equal to zero for an ideal solution ?

A. ΔH_{mix}

B. ΔS_{mix}

C. ΔV_{mix}

D. $\Delta P = P_{observed} - P_{Raoult}$

Answer: B

30. Give mole fraction of solute present in 1.00 m aqueous solution.

A. 0.0354

B. 0.0177

C. 0.177

D. 1.770

Answer: B

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31. $18g$ 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. 759.0

B. 7.6

C. 76.0

D. 752.4

Answer: D

---

32. At $100^\circ C$ the vapour pressure of a solution of 6.5 gm of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be :

A. $100^\circ C$

B. $102^\circ C$

C. $103^\circ C$

D. $101^\circ C$

Answer: D

33. Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct ? Assume that the temperature is constant at $25°C$. (Given, Vapour' Pressure Data at $25°C$, benzene = 12.8 kPa toluene = 3.85 kPa)

A. The vapour will contain a higher percentage of toluene.

B. The vapour will contain equal amounts of benzene and toluene.

C. Not enough information is given to make a prediction.

D. The vapour will contain a higher percentage of benzene.

Answer: D

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34. The van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

A. 2

B. 3

C. 0

D. 1

Answer: B

---

35. Which one of the following is incorrect for ideal solution ?

A. $\Delta P = Pobs - P_{\text{calculated by Raoult's law}} = 0$

B. $\Delta G_{mix} = 0$

C. $\Delta H_{mix} = 0$

D. $\Delta U_{mix} = 0$

Answer: B

36. The freezing point of benzene decreases by $0.45°C$ when 0.2 g of acetic acidis added to 20 g of benzene. If acetic acid associates to form a dimer in benzene, percentage association of acetic acid in benzene will be .... (K_f for benzene = 5.12 K kg mol^{-1})

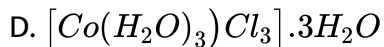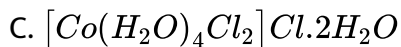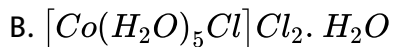A. 64.6 %

B. 80.4 %

C. 74.6 %

D. 94.6 %

Answer: D

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

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

B. $[Co(H_2O)_5Cl]Cl_2.\,H_2O$

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

D. $[Co(H_2O)_3)Cl_3].3H_2O$

Answer: D

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38. If increase in boiling point of 1 molal glucose solution is 2K increase in freezing point of 2 molal glucose solution is also 2K. Then state the relationship of K_b and K_f.

A. $K_b = 1.5K_f$

B. $K_b = 0.5K_f$

C. $K_b = 2K_f$

D. $K_b = K_f$

Answer: C

39. The mixture that forms maximum boiling azeotrope is :

A. Heptane + Octane

B. Water + Nitric acid

C. Ethanol + Water

D. Acetone + Carbon disulphide

Answer: B

40. At $35°C$ the vapour pressure of CS_2 is 512 mm of Hg and that of acetone is 344 mm of Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm of Hg. The false statement among the following is :

A. CS_2 and acetone are less attracted to each other than themselves.

B. Heat must be absorbed in order to produce the solution at $35°C$.

C. Raoult's law is not obeyed by this system

D. A mixture of 100 mL CS_2 and 100 mL acetone has a volume less than 200 mL.

Answer: D

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41. The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is ....

A. 14

B. 12

C. 8

D. 6

Answer: A

1. Freezing point of urea solution is -0.6^0C. How much urea is required to be dissolved in 3 kg water ? $\left[M(\text{urea}) = 60gmol^{-1}, K_f = 1.5^0\text{C Kg mol}^{-1}\right]$

    A. 2.4 g

    B. 3.6 g

    C. 6.0 g

    D. 72 g

Answer: D

2. The increase in boiling point of a solution containing 0.6 gram Urea in 200 gram water is $0.50°$ C. Find the n-olal elevation constant

A. $1.0K \text{ kg mol}^{-1}$

B. $10 \text{ K kg } mol^{-1}$

C. $10 \text{ K kg } mol^{-1}$

D. 10 K kg mol

Answer: C

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3. How many grams of NaOH will be required to Prepare 500 gram solutioncontaining 10% w/w NaOH solution ?
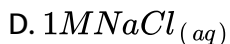
A. 5 g

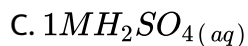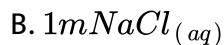B. 50 g

C. 100 g

D. 0.5 g

Answer: B

---

4. Which of the following aqueous solutions will have maximum osmotic pressure at constant temperature ?

A. $1mH_2SO_{4(aq)}$

B. $1mNaCl_{(aq)}$

C. $1MH_2SO_{4(aq)}$

D. $1MNaCl_{(aq)}$
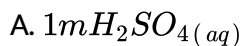
Answer: C

5. If osmotic pressure of a solution at $27°C$ is 0.82 bar, what will be molarity of solution ?

    A. 0.33 M

    B. 0.033 M

    C. 3.3 M

    D. 0.066 M

Answer: B

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6. Which of the following is change with temperature ?

    A. Molality

    B. % W/W

    C. Formality

    D. Mole fraction

Answer: C

7. Which pair is isotonic at same temperature ?

  A. 0.1 M urea and 0.1 M KCl

  B. 0.1 M $Ba(NO_3)_2$ and 0.1 M Na_2SO_4

  C. 0.2 M NaCl and 0.2 M Na_2SO_4

  D. $0.2 M BaCl_2$ and 0.2 M Sucrose

Answer: B

8. What is the normality of 0.04 M H_2SO_4 ?

  A. 0.04 N

B. 0.012 N

C. 0.08 N

D. 0.02 N

Answer: C

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9. Which of the following acts as best semipermeable membrane ?

A. Cell wall of plants

B. Cellophane

C. Parchment paper

D. Copper ferrocynide

Answer: D

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10. The freezing point of the aqueous solution of urea is $-0.6°C$. How much urea should be added to 3 kg water to get such solution ? $\left(K_f = 1.5°C\,\text{Kg. mol}^{-1}\right)$

  A. 72 gram

  B. 6.0 gram

  C. 3.6 gram

  D. 2.4 gram

Answer: A

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11. Find out the osmotic pressure of 0.25 M aqueous solution of Urea at $27°C$. (R = 0.082 Lit. atm./mol. K., R = 1.987 Cal.)

  A. 0.0615 atmosphere

  B. 61.5 atmosphere

C. 6.15 atmosphere

D. 0.615 atmosphere

Answer: C

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12. Find out normality of the solution prepasred by dissolving 9.8 gram H_2SO_4 to 500 mL solution ?

A. 4.0

B. 0.8

C. 0.2

D. 0.4

Answer: D

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13. The increase in boiling point of a solution containing 0.6 gram Urea in 200 gram water is $0.50° C$. Find the n-olal elevation constant

   A. 10 K kg mole

   B. 10 K kg mole^{-1}

   C. 1.0 K kg mole

   D. 100 K kg mole^{-1}

Answer: B

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14. How many grams of NaOH will be required to Prepare 500 gram solutioncontaining 10% w/w NaOH solution ?

   A. 0.5 gram

   B. 100 gram

   C. 5.0 gram

D. 50 gram

Answer: D

---

15. The $[H_3O^+]$ concentration in the 200 mL. H_2SO_4 solution is 1 M. How much H_2SO_4 is dissolved in the solution ? [H = 1, O = 16, S = 32 gram/mole]

A. 4.9 gram

B. 19.6 gram

C. 9.8 gram

D. 0.98 gram

Answer: C

16. Choose the correct statement : When concentration of a salt solution is increased ...

    A. Boiling point increase and vapour pressure decreases.

    B. Boiling point decrease and vapour pressure increases.

    C. Freezing point decrease and vapour pressure increases.

    D. Freezing point increases and vapour pressure decreases.

Answer: A

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17. What is the normality of 250 mL. H_2SO_4 having pH = 0.0 ?

    A. 0.50 N

    B. 0.25 N

    C. 2 N

    D. 1 N

Answer: D

---

18. When gas is dissolve in liquid solvent and form solution, then according to Raoult's law its vapour pressure will be ....

A. $\dfrac{P^\circ - P}{P^\circ} = \dfrac{n}{n + N}$
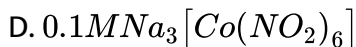
B. $P = K.\dfrac{N}{n + N}$

C. $P = K_H.X_A$

D. $P = P_A + P_B$

Answer: A

---

19. Which of the following solution having same vapour pressure as 0.3 M glucose solution ?

A. $0.1M[Co(H_2O)_3(NO_2)_3]$

B. $0.1MNa_2[Co(H_2O)(NO_2)_5]$

C. $0.1MNa[Co(H_2O)_2(NO_2)_4]$

D. $0.1MNa_3[Co(NO_2)_6]$
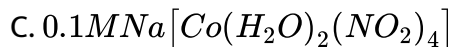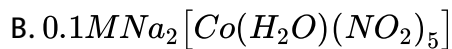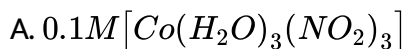
Answer: B

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20. What will be the normality of 0.2 M H_3PO_3 solution ?

A. 0.1 N

B. 0.2 N

C. 0.6 N

D. 0.4 N

Answer: D

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21. Which of the following aqueous solution will have maximum vapour pressure at constant temperature ?

    A. 0.1 M NaCl

    B. $0.1 M FeCl_3$

    C. $0.1 M BaCl_2$

    D. 0.1 M Glucose

Answer: D

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22. What will be the notmality of resulting solution obtained by mixing 4 mL 0.05 M $H_2SO_{4(aq)}$ solution and 6 mL 0.3 M $- (2) SO_{4(aq)}$?

    A. 0.175 N

    B. 0.35 N

C. 0.4 N

D. 0.2 N

Answer: C

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23. Which of the following mixture is the ideal solution ?

A. Chloroform and acetone

B. Benzene and toluene

C. Phenol and aniline

D. HCl and H_2O

Answer: B

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24. What will be the value of molality for an aqueous solution of 10 % w/w NaOH ? (Na = 23, O = 16, H = 1)

A. 2.778

B. 5

C. 10

D. 2.5

Answer: A

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25. From the given graph at constant temperature, which gas has the least solubility ?
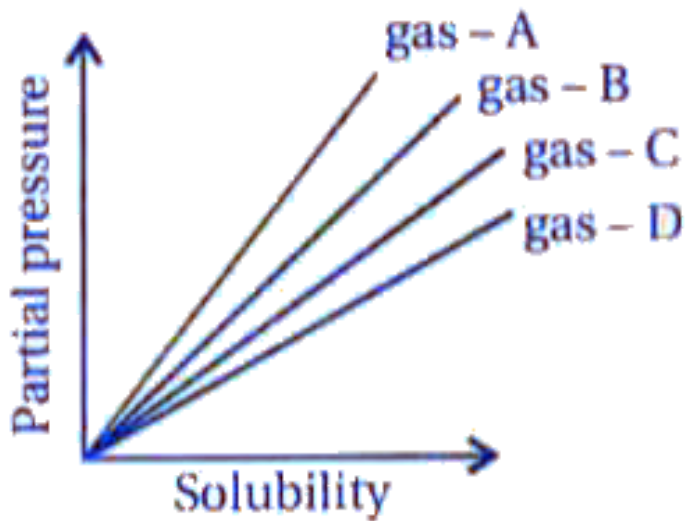
A. gas - D

B. gas - B

C. gas - A

D. gas - C

Answer: C

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26. If 10 mL of 0.1 M aqueous solution of NaCl is divided in to 1000 drops of equal volume, what will be the concentration of one drop ?

A. 0.01 M

B. 0.10 M

C. 0.001 M

D. 0.0001 M

Answer: B

27. The boiling points for aqueous solutions of sucrose and uren are same :11 constant temperature. If 3 gm of urea is dissolved in its 1 litre solution, what is thc weight of sucrose dissolved in its 1 litre solution? (Urea - 60 gm//mole, sucrose = 342 gm/mole]

A. 3.0 gram

B. 17.1 gram

C. 6.0 gram

D. 34.2 gram

Answer: B

28. Which option is inconsistant for Raoult's law?

A. Volume of liquid solvent + volume of liquid solute = volume of solution.

B. The change in heat of dilution for solution = 0.

C. Solute does not undergo association in solution.

D. Solute undergoes dissociation in solution.

Answer: D

29. Which colligative property is more useful to determine the molecular weight of the substances like proteins and polymers?

A. Lowering of vapour pressure.

B. Elevation in boiling point.

C. Depression of freezing point.

D. Osmotic pressure.

Answer: D

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30. At given temperature and pressure adsorption of which gas of the following will take place the most?

A. Di hydrogen

B. Di oxygen

C. Amonia

D. Di nitrogen

Answer: C

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31. Which solution has the highest vapour pressure in identical condition ?

A. $0.1 M FeCl_3$

B. $0.1 M BaCl_2$

C. 0.1 M NaCl

D. 0.1 M Urea

Answer: D

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32. In which of the following solutions, the solubility of solute decreases on heating the solution ?

   A. Aqueous solution of ethylene glycol

   B. Chlorine water

   C. Aqueous solution of sugar

   D. Zn - Hg amalgam

Answer: B

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33. The proportion of CaF_2 in a sample of water is 156 ppm. What will be its molarity ? [Mole. Mass of CaF_2 is 78 gm/mol.]

   A. 0.01 M

   B. 0.02 M

   C. 0.002 M

D. 0.001 M

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34. At certain temperature 1.6% solution of an unknown substance is isotonic with 2.4% solution of Urea. If both the solutions have the same solvent and both the solutions have same density 1 gm/cm^3, what will be the molecular mass of unknown substance in gm/mol.

[Molecular mass of urea = 60 gm/mol]

A. 40

B. 90

C. 80

D. 30

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35. Which of the following aqueous solution will have the boiling point 102.2° C? The molal elevation constant for water is 2.2 K kg mol^{-1}.

    A. 1m NaCl

    B. 1m glucose

    C. 1M NaCl

    D. $1mCH_3COOH$

Answer: B

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36. The depression in freezing points is 0.69 K when 2g phenol is dissolved in 100g benzene. If it is associated as dimeric then find its degree of association. The molal depression constant for solvent is 5.12 K kg mol^{-1} (C = 12, H = 1, O = 16g/mol)

A. 0.633

B. 0.743

C. 0.367

D. 0.734

Answer: C

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37. What are the molecular and formula mass of Potash alumn respectively ?

A. 950, 480

B. 948, 474

C. 474, 948

D. 480, 950

Answer: B

38. Who suggested that the solute in the dilute solution behaves like a gas ?

A. Van't - Hoff and Pfeiffer

B. Boyle and Van't - Hoff

C. Gay - Lussac and Van't - Hoff

D. Avogadro and Van't - Hoff

Answer: A

39. Which of the following factors affect the colligative properties of solution ?

A. Nature of solute

B. Nature of solvent

C. Number of solvent molecules

D. Number of solute particles

Answer: D

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40. Opening and closing of flower is controlled by ....

A. capillary action

B. hydrolysis

C. diffusion

D. osmosis

Answer: D

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41. If a solution is prepared by adding common salt to pure water, which of the following statements is true ?

    A. Both freezing point and boiling point of solution will decreases.

    B. The freezing point of solution will increase but boiling point will decrease.

    C. Both freezing point and boiling point of solution will increase.

    D. The freezing point of solution will decrease but boiling point will increase.

Answer: D

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42. Which of the following is /are the method (s) of determining the molecular mass ?

    A. Using Henry's law

B. Using Raoult's law

C. Osmotic pressure measurement method

D. Both (B) and (C)

Answer: D

43. What is the diameter of molecular particles of homogeneous mixture ?

A. $10^{-9}m$

B. $10^{-8}m$

C. $10^{-10}m$

D. $10^{-12}m$

Answer: A

44. 2m urea solution is diluted from 2 kg to 5 kg by addition of water. Calculate molality of diluted solution (Molecular weight of urea = 60 g/mol)

A. 0.4 m

B. 1.2 m

C. 0.6 m

D. 0.8 m

Answer: D

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45. At 300 K temperature, Beaker A containing 0.02 M solution of urea and Beaker B containing 0.002 M solution of sugar are separated by semipermiable membrane with repsect should be applied to prevent

osmosis ? Molecular weight of urea = 60 g / mol and molecular weight of sugar = 342 g / mol. $\left[R = 0.082 \ \text{L atm. mol}^{-1}k^{-1}\right]$

A. 0.4428 atm. on beaker B

B. 0.4920 atm. on beaker A

C. 0.4920 atm. on beaker B

D. None of the above

Answer: D

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46. Which of the following is a formula to calculate degree of dissociation ?

A. $\alpha n - \alpha = i$

B. $\alpha n - \alpha + 1 = i$

C. $\alpha i - \alpha + 1 = n$

D. $\alpha - \alpha n - 1 = i$

Answer: B

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47. What will be the normality of 500 mL solution of 0.5 M Na_2SO_4 when diluted to 5 litre volume by addition of water ?

    A. 0.1 N

    B. 0.01 N

    C. 10 N

    D. 1 N

Answer: A

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48. Homogeneous mixture of camphor in N_2 is an example of

    A. Gas solute - Solid solvent

    B. Solid solute - Liquid solvent

    C. Solid solute - Gas Solvent

    D. Liquid solute - Solid solvent

Answer: C

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49. Which of the following statement is correct for an ideal solution ?

    A. The value of ΔH and ΔV will not be zero.

    B. Vapour pressure of such solution is either higher or lower than

        predicted by Raoult's law.

    C. Mixture of Phenol and Aniline is an example of an ideal solution.

D. The value of ΔH and ΔV will be zero.

Answer: D

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50. The relative lowering in vapour pressure and mole fraction of a solvent in 1 1.5 molal aqueous solution obeying Raoult's law for non volatile solute and volatile solvent.

A. 0.26 bar, 0.74

B. 2.6 bar, 0.99

C. 0.026 bar, 0.97

D. 0.96 bar, 0.98

Answer: C

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51. Match the following two Column - I and Column - II :

Column - I   Co:

(U)   Raoult's law for volatile solute and volatile solvent   (i) P_A

(V)   Raoult's law for gaseous solute and liquid solvent   (ii) P_A

(W)   Raoult's law for non - volatile solute and volatile solvent   (iii) $\dfrac{p_1^0 -}{p}$

A. $U \to (iii), V \to (i), W \to (ii)$

B. $U \to (iii), V \to (ii), W \to (i)$

C. $U \to (i), V \to (ii), W \to (iii)$

D. $U \to (ii), V \to (i), W \to (iii)$

Answer: D

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52. Match the following Columns :

	Column - I		Column - II
(m)	$Zn_{(s)} \rightarrow Zn^{+2}_{(aq)} + 2e^-$	(i)	Lead storage
(n)	$Zn(Hg) + 2OH^-_{(aq)} \rightarrow ZnO_{(s)} + H_2O + 2e^-$	(ii)	Leclanche ce
(o)	$Pb_{(s)} + SO_4^{-2}{}_{(aq)} \rightarrow PbSO_4 + 2e^-$	(iii)	Mercury cell
(p)	$2H_{2(aq)} + 4OH^-_{(aq)} \rightarrow 4H_2O + 4e^-$	(iv)	Fuel cell of
		(v)	Ni - Cd cell

A. $m \rightarrow (v), n \rightarrow (iii), o \rightarrow (i), p \rightarrow (ii)$

B. $m \rightarrow (ii), n \rightarrow (iii), o \rightarrow (i), p \rightarrow (iv)$
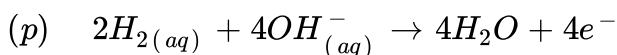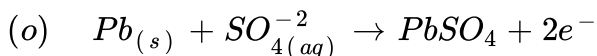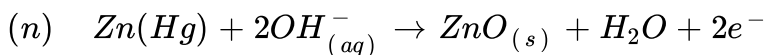
C. $m \rightarrow (ii), n \rightarrow (iii), o \rightarrow (v), p \rightarrow (i)$

D. $m \rightarrow (iv), n \rightarrow (ii), o \rightarrow (iii), p \rightarrow (iv)$
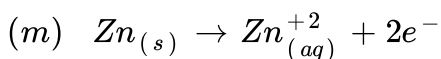
Answer: B

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53. Which of the following solution, where physical state of solute and solvent is liquid and solid, respectively ?

A. Air containing moisture

B. Zinc dissolved in mercury

C. Solution of naphthalene in benzene

D. Sugar solution

Answer: B

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54. Due to which reason, O_2 gas librates from the blood of tissues of animal boidies ?

A. partial pressure of oxygen gas is less in tissues.

B. partial pressure of oxygen is more in tissues.

C. partial pressure of carbon dioxide is less in tissues.

D. less temperature of tissues.

Answer: A

55. At 300 K temperature 2.5 gram unknown substance is dissolved in solvent and made the volume 4 liter of the solution. Its osmotic pressure is found to be 0.2 bar. Calculate the molar mass of unknown substance.

    A. 19.95 gms/mole

    B. 77.94 gms/mole

    C. 199.5 gms/mole

    D. 779.4 gm/mole

Answer: B

56. ...... will be formality of solution in which 948 gram potash alum is dissolved in 5 liter solution. (Potash alum - $K_2SO_4 . Al_2(SO_4)_3 24H_2O$ Mol. Wt. is 948 gms/mole)

A. 0.1 F

B. 0.8 F

C. 0.2 F

D. 0.4 F

Answer: D

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57. The depression in freezing point is 0.69 K when 2 gram phenol is dissolved in 100 gram benzene if it associated as dimeric then finbd its degree of association. The molal depresion constant for solvent is 5.12 K kg mole^{-1}

A. X = 0.950

B. X = 0.704

C. X = 0.473

D. X = 0.734

Answer: D

---

58. Calculate the solubility in water in term of mole fraction in partial pressure of CO_2 is 2×10^{-3} bar at 298 K temperature, the K_a value for CO_2 is 6.02×10^{-4} bar.

    A. 3.322×10^{-3}

    B. 3.011×10^{-3}

    C. 3.322×10^{-4}

    D. 3.011×10^{-6}

Answer: C

59. 12 gm of urea is dissolved in 2 liter solution a 300 K temperature. How many gram of NaCl should be dissolved in 10 liter solution so that it becomes iso - osmotic with urea solution ? [At. Wt. of Na = 23, Cl = 35.5 gm/mole]

A. 29.25 gm

B. 7.31 gm

C. 5.85 gm

D. 19.5 gm

Answer: A

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60. Whose elevation in boiling point will be the same as for 0.1 m KNO_3 ?

A. 0.1 m Urea

B. 0.1 m Potassium sulphate

C. 0.1 m Sodium chloride

D. 0.1 m Aluminium nitrate

Answer: C

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61. If 'n' is the number of ions given by 1 mole of electrolyte, the degree of dissociation $'\alpha'$ of electrolyte is -

A. $\dfrac{i-1}{n+1}$

B. $\dfrac{i-1}{n-1}$

C. $\dfrac{n-1}{i-1}$

D. $\dfrac{n+1}{i-1}$

Answer: B

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62. The van't Hof factor for 0.1 m $Ba(NO_3)_2$ solution is 2.74 percentage of dissociation is .....

A. 91.3 %

B. 100 %

C. 87 %

D. 74 %

Answer: C

63. 45 grams of ethylene glycol $(C_2H_6O_2)$ is mixed with 600 grams of water. What is the depression in freezing point (K_f for water = 1.86 kg mole^{-1}) (C = 12, O = 16, H = 1 g/mol).

A. 2.25 K

B. 22.5 K

C. 3.25 K

D. 32.5 K

Answer: A

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64. The percentage composition (by weight) of a solution is 45% X, 15% Y 40% Z. Calculate the mole fraction of each component of the solution.

(Mol. Wt. of X = 18, Y = 60, Z = 60 gms/mole)

A. X = 0.2 , Y = 0.61, Z = 0.194

B. X = 0.73, Y = 0.073, Z = 0.194

C. X = 0.73, Y = 0.25, Z = 0.194

D. X = 0.3, Y = 0.2, Z = 0.5

Answer: B

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65. The addition of 3 gms of a substance to 100 gms CCl_4 (M.w. = 154 gm/mole) raises the boiling point of CCl_4 by $0.60°C$. If K_b of CCl_4 is 5.03 K Kg mole^{-1} then find out the relative lowering of vapour pressure.

A. 0.0181

B. 0.0224

C. 0.204

D. 0.192

Answer: A

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

A. Depression in freezing point

B. Elevation in boiling point.

C. Boiling point

D. Relative lowering in vapour pressure

Answer: B

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67. Which of the following pair is of non ideal solution ?

A. Water - Nitric acid

B. Benzene - Toluene

C. Acetone - Chloroform

D. Phenol - Aniline

Answer: C

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68. What is the value of Van't Hoff factor for dilute Ferrous sulphate (aqueous) solution ?

A. < 1

B. Zero

C. > 1

D. 1

Answer: C

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69. Which of the following aqueous solution has the highest boiling point having concentration 0.03 m ?

A. $Urea_{(aq)}$

B. $Sodium\ sulphate_{(aq)}$

C. $Aluminium\ sulphate_{(aq)}$

D. Sodium nitrate$_{(aq)}$

Answer: C

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