Liquid Solution & its Colligative Properties

1. Solution Formation, Factors affecting Solubility

Q 1. Formation of a solution from two components can be considered as

1. Pure Solvent $\rightarrow$ separate solvent particles; ΔH_1

2. Pure solute $\rightarrow$ separate solute particles; ΔH_2

3. separated solute & solvent particles $\rightarrow$ solution; ΔH_3 **[CBSE PMT 2003]**

Solution formation will be ideal, if

(A) $\Delta H_{solution} = \Delta H_1 - \Delta H_2 - \Delta H_3$

(B) $\Delta H_{solution} = \Delta H_3 - \Delta H_2 - \Delta H_1$

(C) $\Delta H_{solution} = \Delta H_1 + \Delta H_2 + \Delta H_3$

(D) $\Delta H_{solution} = \Delta H_1 + \Delta H_2 - \Delta H_3$

Q 2. Which of the following is not condition for solution formation?

(A) components should not react with each other

(B) size of components should not differ by large amount

(C) Enthalpy of solution must not be highly +ve

(D) Enthalpy of solution must be Negative

Q 3. In solution formation, Entropy

(A) always increases (B) always decreases

(C) May increase or decrease

(D) No change occur

Q 4. On increasing temperature, solubility increases

(A) for all solution

(B) for endothermic solution formation

(C) for exothermic solution formation

(D) for spontaneous solution formation

Q 5. 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? **[NCERT Exemplar]**

(A) Sugar crystals in cold water

(B) Sugar crystals in hot water

(C) Powdered sugar in cold water

(D) Powdered sugar in hot water

Q 6. At equilibrium the rate of dissolution of a solid solute in a volatile liquid solvent is **[NCERT Exemplar]**

(A) less than the rate of crystallisation

(B) greater than the rate of crystallisation

(C) equal to the rate of crystallisation

(D) zero

Q 7. A beaker contains a solution of substance 'A'. Precipitation of substance 'A' takes place when small amount of 'A' is added to the solution. The solution is **[NCERT Exemplar]**

(A) saturated (B) supersaturated

(C) unsaturated (D) concentrated

Q 8. Maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent does not depend upon **[NCERT Examplar]**

(A) temperature (B) nature of solute

(C) pressure (D) nature of solvent

Q 9. In a pair of immiscible liquids, a common solute dissolves in both & the equilibrium is reached. Then, the concentration of the solute in upper layer is **[CBSE PMT 1994]**

(A) In fixed ratio with that in lower layer

(B) same as the lower layer

(C) lower than the lower layer

(D) higher than the lower layer

Q 10. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to **[NCERT Exemplar]**

(A) low temperature

(B) low atmospheric pressue

(C) high atmospheric pressure

(D) Both low temperature and high atmospheric pressure

Q 11. Value of Henry's constant **[NCERT Examplar]**

(A) increases with increase in temperature

(B) decreases with increase in temperature

(C) remains constnat

(D) first increases then decreases

Q 12. The value of Henry's constnat, K_H is **[NCERT Examplar]**

(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

Q 13 The Henary's law constant for solubility of N_2 gas in water at 298 K is 1.0×10^5 atm. The mole fraction of N_2 in air is 0.8. The number of mole of N_2 from air dissolved in 10 moles of water at 298 K & 5 atm pressure is **[IIT-JEE 2009]**

(A) 4×10^{-4} (B) 5×10^{-3}

(C) 6×10^{-5} (D) 4.6×10^{-4}

Q 14 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

(A) 0.716 (B) 7.16

(C) 0.355 (D) 3.55

Q 15 Find the mole fraction of O_2 in a saturated solution of oxygen in water at 25°C, when partial pressure of O_2 above the solution is 0.21 atm. Given that Henry's constant for O_2 in water at 25°C is $2.3\times10^{-5}\text{atm}^{-1}$

(A) 3.4×10^{-6} (B) 6.5×10^{-7}

(C) 4.8×10^{-6} (D) 7.6×10^{-6}

Q 16 Henry's law constant for CO_2 in water is 1.6×10^8 Pa at 298 K. The quantity of CO_2 in 500g of soda water when packed under 3.2 bar pressure at 298 K, is

(A) 2.44 g (B) 24.4 g

(C) 0.244g (D) 0.61 g

Q 17. 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. **[NCERT Exemplar]**

(A) $HCHO < CH_4 < CO_2 < Ar$

(B) $HCHO < CO_2 < CH_4 < Ar$

(C) $Ar < CO_2 < CH_4 < HCHO$

(D) $Ar < CH_4 < CO_2 < HCHO$

Q 18. Henry law is not valid for

(A) $CO_2(g)$ over H_2O

(B) HCl over $C_6H_6(\ell)$

(C) $O_2(g)$ over H_2O

(D) $NH_3(g)$ over C_2H_5OH

Q 19. 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 N_2 exerts partial pressure of 0.987 bar. Given: Henry's law constant for N_2 at 293 K is 76.48 kbar. **[NCERT Solved]**

Q 20. 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 0.195m, calculate Henry's law constant. **[NCERT Solved]**

Q 21. The air is a mixture of a number of gases. The major components ar oxygen and nitrogen with approximate proportion of 20% is to 79% by volume at 298K. 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 nitrogen at 298K are 3.30×10^7 mm and 6.51×10^7 mm respectively, calculate the composition of these gases in water. **[NCERT]**

Q 22. Based on solute solvent interactions arrange the following in order of increasing solubility in n-octane and explain. **[NCERT]**

Cyclohexane, KCl, CH_3OH, CH_3CN

2. Vapour Pressure of Pure Liquid & of Solution with Volatile Solute

Q 1. At 300K temperature in a 5 litre container saturated vapour pressure is 300 mm of Hg. At the same temperature what will be saturated vapour pressure in a 10L container

(A) 600 mm of Hg (B) 400 mm of Hg

(C) 300 mm of Hg (D) 150 mm of Hg

Q 2. The intermolecular attraction in liquid A is considerably larger than in liquid B. Which is not expected to be larger for liquid A than for liq. B?

(A) Vapour pressure at given temperature

(B) Critical temperature

(C) Enthalpy of vaporization

(D) Temperature at which the vapour pressure is 0.50 atm

Q 3. At same temperature which of the following is the correct order of vapour pressure

(A) V.P. of $Hg > H_2O > CH_3OH$

(B) V.P. of $H_2O > Hg > CH_3OH$

(C) V.P. of $CH_3OH > Hg > H_2O$

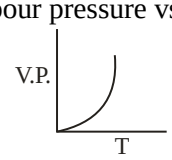
(D) V.P. of $CH_3OH > H_2O > Hg$

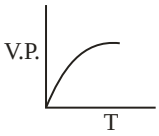
Q 4. The boiling points of $C_6H_6, CH_3OH, C_6H_5NH_2$ and $C_6H_5NO_2$ are 80°C, 65°C, 184°C and 212°C respectively. Which of the following will have the highest vapour pressure at room temperature ?

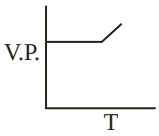
(A) C_6H_6 (B) CH_3OH

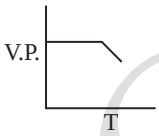
(C) $C_6H_5NH_2$ (D) $C_6H_5NO_2$

Q 5. Which of the following graphs correctly represent the vapour pressure vs temperature?

(A) 

(B) 

(C) 

(D) 

Q 6. When temperature of a liquid increases from 300 K to 400K, vapour pressure becomes two times of its initial value ΔH_{vap} will be (ln 2 = 0.7)

(A) 400 R (B) 840 R

(C) 600R (D) 340 R

Q 7. Find vapour pressure of H_2O at 400°C if ΔHvap. For H_2O is 57.2 KJ/mol & Normal B.P. of H_2O is 100°C (log 15 = 1.7)

(A) 30 atm (B) 15 atm

(C) 5 atm (D) 225 atm

Q 8. For immiscible liquid mixture of $A\left(P_A^0 = 100mm\right)$ & $B\left(P_B^0 = 60mm\right)$ vapour pressure of solution if 1 mole each of A & B is taken inside solution is

(A) 80 mm (B) 120 mm

(C) 160 mm (D) None of these

Q 9. Two liquids P & Q form an ideal solution. What is the vapour pressure of solution containing 3 moles of P and 2 moles of Q at 300 K? [Given: $P_p^0 = 80torr,\ P_Q^0 = 60torr$] **[CBSE PMT 2005]**

(A) 140 torr (B) 20 torr

(C) 68 torr (D) 72 torr

Q 10. Benzene $\left(C_6H_6, 78g/mol\right)$ and toluene $\left(C_7H_8, 92g/mol\right)$ form an ideal solution. At 60°C the vapour pressure of pure benzene and pure toluene are 0.507 atm and 0.184 atm, respectively. Calculate the mole fraction of benzene in a solution of these two chemicals that has a vapour pressure of 0.0350 atm at 60°C

(A) 0.514 (B) 0.690

(C) 0.486 (D) 0.190

Q 11. The mole fraction of toluene in vapour phase which is in equilibrium with a solution of pbenzene and touene having a mole fraction of toluene I liquid phase is equal to 0.500 is (vapour pressure of pure benzene and pure toluene are 119 torr and 37.0 torr respectively)

(A) 0.5 (B) 0.763

(C) 0.237 (D) 1

Q 12. The vapour pressure of hexane $\left(C_6H_{14}\right)$ and heptanes $\left(C_7H_{16}\right)$ at 50°C are 408 Torr and 141 Torr, respectively. The composition of the vapour above a binary solution containing a mole fraction of 0.300 hexane is (Y_6 = mole fraction of hexane and Y_7 = mol fractioin of heptanes, in vapour phase)

(A) $Y_6 = 0.8, Y_7 = 0.2$

(B) $Y_6 = 0.554, Y_7 = 0.446$

(C) $Y_6 = 0.3, Y_7 = 0.7$

(D) $Y_6 = 0.871, Y_7 = 0.129$

Q 13. Two liquids A and B form an ideal solution at temperature T. When the total vapour pressure aboe the solution is 400 torr, the mole fraction of A in the vapour phase is 0.40 and in the liquid phase 0.75. What are the vapour pressure of pure A and pure B at temperature T ?

(A) $P_A^0 = 213.33torr,\ P_B^0 = 960torr$

(B) $P_A^0 = 213.0torr, P_B^0 = 950torr$

(C) $P_A^0 = 113.33torr, P_B^0 = 860torr$

(D) $P_A^0 = 210.33 torr, P_B^0 = 960 torr$

Q 14. Benzene and toluene form an ideal solution. The vapour pressure of benzene and toluene are respectively 75mm and 22 mm at 20°C. If the mole fraction of benzene and toluene in vapour phase are 0.63 and 0.37 respectively, calculate the vapour pressure of mixture.

(A) 39.68 mm (B) 40 mm
(C) 40.88 mm (D) 38 mm

Q 15. At 90°C, the vapour pressure of toluene is 400 torr and that of S-xylene is 150 torr. What is the composition of the liquid mixture that boils at 90°C, when the pressure is 0.50 atm? What is the composition of vapour produced?

(A) 91 & 92.8 mol % toluene
(B) 90 & 95 mol % toluene
(C) 92 & 93.8 mol % toluene
(D) 92 & 96.8 mol % toluene

Q 16. Mixture of volatile components A and B has total vapour pressure (in Torr): $P = 254 - 119X_A$
Where X_A is mole fraction of A in mixture. Hence, P_A^0 and P_B^0 are (in Torr)

(A) 254, 119 (B) 119, 254
(C) 135, 254 (D) 154, 119

Q 17. Two liquids X and Y form an ideal solution. At 300 K, vapour pressure of the solution containing 1 mole of X and 3 mol of Y is 550 mmHg. At the same temperature, if 1 mole of Y is further added to this solution, vapour pressure of the solution increases by 10 mmHg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively: **[JEE Main 2009]**

(A) 300 and 400 (B) 400 and 600
(C) 500 and 600 (D) 200 and 300

Q 18. A mixture contains 1 mole of volatile liquid $A\left(P_A^0 = 100 mm\ Hg\right)$ and 3 moles of volatile liquid $B\left(P_B^0 = 80 mm\, Hg\right)$. If solution behaves ideally, the total vapour pressure of the distillate is

(A) 85 mm Hg (B) 85.88 mm Hg
(C) 90 mm Hg (D) 92 mm Hg

Q 19. Vapour pressure of chloroform ($CHCl_3$) and dichloromethane (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 40g of CH_2Cl_2 at 298 K and, (ii) mole fractions of each component in vapour phase. **[NCERT Solved]**

Q 20. 100 g of liquid A (molar mass 140 g mol^{-1}) was dissolved in 1000g of liquid 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. **[NCERT]**

Q 21. Pressure over ideal binary liquid mixture containing 10 moles each of liquid A and B is gradually decreased isothermally. If $P_A^0 = 200 mm$ Hg and $P_B^0 = 100 mm Hg$, find the pressure at which half of the liquid is converted into vapour

(A) 150 mm Hg (B) 166.5 mm Hg
(C) 133 mm Hg (D) 141.4 mm Hg

Q 22. (1) A liquid mixture of benzene and toluene is composed of 1 mol of benzene and 1 mol of toluene. If the pressure over the mixture at 300K is reduced, at what pressure does the first bubble form ?

(2) What is the composition of the first bubble formed

(3) If the pressure is reduced further, at what pressure does the last trace of liquid disappear?

(4) What is the composition of the last drop of liquid?

(5) What will be the pressure when 1 mol of the mixture has been vaporized?

(Given $P_T^0 = 40$ mm Hg, $P_B^0 = 100 mm\, Hg$]

3. Properties of an Ideal Solution

Q 1. Which of the following pair of solute & solvent form ideal solution?

(A) C_6H_6 & CH_3OCH_3

(B) CH_3OCH_3 & CH_3OH

(C) CH_3OH & C_2H_3OH

(D) Acetone (CH_3COCH_3) & Water

Q 2. For A and B to form an ideal solution which of the following conditions should be satisfied ?

(A) $\Delta H_{(mixing)} = 0$ (B) $\Delta V_{(mixing)} = 0$

(C) $\Delta S_{(mixing)} > 0$

(D) All the three conditions mentioned above

Q 3. Which of the following is less than zero for ideal solutions ? **[IIT JEE 2003 S]**

(A) ΔH_{mix} (B) ΔV_{mix}

(C) ΔG_{mix} (D) ΔS_{mix}

Q 4. Which of the following plots does not represent the behavior of an ideal binary liquid solution ?

(A) Plot of p_A versus x_A (mole fraction of a liquid phase) is linear

(B) plot of p_B versus x_B is linear

(C) plot of p_{total} versus x_A (or x_B) is linear

(D) plot of p_{total} versus y_A is linear

Q 5. Which of the following plots represents an ideal binary mixture ?

(A) Plot of P_{total} v/s $\frac{1}{X_B}$ is linear (X_B = mole fraction of 'B' in liquid phase)

(B) Plot of P_{total} v/s Y_A is linear (Y_B = mole fraction of 'A' in vapour phase)

(C) Plot of $\frac{1}{P_{total}\text{ v/s}}$ Y_A is linear

(D) Plot of $\frac{1}{P_{total}\text{ v/s}}$ Y_B is non linear

Q 6. For an ideal solution with $P_A^0 > P_B^0$, which of the following will be true when $P_A > P_B$?

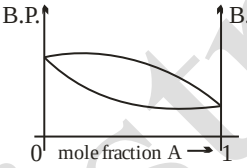
(A) (X_A) liquid = (Y_A) vapour

(B) (X_A) liquid > (Y_A) vapour

(C) (X_A) liquid < (Y_A) vapour

(D) (X_A) liquid and (Y_A) vapour do not bear any relationship with each other

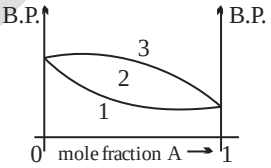
Q 7. In the curve given below for B.P. temperature with mole fraction which relation is correct



(A) $P_A^0 > P_B^0$ (B) $P_B^0 > P_A^0$

(C) $P_A > P_B$ (D) $P_B > P_A$

Q 8. In the given curve for B.P. temperature with mole fraction of A the region which represent liquid gas mixture is



(A) 1 (B) 2

(C) 3 (D) depends on P_A^0 & P_B^0

Q 9. 1 mole each of $A(P_A^0 = 100mm)$ & $B(P_B^0 = 50mm)$ are taken together. The no. of steps after which distillate has mole fraction of $A > 0$

(A) 2 (B) 3

(C) 5 (D) 6

Q 10. On fractional distillation of ideal solution

(A) vapour phase obtained as pure more volatile liquid & liquid phase obtained as pure less volatile liquid

(B) vapour phase obtained as pure less volatile liquid & gas phase obtained as pure more volatile liquid

(C) vapours phase becomes pure & liquid phase becomes mix

(D) vapour phase becomes mixture & liquid phase become pure

4. Non – deal Solution & Azeotropic Solution

Q 1. In a mixture of A and B, components show negative deviation when

(A) $A-B$ interaction is stronger than $A-A$ and $B-B$ interaction

(B) $A-B$ interaction is weaker than $A-A$ and $B-B$ interaction

(C) $\Delta V_{mix} > 0, \Delta S_{mix} > 0$

(D) $\Delta V_{mix} = 0, \Delta S_{mix} > 0$

Q 2. A binary liquid solution of n-heptane and ethyl alcohol is prepared. Which of the following statements correctly represents the behavior of this liquid solution ?

(A) The solution formed is an ideal solution

(B) The solution formed is a non – ideal solution with positive deviations from Raoult's law

(C) The solution formed is non – ideal solution with negative deviations from Raoult's law

(D) Normal –heptane exhibits positive deviations; whereas ethyl alcohol exhibits negative deviations from Raoult's law

Q 3. A solution of acetone in ethanol **[CBSE PMT 2006]**

(A) shows -ve deviation from Raoult's Law

(B) shows +ve deviation from Raoult's Law

(C) behaves like a near ideal solution

(D) obeys Raoult's Law

Q 4. Which of the following liquid pairs shows a positive deviation from Raoult's law ?

(A) Water –hydrochloric acid

(B) carbondisulphide-methanol

(C) water – nitric acid

(D) Acetone- Chloroform

Q 5. Which of the liquid pairs shows a negative deviation from Raoult's law ? **[IIT-JEE 2004S]**

(A) Water – nitric acid

(B) Benzene – methanol

(C) Water – Methanol acid

(D) Acetone-toulene

Q 6. Considering the formation, breaking and strength of hydrogen bond, predict which of the following mixtures will show a positive deviation from Raoult's law? **[NCERT Examplar]**

(A) CH_3OH & acetone (B) $CHCl_3$ & acetone

(C) HNO_3 & water (D) Phenol and aniline

Q 7. If ethanol dissolves in water, then which of the following would happen? **[AIIMS 2011]**

(A) Absorption of heat & Contraction in volume

(B) liberation of heat & Contraction in volume

(C) Absorption of heat & increase in volume

(D) liberation of heat & increase in volume

Q 8. The vapour pressure of the solution of two liquids $A\left(P^0 = 80mm\right)$ and $\left(P^0 = 120mm\right)$ is found to be 100 mm when $x_A = 0.4$. The result shows that

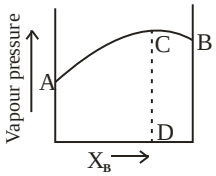
(A) solution exhibits ideal behavior

(B) solution shows positive deviations

(C) solution shows negative deviations

(D) solution will show positive deviations for lower concentration and negative deviations for higher concentrations

Q 9. The diagram given below is a vapour pressure composition diagram for a binary solution of A and B in the solution, A –B interactions are



(A) similar to A-A and B-B interactions

(B) greater than A-A and B-B interaction

(C) smaller than A-A and B-B interaction

(D) unpredictable

Q 10. An azeotropic solution of two liquids has boiling point lower than either of them when it **[IIT-JEE 1981]**

(A) shows –ve deviation from Raoult's law

(B) shows no deviation from Raoult's law

(C) shows +ve deviation from Raoult's law

(D) is saturated

Q 11. Azeotropic mixture is formed in solution having

(A) Negative deviation from Raoult's law

(B) Positive deviation from Raoult's law

(C) In all type of solution

(D) In any type of non – ideal solution

Q 12. Azeotropic solution is formed when

(A) $X_A = Y_A$ & $X_B = Y_B$

(B) $Y_A = X_B$ & $Y_A = Y_B$

(C) $X_A = Y_B$ & $X_B = Y_A$

(D) None of these

Q 13. Solution having positive deviation from Raoult's law form
(A) minimum boiling Azeotrope
(B) Maximum boiling Azeotrope
(C) Does not form Azeotropic mixture
(D) Normal boiling Azeotrope

Q 14. If two liquids A and B from minimum boiling azeotrope at some specific composition then **[NCERT Examplar]**
(A) A-B interactions are stronger than those between $A-B$ or $B-B$
(B) vapour pressure of solution increases because more number of molecules of liquids A and B can escape from the solutin
(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 $A-A$

Q 15. 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 **[NCERT Examplar]**
(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 will form 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

5. Colligative Properties & Relative Lowering of Vapour Pressure

Q 1. Colligative properties depend on **[NCERT Exemplar]**
(A) the nature of the solute in solution
(B) the number of solute particle in solution
(C) the physical properties of the solute in solution
(D) the nature of solvent particles

Q 2. When a solute is added to a solvent, Vapour pressure
(A) always decreases
(B) always increases
(C) doesn't change
(D) May decrease, increase or remain same

Q 3. The vapour pressure of pure A is 10 torr and at the same temperature when 1 g of non – volatile solute B is dissolved in 20 g of A, its vapour pressure is reduced to 9.0 torr. If the molecular mass of A is 200, then the molecular mass of B is
(A) 100 (B) 90 (C) 75 (D) 120

Q 4. The vapour pressure of benzene at 30°C is 121.8 mm of Hg. By adding 15 g of a non-volatile solute in 250 g of benzene, its vapour pressure is decreased to 120.2 mm of Hg. The molar mass of the non – volatile substance is **[AIIMS 1997]**
(A) 156.6 (B) 267.4 (C) 356.3 (D) 467.4

Q 5. A sample of 20.0 g of a compound (molecular weight 120) which is a non – electrolyte is dissolved in 10.0g. of ethanol $\left(C_2H_5OH\right)$. If the vapour pressure of pure ethanol at the temperature is 0.250 atm, what is the vapour pressure of ethanol above the solution ?
(A) 0.250 atm (B) 0.83 atm
(C) 0.125 atm (D) 0.14 atm

Q 6. The vapour pressure of a solution of a non – volatile electrolyte B in a solvent A is 95% of the vapour pressure of the solvent at the same temperature. If the molecular weight of the solvent is 0.3 times the molecular weight of solute, the weight ratio of solvent and solute are
(A) 0.15 (B) 5.7 (C) 0.2 (D) 4.0

Q 7. The vapour pressure of a solvent decreased by 10 mm of Hg when a non – volatile solute was added to the solvent. The mole fraction of solute

in solution is 0.2, what would be mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg. **[CBSE PMT 1998]**
(A) 0.2 (B) 0.4 (C) 0.6 (D) 0.8

Q 8. The vapour pressure of pure liquid (molecular weight = 50) at 25°C is 640 mm of Hg and the vapour pressure of a solution of a solute in the liquid at the same temperature is 600 mm of Hg. Molality of solution is
(A) 3/4 (B) 3/8 (C) 4/3 (D) 4/6

Q 9. The vapour pressure of pure water at 26° is 25.21 torr. What is the vapour pressure of a solution which contains 18g glucose, in 90 g water ?
(A) 34.8 torr (B) 24.7 torr
(C) 28.7 torr (D) 21.3 torr

Q 10. V.P. of solute containing 6 gm of non volatile solute in 180 gm of water is 20 torr of Hg. If 1 mole of water is further added in to the V.P. increases by 0.02 torr. calculate V.P of pure water & molecular weight of non volatile solute
(A) 12.22, 64 (B) 20.22,54
(C) 21.42 (D) 25.30

Q 11. An aqueous solution of 2% non – volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent. What is the molar mass of the solute? **[NCERT]**

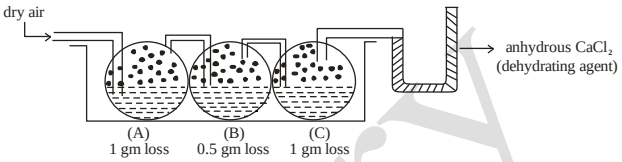
Q 12. The vapour pressure of water is 12.3 kPa at 300 K. Calculate vapor pressure of 1 molal solution of a non – volatile solute in it. **[NCERT]**

Q 13. Calculate the mass of a non – volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114 g octane to reduce its vapour pressure to 80% **[NCERT]**

Q 14. 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, 18g of water is then added to the solution and the new vapour pressure becomes 2.9 kPa at 298 K. Calculate **[NCERT]**
(i) molar mass of the solute
(ii) vapour pressure of water at 298 K

Q 15. Dry air was passed through a solution of 5 gm of a solute in 80 gm of water & then it is passed through pure water. Loss in weight of solution was 2.50 g & that of pure solvent was 0.04g. Calculate the molecular mass of the solute.
(A) 70 g/mol (B) 35 g/mol
(C) 70g/mol (D) None of these

Q 16. In the given experiment,



If same volume solution of different solute is used then what is (a) order of vapour pressure (b) order of moles of solute (c) order of molar mass of solute. (Assuming same mass of solutes)

6. Elevation in B.P. Temperature

Q 1. Atmospheric pressures recorded in different cities are as follows

Cities	Shimla	Bangalore	Delhi	Mumbai
p in N/m^2	1.01×10^5	1.2×10^5	1.02×10^5	1.21×10^5

Consider the above data and mark the place at which liquid will boil first. **[NCERT Exemplar]**
(A) shimla (B) Bangalore
(C) Delhi (D) Mumbai

Q 2. A person living in Shimla observed that cooking food without using pressure cooker takes more time. The reason for this observation is that at high altitude **[NCERT Exemplar]**
(A) pressure increases (B) temperature decreases
(C) pressure decreases (D) temperature increases

Q 3. The unit of ebullioscopic constant is **[NCERT Examplar]**
(A) K kg mol^{-1} of K $(molality)^{-1}$
(B) mol kg K^{-1} or $K^{-1}(molality)$
(C) kg $mol^{-1}K^{-1}$ or $K^{-1}(molality)^{-1}$
(D) K mol kg^{-1} or $K(molality)$

Q 4. **Assertion (A)** Molarity of a solution in liquid state changes with temperature

Reason (R) The volume of a solution changes with change in temperature **[NCERT Exemplar]**

(A) Assertion and reason both are correct statements and reason is correct explanatin 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 is wrong statement but reason is correct statement

Q 5. When 0.6 g of urea (mol. Wt 60) is dissolved in 100g of water. The water will boil at (K_b for water = 0.52 km^{-1}) and normal boiling point of water = 100°C

(A) 372.48 K (B) 373.52 K

(C) 373.052 K (D) 273.52 K

Q 6. On mixing 3 g of non-volatile solute in 200 ml of water, its boiling point becomes 100.52^0C. If Kb for water is 0.6 K-Kg/mol then molecular weight of solute is **[AIIMS 2000]**

(A) 10.5 (B) 12.6

(C) 15.7 (D) 17.3

Q 7. An aqueous solution of glucose boils at 100.01°C. The molal elevation constant for water is 0.5 K $mol^{-1}Kg$. The number of molecules of glucose in solution containing 100g of water is

(A) 6.023×10^{23} (B) 6.023×10^{22}

(C) 12.46×10^{20} (D) 12.046×10^{23}

Q 8. 0.48g of a non electrolyte substance is dissolved in 10.6g of C_6H_6. The freezing point of benzene is lowered by 1.8°C. What will be the mol. Wt. of the substance (K_f for benzene = 6)

(A) 250.2 (B) 90.8

(C) 125.79 (D) 102.5

Q 9. When 10.6 g of a nonvolatile substance is dissolved in 740g of ether, it's boiling point is raised by 0.284°C. What is the molecular weight of the substance ? Molal boiling point constant for ether is 2.11°C. kg/mol.

(A) 100g/mol (B) 102g/mol

(C) 106 g/mol (D) 120 g/mol

Q 10. **Assertion (A):** When methyl alcohol is added to water, boiling point of water increases

Reason (R): When a volatile solute is added to a volatile solvent elevation in boiling point is observed **[NCERT Examplar]**

(A) Assertion and reason both are correct statements and reason is correct explanatin 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 is wrong statement but reason is correct statement

Q 11. An aqueous solution boils at 100.51°C. The freezing point of the solution would be (K_b for water = 0.51°C/m), (K_f for water = 1.86°C/m) [No association or dissociation]

(A) 0°C (B) –1.86°C

(C) –1.82°C (D) + 1.82°C

Q 12. Elevation in b.p of a solution of non – electrolyte is CCl_4 is 0.60. What is depression in f.p. for the same solution ? $K_f(CCl_4)=30.00kg\ mol^{-1}K; K_b(CCl_4)=5.02kg\ mol^{-1}K$.

(A) 0° (B) 5.39°

(C) 3.59° (D) 2.49°

Q 13. 18 g of glucose, $C_6H_{12}O_6$, is dissolved in 1 kg of water in a saucepan. At what temperature will water boil at 1.013 bar ? K_b water is 0.52 K kg mol^{-1}. **[NCERT Solved]**

Q 14. 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 benzene = 2.53 K kg/mol **[NCERT Solved]**

7. Depression in F.P. Temperature

Q 1. Pure benzene freezes at 5.45^0C. A 0.374 m solution of tetracholoromethane in benzene freezes at 3.55^0C. The $K_f(^0C/m)$ for benzene is **[AIIMS 1998]**

(A) 0.508 (B) 5.08
(C) 50.8 (D) 508

Q 2. 4.00g of substance A, dissolved in 100g H_2O depressed the f. pt. of water by 0.1°C while 4 g of another substance B, depressed the f. pt. by 0.2°C. What is the relation between molecular weights of the two substance ?

(A) $M_A = 4M_B$ (B) $M_A = M_B$
(C) $M_A = 0.5M_B$ (D) $M_A = 2M_B$

Q 3. If molality of a dilute solution is doubled, then the value of molal depression constant (K_f) will be **[NEET 2017]**

(A) doubled (B) Halved
(C) Tripled (D) unchanged

Q 4. The elements X and Y form compounds having molecular formula XY_2 and XY_4. When dissolved in 20 gm of benzene, 1gm XY_2 lowers the freezing point by 2.3°, whereas 1gm of XY_4 lowers the freezing point by 1.3°C. The molal depression constant for benzene is 5.1°C/m. Calculate atomic masses of X and Y. **[NCERT]**

(A) $x = 25.6, y = 42.6$
(B) $x = 26, y = 46$
(C) $x = 22.3, y = 40.6$
(D) $x = 42.6, y = 25.6$

Q 5. On freezing an aqueous solution of sugar, the solid which separates out is

(A) sugar (B) ice
(C) a solution with the same composition
(D) a solution with a different composition

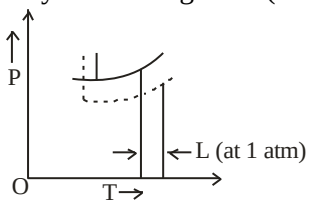
Q 6. Assertion (A) When NaCl is adeed to water a depression in freezing point is observed
Reason (R) The lowering of vapour pressure of a solution causes depression in the freezing point. **[NCERT Examplar]**

(A) Assertion and reason both are correct statements and reason is correct explanatin 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 is wrong statement but reason is correct statement

Q 7. If T_0 is the boiling point of a solvent and ΔH_v is the latent heat of vapourisation, the molal elevation constant is given by the expression

(A) $\frac{M_1RT_0^2}{100\Delta H_v}$ (B) $\frac{100RT_0^2}{M_1\Delta H_v}$
(C) $\frac{100M_1T_0^2}{R\Delta H_v}$ (D) $\frac{\Delta H_v}{100M_1RT_0^2}$

Q 8. The phase diagrams for the pure solvent (solid lines) and the solution (non-volatile solute, dashed line) are recoreded below: The quantity indicated by L in the figure is (m = molality)



(A) Δp (B) ΔT_f
(C) $K_b m$ (D) $K_f m$

Q 9. The amount of ice that will separate out from a solution containing 25 g of ethylene glycol in 100g of water when cooled to -10°C, will be [Given: K_f for $H_2O = 1.86K\ mol^{-1}kg$]

(A) 50.0 g (B) 25.0 g
(C) 12.5 gm (D) 30.0 gm

Q 10. Calculate the amount of ice that will separate out of cooling a solution containing 50g of ethylene glycol in 200g water to –9.3°C. (K_f for water = $1.86K\ mol^{-1}kg$)

(A) 37.8g (B) 38.71 g
(C) 40 g (D) 40.71 g

Q 11. If glycerene $C_3H_5(OH)_3$ & Methyl alcohol, CH_3OH are sold at some price per kg, which would be cheaper for preparing an antifreeze.

Q 12. 45 g of ethylene glycol $(C_2H_6O_2)$ is mixed with 600g of water. Calculate (A) the freezing point depression and (B) the freezing point of the solution. **[NCERT Solved]**

Q 13. 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 constant of benzene is 5.12 K kg mol^{-1}. Find the molar mass of the solute. **[NCERT Solved]**

Q 14. 5% solution (by mass) of cane sugar in water has freezing point of 271 K. Calculate the freezing point of 5% glucose in water if freezing point of pure water is 273.15 K. **[NCERT]**

8. Osmotic Pressure

Q 1. At a given temperature, osmotic pressure of a concentrated solution of a substance .. **[NCERT Examplar]**

(A) is higher than that of 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

Q 2. The solution containing 4.0 g to PVC in 1L of dioxane was found to have osmotic pressure of 0.006 atm at 300 K. The molecular mass of the polymer PVC is

(A) 16.420 (B) 1642
(C) 1,64,200 (D) 4105

Q 3. 5g of a polymer of molecular weight 50 kg mol^{-1} is dissolved in $1dm^3$ solution. If the density of this solution is $0.96kg\ dm^{-3}$ at 300 K, the height of solution that will represent this pressure is

(A) 28.13 mm (B) 20.85 mm
(C) 26.50 mm (D) 24.94 mm

Q 4. At 300 K, 36 g of glucose present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of solution is 1.52 bar at the same T, find its concentration. **[AIIMS 2013]**

(A) 11 g/lit (B) 22 g/lit
(C) 36 g/lit (D) 42 g/lit

Q 5. The osmotic pressure of a solution containing 100 ml of 0.3% solution (w/v) of urea (m.wt. 60) and 100 ml of 1.71% solution (w/v) of cane –sugar (m.wt 342) at 27° is

(A) 10.56 atm (B) 8.98 atm
(C) 17.06 atm (D) 1.23 atm

Q 6. A solution having 54g of glucose per litre has an osmotic pressure of 4.56 bar. If the osmotic pressure of a urea solution is 1.52 bar at the same temperature, what would be its concentration ?

(A) 1.0 M (B) 0.5 M
(C) 0.3 M (D) 0.1 M

Q 7. A 10% W/V urea solution is isotonic with a 20 % W/V solution of a non – volatile solute, at the same temperature. Calculate the molecular weight of the solute

(A) 240 (B) 120
(C) 360 (D) 480

Q 8. A quantity of 10g of solute 'A' and 20g of solute 'B' is dissolved in 500 ml water. The solution is isotonic with the solution obtained by dissolving 6.67 g of 'A' and 30g of 'B' in 500 ml water at the same temperature. The ratio of molar masses, $M_A : M_B$, is

(A) 1:1 (B) 3:1
(C) 1:3 (D) 2:3

Q 9. During osmosis, flow of water through a Semipermeable membrane is **[CBSE PMT 2006]**

(A) from solution having higher conc. only
(B) from both side of SPM with equal flow rate
(C) from both side of SPM with unequal flow rate
(D) from solution having lower conc. only

Q 10. Assertion (A): 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 (R): Diffusion of solvent occurs from a region of high concentration solution to a region of low conc. solution. **[NCERT Exemplar]**

(A) Assertion and reason both are correct statements and reason is correct explanatin 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 is wrong statement but reason is correct statement

Q 11. An unripe mango placed in a concentrated salt solution to prepare pickle shrivels because .. **[NCERT Exemplar]**

(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

Q 12. Which of the following statements is false? **[NCERT Examplar]**

(A) Units of atmospheric pressure and osmotic pressure are the same

(B) In reverse osmosis, solvent molecules move through a semipermeable membrance 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

Q 13. If 'A' contains 2% NaCl and is separated by a semipermeable membrane from 'B' which contains 10% NaCl, which event will occur ?

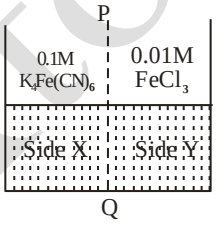
(A) NaCl will flow from 'A' to 'B'

(B) NaCl will flow from 'B' to 'A'

(C) Water will flow from 'A' to 'B'

(D) Water will flow from 'B' to 'A'

Q 14. $FeCl_3$ on reaction with $K_4\left[Fe(CN)_6\right]$ in aq. Solution gives blue colour. These are separated by a semipermeable membrane PQ as shown. Due to osmosis there is



(A) blue colour formation in side X

(B) blue colour formation in side Y

(C) blue colour formation in both of the the sides X and Y

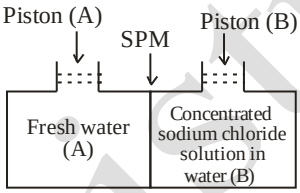
(D) no blue colour formation

Q 15. At 300 K, two solutions of glucose in water of concentration 0.01M and 0.001M are separated by semipermeable membrane. Pressure needs to applied on which solution, to prevent osmosis? Calculate the magnitude of this applied pressure.

(A) 0.320 atm (B) 0.221 atm

(C) 1.225 atm (D) 1.0 atm

Q 16. Consider the figure and mark the correct option **[NCERT Examplar]**



(A) Water will move from side (A) to side (B) if a pressure lower osmotic pressure is applied on piston (B)

(B) Water will move from side (B) to side (A) if a pressure greater than osmotic pressure 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) side (B) if pressure equal to osmotic pressure greater than osmotic pressure is applied on piston (B)

Q 17. At 10°C, the osmotic pressure of urea solution is 500 mm of Hg. The solution is diluted and the temperature is raised to 25°C, when the osmotic pressure is found to be 105.3 mm of Hg. Determine extent of dilution.

(A) $V_{final} = 4V_{original}$ (B) $V_{final} = 6V_{original}$

(C) $V_{final} = 5V_{original}$ (D) $5V_{final} = V_{original}$

Q 18. Insulin is dissolved in a suitable solvent and the osmotic pressure π of the solution of various concentration (in kg/m^3) is measured at 20°C. The slope of a plot of π against c is found to be 8.314×10^{-3} (SI units) The molecular weight of the insulin (in kg/mol) is

(A) 4.8×10^5 (B) 9×10^5

(C) 293×10^3 (D) 8.314×10^5

Q 19. $200cm^3$ 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 mas of the protein. **[NCERT Solved]**

Q 20. Calculate the osmotic pressure in Pascal exerted by a solution prepared by dissolving 1.0g of polymer of molar mass 185,000 in 450 mL of water at 37°C. **[NCERT Solved]**

Q 21. At 300 K, 36 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bars at the same temperature, what would be its concentration ? **[NCERT]**

9. Van't Hoff Factors & Abnormal C.P.

Q 1. The values of van't Hoff factors for KCl, NaCl & K_2SO_4 respectively are **[NCERT Examplar]**

(A) 2,2 and 2 (B) 2,2 and 3
(C) 1,1 and 2 (D) 1, 1 and 1

Q 2. We have three aqueous of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1 M, 0.01 M and 0.001M, respectively. The value of van't Hoff factor for these solutions ill be in the order **[NCERT Examplar]**

(A) $i_A < i_B < i_C$ (B) $i_A > i_B > i_C$
(C) $i_a = i_B = i_C$ (D) $i_A < i_B < i_C$

Q 3. Which salt may show the same value of vant Hoff factor (i) as that of $K_4\left[Fe(CN)_6\right]$ in very dilute solution state:

(A) $Al_2(SO_4)_3$ (B) NaCl
(C) $Al(NO_3)_3$ (D) Na_2SO_4

Q 4. Calculate Van't Hoff factor (i) of the compound $K_4\left[Fe(CN)_6\right]$ if their $\alpha = 80\%$

(A) 4.2 (B) 4
(C) 5 (D) 2.5

Q 5. Calculate Van't Hoff factor (i) of the compound Acetic acid in benzene if their $\alpha = 50\%$ (Acetic acid in benzene dimerises)

(A) 0.25 (B) 1.5
(C) 0.75 (D) 2

Q 6. Vapour density of $PCl_5(g)$ dissociating into $PCl_3(g)$ and $Cl_2(g)$ is 100. Hence, van't Hoff factor for the case:

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is

(A) 1.85 (B) 3.70
(C) 1.085 (D) 1.0425

Q 7. If $pK_a = -\log k_a = 4$, and $K_a = Cx^2$ then van't Hoff factor for weak monobasic acid when $C = 0.01M$ is (where x= degree of dissociation)

(A) 1.01 (B) 1.02
(C) 1.10 (D) 1.20

Q 8. The boiling point of 0.2 mol/Kg olution of X in water is greater than equimolal solution of Y in water. Which one of the following statements is true in this case? **[CBSE PMT 2015]**

(A) X is undergoing dissociation in water
(B) Molecular mass of X is greater than that of Y
(C) Molecular mass of X is less than that of Y
(D) Y is undergoing dissociation in water while X undergoing no change.

Q 9. Which of the following aqueous solution will show maximum vapour pressure at 300 K?

(A) 1M NaCl (B) 1M $CaCl_2$
(C) $1MAlCl_3$ (D) $1MC_{12}H_{22}O_{11}$

Q 10. What is freezing point of a solution containg 8.1 g of HBr in 100 g of water? Assume 90 % dissociation of Acid and Kb for water = 1.86 K.Kg/mol. **[AIIMS 2017]**

(A) -0.35^0C (B) -1.35^0C
(C) -2.35^0C (D) -3.53^0C

Q 11. Which of the following aqueous solutions should have highest boiling point? **[NCERT Exampler]**

(A) 1.0 m NaOH (B) 1.0 Na_2SO_4
(C) 1.0M NH_4NO_3 (D) 1.0M KNO_3

Q 12. In comparison to a 0.01 M solution of glucosse, the depression in freezing point of a 0.01 M $MgCl_2$ solution is… **[NCERT Examplar]**

(A) the same (B) about twice
(C) about 3 times (D) about 6 times

Q 13. Which of the following statements is false? **[NCERT Examplar]**

(A) two 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 thesolution)

(C) Decreasing order of osmotic pressure for 0.01 M aquous solutions of barium chloride, potassium chloride, acetic acid and sucrose is $BaCl_2 > KCl > CH_3COOH >$ sucrose

(D) Acording 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

Q 14. Determine the amount of $CaCl_2$ (i = 2.47) dissolved in 2.5 litre of water such that its osmotic pressure is 0.75 atm at 27°C. **[NCERT]**

Q 15. 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. **[NCERT]**

10. Abnormal C.P.

Q 1. A 0.001 molal solution of a complex $[MA_8]$ in water has the freezing point of -0.0054^0C. Assuming 100% ionization of the complex salt and K_f for H_2O = 1.86 K/m, write the correct representation for the complex

(A) $[MA_8]$ (B) $[MA_7]A$
(C) $[MA_6]A_2$ (D) $[MA_5]A_3$

Q 2. 1.0 molal aqueous solution of an electrolyte A_2B_3 is 60% ionized. The boiling point of the solution at 1 atm is (K_b for H_2O = 0.52 K/m)

(A) 274.76 K (B) 377 K
(C) 376.4 K (D) 374. 76K

Q 3. Which of the following has been arranged in order of decreasing freezing point?

(A) $0.05M\ KNO_3 > 0.04MBaCl_2 > 0.140Msugar > 0.075MCuSO_4$

(B) $0.04MBaCl_2 > 0.140Msucrose > 0.075MCuSO_4 > 0.05MKNO_3$

(C) $0.075M\ CuSO_4 > 0.140Msucrose > 0.04MBaCl_2 > 0.05MKNO_3$

(D) $0.075M\ CuSO_4 > 0.05MNaNO_3 > 0.140M$ sucrose $> 0.04MBaCl_2$

Q 4. The freezing point of equimolal aqueous solutions will be highest for

(A) $C_6H_5NH_3Cl$ (B) $Ca(NO_3)_2$
(C) $La(NO_3)_3$ (D) $C_6H_{12}O_6$

Q 5. Which one of the following aqueous solutions will exhibit highest boiling point?

(A) 0.01 M Na_2SO_4 (B) 0.01 M KNO_3
(C) 0.015 M urea (D) 0.015 M glucose

Q 6. Consider separate solution of 0.500 M C_2H_5OH (aq), 0.100 M $Mg_3(PO_4)_2$ (Aq), 0250 M KBr (aq) , 0.250 M KBr(aq) and 0.125M Na_3PO_4 (aqs) at 25°C. Which statement is true about these solutions, assuming all salts to be strong electrolytes? **[JEE Main 2014]**

(A) They all have the same osmotic pressure
(B) 0.100 M $Mg_3(PO_4)_2$(aq) has the highest osmotic pressure
(C) 0.125 M Na_3PO_4 (aqs) has the highest osmotic pressure
(D) 0.500 M C_2H_5OH(aqs) has the highest osmotic pressure

Q 7. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.010 M solution of glucose at same temperature. The degree of dissociation of Na_2SO_4 is

(A) 25% (B) 50%
(C) 75% (D) 85%

Q 8. Barium ions, CN^- and Co^{2+} form an ionic complex. If that complex is supposed to be 75% ionized in water with vant Hoff factor 'I' equal to four, then the coordination number of Co^{2+} in the complex can be

(A) Six (B) Five
(C) Four (D) Six and Four both

Q 9. The vapour pressure of a saturated solution of sparingly soluble salt (XCl_3) was 17.20 mm Hg at 27°C. If the vapour pressure of pure H_2O is 17.25 mm Hg at 300 K, what is the solubility of sparingly soluble salt XCl_3 in mole/Litre

(A) 4.04×10^{-2} (B) 8.08×10^{-2}
(C) 2.02×10^{-2} (D) 4.04×10^{-3}

Q 10. Find the vap. Pressure of $CdCl_2(s)$ in H_2O at 20°C if solubility of $CdCl_2$ is 0.005 M
(Vap. Pressure of pure water = 20 mm)

Q 11. 0.6 mL of acetic acid(CH_3COOH) Having density 1.06 g/ml, 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 & dissociation constant of acid.
[NCERT Solved]

Answer Key

1. Solution Formation, Factors affecting Solubility

(1). C (2). D (3). A
(4). B (5). D (6). C
(7). B (8). C (9). A
(10). B (11). A (12). B
(13). A (14). A (15). C
(16). A (17). C (18). D
(19). 0.716 mol (20). 282 bar
(21). $X_{O_2}=4.61\times10^{-5}$ $X_{N_2}=9.22\times10^{-5}$
(22). $KCl < CH_3OH < CH_3CN <$ Cyclohexane

2. Vapour Pressure of Pure Liquid & of Solution with Volatile Solute

(1). C (2). A (3). D
(4). B (5). A (6). B
(7). B (8). C (9). D
(10). A (11). C (12). B
(13). B (14). C (15). C
(16). C (17). B (18). B
(19). $X_{CH_2Cl_2}=0.82$, $X_{CHCl_3}=0.18$
(20). PA = 32 torr, P_A^0 = 280.7 torr
(21). D
(22). 1). 70 mm 2). Y_A = 2/7
3). 400/7 mm 4). X_A = 5/7
5). P = $20\sqrt{10}$ mm

3. Properties of an Ideal Solution

(1). C (2). D (3). C
(4). D (5). C (6). C
(7). A (8). B (9). B
(10). A

4. Non – deal Solution & Azeotropic Solution

(1). A (2). B (3).B
(4). B (5). A (6). A
(7). C (8). C (9). C
(10). C (11). D (12). A
(13). A (14). A (15). B

5. Colligative Properties & Relative Lowering of Vapour Pressure

(1). B (2). D (3). B
(4). D (5). D (6). B
(7). C (8). C (9). D
(10). D (11). 41.35 g/mol
(12). 12.08 KPa (13). 10 g
(14). (i) 23 g/mol (ii) 3.53 KPa
(15). A (16). A). $P_c > P_A > P_B$
B). $n_c < n_A < n_B$ C). $M_c > M_A > M_B$

6. Elevation in B.P. Temperature

(1). A (2). C (3). A
(4). A (5). C (6). D
(7). C (8). C (9). B
(10). D (11). B (12). C
(13). 373.02 K (14). 58 g/mol

7. Depression in F.P. Temperature

(1). B (2). D (3). D
(4). A (5). B (6). A
(7). A (8). C (9). B
(10). C (11). CH_3OH (12). 270.95K
(13). 256 g/mol (14). 269.06 K

8. Osmotic Pressure

(1). A (2). A (3). C
(4). A (5). D (6). D
(7). B (8). C (9). D
(10). B (11). D (12). B
(13). C (14). D (15). C
(16). B (17). A (18). C
(19). 61.022 g/mol
(20). 30.96 (21). 0.06 M

9. Van't Hoff Factors & Abnormal C.P.

(1). B (2). C (3). A
(4). A (5). C (6). D
(7). C (8). A (9). D
(10). A (11). B (12). C
(13). A (14). 3.42 g
(15). $5.27 \times 10^{-3}\, atm$

10. Abnormal C.P.

(1). C (2). D (3). A
(4). D (5). A (6). A
(7). C (8). B (9). A
(10). 19.9982 mm of Hg
(11). 1.86×10^{-5}