# 2 Solutions

## Past Years NEET/JEE/Boards Trend

## Investigation Report

| TARGET EXAM | PREDICTED NO. OF MCQs | CRITICAL CONCEPTS |
|---|---|---|
| JEE/NEET | 2-3 | • Calculations based on Raoult's law of Relative lowering of vapour presure and other colligative properties |

| List of Concepts | 2018 | 2019 | | 2020 | |
|---|---|---|---|---|---|
| | | | | | |
| Henry's Law, Raoult's Law | | 2 Q (2 marks) | | 2 Q (2 marks) | |
| Ideal and Non-ideal Solution | | 1 Q (2 marks) | 2 Q (2 marks) | 1 Q (1 marks) | |
| Colligative Properties | 1 Q (3 marks) | | 1 Q (2 marks) | 2 Q (1 marks) | - |
| Numericals based on Colligative Properties | 1 Q (2 marks) | 1 Q (3 marks) | 1 Q (3 marks) | 1 Q (3 marks) | 1 Q (3 marks) |

| TARGET EXAM | PREDICTED NO. OF QUESTION |
|---|---|
| BOARDS | 2-4 (7 Marks) |

## Perfect Study Plan

| | | | |
|---|---|---|---|
| Topic Wise Questions | - 179 | Learning Plus | - 91 |
| Multi Concept MCQs | - 52 | JEE/NEET PYQs | - 67 |
| BOARD PYQs | - | TOTAL Question | - 500+ |

## EXPRESSING CONCENTRATIONS OF SOLUTIONS

**1.** The density of a solution prepared by dissolving 120 g of urea (molecular mass = 60 g ) in 1000 g of water is 1.15 g/ml. The molarity of this solution is:
(*a*) 1.78 M (*b*) 1.02 M
(*c*) 2.05 M (*d*) 0.50

**2.** When the volume of the solution is doubled, the following becomes exactly half
(*a*) Molality (*b*) Mole-fraction
(*c*) Molarity (*d*) Weight percent

**3.** A semi molar solution is the one, which contains
(*a*) One mole solute in 2 litres
(*b*) 2 moles solute in 2 litres
(*c*) 0.1 mole solute in 1 litre
(*d*) 0.2 moles solute in 2 litres

**4.** 1 kg of NaOH is added to 10 ml of 0.1N HCl, the resulting solution will
(*a*) Turn blue litmus red
(*b*) Turn phenolphthalein solution pink
(*c*) Turn methyl orange red
(*d*) Will have no effect on red or blue litmus paper

**5.** What is the mole fraction of glucose in 10% w/w glucose solution?
(*a*) 0.01 (*b*) 0.02
(*c*) 0.03 (*d*) 0.04

**6.** Normality of 0.1M $H_3PO_3$ is
(*a*) 0.2N (*b*) 0.30N
(*c*) 0.033N (*d*) 0.05N

**7.** In a normal solution of $BaCl_2$, normalities of $Ba^{2+}$ and $Cl^-$ are in the ratio
(*a*) 2:1 (*b*) 1:2
(*c*) 1:1 (*d*) 2:3

**8.** Molarity of 0.1N oxalic acid is
(*a*) 0.05 M (*b*) 0.1 M
(*c*) 0.2 M (*d*) 0.3M

**9.** 138 g ethyl alcohol is mixed with 72 g of water. The ratio of mole fraction of alcohol to water is:
(*a*) 3 : 4 (*b*) 1 : 2
(*c*) 1 : 4 (*d*) 1 : 1

**10.** When an oxide $M_2O_3$ is oxidised to $M_2O_5$ its equivalent weight is
(*a*) M. w/1 (*b*) M. w/2
(*c*) M. w/4 (*d*) M. w/8

**11.** The equivalent weight of $H_3PO_4$ in the following reaction is
(*a*) 98 (*b*) 49
(*c*) 32.66 (*d*) 40

**12.** The equivalent weight of Mohr's salt during redox reaction is equal to its
(*a*) Molecular weight / 2 (*b*) Atomic weight / 2
(*c*) Molecular weight / 3 (*d*) Molecular weight

**13.** The equivalent weight of $MnSO_4$ is half its molecular weight, when it is converted to
(*a*) $Mn_2O_3$ (*b*) $MnO_2$
(*c*) $MnO_4$ (*d*) $MnO_4^{-2}$

**14.** 2.5 $cm^3$ of 0.2 M $H_2SO_4$ solution is diluted to 0.5 $dm^3$. Find normality of the diluted solution:
(*a*) 0.2 N (*b*) 0.02 N
(*c*) 0.002 N (*d*) 0.04 N

**15.** Number of moles of solute dissolved in 1000g. of the solvent is called
(*a*) Molarity (*b*) Molality
(*c*) Formality (*d*) Normality

**16.** Which of the following has no units?
(*a*) Molarity (*b*) Normality
(*c*) Molality (*d*) Mole fraction

**17.** Molarity of 4% (w/v) solution of NaOH is
(*a*) 0.1 (*b*) 0.5
(*c*) 0.001 (*d*) 1.0

**18.** The number of moles of solute present in 2.0 lits of 0.5M NaOH solution is
(*a*) 2 (*b*) 1
(*c*) 4 (*d*) 0.1

**19.** What is the molarity of 0.2 N $Na_2CO_3$ solution?
(*a*) 0.1 M (*b*) 0 M
(*c*) 0.4 M (*d*) 0.2 M

**20.** 10 millimoles of solute is present in the following volume of 0.08M solution
(*a*) 125ml (*b*) 625ml
(*c*) 500 ml (*d*) 1000ml

**21.** The concentration of a 100 ml solution containing X grams of $Na_2CO_3$ (mol. wt. = 106) is Y M. The values of X and Y are respectively:
(*a*) 2.12, 0.05 (*b*) 1.06, 0.2
(*c*) 1.06, 0.1 (*d*) 2.12, 0.1

**22.** Zinc reacts with $CuSO_4$ according to the equation $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$. If excess of zinc is added to 100ml, 0.05M $CuSO_4$, the amount of copper formed in moles will be
(*a*) 5 (*b*) 0.5
(*c*) 0.05 (*d*) 0.005

**23.** How many milli litres of 1M $H_2SO_4$ will be neutralised by 10ml of 1M NaOH solution?
(*a*) 10 (*b*) 20
(*c*) 2.5 (*d*) 5

**24.** The normality of orthophosphoric acid having purity of 70% by weight and specific gravity 1.54 gm/ml is:
(*a*) 11 N (*b*) 22 N
(*c*) 33 N (*d*) 44 N

**25.** The volume of water that must be added to a mixture of 250ml of 6M HCl and 650ml of 3M HCl to obtain 3M solution is
(*a*) 75ml (*b*) 150ml
(*c*) 300ml (*d*) 250ml

**26.** If 36.0 g of glucose is present in 400 ml of solution, molarity of the solution is
(*a*) 0.05M (*b*) 11.0 M
(*c*) 0.5M (*d*) 2.0 M

**27.** What volume of 0.8M solution contains 0.1 mole of the solute?
(*a*) 100 ml (*b*) 125 ml
(*c*) 500 ml (*d*) 62.5 ml

**28.** If 0.01 mole of solute is present in 500 ml of solution, its molarity is
(*a*) 0.01 M (*b*) 0.005M
(*c*) 0.02 M (*d*) 0.1M

**29.** Number of milli equivalents of solute in 0.5 litres of 0.2N solution is
(*a*) 10 (*b*) 1
(*c*) 100 (*d*) 1000

**30.** 0.126 g of an acid is titrated with 0.1 N 20 ml of a base. The equivalent weight of the acid is:
(*a*) 63 (*b*) 50
(*c*) 53 (*d*) 23

**31.** 250 ml of a solution contains 6.3 grams of oxalic acid (mol. wt. =126 g/mol). What is the volume (in litres) of water to be added to this solution to make it a 0.1 N solution?
(*a*) 750 (*b*) 7.5
(*c*) 0.075 (*d*) 0.75

**32.** Volume of 0.1 M $K_2Cr_2O_7$ required to oxidise 35ml of 0.5 M $FeSO_4$ solution is
(*a*) 35ml (*b*) 29ml
(*c*) 17.5ml (*d*) 175ml

**33.** The weight of $H_2C_2O_4.2H_2O$ required to prepare 500ml of 0.2N solution is
(*a*) 1.26g (*b*) 6.3g
(*c*) 1.575g (*d*) 3.15g

**34.** 3.42 g of a substance of molecular weight 342 g is present in 250g of water. Molality of this solution is
(*a*) 0.4m (*b*) 0.04 m
(*c*) 0.8 m (*d*) 4m

**35.** 3g of a salt [mol. wt. 30 g/mol] is dissolved in 250 g of water the molality of the solution is
(*a*) 0.4 (*b*) 0.2
(*c*) 0.6 (*d*) 0.8

**36.** Mole fraction of a solute in benzene is 0.2, then find molality of solution:
(*a*) 3.2 (*b*) 2
(*c*) 4 (*d*) 3.6

**37.** How much volume of 1 M $H_2SO_4$ is required to neutralise 20 ml of 1 M NaOH?
(*a*) 10 ml (*b*) 20 ml
(*c*) 5 ml (*d*) 15 ml

## SOLUBILITY

**38.** How many grams of $CO_2$ gas is dissolved in a 1 L bottle of carbonated water if the manufacturer uses a pressure of 2.4 atmosphere in the bottling process at 25°C Given $K_H$ of $CO_2$ water = 29.76 atm/mole/L at 25°C
(*a*) 3.52 (*b*) 4.2
(*c*) 3.1 (*d*) 2.5

**39.** $H_2S$ is a toxic gas used in qualitative analysis. If solubility of $H_2S$ in water at STP is 0.195 m, what is the value of $K_H$?
(*a*) 0.0263 bar (*b*) 69.16 bar
(*c*) 192 bar (*d*) 282 bar

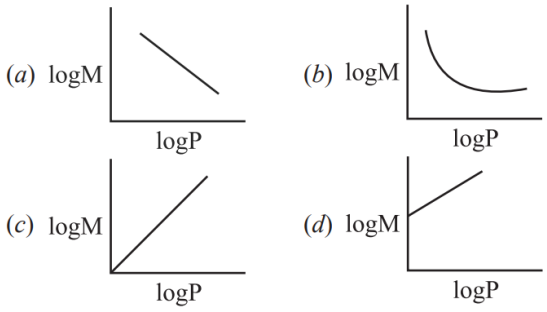
**40.** The law which indicates the relationship between solubility of a gas in liquid and pressure is:
(*a*) Raoult's law
(*b*) Henry's law
(*c*) Lowering of Vapour pressure
(*d*) Van't Hoff's law

**41.** Among the following substance the lowest vapour pressure is exerted by:
(*a*) Water (*b*) Alcohol
(*c*) Ether (*d*) Mercury

**42.** Partial pressure of a solution component is directly proportional to its mole fraction. This is known as:
(*a*) Henry's law (*b*) Raoult's law
(*c*) Distribution law (*d*) Ostwald's dilution law

**43.** 3 moles of 'P' and 2 moles of "Q" are mixed, what will be their total vapour pressure in the solution if their partial vapour pressures in pure state are 80 and 60 torr respectively:
(*a*) 80 torr (*b*) 140 torr
(*c*) 72 torr (*d*) 70 torr

**44.** Which of these curves represents Henry's Law?




**45.** In which case Raoult's law is not applicable?
(*a*) 1 m NaCl (*b*) 1 m urea
(*c*) 1 m glucose (*d*) 1 m sucrose

**46.** Which one of the following gases has the lowest value of Henry's law constant?

(*a*) $N_2$ (*b*) He

(*c*) $CO_2$ (*d*) $O_2$

**47.** If two components A and B have $P_A^0 : P_B^0 = 1 : 2$ and have mole fraction in solution 1 : 2 then mole fraction of A in vapour is:

(*a*) 0.33 (*b*) 0.25

(*c*) 0.52 (*d*) 0.2

**48.** Henry's law constant of oxygen is $1.4 \times 10^{-3}$ mol $l^{-1}$ $atm^{-1}$ at 298 K. How much of oxygen is dissolved in 100 ml at 298 K when the partial pressure of oxygen is 0.5 atm?

(*a*) 1.4 g (*b*) 3.2 g

(*c*) 2.24 mg (*d*) 3.2 g

**49.** Vapour pressure of chloroform ($CHCl_3$) and dichloromethane ($CH_2Cl_2$) at 25°C are 200 mmHg and 41.5 mmHg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of $CH_2Cl_2$ at the same temperature will be (Molecular mass of $CHCl_3$ = 119.5 u and molecular mass of $CH_2Cl_2$ = 85 u):

(*a*) 173.9 mmHg (*b*) 615.0 mmHg

(*c*) 347.9 mmHg (*d*) 90.63 mmHg

## VAPOUR PRESSURE OF LIQUID SOLUTIONS

**50.** The amount of solute (molar mass 60 g $mol^{-1}$) that must be added to 180 g of water so that the vapour pressure of water is lowered by 10% is:

(*a*) 30 g (*b*) 60 g

(*c*) 120 g (*d*) 12 g

**51.** The boiling point 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 will show highest vapour pressure at room temperature?

(*a*) $C_4H_6$ (*b*) $CH_3OH$

(*c*) $C_6H_5NH_2$ (*d*) $C_6H_5NO_2$

**52.** 12g of urea is present in 1 litre of solution and 68.4 g of sucrose is separately dissolved in 1 litre of another sample of solution. The lowering of vapour pressure of first solution is

(*a*) Equal to second

(*b*) Greater than second

(*c*) Less than second

(*d*) Double that of second

**53.** Lowering of vapour pressures of equimolar solution of glucose, sodium chloride and barium nitrate are in the order.

(*a*) Glucose > NaCl > Ba $(NO_3)_2$

(*b*) Glucose = NaCl = Ba $(NO_3)_2$

(*c*) $Ba(NO_3)_2$ > NaCl > Glucose

(*d*) NaCl > $Ba(NO_3)_2$ > Glucose

**54.** The vapour pressure of water depends upon

(*a*) Surface area of container

(*b*) Volume of container

(*c*) Temperature

(*d*) All

**55.** Two liquids X and Y form an ideal solution. At 300 K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 550 mm Hg. At the same temperature if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 mm Hg. Vapour pressure (in mm Hg) of X and Y in their pure states will be respectively

(*a*) 200 and 300 (*b*) 300 and 400

(*c*) 400 and 600 (*d*) 500 and 600

**56.** A solution is obtained by dissolving 0.2 moles of urea in a litre of water. Another solution is obtained by dissolving 0.4 moles of cane-sugar in a litre of water at the same temperature. The lowering of vapour pressure to the first solution is.

(*a*) Same as that of the second solution

(*b*) Half to that of the second solution

(*c*) Double to that of the second solution

(*d*) None

**57.** At a certain temperature, the vapour pressure of water is 90 mm. At the same temperature the vapour pressure of a solution containing a non-volatile solute is 81mm. The relative lowering of vapour pressure is

(*a*) 9 (*b*) 0.9

(*c*) 10 (*d*) 0.1

**58.** 3 gms of urea is added to 36 gms of boiling water. How much lowering in its vapour pressure is noticed?

(*a*) 19 mm (*b*) 38 mm

(*c*) 760 mm (*d*) 76 mm

**59.** Two liquids X and Y form an ideal solution. The mixture has a vapour pressure of 400 mm at 300 K when mixed in the molar ratio of 1 : 1 and a vapour pressure of 350 mm when mixed in the molar ratio of 1 : 2 at the same temperature. The vapour pressures of the two pure liquids X and Y respectively are:

(*a*) 250 mm, 550 mm (*b*) 350 mm, 450 mm

(*c*) 350 mm, 700 mm (*d*) 550 mm, 250 mm

## IDEAL AND NON-IDEAL SOLUTIONS

**60.** The system that forms maximum boiling azeotrope is:

(*a*) Carbon disulphide - acetone

(*b*) Benzene - toluene

(*c*) Acetone - chloroform

(*d*) n - hexane - n heptane

**61.** A non-ideal solution was prepared by mixing 30 ml chloroform and 50 ml acetone. The volume of mixture will be:

(*a*) > 80 ml (*b*) < 80 ml

(*c*) = 80 ml (*d*) ≥ 80 ml

**62.** A solution of acetone in ethanol:

(*a*) Shows a negative deviation from Raoult's law

(*b*) Shows a positive deviation from Raoult's law

(*c*) Behaves like a near ideal solution

(*d*) Obey Raoult's law

**63.** Which of the following will show a negative deviation from Raoult's law?

(*a*) Acetone - benzene (*b*) Acetone - ethanol

(*c*) Benzene - methanol (*d*) Acetone - chloroform

**64.** A solution containing components A and B follows Raoult's law:

(*a*) A – B attraction is greater than A – A and B – B

(*b*) A – B attraction forces is less than A – A and B – B

(*c*) A – B attraction forces remains same as A – A and B – B

(*d*) Volume of solution is different from sum of volumes of solute and solvent

**65.** What are the conditions for an ideal solution which obeys Raoult's law over the entire range of concentration?

(*a*) $\Delta H_{mix} = 0, \Delta V_{mix} = 0, \ P_{total} = P_A^0 x_A + P_B^0 x_B$

(*b*) $\Delta H_{mix} = +ve, \Delta V_{mix} = 0, P_{total} = P_A^0 x_A + P_B^0 x_B$

(*c*) $\Delta H_{mix} = 0, \Delta V_{mix} = +ve, P_{total} = P_A^0 x_A + P_B^0 x_B$

(*d*) $\Delta H_{mix} = 0, \Delta V_{mix} = 0, \ P_{total} = P_B^0 x_B$

**66.** For an ideal solution with $P_A > P_B$, Which of the following is true?

(*a*) $(x_A)_{liquid} = (x_A)_{vapour}$ (*b*) $(x_A)_{liquid} > (x_A)_{vapour}$

(*c*) $(x_A)_{liquid} > (x_A)_{vapour}$ (*d*) $(x_A)_{liquid} < (x_A)_{vapour}$

**67.** Which of the following azeotropes is not correctly matched?

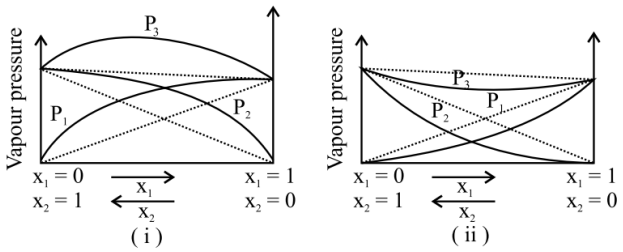
(*a*) $HNO_3$ (68%) + $H_2O$ (32%): Maximum boiling azeotrope, B.P = 393.5 K

(*b*) $H_2O$ (43%) + HI (56.7%): Minimum boiling azeotrope, B.P = 290 K

(*c*) $C_2H_5OH$(95.5%) + $H_2O$(4.5%): Minimum boiling azeotrope, B.P. = 351.15 K

(*d*) Chloroform (93.2%) + $C_2H_5OH$ (6.8%): Minimum boiling azeotrope, B.P. = 332.3 K

**68.** Study the figures given below and mark the correct statement:




(*a*) (*i*) Nitric acid + water(*ii*) Acetone + ethyl alcohol

(*b*) (*i*) Water + ethyl alcohol(*ii*) Acetone + Benzene

(*c*) (*i*) Acetone + ethyl alcohol(*ii*) Acetone + chloroform

(*d*) (*i*) Benzene + chloroform(*ii*) Acetone + chloroform

**69.** Which of the following gas mixture is used by the divers inside the sea?

(*a*) $O_2$ + He (*b*) $O_2$ + Xe

(*c*) $O_2$ + Ar (*d*) $O_2 + N_2$

**70.** The vapour pressure of pure solvent is 0.8 mm of Hg at a particular temperature. On addition of a non - volatile solute 'A' the vapour pressure of solution becomes 0.6 mm of Hg. The mole fraction of component 'A' is:

(*a*) 0.25 (*b*) 0.75

(*c*) 0.5 (*d*) 0.35

**71.** Lowering of vapour pressure of an aqueous solution of a non-volatile, non-electrolyte 1 M aqueous solution at $100^0$C is:

(*a*) 14.12 torr (*b*) 312 torr

(*c*) 13.45 torr (*d*) 352 torr

**72.** A solution of two liquids boils at a temperature more than the boiling point of either of them. Hence, the binary solution shows:

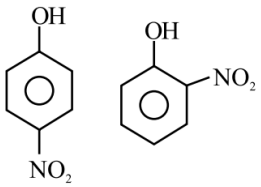
(*a*) Negative deviation from Raoult's law

(*b*) Positive deviation from Raoult's law

(*c*) No deviation from Raoult's law

(*d*) Positive or negative deviation from Raoult's law depending upon the composition.

**73.** Out of the compounds given below, the vapour pressure of (B) at a particular temperature is:




(A) (B)

(*a*) Higher than that of A

(*b*) Lower than that of B

(*c*) Higher of lower than (A), depending on the size of the vessel

(*d*) Same as that of (A)

## COLLIGATIVE PROPERTIES AND DETERMINATION OF (MOLAR) MASS

**74.** Camphor is used as solvent to determine the molecular mass of non volatile solute by Rast method because for Camphor

(*a*) Molal depression constant is high

(*b*) Melting point is high

(*c*) Being cheap

(*d*) All the above

**75.** If the elevation in boiling point of a solution of 10gm of solute (mol. wt.=100) in 100 gm of water is $\Delta T_b$, the ebullioscopic constant of water is

(*a*) 10 (*b*) $10\Delta T_b$

(*c*) $\Delta T_b$ (*d*) $\frac{\Delta T_b}{10}$

**76.** In a 0.2 molal aqueous solution of a weak acid HX, the degree of ionization is 0.3. Taking $k_f$ for water as 1.85, the freezing point of the solution will be nearest to

(*a*) -0.360°C (*b*) - 0.260°C

(*c*) +0.480°C (*d*) -0.480°C

**77.** A solution containing 12.5 g of non-electrolyte substance in 185 g of water shows boiling point elevation of 0.80 K. Calculate the molar mass of a substance: ($k_b$ = 0.52 k kg $mol^{-1}$)

(*a*) 53.06 g $mol^{-1}$ (*b*) 25.3 g $mol^{-1}$

(*c*) 16.08 g $mol^{-1}$ (*d*) 43.92 g $mol^{-1}$

**78.** 10% solution of urea is isotonic with 6% solution of a non-volatile solute X, what is the molecular mass of solute X?
(*a*) 6 g $mol^{-1}$ (*b*) 60 g $mol^{-1}$
(*c*) 36 g $mol^{-1}$ (*d*) 32 g $mol^{-1}$

**79.** Choose the correct statement
(*a*) The boiling point of the solution falls on increasing the amount of the solute
(*b*) The freezing point of the solution is lowered on adding more of solvent
(*c*) The freezing point of the solution is raised on adding more of solute
(*d*) The freezing point of the solution decreases on increasing the amount of the solute

**80.** Osmotic pressure of a solution containing 2 g dissolved protein per 300 $cm^3$ of solution is 20 mm of Hg at 27°C. The molecular mass of protein is:
(*a*) 6239.3 g $mol^{-1}$ (*b*) 12315.5 g $mol^{-1}$
(*c*) 3692.1 g $mol^{-1}$ (*d*) 7368.4 g $mol^{-1}$

**81.** A solution is made by dissolving 20 g of a substance in 500ml of water. Its osmotic pressure was found to be 600 mm of Hg at 15°C. Find the molecular weight of the substance:
(*a*) 1198 g $mol^{-1}$ (*b*) 500 g $mol^{-1}$
(*c*) 1200 g $mol^{-1}$ (*d*) 1000 g $mol^{-1}$

**82.** An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at a normal boiling point of the solvent. What is the molecular mass of the solute?
(*a*) 23.4 g $mol^{-1}$ (*b*) 41.35 g $mol^{-1}$
(*c*) 10 g $mol^{-1}$ (*d*) 20.8 g $mol^{-1}$

**83.** Which of the following statement is correct?
(*a*) A saturated solution will remain saturated at all temperatures
(*b*) A plant cell swells when placed in hypertonic solution
(*c*) The depression in freezing point is directly proportional to molality of the solution
(*d*) Lowering in vapour pressure is a colligative property.

**84.** A solution containing 10.2 g glycerine per litre is isotonic with a 2% (w/v)solution of glucose. What is the molecular mass of glycerine?
(*a*) 91.8 g (*b*) 1198 g
(*c*) 83.9 g (*d*) 890.3 g

**85.** Which among the following will show maximum osmotic pressure?
(*a*) 1M NaCl (*b*) 1M $MgCl_2$
(*c*) 1M $(NH_4)_3PO_4$ (*d*) 1M $Na_2SO_4$

**86.** What weight of glycerol should be added to 600 g of water in order to lower its freezing point by 10°C? ($k_f$ = 1.86 K kg $mol^{-1}$)
(*a*) 496 g (*b*) 297 g
(*c*) 310 g (*d*) 426 g

**87.** If 1 g of solute (molar mass = 50 g $mol^{-1}$) is dissolved in 50 g of solvent and the elevation in boiling point is 1 K. The molal elevation constant of the solvent is:
(*a*) 2 (*b*) 3
(*c*) 2.5 (*d*) 5

**88.** The colligative property is not represented by:
(*a*) Elevation in boiling point
(*b*) Osmotic pressure
(*c*) Optical activity
(*d*) Relative lowering of vapour pressure

**89.** Isotonic solutions have
(*a*) Same boiling point
(*b*) Same vapour pressure
(*c*) Same melting point
(*d*) Same osmotic pressure

**90.** Distribution law was given by:
(*a*) Ostwald (*b*) Nernst
(*c*) Henry (*d*) Van't hoff

**91.** If the elevation in boiling point of a solution of 1 g of solute (molecular weight = 100) in 100 g of water is $\Delta T_b$, the ebullioscopic constant of water is:
(*a*) 10 (*b*) 100 $T_b$
(*c*) 10 $\Delta T_b$ (*d*) $\frac{\Delta T_b}{10}$

**92.** The osmotic pressure is expressed in the unit of:
(*a*) MeV (*b*) Calorie
(*c*) cm/sec (*d*) atm

**93.** Which of the following will have highest boiling point at 1 atm pressure?
(*a*) 0.1M NaCl
(*b*) 0.1 M Sucrose
(*c*) 0.1M $BaCl_2$
(*d*) 01. M Glucose

**94.** The freezing point of one molal NaCl, assuming NaCl to be 100% dissociated in water is: (molar depression constant is 1.86)
(*a*) – 2.72°C (*b*) – 3.72°C
(*c*) 2.72°C (*d*) 3.72°C

**95.** What happens to freezing point of benzene when naphthalene is added?
(*a*) Increases
(*b*) Decreases
(*c*) Remain unchanged
(*d*) First decreases and then increases

**96.** The order of boiling point of four equimolar aqueous solutions is C< B < A < D. The correct order of their freezing point is:
(*a*) D < C < B < A (*b*) D > C < B < A
(*c*) D < A < B < C (*d*) D > A > B > C

**97.** The boiling point of a solution of 0.11g of a substance in 15 g of ether was found to be 0.1°C higher than that of pure ether. The molecular weight of the substance will be ($K_b$ = 2.16 K kg $mol^{-1}$).
(*a*) 148 (*b*) 158
(*c*) 168 (*d*) 178

**98.** Dissolution of 1.5 g of a non-volatile solute (molecular weight = 60) in 250 g of a solvent reduces its freezing point by 0.01°C. Find the molal depression constant of the solvent:
(*a*) 0.01 (*b*) 0.001
(*c*) 0.0001 (*d*) 0.1

**99.** A solution has higher osmotic pressure than its standard solution. Which of the following term will be used for this solution?
(*a*) Isotonic (*b*) Hypertonic
(*c*) Dilute (*d*) Hypotonic

**100.** The boiling point of 0.1molal $K_4[Fe(CN)_6]$ solution will be (Given $K_b$ for water = 0.52 K kg $mol^{-1}$.
(*a*) 100.52°C (*b*) 100.104°C
(*c*) 100.26°C (*d*) 102.6°C

**101.** 20 g of an non-volatile solute is added to 500 g of solvent, freezing point of pure solvent = 5.48°C and that of solution is 4.47°C, $K_f$ = 1.93 k kg $mol^{-1}$ molecular mass of solute is:

(*a*) 77.2 (*b*) 76.4

(*c*) 73.2 (*d*) 70.6

**102.** Which has the least freezing point?

(*a*) 1% sucrose (*b*) 1% NaCl

(*c*) 1% $CaCl_2$ (*d*) 1% glucose

**103.** Which of the following solutions will have the highest boiling point

(*a*) 0.1M $Al_2(SO_4)_3$

(*b*) 0.1M $FeCl_3$

(*c*) 0.1M NaCl

(*d*) 0.1 M Urea

**104.** The molality of the solution prepared by dissolving 125 mL of pure methanol (d = 0.8gm$L^{-1}$) in 375 g of ethanol is :

(*a*) 10.8 (*b*) 11.2

(*c*) 8.33 (*d*) 10.4

**105.** A compound $MX_2$ has observed and normal molar masses 65.6 and 164 respectively. Calculate the apparent degree of ionization of $MX_2$ :

(*a*) 75% (*b*) 85%

(*c*) 65% (*d*) 25%

**106.** An ideal solution was obtained by mixing methanol and ethanol. If the partial vapour pressure of methanol and ethanol in solution are 2.619 kPa and 4.556 kPa respectively, the composition of vapour (in terms of mole fraction) will be:

(*a*) 0.635 MeOH, 0.365 EtOH

(*b*) 0.365 MeOH, 0.635 EtOH

(*c*) 0.574 MeOH, 0.326 EtOH

(*d*) 0.173 MeOH, 0.827 EtOH

**107.** What is the normal b.p of an aqueous solution whose freezing point is –2.48°C ?

($K_f$ = 1.86°C.kg/mol, $K_b$ = 0.512°C.kg/mol)

(*a*) 100.7°C (*b*) 102.5°C

(*c*) 109.0°C (*d*) 99.3°C

**108.** The mass of glucose that should be dissolved in 100 g of water in order to produce same lowering of vapour pressure as is produced by dissolving 1 g of urea (mol. Mass = 60) in 50 g of water is : (Assume dilute solution in both cases)

(*a*) 1 g (*b*) 2 g

(*c*) 6 g (*d*) 12 g

**109.** The osmotic pressure of a decimolar solution of urea at 27°C is

(*a*) 2.49 bar (*b*) 5 bar

(*c*) 3.4 bar (*d*) 1.25 bar

**110.** What is the volume of solution containing 1 gm mole of sugar that will give rise to an osmotic pressure of 1 atm at 0°C?

(*a*) 11.2 lit (*b*) 112 lit

(*c*) 224 lit (*d*) 22.4 lit

## ABNORMAL MOLAR MASS

**111.** Which of following representations of i (van't hoff factor) is not correct?

(*a*) $i = \dfrac{\text{Observed colligative property}}{\text{Expected colligative property}}$

(*b*) $i = \dfrac{\text{Normal molecular mass}}{\text{Observed molecular mass}}$

(*c*) $i = \dfrac{\text{No. of molecules actually present}}{\text{Observed of molecules expected to be present}}$

(*d*) $i = \dfrac{\text{Total number of particles taken before association / dissociation}}{\text{Total number of particles taken after association / dissociation}}$

**112.** Which of the following will have same value of Van't Hoff factor as that of $K_4$ [$Fe(CN)_6$]?

(*a*) $Al_2(SO_4)_3$ (*b*) $AlCl_3$

(*c*) $Al(NO_3)_3$ (*d*) $Al(OH)_3$

**113.** What will be the degree of dissociation of 0.1 M $Mg(NO_3)_2$ solution if Van't Hoff factor is 2.74?

(*a*) 75% (*b*) 87%

(*c*) 100% (*d*) 92%

**114.** Which of the following has the highest freezing point?

(*a*) 1m NaCl solution (*b*) 1m KCl solution

(*c*) 1m $AlCl_3$ solution (*d*) 1m $C_6H_{12}O_6$ solution

**115.** If α is the degree of dissociation of $Na_2SO_4$, the van't Hoff's factor (*i*) used for calculating the molecular mass is:

(*a*) 1 + α (*b*) 1 - α

(*c*) 1+ 2 α (*c*) 1 - 2α

**116.** The Van't Hoff factor of 0.005 M aqueous solution of KCl is 1.95. The degree of ionisation of KCl is:

(*a*) 0.95 (*b*) 0.97

(*c*) 0.94 (*d*) 0.96

**117.** 0.2 molal aq. HA acid ionises to the extent of 20%. $K_f$ for acid is 1.86, then calculate the freezing point of the solution:

(*a*) –0.45°C (*b*) –0.50°C

(*c*) –0.31°C (*d*) –0.53°C

**118.** Van't Hoff factor more than unity indicates that the solute in solution is:

(*a*) Dissociated (*b*) Associated

(*c*) Both (a) and (*b*) (*d*) Cannot say anything

**119.** KBr is 80% dissociated in aqueous solution of 0.5 m concentration (given, $K_f$ for water = 1.86 K Kg $mol^{-1}$). The solution freezes at:

(*a*) 271.326 K (*b*) 272 K

(*c*) 270.5 K (*d*) 268.5 K

**120.** Van't Hoff factor of $Ca(NO_3)_2$ is:

(*a*) One (*b*) Two

(*c*) Three (*d*) Four

# Topicwise Questions 2

## Concentration Terms (Revision of Mole)

**1.** The amount of anhydrous $Na_2CO_3$ present in 250 ml of 0.25 *M* solution is
(*a*) 225 g (*b*) 66.25 g
(*c*) 6.0 g (*d*) 6.625 g

**2.** 2.0 molar solution is obtained , when 0.5 *mole* solute is dissolved in
(*a*) 250 *ml* solvent (*b*) 250 *g* solvent
(*c*) 250 *ml* solution (*d*) 1000 *ml* solvent

**3.** 36*g* water and 828*g* ethyl alcohol form an ideal solution. The mole fraction of water in it, is
(*a*) 1.0 (*b*) 0.7
(*c*) 0.4 (*d*) 0.1

**4.** With 63 *gm* of oxalic acid how many *litres* of $\frac{N}{10}$ solution can be prepared
(*a*) 100 *litre* (*b*) 10 *litre*
(*c*) 1 *litre* (*d*) 1000 *litre*

**5.** Mole fraction $(X)$ of constituent in solution is equal to
(*a*) $\frac{\text{No. of moles of solute}}{\text{Volume of solution in litre}}$
(*b*) $\frac{\text{No. of gram equivalent of solute}}{\text{Volume of solution in litre}}$
(*c*) $\frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}}$
(*d*) $\frac{\text{No. of moles of any constituent}}{\text{Total no. of moles of all constituents}}$

**6.** An $X$ molal solution of a compound in benzene has mole fraction of solute equal to 0.2. The value of $X$ is
(*a*) 14 (*b*) 3.2
(*c*) 4 (*d*) 2

**7.** The molarity of pure water is
(*a*) 55.6 (*b*) 5.56
(*c*) 100 (*d*) 18

**8.** 4.0 *gm* of $NaOH$ are contained in one decilitre of solution. Its molarity would be
(*a*) 4 *M* (*b*) 2 *M*
(*c*) 1 *M* (*d*) 1.5 *M*

**9.** The number of moles of KCl in 1000 ml of 3 molar solution is
(*a*) 1 (*b*) 2
(*c*) 3 (*d*) 1.5

## General Introduction & Types of Solution

**10.** For a solution of two liquids A and B. it was proved that $P = X_A(P_A^0 - P_B^0) + P_B^0$. The solution is:
(*a*) Ideal (*b*) Non ideal
(*c*) Semiideal (*d*) None of these

## Vapour Pressure

**11.** 1 mole of heptane (V.P. = 92 mm of Hg) was mixed with 4 moles of octane (V.P. = 31 mm of Hg) The vapour pressure of resulting ideal solution is:
(*a*) 46.2 mm of Hg (*b*) 40.0 mm of Hg
(*c*) 43.2 mm of Hg (*d*) 38.4 mm of Hg

## Immiscible Liquids

## Completely Miscible Liquids : Raoult's Law

**12.** If Raoult's law is obeyed, the vapour pressure of the solvent in a solution is directly proportional to
(*a*) Mole fraction of the solvent
(*b*) Mole fraction of the solute
(*c*) Mole fraction of the solvent and solute
(*d*) The volume of the solution

**13.** The vapour pressure of pure benzene and toluene are 160 and 60 torr respectively. The mole fraction of toluene in vapour phase in contact with equimolar solution of benzene and toluene is:
(*a*) 0.50 (*b*) 0.6
(*c*) 0.27 (*d*) 0.73

## Non-Ideal Solutions

**14.** Which pair from the following will not form an ideal solution
(*a*) $CCl_4 + SiCl_4$ (*b*) $H_2O + C_4H_9OH$
(*c*) $C_2H_5Br + C_2H_5I$ (*d*) $C_6H_{14} + C_7H_{16}$

**15.** An ideal solution is that which
(*a*) Shows positive deviation from Raoult's law
(*b*) Shows negative deviation from Raoult's law
(*c*) Has no connection with Raoult's law
(*d*) Obeys Raoult's law

**16.** Which property is shown by an ideal solution
(*a*) It follows Raoult's law
(*b*) $\Delta H_{mix} = 0$
(*c*) $\Delta V_{mix} = 0$
(*d*) All of these

**17.** When two liquid A and B are mixed then their boiling points becomes greater than both of them. What is the nature of this solution
(*a*) Ideal solution
(*b*) Positive deviation with non ideal solution
(*c*) Negative deviation with non ideal solution
(*d*) Normal solution

**18.** All form ideal solution except
(*a*) $C_2H_5Br$ and $C_2H_5I$
(*b*) $C_2H_5Cl$ and $C_6H_5Br$
(*c*) $C_6H_6$ and $C_6H_5CH_3$
(*d*) $C_2H_5I$ and $C_2H_5OH$

**19.** Which of the following is true when components forming an ideal solution are mixed

(*a*) $\Delta H_m = \Delta V_m = 0$ (*b*) $\Delta H_m > \Delta V_m$

(*c*) $\Delta H_m < \Delta V_m$ (*d*) $\Delta H_m = \Delta V_m = 1$

**20.** An azeotropic solution of two liquids has boiling point lower than either when it

(*a*) Shows a negative deviation from Raoult's law

(*b*) Shows no deviation from Raoult's law

(*c*) Shows positive deviation from Raoult's law

(*d*) Is saturated

## Degree of Ionisation/Dissociation for Weak Electrolytes & Vant's Hoff Factor

**21.** Which of the following salt has the same value of Van't Hoff factor $i$ as that of $K_4[Fe(CN)_6]$

(*a*) $Al_2(SO_4)_3$ (*b*) NaCl

(*c*) $Na_2SO_4$ (*d*) $Al(NO_3)_3$

**22.** Van't Hoff factor of $Ca(NO_3)_2$ is

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

**23.** One mole of a solute $A$ is dissolved in a given volume of a solvent. The association of the solute take place according to $nA \rightleftharpoons A_n$.

If x is the degree of association of A, then Van't Hoff factor $i$ is expressed as

(*a*) $i = 1 - x$ (*b*) $i = 1 + \frac{x}{n}$

(*c*) $i = \frac{1 - x + \frac{x}{n}}{1}$ (*d*) $i = 1$

**24.** The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to

(*a*) Ionization of benzoic acid

(*b*) Dimerization of benzoic acid

(*c*) Trimerization of benzoic acid

(*d*) Solvation of benzoic acid

## Relative Lowering of Vapour Pressure

**25.** For a solution of volatile liquids the partial vapour pressure of each component in solution is directly proportional to

(*a*) Molarity (*b*) Mole fraction

(*c*) Molality (*d*) Normality

**26.** When a substance is dissolved in a solvent the vapour pressure of the solvent is decreased. This results in

(*a*) An increase in the b.p. of the solution

(*b*) A decrease in the b.p. of the solvent

(*c*) The solution having a higher freezing point than the solvent

(*d*) The solution having a lower osmotic pressure than the solvent

**27.** If $P^o$ and $P$ are the vapour pressure of a solvent and its solution respectively and $N_1$ and $N_2$ are the mole fractions of the solvent and solute respectively, then correct relation is

(*a*) $P = P^o N_1$ (*b*) $P = P^o N_2$

(*c*) $P^o = P N_2$ (*d*) $P = P^o (N_1 / N_2)$

**28.** The relative lowering of the vapour pressure is equal to the ratio between the number of

(*a*) Solute moleules and solvent molecules

(*b*) Solute molecules and the total molecules in the solution

(*c*) Solvent molecules and the total molecules in the solution

(*d*) Solvent molecules and the total number of ions of the solute

**29.** The vapour pressure lowering caused by the addition of 100 $g$ of sucrose(molecular mass = 342) to 1000 $g$ of water if the vapour pressure of pure water at $25^\circ C$ is 23.8 $mm$ $Hg$

(*a*) 1.25 $mm\,Hg$ (*b*) 0.125 $mm\,Hg$

(*c*) 1.15 $mm\,Hg$ (*d*) 00.12 $mm\,Hg$

**30.** According to Raoult's law the relative lowering of vapour pressure of a solution of volatile substance is equal to

(*a*) Mole fraction of the solvent

(*b*) Mole fraction of the solute

(*c*) Weight percentage of a solute

(*d*) Weight percentage of a solvent

**31.** The vapour pressure of water at $20^\circ C$ is 17.54 $mm$. When 20$g$ of a non-ionic, substance is dissolved in 100$g$ of water, the vapour pressure is lowered by 0.30 $mm$. What is the molecular weight of the substances

(*a*) 210.2 (*b*) 206.88

(*c*) 215.2 (*d*) 200.8

**32.** For a dilute solution, Raoult's law states that

(*a*) The lowering of vapour pressure is equal to mole fraction of solute

(*b*) The relative lowering of vapour pressure is equal to mole fraction of solute

(*c*) The relative lowering of vapour pressure is proportional to the amount of solute in solution

(*d*) The vapour pressure of the solution is equal to the mole fraction of solvent

## Elevation of Boiling Point & Depression of Freezing Point

**33.** The latent heat of vapourisation of water is $9700\ Cal/mole$ and if the *b.p.* is $100^\circ C$, ebullioscopic constant of water is

(*a*) 0.513°C (*b*) 1.026°C

(*c*) 10.26°C (*d*) 1.832°C

**34.** If $0.15\ g$ of a solute dissolved in $15\ g$ of solvent is boiled at a temperature higher by $0.216^\circ C$ than that of the pure solvent. The molecular weight of the substance (molal elevation constant for the solvent is $2.16^\circ C$) is

(*a*) 1.01 (*b*) 10

(*c*) 10.1 (*d*) 100

**35.** The temperature, at which the vapour pressure of a liquid becomes equal to the atmospheric pressure is known as

(*a*) Freezing point (*b*) Boiling point

(*c*) Absolute temperature (*d*) None of these

**36.** At higher altitudes the boiling point of water lowers because

(*a*) Atmospheric pressure is low

(*b*) Temperature is low

(*c*) Atmospheric pressure is high

(*d*) None of these

**37.** Mark the correct relationship between the boiling points of very dilute solutions of $BaCl_2(T_1)$ and $KCl(T_2)$, having the same molarity

(*a*) $T_1 = T_2$

(*b*) $T_1 > T_2$

(*c*) $T_2 > T_1$

(*d*) $T_2$ is approximately equal to $T_1$

**38.** What is the freezing point of a solution containing $8.1\ g\ HBr$ in $100\ g$ water assuming the acid to be 90% ionised ($K_f$ for water $= 1.86\ K\ mole^{-1}$)

(*a*) $0.85^\circ C$ (*b*) $-3.53^\circ C$

(*c*) $0^\circ C$ (*d*) $-0.35^\circ C$

**39.** The molar freezing point constant for water is $1.86^\circ C\ mole^{-1}$. If 342 gm of canesugar ($C_{12}H_{22}O_{11}$) are dissolved in 1000 *gm* of water, the solution will freeze at

(*a*) $-1.86^\circ C$ (*b*) $1.86^\circ C$

(*c*) $-3.92^\circ C$ (*d*) $2.42^\circ C$

**40.** The freezing point of one molal $NaCl$ solution assuming $NaCl$ to be 100% dissociated in water is (molal depression constant = 1.86)

(*a*) $-1.86^\circ C$ (*b*) $-3.72^\circ C$

(*c*) $+1.86^\circ C$ (*d*) $+3.72^\circ C$

**41.** 1.00 *gm* of a non-electrolyte solute dissolved in 50 *gm* of benzene lowered the freezing point of benzene by 0.40 *K*. $K_f$ for benzene is $5.12\ kg\ mol^{-1}$. Molecular mass of the solute will be

(*a*) $256\ g\ mol^{-1}$ (*b*) $2.56\ g\ mol^{-1}$

(*c*) $512\times10^3\ g\ mol^{-1}$ (*d*) $2.56\times10^4\ g\ mol^{-1}$

## Osmotic Pressure

**42.** The concentration in *gms* per *litre* of a solution of cane sugar ($M = 342$) which is isotonic with a solution containing $6\ gms$ of urea ($M = 60$) per *litre* is

(*a*) 3.42 (*b*) 34.2

(*c*) 5.7 (*d*) 19

**43.** Osmotic pressure is 0.0821 *atm* at temperature of $300\ K$. Find concentration in *mole/litre*

(*a*) 0.033 (*b*) 0.066

(*c*) $0.33\times10^{-2}$ (*d*) 3

**44.** A 5% solution of canesugar (mol. wt. =342) is isotonic with 1% solution of a substance $X$. The molecular weight of $X$ is

(*a*) 34.2 (*b*) 171.2

(*c*) 68.4 (*d*) 136.8

**45.** Which statement is wrong regarding osmotic pressure (P), volume (V) and temperature (T)

(*a*) $P \propto \frac{1}{V}$ if $T$ is constant

(*b*) $P \propto T$ if $V$ is constant

(*c*) $P \propto V$ if $T$ is constant

(*d*) $PV$ is constant if $T$ is constant

**46.** The value of osmotic pressure of a 0.2 *M* aqueous solution at $293K$ is

(*a*) 8.4 *atm* (*b*) 0.48*atm*

(*c*) 4.8 *atm* (*d*) 4.0 *atm*

**47.** If a $0.1M$ solution of glucose (mol. wt. 180) and 0.1 molar solution of urea (mol. wt. 60) are placed on the two sides of a semipermeable membrane to equal heights, then it will be correct to say

(*a*) There will be no net movement across the membrane

(*b*) Glucose will flow across the membrane into urea solution

(*c*) Urea will flow across the membrane into glucose solution

(*d*) Water will flow from urea solution into glucose solution

**48.** If osmotic pressure of a solution is 2atm at $273K$, then at $546K$, the osmotic pressure is

(*a*) 0.5 *atm* (*b*) 1 *atm*

(*c*) 2 *atm* (*d*) 4 *atm*

**49.** A solution of urea contain 8.6 gm/litre (*mol. wt.* 60.0). It is isotonic with a 5% solution of a non-volatile solute. The molecular weight of the solute will be

(*a*) 348.9 (*b*) 34.89

(*c*) 3489 (*d*) 861.2

## Miscellaneous

**50.** Which of the following is not a colligative property

(*a*) Osmotic pressure

(*b*) Elevation in B.P.

(*c*) Vapour pressure

(*d*) Depression in freezing point

**51.** Colligative properties of a solution depends upon

(*a*) Nature of both solvent and solute

(*b*) The relative number of solute and solvent particles

(*c*) Nature of solute only

(*d*) Nature of solvent only

**52.** What does not change on changing temperature

(*a*) Mole fraction

(*b*) Normality

(*c*) Both (*a*) and (*b*)

(*d*) None of these

**53.** Osmotic pressure of 0.1 M solution of NaCl and $Na_2SO_4$ will be

(*a*) Same

(*b*) Osmotic pressure of NaCl solution will be more than $Na_2SO_4$ solution

(*c*) Osmotic pressure of $Na_2SO_4$ solution will be more than NaCl

(*d*) Osmotic pressure of $Na_2SO_4$ will be less than that of NaCl solution

**54.** In equimolar solution of glucose, $NaCl$ and $BaCl_2$, the order of osmotic pressure is as follow

(*a*) Glucose $> NaCl > BaCl_2$

(*b*) $NaCl > BaCl_2 >$ Glucose

(*c*) $BaCl_2 > NaCl >$ Glucose

(*d*) Glucose $> BaCl_2 > NaCl$

**55.** Which of the following will have the highest boiling point at 1 *atm* pressure

(*a*) 0.1*M NaCl* (*b*) 0.1*M* sucrose

(*c*) 0.1*M* $BaCl_2$ (*d*) 0.1*M* glucose

**56.** Which of the following aqueous solutions containing 10 gm of solute in each case has highest B.P.

(*a*) $NaCl$ solution

(*b*) $KCl$ solution

(*c*) Sugar solution

(*d*) Glucose solution

**57.** The freezing points of equimolar solutions of glucose, $KNO_3$ and $AlCl_3$ are in the order of

(*a*) $AlCl_3 < KNO_3 <$ Glucose

(*b*) Glucose $< KNO_3 < AlCl_3$

(*c*) Glucose $< AlCl_3 < KNO_3$

(*d*) $AlCl_3 <$ Glucose $< KNO_3$

**58.** Which of the following has minimum freezing point

(*a*) 0.1*M* $K_2Cr_2O_7$

(*b*) 0.1 *M* $NH_4Cl$

(*c*) 0.1 *M* $BaSO_4$

(*d*) 0.1 *M* $Al_2(SO_4)_3$

**59.** For 0.1 *M* solution, the colligative property will follow the order

(*a*) $NaCl > Na_2SO_4 > Na_3PO_4$

(*b*) $NaCl < Na_2SO_4 < Na_3PO_4$

(*c*) $NaCl > Na_2SO_4 \approx Na_3PO_4$

(*d*) $NaCl < Na_2SO_4 = Na_3PO_4$

# Learning Plus

**1.** Mole fraction of $C_3H_5(OH)_3$ in a solution of 36 g of water and 46 g of glycerine is:

(*a*) 0.46 (*b*) 0.36

(*c*) 0.20 (*d*) 0.40

**2.** An aqueous solution of urea containing 18 g urea in 1500 $cm^3$ of solution has a density of 1.052 $g/cm^3$. If the molecular weight of urea is 60, then the molality of solution is:

(*a*) 0.2 (*b*) 0.192

(*c*) 0.064 (*d*) 1.2

**3.** What is the molarity of $H_2SO_4$ solution that has a density of 1.84 gm/cc at $35^0$C and contains 98% by weight:

(*a*) 4.18 M (*b*) 8.14 M

(*c*) 18.4 M (*d*) 18 M

**4.** 25 mL of 3 M HCl were added to 75 mL of 0.05 M HCl. The molarity of HCl in the resulting solution is approximately:

(*a*) 0.055 M (*b*) 0.35 M

(*c*) 0.787 M (*d*) 3.05 M

**5.** 0.2 mole of HCl and 0.1 mole of $CaCl_2$ were dissolved in water to have 500 ml of solution, the molarity of $Cl^-$ ions is:

(*a*) 0.04 M (*b*) 0.8 M

(*c*) 0.4 M (*d*) 0.08 M

6. When 5.0 gram of $BaCl_2$ is dissolved in water to have $10^6$ gram of solution. The concentration of solution is:
(a) 2.5 ppm (b) 5 ppm
(c) 5M (d) 5 gm $L^{-1}$

7. The vapour pressure of water depends upon:
(a) Surface area of container
(b) Volume of container
(c) Temperature
(d) All

8. A vessel has nitrogen gas and water vapours in equilibrium with liquid water at a total pressure of 1 atm. The partial pressure of water vapours is 0.3 atm. The volume of this vessel is reduced to one third of the original volume, at the same temperature, then total pressure of the system is: (Neglect volume occupied by liquid water)
(a) 3.0 atm (b) 1 atm
(c) 3.33 atm (d) 2.4 atm

9. If $P_0$ and P are the vapour pressures of a solvent and its solution respectively and $N_1$ and $N_2$ are the mole fractions of the solvent and non-volatile solute respectively, then correct relation is:
(a) $P = P_0N_2$ (b) $P = P_0N_1$
(c) $P_0 = PN_1$ (d) $P = P_0(N_1/N_2)$

10. A mixture contains 1 mole of volatile liquid A ($P_A^0 = 100$ mm Hg) and 3 moles of volatile liquid B($P_B^0 = 80$ mmHg). If solution behaves ideally, the total vapour pressure of the distillate is
(a) 85 mm Hg (b) 85.88 mmHg
(c) 90 mm Hg (d) 92 mm Hg

11. Mixture of volatile components A and B has total vapour pressure (in Torr) $p = 254 - 119\,x_A$ 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) 119, 373

12. Ratio of Mole fraction of benzene ($P_B^0$= 150 torr) and toluene ($P_T^0 = 50$ torr) in vapour phase if the given solution has a vapour pressure of 120 torr?
(a) 7 : 1 (b) 7 : 3
(c) 8 : 1 (d) 7 : 8

13. Two liquids A & B form an ideal solution. What is the vapour pressure of solution containing 2 moles of A and 3 moles of B at 300 K? [Given : At 300 K, Vapour pr. of pure liquid A($P_A^0$) = 100 torr, Vapour pr. of pure liquid B($P_B^0$) = 300 torr]
(a) 200 torr (b) 140 torr
(c) 180 torr (d) None of these

14. At 300 K, the vapour pressure of an ideal solution containing 3 mole of A and 2 mole of B is 600 torr. At the same temperature, if 1.5 mole of A & 0.5 mole of C(non-volatile) are added to this solution the vapour pressure of solution increases by 30 torr. What is the value of $P_B^0$?
(a) 940 (b) 405
(c) 90 (d) None of these

15. At a constant temperature, $\Delta S$ will be maximum for which of the following processes :
(a) Vaporisation of a pure solvent
(b) Vaporisation of solvent from a solution containing nonvolatile and nonelectrolytic solute in it
(c) Vaporisation of solvent from a solution containing nonvolatile but electrolytic solute in it
(d) Entropy change will be same in all the above cases

16. Which of the following is less than zero for ideal solutions?
(a) $\Delta H_{mix}$ (b) $\Delta V_{mix}$
(c) $\Delta G_{mix}$ (d) $\Delta S_{mix}$

17. If vapour pressures of pure liquids 'A' & 'B' are 300 and 800 torr respectively at 25°C. When these two liquids are mixed at this temperature to form a solution in which mole percentage of 'B' is 92, then the total vapour pressure is observed to be 0.95 atm. Which of the following is true for this solution.
(a) $\Delta V_{mix} > 0$ (b) $\Delta H_{mix} < 0$
(c) $\Delta V_{mix} = 0$ (d) $\Delta H_{mix} = 0$

18. Consider a binary mixture of volatile liquids. If at $X_A = 0.4$ the vapour pressure of solution is 580 torr then the mixture could be ($p_A^\circ = 300$ torr, $p_B^\circ = 800$ torr) :
(a) $CHCl_3 - CH_3COCH_3$
(b) $C_6H_5Cl - C_6H_5Br$
(c) $C_6H_6 - C_6H_5CH_3$
(d) $nC_6H_{14} - n\,C_7H_{16}$

19. Which of the following will form ideal solution?
(a) $C_2H_5OH$ and water
(b) $HNO_3$ and water
(c) $CHCl_3$ and $CH_3COCH_3$
(d) $C_6H_6$ and $C_6H_5CH_3$

20. Which of the following shows negative deviation from Raoult's law?
(a) $CHCl_3$ and acetone
(b) $CHCl_3$ and $C_2H_5OH$
(c) $C_6H_5CH_3$ and $C_6H_6$
(d) $C_6H_6$ and $CCl_4$

21. The osmotic pressure of equimolar solutions of $BaCl_2$, NaCl and glucose will be in the order
(a) glucose > NaCl > $BaCl_2$
(b) $BaCl_2$ > NaCl > glucose
(c) NaCl > $BaCl_2$ > glucose
(d) NaCl > glucose > $BaCl_2$

22. The osmotic pressure of a solution of benzoic acid dissolved in benzene is less than expected because-
(a) Benzoic acid is an organic solute
(b) Benzene is a non-polar solvent
(c) Benzoic acid dissociates in benzene
(d) Benzoic acid gets associated in benzene

**23.** Assuming each salt to be completely dissociated which of the following will have highest osmotic pressure-
(*a*) Decimolar $Al_2(SO_4)_3$
(*b*) Decimolar $BaCl_2$
(*c*) Decimolar $Na_2SO_4$
(*d*) A solution obtained by mixing equal volumes of (*b*) and (*c*) and filtering

**24.** A complex containing $K^+$, Pt (IV) and $Cl^-$ is 100% ionised giving i = 3. Thus, complex is
(*a*) $K_2[PtCl_4]$ (*b*) $K_2[PtCl_6]$
(*c*) $K_3[PtCl_5]$ (*d*) $K[PtCl_3]$

**25.** pH of 1M HA (weak acid) is 2. Hence van't Hoff factor is:
(*a*) 1.2 (*b*) 1.02
(*c*) 1.1 (*d*) 1.01

**26.** In which case van't Hoff factor is maximum
(*a*) KCl, 50% ionised (*b*) $K_2SO_4$ 40% ionised
(*c*) $FeCl_3$, 30% ionised (*d*) $SnCl_4$, 20% ionised

**27.** The vapour pressure of water at room temperature is lowered by 5% by dissolving a solute in it, then the approximate molality of solution is :
(*a*) 2 (*b*) 1
(*c*) 4 (*d*) 3

**28.** The Van't Hoff factor for a dilute aqueous solution of glucose is
(*a*) zero (*b*) 1.0
(*c*) 1.5 (*d*) 2.0

**29.** The van't Hoff factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is
(*a*) 91.3% (*b*) 87%
(*c*) 100% (*d*) 74%

**30.** The vapour pressure of pure liquid A is 10 torr and at the same temperature when 1 g of B solid is dissolved in 20 g of A, its vapour pressure is reduced to 9.0 torr. If the molecular mass of A is 200 amu, then the molecular mass of B is:
(*a*) 100 amu (*b*) 90 amu
(*c*) 75 amu (*d*) 120 amu

**31.** The vapour pressure of a solution of a non-volatile solute 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 the solute, what is the ratio of weight of solvent to solute.
(*a*) 0.15 (*b*) 5.7
(*c*) 0.2 (*d*) none of these

**32.** The vapour pressure of a dilute aqueous solution of glucose is 750 mm of mercury at 373 K. The mole fraction of solute is-
(*a*) $\frac{1}{10}$ (*b*) $\frac{1}{7.6}$
(*c*) $\frac{1}{35}$ (*d*) $\frac{1}{76}$

**33.** 1 mol each of following solutes are taken in 5 mol water,
A. NaCl B. $K_2SO_4$
C. $Na_3PO_4$ D. glucose
Assuming 100% ionisation of the electrolyte, relative decrease in vapour pressure will be in order :
(*a*) A < B < C < D (*b*) D < C < B < A
(*c*) D < A < B < C (*d*) equal

**34.** 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.
(*a*) 0.2 (*b*) 0.4
(*c*) 0.6 (*d*) 0.8

**35.** 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*) $4.04 \times 10^{-2}$ (*b*) $8.08 \times 10^{-2}$
(*c*) $2.02 \times 10^{-2}$ (*d*) $4.04 \times 10^{-3}$

**36.** Select correct statement -
(*a*) b.p. of 1 molal NaCl solution is twice that of 1 molal sucrose solution
(*b*) b.p. elevation of 1 molal glucose solution is half of the 1 molal KCl solution
(*c*) b.p. is a colligative property
(*d*) All of the above

**37.** Which has the equal boiling point ?
A. 0.1 M $Na_2SO_4$ C. 0.1 M $C_6H_{12}O_6$ (glucose)
B. 0.1 M $MgCl_2$ D. 0.1 M $Al(NO_3)_3$
(*a*) (A) and (B) (*b*) (B) and (C)
(*c*) (C) and (D) (*d*) None of these

**38.** Aluminium phosphate is 100% ionised in 0.01 molal aqueous solution. Hence, $\Delta T_b / K_b$ is :
(*a*) 0.01 (*b*) 0.015
(*c*) 0.0175 (*d*) 0.02

**39.** A 0.001 molal solution of a complex $[MA_8]$ in water has the freezing point of –0.0054°C. Assuming 100% ionization of the complex salt and $K_f$ for $H_2O$ = 1.86 $Km^{-1}$, write the correct representation for the complex
(*a*) $[MA_8]$ (*b*) $[MA_7]A$
(*c*) $[MA_6]A_2$ (*d*) $[MA_5]A_3$

**40.** Which of the following has been arranged in order of decreasing freezing point?
(*a*) 0.05 M $KNO_3$ > 0.04 M $BaCl_2$ > 0.140 M sucrose > 0.075 M $CuSO_4$
(*b*) 0.04 M $BaCl_2$ > 0.140 M sucrose > 0.075 M $CuSO_4$ > 0.05 M $KNO_3$
(*c*) 0.075 M $CuSO_4$ > 0.140 M sucrose > 0.04 M $BaCl_2$ > 0.05 M $KNO_3$
(*d*) 0.075 M $CuSO_4$ > 0.05 M $KNO_3$ > 0.140 M sucrose > 0.04 M $BaCl_2$

**41.** Aqueous solution of barium phosphate which is 100% ionised has $\Delta T_f / K_f$ as 0.05. Hence, given solution is
(*a*) 0.01 molal (*b*) 0.02 molal
(*c*) 0.04 molal (*d*) 0.05 molal

**42.** A 0.2 molal aqueous solution of a weak acid (HX) is 20 per cent ionised. The freezing point of this solution is (Given $k_f$ = 1.86° C kg $mol^{-1}$ for water) :
(*a*) –0.45°C (*b*) –0.90°C
(*c*) –0.31 °C (*d*) –0.53°C

**43.** A complex of iron and cyanide ions is 100% ionised at 1m (molal). If its elevation in b.p. is 2.08. Then the complex is ($K_b = 0.52°\ mol^{-1}\ kg$) :

(*a*) $K_3[Fe(CN)_6]$ (*b*) $Fe(CN)_2$

(*c*) $K_4[Fe(CN)_6]$ (*d*) $Fe(CN)_4$

**44.** A solution of x moles of sucrose in 100 grams of water freezes at $-0.2^0$C. As ice separates the freezing point goes down to $0.25^0$C. How many grams of ice would have separated?

(*a*) 18 grams (*b*) 20 grams

(*c*) 25 grams (*d*) 23 grams

**45.** Elevation of boiling point of 1 molar aqueous glucose solution (density = 1.2 g/ml) is

(*a*) $K_b$ (*b*) $1.20\,K_b$

(*c*) $1.02\,K_b$ (*d*) $0.98\,K_b$

**46.** Osmotic pressure of blood is 7.40 atm at 27°C. Number of mol of glucose to be used per L for an intravenous injection that is to have the same osmotic pressure as blood is:

(*a*) 0.3 (*b*) 0.2

(*c*) 0.1 (*d*) 0.4

**47.** A solution of glucose ($C_6H_{12}O_6$) is isotonic with 4 g of urea ($NH_2$–CO–$NH_2$) per liter of solution. The concentration of glucose is :

(*a*) 4 g/ $\ell$ (*b*) 8 g/ $\ell$

(*c*) 12 g/ $\ell$ (*d*) 14 g/ $\ell$

**48.** A solution of a substance containing 1.05 g per 100 mL. was found to be isotonic with 3% glucose solution. The molecular mass of the substance is :

(*a*) 31.5 (*b*) 6.3

(*c*) 630 (*d*) 63

**49.** The relationship between osmotic pressure at 273 K when 10 g glucose ($P_1$) 10 g urea ($P_2$) and 10 g sucrose ($P_3$) are dissolved in 250 ml of water is -

(*a*) $P_1 > P_2 > P_3$ (*b*) $P_3 > P_1 > P_2$

(*c*) $P_2 > P_1 > P_3$ (*d*) $P_2 > P_3 > P_1$

**50.** Which one of the following pairs of solution can we expect to be isotonic at the same temperature-

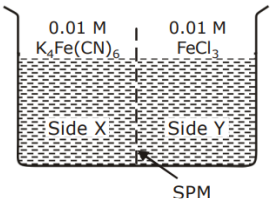
(*a*) 0.1 M urea and 0.1 M NaCl

(*b*) 0.1 M urea and 0.2 M $MgCl_2$

(*c*) 0.1 M NaCl and 0.1M $Na_2SO_4$

(*d*) 0.1 M $Ca(NO_3)_2$ and 0.1 M $Na_2SO_4$

**51.** $FeCl_3$ on reaction with $K_4[Fe(CN)_6]$ in aqueous solution gives blue colour. These are separated by a semipermeable membrane AB 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 sides X and Y.

(*d*) No blue colour formation.

# Learning Plus 2

**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

**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*) Powdered sugar in cold water
(*c*) Sugar crystals in hot water
(*d*) Powdered sugar in hot water

**3.** At equilibrium the rate of dissolution of a solid 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

**4.** 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:
(*a*) Saturated (*b*) Supersaturated
(*c*) Unsaturated (*d*) Concentrated

**5.** Maximum amount of a solid solute that can be dissolved in amount of a given liquid solvent does not depend upon:
(*a*) Temperature (*b*) Nature of solute
(*c*) Pressure (*b*) Nature of solvent

**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

**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*) Chloroform and acetone
(*c*) Nitric acid and water (*d*) Phenol and aniline

**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

**9.** Which of the following aqueous solutions should have the highest boiling point?
(*a*) 1.0 M NaOH (*b*) 1.0 $MNa_2SO_4$
(*c*) 1.0 M $NH_4NO_3$ (*d*) 1.0 $MKNO_3$

**10.** The unit of ebullioscopic constant is:
(*a*) K kg $mol^{-1}$ or 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)

**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

**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

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

**14.** Which of the following statements is false?
(*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 the solution.
(*c*) Decreasing order of osmotic pressure for 0.01 M aqueous solutions of barium chloride, potassium chloride, acetic acid and sucrose is $BaCl_2 > KCl > CH3COOH >$ sucrose
(*d*) According to Raoult's law, the vapor pressure exerted by a volatile component of a solution is directly proportional to its mole fraction in the solution

**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

**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

**17.** Value of Henry's constant $K_H$:

(*a*) Increases with increase in temperature represents the decrease in solubility

(*b*) Decreases with increase in temperature the decrease in solubility

(*c*) Remains constant

(*d*) First increases then decreases

**18.** The value of Henry's constant, *KH* is:

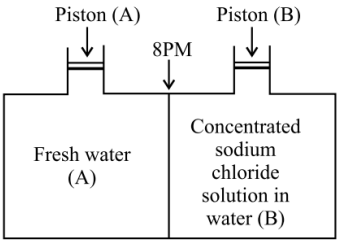
(*a*) Greater for gases with higher solubility

(*b*) Greater for gases with lower solubility

(*c*) Constant for all gases

(*d*) Not related to the solubility of gases

**19.** Consider the figure and mark the correct option:




(*a*) Water will move from side (*a*) to side (*b*) if a pressure lower than 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*) to side (*b*) if pressure equal to osmotic pressure is applied on piston (*b*)

**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*) $iA < iB < iC$ (*b*) $iA > iB > iC$

(*c*) $iA = iB = iC$ (*d*) $iA < iB > iC$

**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 ethanol 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:

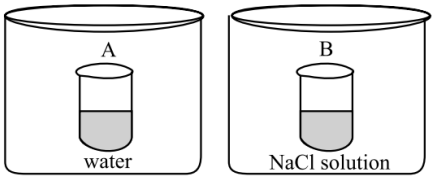
(*a*) Solution (*i*) will follow Raoult's law

(*b*) Solution (*ii*) will show positive deviation from Raoult's law

(*c*) Solution (*i*) will show negative deviation from Raoult's law

(*d*) Solution (*iii*) will show positive deviation from Raoult's law

**22.** Two beakers of capacity 500 mL were taken. One of these beakers, 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 beakers were placed in closed containers of same material and same capacity as shown in figure:




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 vapour pressure in container (*a*)

**23.** In isotonic solutions:

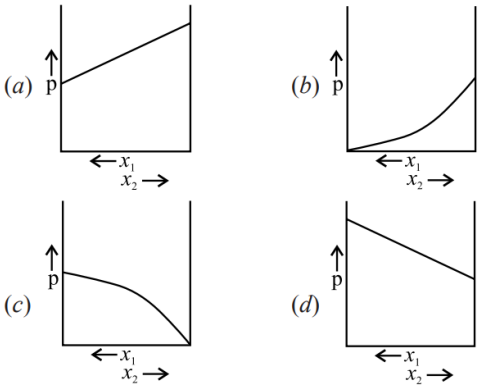
(*a*) Solute and solvent both are same

(*b*) Osmotic pressure is same

(*c*) Solute and solvent may or may not be same

(*d*) Solute is always same solvent may be different

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




**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 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

**26.** $K_H$ value for Ar(g), $CO_2$ (g), HCHO (g) and $CH_4$ (g) are 40.39, 1.67, $1.83 \times 10^{-5}$ 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*) $Ar < CH_4 < CO_2 < HCHO$

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

(*i*) Nature of solute

(*ii*) Temperature

(*iii*) Pressure

(*a*) (*i*) and (*iii*) at constant T (*b*) (*i*) and (*ii*) at constant p

(*c*) (*ii*) and (*iii*) (*d*) Only (*iii*)

**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*) $\Delta_{mix}$ V = zero

(*c*) These will form maximum 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 does not 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

**30.** Van't Hoff factor (*i*) is given by the expression:

(*a*) $i = \dfrac{\text{molar mass}}{\text{abnormal molar mass}}$

(*b*) $i = \dfrac{\text{abnormal molar mass}}{\text{normal molar mass}}$

(*c*) $i = \dfrac{\text{observed colligative property}}{\text{calculated colligative property}}$

(*d*) $i = \dfrac{\text{calculated colligative property}}{\text{observed colligative property}}$

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

(*a*) Solute (*b*) Density

(*c*) Elevation in boiling point (*d*) None of these

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

(*a*) Benzene-toluene

(*b*) Water-methanol

(*c*) Water-ethanol

(*d*) *n*-hexane – *n*-heptane

**33.** Discounting economic considerations, which of the following would be the best to shrink an icy road, in quantities proportion to their respective formula weights-

(*a*) NaCl

(*b*) $CaCl_2$

(*c*) $CuSO_4.5H_2O$

(*d*) $Al_2(SO_4)_3$

**34.** Van't Hoff factor of $Hg_2Cl_2$ in its aqueous solution will be : ($Hg_2Cl_2$ is 80% ionized in the solution)

(*a*) 1.6 (*b*) 2.6

(*c*) 3.6 (*d*) 4.6

**35.** Which of the following solutions will have the highest boiling point?

(*a*) 1% of glucose in water (*b*) 1% sucrose in water

(*c*) 1% NaCl in water (*d*) 1% $CaCl_2$ in water

**36.** Benzoic acid is dissolved in benzene, van't Hoff factor will be:

(*a*) 1 (*b*) 0.5

(*c*) 1.5 (*d*) 2

**37.** The freezing point depression constant for water is 1.86 K kg $mol^{-1}$. If 5.00 g $Na_2SO_4$ is dissolved in 45.0 g $H_2O$, the freezing point is changed by –3.82°C.calculate the van't Hoff factor for $Na_2SO_4$:

(*a*) 0.381 (*b*) 2.05

(*c*) 2.63 (*d*) 3.11

**38.** The van't Hoff factor (*i*) for a compound which undergoes dissociation in one solvent and association in other solvent is respectively:

(*a*) Greater than one and greater than one

(*b*) Less than one and less greater than one

(*c*) Less than one and less than one

(*d*) Greater than one and less than one

**39.** What is the freezing point of a solution containing 8.1 g of HBr in 100 g water, assuming the acid to be 90% ionised ? ($K_f$ for water = 1.86 K kg $mol^{-1}$)

(*a*) 0.85°C (*b*) –3.53°C

(*c*) 0°C (*d*) –0.35°C

**40.** Maximum lowering of vapour pressure is observed in the case of:

(*a*) 0.1 M glucose

(*b*) 0.1 M $BaCl_2$

(*c*) 0.1 M $MgSO_4$

(*d*) 0.1 M NaCl

# Multiconcept MCQs

**1.** Equal weight of a solute are dissolved in equal weight of two solvents A & B and formed a very dilute solution. The relative lowering of vapour pressure for solution B has twice the relative lowering of vapour pressure for solution A. If $M_A$ and $M_B$ are molecular weights of solvents A & B respectively, then:

(*a*) $M_B = 2M_A$ (*b*) $M_A = 4M_B$

(*c*) $M_A = 2M_B$ (*d*) $M_A = M_B$

**2.** If $M_{normal}$ is the normal molecular mass and α is the degree of ionization of $K_3[Fe(CN)_6]$, then the abnormal molecular mass of complex is:

(*a*) $M_{normal}\,(1+3\alpha)^{-1}$ (*b*) $M_{normal}\,(1+2\alpha)^{-1}$

(*c*) $M_{normal}\,(1+\alpha)^{-1}$ (*d*) None of these

**3.** A living cell contains a solution which is isotonic with 0.2 M glucose solution. What osmotic pressure develops when the cell is placed in 0.05 M $BaCl_2$ solution at 300 K?

(*a*) 1.23 atm (*b*) 6.15 atm

(*c*) 3.69 atm (*d*) None of these

**4.** The vapour pressure of water is 12.3 kPa at 300 K. What is the vapour pressure of 1 molal aqueous solution of a non-volatile solute at 300 K?

(*a*) 1.208 kPa (*b*) 12.08 kPa

(*c*) 1208 kPa (*d*) 2.08 kPa

**5.** Which one of the following aqueous solutions will show the highest boiling point?

(*a*) 0.015 M glucose (*b*) 0.10 M $Na_2SO_4$

(*c*) 0.01 M $KNO_3$ (*d*) 0.015 M urea

**6.** Calculate the number of moles of sodium sulphate required to be dissolved in 12 moles of water to lower its vapour pressure by 10 mmHg at a 300 K temperature (V.P. of $H_2O$ at 300K = 50 mmHg):

(*a*) 2 moles (*b*) 3 moles

(*c*) 1 moles (*d*) 1.5 moles

**7.** For an ideal binary liquid solution with $P_A^0 > P_B^0$, which relation between $X_A$ (mole fraction of A in liquid phase) and $Y_A$ (mole fraction of A in vapour phase) is correct?

(*a*) $Y_A = Y_B$ (*b*) $\frac{Y_A}{Y_B} = \frac{X_A}{X_B}$

(*c*) $\frac{Y_A}{Y_B} > \frac{X_A}{X_B}$ (*d*) $\frac{Y_A}{Y_B} < \frac{X_A}{X_B}$

**8.** 18 g glucose ($C_6H_{12}O_6$) is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is:

(*a*) 76 (*b*) 752.4

(*c*) 759 (*d*) 760.4

**9.** How many grams of sucrose (M. mass = 342) should be dissolved in 100grams $H_2O$ in order to produce a solution with 105°C difference between the freezing point & boiling point temperature?

($K_f$ = 1.86 k kg/mole) & ($K6_b$ = 0.51 k kg/mole)

(*a*) 34.2 gm (*b*) 72 gm

(*c*) 342 gm (*d*) 460 gm

**10.** 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 the same temperature, what is the solubility of sparingly soluble salt $XCl_3$, in moles per ltr. (Assume solution to be dilute)

(*a*) $4.02 \times 10^{-2}$ (*b*) $6 \times 10^{-7}$

(*c*) $8 \times 10^{-5}$ (*d*) $2 \times 10^{-4}$

**11.** To 500 $cm^3$ of water, $3 \times 10^{-3}$ kg of $CH_3COOH$ is added. I f 23% of $CH_3COOH$ is disociated, what will be the depression in freezing point- ($K_f$ for water is 1.86 k kg $mol^{-1}$)

(*a*) 0.372 K (*b*) 0.228 K

(*c*) 0.328 K (*d*) 0.556 K

**12.** An aqueous solution of a compound AB freezes at 0.48°C. At this temperature, AB behaves as a Non-electrolyte. The same solution boils at 100.26°C at a P of 1 atm (for water, $\frac{K_f}{K_b} = 3.7$ ) we can conclude that compound AB at the boiling point of solution,

(*a*) Behaves as a non-electrolyte

(*b*) Ionises to the extent of 50%

(*c*) Behaves as a strong electrolyte

(*d*) Dissociates in solution

**13.** An ideal mixture of liquids A and B with 2 moles of A and 2 moles of B has a total vapour pressure of 1 atm at a certain temperature. Another mixture with 1 mole of A and 3 moles of B has vapour pressure greater than 1 atm. When 4 moles of C are added to second mixture, the vapour pressure comes down to 1 atm. Vapour pressure of C in pure state i.e., $P_C^o$ = 0.8 atm. What will be the value of $P_A^o$ & $P_B^o$

(*a*) $P_A^o = 1.2\,atm, P_B^o = 0.7\,atm$ (*b*) $P_A^o = 1.2\,atm, P_B^o = 0.6\,atm$

(*c*) $P_A^o = 0.6\,atm, P_B^o = 1.4\,atm$ (*d*) $P_A^o = 1.4\,atm, P_B^o = 0.6\,atm$

**14.** If all the four compounds were sold at the same price, which would be cheapest for preparing an antifreeze solution for a car radiator?

(*a*) $CH_3OH$ (*b*) $C_2H_5OH$

(*c*) $C_2H_4(OH)_2$ (*d*) $C_3H_5(OH)_3$

**15.** The volume of water ($K_f$ = 18.6 k/molal in 100 g solvent) required to dissolve 3 g of urea to produce a depression of 0.186°C in freezing point is:

(*a*) 1 L (*b*) 200 ml

(*c*) 500 ml (*d*) 300 ml

**16.** Aqueous solution of $HNO_3$ is 63% by mass (density = 1.1 g/cc). What volume of this solution should be taken to prepare 1 L solution which exerts osmotic pressure of 49.2 atm at 27°C.

(*a*) 90.9 ml (*b*) 90.9 L

(*c*) 0.9 ml (*d*) 909 ml

**17.** The pH of 1 m solution of a weak monobasic acid (HA) is 2. Then, what is its van't hoff factor?

(*a*) 1.01 (*b*) 2.3

(*c*) 3.5 (*d*) 7

**18.** A solution is prepared by mixing 100 mL each of methanol (d = 0.791 g/mL) and ethanol (d = 0.998 g/mL). If $M_1$ is molarity of solution described as MeOH solute in EtOH solvent and $M_2$ is molarity of solution described as EtOH solute in MeOH solvent. Then :

(*a*) $M_1 < M_2$ (*b*) $M_1 > M_2$

(*c*) $M_1 = M_2$ (*d*) $M_1 + M_2 > 50$

**19.** The vapour pressure of a solvent decreases by 10 mm of Hg than a non-volatile solute was added is 0.2. What should be the mole fraction of the solvent if the decrease in vapour pressure is to be 20 mm of Hg.

(*a*) 0.6 (*b*) 0.4

(*c*) 0.2 (*d*) 1

**20.** $PtCl_4 . 6H_2O$ can exist as a hydrated complex 1 molal aqueous solution of the salt has value of $\Delta T_f$ of 3.72°. Assuming 100% ionisation of the salt and $K_f$ ($H_2O$) = 1.86° $mol^{-1}$ kg, the correct representation of the complex is

(*a*) $[Pt(H_2O)_6]Cl_4$ (*b*) $[Pt(H_2O)_4Cl_2].2H_2O$

(*c*) $[Pt(H_2O)_3Cl_3]Cl.3H_2O$ (*d*) $[Pt(H_2O)_2Cl_4].4H_2O$

**21.** The boiling point of an aqueous solution of a non volatile solute is 100.15°C. What is the freezing point of an aqueous solution obtained by diluting the above solution with an equal volume of water? The values of $K_b$ and $K_f$ for water are 0.512 and 1.86 K molality$^{-1}$

(*a*) –0.544°C (*b*) –0.512°C

(*c*) –0.272°C (*d*) –1.86°C

**22.** 1 mol $CH_3COOH$ is added in 250 g benzene. Acetic acid dimerises in benzene due to hydrogen bond, $K_b$ of benzene is 2 K kgmol$^{-1}$. The boiling point has increased by 6.4K. % dimerisation of acetic acid is:

(*a*) 50 (*b*) 40

(*c*) 30 (*d*) 20

**23.** In which of the following pairs of solutions will the values of the van't Hoff factor be the same?

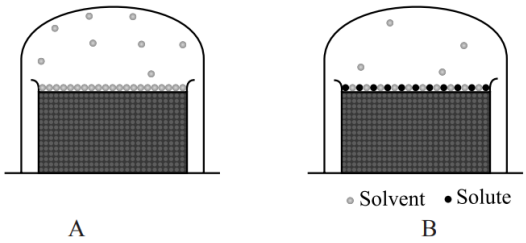
(*a*) 0.05 M $K_4[Fe(CN)_6]$ and 0.10 M $FeSO_4$.

(*b*) 0.10 M $K_4[Fe(CN)_6]$ and 0.05 M $FeSO_4 . (NH_4)_2SO_4 . 6H_2O$

(*c*) 0.20 M NaCl and 0.10 M $BaCl_2$

(*d*) 0.05 M $FeSO_4 (NH_4)_2 SO_4 . 6H_2O$ and 0.02 M KCl. $MgCl_2 . 6H_2O$

**24.** Interpret the correct statement for the following figure.



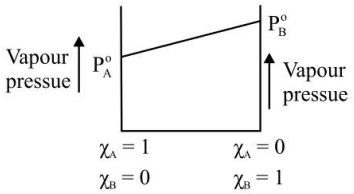

(*a*) Vapour pressure of the solution in beaker A is more than in the beaker B

(*b*) Vapour pressure of the solution in beaker A is less than in the beaker B

(*c*) Vapour pressure of the solution in both the beaker is same

(*d*) None of the above

**25.** The following is a graph plotted between the vapour pressure of two volatile liquids against their respective mole fractions. Which of the following statements is/are correct?



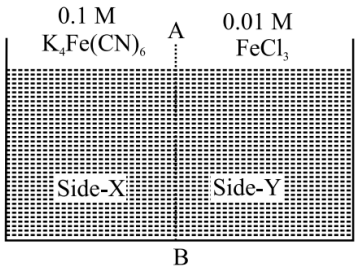

(*a*) When $\chi_A = 1$ and $\chi_B = 0$, then $P = P^o_A$

(*b*) When $\chi_B = 1$ and $\chi_A = 0$, then $P = P^o_B$

(*c*) When $\chi_A = 1$ and $\chi_B = 0$, then $P = P^o_B$

(*d*) When $\chi_B = 1$ and $\chi_A = 1$, then $P = P^o_A$

**26.** $FeCl_3$ on reaction with $K_4[Fe(CN)_6]$ in aqueous solution gives blue colour. These are separated by a semi-permeable membrane AB as shown. Due to osmosis, there is




(*a*) Blue colour formation in side X

(*b*) Blue colour formation in side Y

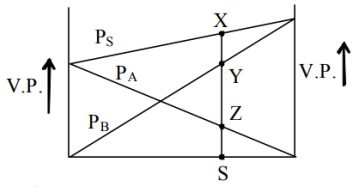
(*c*) Blue colour formation in both of sides X and Y

(*d*) No blue colour formation

# Advanced Level Multiconcept Questions

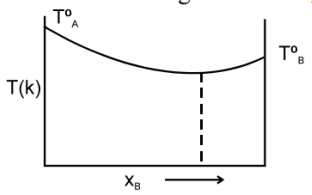
## MCQ/COMPREHENSION/STATEMENT/ MATCHING

**1.** Consider following vapour pressure composition graph. Hence-




(*a*) V.P. of A = SZ
(*b*) V.P. of B = ZY
(*c*) V.P. of B = SY
(*d*) V.P. of solution at X = SZ + SY

**2.** The diagram given below represents boiling point composition diagram of solution of component A and B, which is/are incorrect among the following?




(*a*) The solution shows negative deviation
(*b*) A-B-interactions are stronger than A-A and B-B
(*c*) The solution is ideal solution
(*d*) The solution shows positive deviation.

**3.** The example of negative deviationis
(*a*) HCl & $H_2O$
(*b*) $C_2H_5OH$ & $H_2O$
(*c*) $CHCl_3$ & $CH_3COCH_3$
(*d*) $C_6H_6$ & $C_6H_5CH_3$

**4.** Acetone and carbon disulphide form binary liquid solution showing positive deviation from Raolut law. The normal polling point ($T_b$) of pure acetone is less than that of pure $CS_2$. Pick out the **incorrect** statements among the following.
(*a*) Boiling temperature of mixture is always less than boiling temperature of acetone.
(*b*) Boiling temperature Azeotropic mixture is always less than boiling temperature of pure $CS_2$
(*c*) When a small amount $CS_2$(less volatile component) is added to excess of acetone boiling point of resulting mixture increases.
(*d*) A mixture of $CS_2$ and $CH_3COCH_3$ can be completely separated by simple fractional distillation.

**5.** Which of the following is correct for an ideal solution?
(*a*) Raoult's law is obeyed for entire concentration range and temperatures
(*b*) $\Delta H_{mix} = 0$
(*c*) $\Delta V_{mix} = 0$
(*d*) $\Delta S_{mix} = 0$

**6.** Which of the following will form non-ideal solution?
(*a*) $C_2H_5OH$ and water
(*b*) $HNO_3$ and water
(*c*) $CHCl_3$ and $CH_3COCH_3$
(*d*) $C_6H_6$ and $C_6H_5CH_3$

**7.** In which of the following pairs of solutions will the values of the vant Hoff factor be the same?
(*a*) 0.05 M $K_4[Fe(CN)_6]$ and 0.10 M $FeSO_4$
(*b*) 0.10 M $K_4[Fe(CN)_6]$ and 0.05 M $FeSO_4$ $(NH_4)_2SO_4 \cdot 6H_2O$
(*c*) 0.20 M NaCl and 0.10 M $BaCl_2$
(*d*) 0.05 M $FeSO_4$ $(NH_4)_2SO_4$ . $6H_2O$ and 0.02 M KCl . $MgCl_2$ . $6H_2O$

**8.** In which case van't Hoff factor are equal?
(*a*) KCl, 50% ionised
(*b*) $K_2SO_4$, 40% ionised
(*c*) $FeCl_3$, 30% ionised
(*d*) $SnCl_4$, 20% ionised

**9.** For the given electrolyte $A_xB_y$, the degree of dissociation 'α' can be given as

(*a*) $\alpha = \dfrac{i-1}{x+y-1}$ (*b*) $i = (1-\alpha) + x\alpha + y\alpha$

(*c*) $\alpha = \dfrac{1-i}{1-x-y}$ (*d*) None

**10.** When $CuSO_4$ is dissolved in $NH_4OH$ solution then the correct statement is
(*a*) Freezing point of solution is raised
(*b*) Boiling point of solution is lowered
(*c*) Freezing point of solution is lowered
(*d*) Boiling point of solution is raised

**11.** Which has the equal boiling point?
(*a*) 0.1 M $Na_2SO_4$
(*b*) 0.1 M $C_6H_{12}O_6$ (glucose)
(*c*) 0.1 M $MgCl_2$
(*d*) 0.1 M $Al(NO_3)_3$

**Comprehenson # 1 ( No. 12 to 14)**

Colligative properties i.e., the properties of solution which depend upon the number of particles present in solution are osmotic pressure, depression in freezing point, elevation in boiling point and lowering in vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoretically because electrolytes dissociate to furnish more ions in solution. On the other hand experimentally obtained values of colligative properties for associating nature of solute are lower than those obtained theoretically. The ratio of experimental colligative properties to theoretical colligative properties is called as vant Hoff factor (***i***).

**12.** A weak monoprotic acid (molar mass 180) aqueous solution of 0.18 % w/v at 300 K has observed osmotic pressure 0.369 atm. What should be its Vant Hoff factor (***i***). (R = 0.082 atm × L/K × mole)
(*a*) 1.2
(*b*) 1.5
(*c*) 1
(*d*) 0.5

**13.** What is observed molar mass of weak acid in solution in above question.
(*a*) 270 gm
(*b*) 180 gm
(*c*) 120 gm
(*d*) 90 gm

**14.** If equal volume of 0.01 M NaOH is added in the solution of above weak acid solution then what will be new observed osmotic pressure at same temperature. Neglect the hydrolysis, dissociation of water and any volume contraction or expansion. Assume 100% dissociation of salt formed.
(*a*) 0.246 atm
(*b*) 0.369 atm
(*c*) 0.123 atm
(*d*) 0.492 atm

**Comprehension # 2 ( No. 15 to 17)**

Vapour pressure of a solvent is the pressure exerted by vapours when they are in equilibrium with its solvent at that temperature. The vapour pressure of solvent is dependent on nature of solvent, temperature, addition of non-volatile solute as well as nature of solute to dissociate or associate. The vapour pressure of a mixture obtained by mixing two volatile liquids is given by $P_M = P^o_A . X_A + P^o_B . X_B$ where $P^o_A$ and $P^o_B$ are vapour pressures of pure components A and B and $X_A$, $X_B$ are their mole fraction in mixture. For solute-solvent system, the relation becomes $P_M = P^o_A . X_A$ where B is non-volatile solute.

**15.** The vapour pressure of benzene and its solution with a non-electrolyte are 640 and 600 mm respectively. The molality of the solution is -
(*a*) 0.80
(*b*) 0.86
(*c*) 0.90
(*d*) 0.95

**16.** A mixture of two volatile liquids A and B for 1 and 3 moles respectivley has a V.P. of 300 mm at 27ºC. If one mole of A is further added to this solution, the vapour pressure becomes 290 mm at 27ºC. The vapour pressure of pure A is-
(*a*) 250 mm
(*b*) 316 mm
(*c*) 220 mm
(*d*) 270 mm

**17.** The amount of solute (mol. wt. 60) required to dissolve in 180 g of water to reduce the vapour pressure to 4/5 of the pure water -
(*a*) 120 g (*b*) 150 g
(*c*) 200 g (*d*) 60 g

**18-20 P.T.O**

## NUMERICAL VALUE BASED

**21.** 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 be105.3 mm of Hg . Determine extent of dilution.

**22.** The freezing point of a solution containing 2.40 g of a compound in 60.0 g of benzene is 0.10°C lower than that of pure benzene. What is the molecular weight of the compound? ($K_f$ is 5.12°C/m for benzene)

**23.** A solution containing 3.24 g of a nonvolatile nonelectrolyte and 200 g of water boils at 100.130°C at 1atm. What is the molecular weight of the solute? ($K_b$ for water 0.513°C/m)

**24.** Two liquids A and B have $P_A^0$: $P_B^0$ = 1: 3 at a certain temperature. If the mole fraction ratio of $x_A : x_B = 1 : 3$, the mole fraction of A in vapour in equilibrium with the solution at a given temperature is-

**25.** The vapour pressure of water at room temperature is lowered by 5% by dissolving a solute in it, then the approximate molality of solution is :

**26.** Van't Hoff factor of $Ca(NO_3)_2$ is

**18.** Assuming all the solutes are non volatile and all solutions are ideal and neglect the hydrolysis of cation and anion.

| **Column – I** | **Column – II** |
|---|---|
| (*a*) 10 ml 0.1 M NaOH aqueous solution is added to 10 ml 0.1 M HCl aqueous solution | (p) Osmotic pressure of solution increases |
| (*b*) 10 ml 0.1 M NaOH aqueous solution is added to 10 ml 0.1 M $CH_3COOH$ aqueous solution | (q) Vapour pressure of solution increases |
| (*c*) 10 ml 0.1 M HCl aqueous solution is added to 10 ml 0.1 M $NH_3$ aqueous solution | (r) Boiling point of solution increases |
| (*d*) 10 ml 0.1 M HCl aqueous solution is added to 10 ml 0.1 M KOH aqueous solution | (s) Freezing point of solution increases |

**19.**

| **Column-I** | **Column-II** |
|---|---|
| (*a*) Ideal solution solute | (P) Solute-solvent interactions are weaker than solute- |
| (*b*) Solutions showing positive deviations | (Q) Solute-solvent interactions are similar to solute-solute |
| (*c*) Solutions showing negative deviations | (R) Solute-solvent interactions are stronger than solute-solute interactions |

**20.**

| **Column-I** | **Column-II** |
|---|---|
| (*a*) Acetone + $CHCl_3$ | (p) $\Delta S_{mix.} > 0$ |
| (*b*) Ethanol + Water | (q) $\Delta V_{mix.} > 0$ |
| (*c*) $C_2H_5Br + C_2H_5I$ | (r) $\Delta H_{mix.} < 0$ |
| (*d*) Acetone + Benzene | (s) Maximum boiling azeotropes |
| | (t) Minimum boiling azeotropes |

# NEET Past 10 Years Questions

**1.** The following solutions were prepared by dissolving 10 g of glucose ($C_6H_{12}O_6$) in 250 ml of water ($P_1$), 10 g of urea ($CH_4N_2O$) in 250 ml of water ($P_2$) and 10 g of sucrose ($C_{12}H_{22}O_{11}$) in 250 ml of water ($P_3$). The right option for the decreasing order of osmotic pressure of these solutions is: ***(2021)***

(*a*) $P_1 > P_2 > P_3$ (*b*) $P_2 > P_3 > P_1$

(*c*) $P_3 > P_1 > P_2$ (*d*) $P_2 > P_1 > P_3$

**2.** The correct option for the value of vapour pressure of a solution at 45°C with benzene to octane in molar ratio 3 : 2 is: ***(2021)***

[At 45°C vapour pressure of benzene is 280 mm Hg and that of octane is 420 mm Hg. Assume Ideal gas]

(*a*) 168 mm of Hg (*b*) 336 mm of Hg

(*c*) 350 mm of Hg (*d*) 160 mm of Hg

**3.** The mixture which shows positive deviation from Raoult's law is: ***(2020)***

(*a*) Benzene + Toluene

(*b*) Acetone + Chloroform

(*c*) Chloroethane + Bromoethane

(*d*) Ethanol + Acetone

**4.** The freezing point depression constant (K*f*) of benzene is 5.12 K kg $mol^{-1}$. The freezing point depression for the solution of molality 0.078 m containing a non-electrolyte solute in benzene is (rounded off upto two decimal places) : ***(2020)***

(*a*) 0.80 K (*b*) 0.40 K

(*c*) 0.60 K (*d*) 0.20 K

**5.** If 8 g of a non-electrolyte solute is dissolved in 114 g of n-octane to reduce its vapour pressure to 80%, the molar mass (in g $mol^{-1}$) of the solute is

[Given that molar mass of n-octane is 114 g $mol^{-1}$] ***(2020 Covid Re-NEET)***

(*a*) 60 (*b*) 80

(*c*) 20 (*d*) 40

**6.** Isotonic solutions have same ***(2020 Covid Re-NEET)***

(*a*) Freezing temperature (*b*) Osmotic pressure

(*c*) Boiling temperature (*d*) Vapour pressure

**7.** For an ideal solution, the correct option is : ***(2019)***

(*a*) $\Delta_{mix} S = 0$ at constant T and P

(*b*) $\Delta_{mix} V \neq 0$ at constant T and P

(*c*) $\Delta_{mix} H = 0$ at constant T and P

(*d*) $\Delta_{mix} G = 0$ at constant T and P

**8.** The mixture that forms maximum boiling azeotrope is: ***(2019)***

(*a*) Water + Nitric acid

(*b*) Ethanol + Water

(*c*) Acetone + Carbon disulphide

(*d*) Heptane + Octane

**9.** If molality of the dilute solution is doubled, the value of molal depression constant ($K_f$) will be: ***(2017-Delhi)***

(*a*) Unchanged (*b*) Doubled

(*c*) Halved (*d*) Tripled

**10.** Which of the following is dependent on temperature? ***(2017-Delhi)***

(*a*) Weight percentage (*b*) Molality

(*c*) Molarity (*d*) Mole fraction

**11.** Toluene in the vapour phase is in equilibrium with a solution of benzene and toluene having mole fraction of toluene 0.50. If vapour pressure of pure benzene is 119 torr and that of toluene is 37.0 torr at the same temperature, mole fraction of toluene in vapour phase will be: ***(2017-Gujarat)***

(*a*) 0.325 (*b*) 0.462

(*c*) 0.237 (*d*) 0.506

**12.** Which one of the following is incorrect for ideal solution? ***(2016 - II)***

(*a*) $\Delta P = P_{obs} - P_{calculated\ by\ Raoult's\ law} = 0$

(*b*) $\Delta G_{mix} = 0$

(*c*) $\Delta H_{mix} = 0$

(*d*) $\Delta U_{mix} = 0$

**13.** The van't Hoff factor (*i*) for a dilute aqueous solution of the strong electrolyte barium hydroxide is: ***(2016 - II)***

(*a*) 2 (*b*) 3

(*c*) 0 (*d*) 1

**14.** At 100°C, the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be: ***(2016 - I)***

(*a*) 103° C (*b*) 101° C

(*c*) 100° C (*d*) 102° C

**15.** 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 at 25°C. (Given, vapour pressure data at 25°C, benzene = 12.8 kPa, toluene = 3.85 kPa) ***(2016-I)***

(*a*) The vapour will contain equal amounts of benzene and toluene

(*b*) Not enough information is given to make a prediction

(*c*) The vapour will contain a higher percentage of benzene

(*d*) The vapour will contain a higher percentage of toluene

**16.** What is the mole fraction of the solute in a 1.00 m aqueous solution? ***(2015 Re)***

(*a*) 0.0177 (*b*) 0.177

(*c*) 1.770 (*d*) 0.0354

**17.** Which one 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)? ***(2015)***

(*a*) $K_3[Fe(CN)_6]$ (*b*) $Al(NO_3)_3$

(*c*) $K_4[Fe(CN)_6]$ (*d*) $K_2SO_4$

**18.** Which one is not equal to zero for an ideal solution? ***(2015)***

(*a*) $\Delta S_{mix}$ (*b*) $\Delta V_{mix}$

(*c*) $\Delta P = P_{observed} - P_{Raoult}$ (*d*) $\Delta H_{mix}$

**19.** 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? ***(2015)***

(*a*) Molecular mass of X is greater than the molecular mass of Y

(*b*) Molecular mass of X is less than the molecular mass of Y

(*c*) Y is undergoing dissociation in water while X undergoes no change

(*d*) X is undergoing dissociation in water

**20.** Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression? ***(2014)***

(*a*) $C_6H_{12}O_6$ (*b*) $Al_2(SO_4)_3$

(*c*) $K_2SO_4$ (*d*) KCl

**21.** How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M $HNO_3$? The concentrated acid is 70% $HNO_3$. ***(2013)***

(*a*) 70.0 g conc. $HNO_3$ (*b*) 54.0 g conc. $HNO_3$

(*c*) 45.0 g conc. $HNO_3$ (*d*) 90.0 g conc. $HNO_3$

**22.** Vapour pressure of chloroform ($CHCl_3$) and dichloromethane ($CH_2Cl_2$) at 25°C are 200 mm Hg and 41.5 mm Hg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of $CH_2Cl_2$ at the same temperature will be: (Molecular mass of $CHCl_3$ = 119.5 u and molecular mass of $CH_2Cl_2$ = 85 u): ***(2012 Mains)***

(*a*) 285.5 mm Hg (*b*) 173.9 mm Hg

(*c*) 615.0 mm Hg (*d*) 90.3 mm Hg

**23.** $p_A$ and $p_B$ are the vapour pressure of pure liquid components A and B, respectively of an ideal binary solution. If $x_A$ represents the mole fraction of component A, the total pressure of the solution will be: ***(2012 Pre)***

(*a*) $p_B + x_A(p_A - p_B)$ (*b*) $p_A + x_A(p_B - p_A)$

(*c*) $p_A + x_A(p_A - p_B)$ (*d*) $p_B + x_A(p_B - p_A)$

**24.** Molecular weight of glucose is 180. A solution of glucose which contains 18 g per litre is: ***(2012 Pre)***

(*a*) 2 molal (*b*) 1 molal

(*c*) 0.1 molal (*d*) 18 molal

# JEE Mains & Advanced Past Years Questions

## JEE-MAIN PREVIOUS YEAR'S

**1.** 18 g glucose ($C_6H_{12}O_6$) is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is:

***[JEE Main-2016]***

(*a*) 7.6 (*b*) 76.0

(*c*) 752.4 (*d*) 759.0

**2.** The vapour pressure of acetone at 20°C is 185 torr. When 1.2 g of a non-volatile substance was dissolved in 100 g of acetone at 20°C, its vapour pressure was 183 torr. The molar mass (g $mol^{-1}$) of the substance is:

***[JEE Main-2017]***

(*a*) 32 (*b*) 128

(*c*) 488 (*d*) 64

**3.** Liquids A and B form ideal solution in the entire composition range. At 350 K, the vapour pressures of pure A and pure B are $7 \times 10^3$ Pa and $12 \times 10^3$ Pa, respectively. The composition of the vapour in equilibrium with a solution containing 40 mole percent of A at this temperature is

***[JEE Main-2019 (January)]***

(*a*) $X_A = 0.37; X_B = 0.63$

(*b*) $X_A = 0.28; X_B = 0.72$

(*c*) $X_A = 0.4; X_B = 0.6$

(*d*) $X_A = 0.76; X_B = 0.24$

**4.** Molecules of benzoic acid ($C_6H_5COOH$) dimerise in benzene. 'w' g of the acid dissolved in 30g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is:

**(Given** that $K_f$ =5 K kg $mol^{-1}$, Molar mass of benzoic acid =122 g $mol^{-1}$)

**[*JEE Main-2019 (January)*]**

(*a*) 2.4 g (*b*) 1.0 g

(*c*) 1.5 g (*d*) 1.8 g

**5.** Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point for 2 molar solution of glucose in the same solvent is 2 K. The relation between $K_b$ and $K_f$ is;

**[*JEE Main-2019 (January)*]**

(*a*) $K_b = 1.5\ K_f$ (*b*) $K_b = K_f$

(*c*) $K_b = 0.5\ K_f$ (*d*) $K_b = 2K_f$

**6.** Which one of the following statements regarding Henry's law is not correct? **[*JEE Main-2019 (January)*]**

(*a*) Higher the value of $K_H$ at a given pressure, higher is the solubility of the gas in the liquids

(*b*) Different gases have different $K_H$ (Henry's law constant) value at the same temperature

(*c*) The partical pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution

(*d*) The value of $K_H$ increases with increase of temperature and $K_H$ is function of the nature of the gas.

**7.** The freezing point of diluted milk sample is found to be –0.2ºC, while it should have been –0.5ºC for pure milk. How much water been added to pure milk to make the diluted sample? **[*JEE Main-2019 (January)*]**

(*a*) 1 cup of water to 2 cups of pure milk

(*b*) 1 cup of water to 2 cups of pure milk

(*c*) 1 cup of water to 3 cups of pure milk

(*d*) 2 cup of water to 3 cups of pure milk

**8.** $K_2HgI_4$ is 40% ionized in aqueous solution. The value of its van't Hoff factor (i) is :

**[*JEE Main-2019 (January)*]**

(*a*) 1.6 (*b*) 1.8

(*c*) 2.0 (*d*) 2.2

**9.** The vapour pressure of pure liquids A and B are 400 and 600 mmHg, respectively at 298K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fraction of components A and B in vapour phase, respectively are:

**[*JEE Main-2019 (April)*]**

(*a*) 500 mmHg, 0.5, 0.5 (*b*) 450 mm Hg, 0.4, 0.6

(*c*) 450 mm Hg, 0.5, 0.5 (*d*) 500 mmHg, 0.4, 0.6

**10.** The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol $L^{-1}$) in solution is:

**[*JEE Main-2019 (April)*]**

(*a*) $6 \times 10^{-2}$ (*b*) $4 \times 10^{-4}$

(*c*) $16 \times 10^{-4}$ (*d*) $4 \times 10^{-2}$

**11.** Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is:

($x_M$ = Mole fraction of 'M' in solution ;

$x_N$ = Mole fraction of 'N' in solution ;

$y_M$ = Mole fraction of 'M' in vapour phase ;

$y_N$ = Mole fraction of 'N' in vapour phase)

**[*JEE Main-2019 (April)*]**

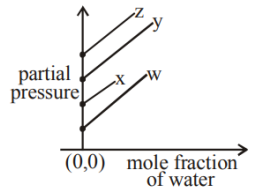
(*a*) $(x_M - y_M) < (x_N - y_N)$ (*b*) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(*c*) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$ (*d*) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

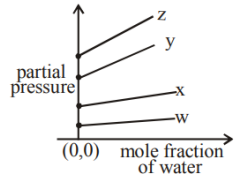
**12.** For the solution of the gases w, x, y and z in water at 298K, the Henrys law constants ($K_H$) are 0.5, 2, 35 and 40 kbar, respectively. The correct plot for the given data is:

**[*JEE Main-2019 (April)*]**

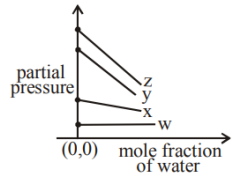
(*a*)



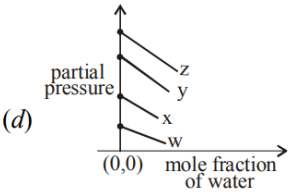

(*b*)




(*c*)




(*d*)



**13.** A solution is prepared by dissolving 0.6 g of urea (molar mass = 60 g $mol^{-1}$) and 1.8 g of glucose (molar mass = 180 g $mol^{-1}$ ) in 10 mL of water at 27ºC. The osmotic pressure of the solution is : (R = 0.08206 L atm $K^{-1}$ $mol^{-1}$)

[*JEE Main-2019 (April)*]

(*a*) 4.92 atm (*b*) 1.64 atm

(*c*) 2.46 atm (*d*) 8.2 atm

**14.** Molal depression constant for a solvent is 4.0 kg $mol^{-1}$ solution of $K_2SO_4$ is : (**Assume** complete dissociation of the electrolyte)

[*JEE Main-2019 (April)*]

(*a*) 0.12 (*b*) 0.36

(*c*) 0.18 (*d*) 0.24

**15.** At room temperature, a dilute solution of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mmHg, lowering of vapour pressure will be (molar mass of urea = 60 g $mol^{-1}$):

[*JEE Main-2019 (April)*]

(*a*) 0.027 mmHg (*b*) 0.028 mmHg

(*c*) 0.017 mmHg (*d*) 0.031 mmHg

**16.** 1 g of non-volatile non-electrolyte solute is dissolved in l00g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_b(A)}{\Delta T_b(B)}$

[*JEE Main-2019 (April)*]

(*a*) 5 : 1 (*b*) 10 : 1

(*c*) 1 : 5 (*d*) 1 : 0.2

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

[*JEE Main-2020 (January)*]

(*a*) heat must be absorbed in order to produce the solution at 35°C

(*b*) Raoult's law is not obeyed by this system

(*c*) a mixture of 100 mL $CS_2$ and 100 mL acetone has a volume < 200 mL

(*d*) $CS_2$ and acetone are less attracted to each other than to themselves.

**18.** The ammonia ($NH_3$) released on quantitative reaction of 0.6 g urea ($NH_2CONH_2$) with sodium hydroxide (NaOH) can be neutralized by:

[*JEE Main-2020 (January)*]

(*a*) 200 ml of 0.4 N HCl

(*b*) 200 ml of 0.2 N HCl

(*c*) 100 ml of 0.1 N HCl

(*d*) 100 ml of 0.2 N HCl

**19.** Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time

[*JEE Main-2020 (January)*]

(*a*) the volume of the solution decreases and the volume of the solvent increases

(*b*) the volume of the solution and the solvent does not change

(*c*) the volume of the solution increases and the volume of the solvent decreases

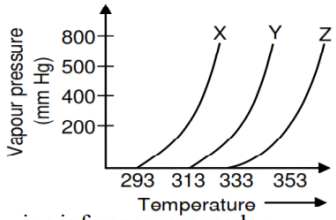
(*d*) the volume of the solution does not change and the volume of the solvent decreases

**20.** Ferrous sulphate heptahydrate is used to fortify foods with iron. The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat is _____.
Atomic weight : Fe = 55.85 ; S = 32.00 ; O = 16.00

[*JEE Main-2020 (January)*]

**21.** A graph of vapour pressure and temperature for three different liquids X, Y and Z is shown below:

[*JEE Main-2020 (January)*]




The following inferences are made :

(*a*) X has higher intermolecular interactions compared to Y

(*b*) X has lower intermolecular interactions compared to Y

(*c*) Z has lower intermolecular interactions compared to Y

The correct inference (s) is/are :

(*a*) (*c*) (*b*) (*b*)

(*c*) (*a*) and (*b*) (*d*) (*a*)

**22.** The molarity of $HNO_3$ in a sample which has density 1.4 g/mL and mass percentage of 63% is _____.
(Molecular Weight of $HNO_3$ = 63)

[*JEE Main-2020 (January)*]

**23.** How much amount of NaCl should be added to 600 g for water (ρ = 1.00 g/mL) to decrease the freezing point of water to –0.2°C ? _____.

[*JEE Main-2020 (January)*]

(The freezing point depression constant of water = 2 K kg $mol^{-1}$)

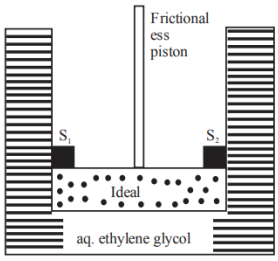
**24.** 10.30 mg of $O_2$ dissolved into a litre of sea water of density 1.03 g/mL. The concentration of $O_2$ in ppm is__.

[*JEE Main-2020 (January)*]

**25.** A cylinder containing an ideal gas (0.1 mol of 1.0 $dm^3$) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers $S_1$ and $S_2$ (as shown in the Figure) are suddenly

withdrawn, the volume of the gas in litres after equilibrium is achieved will be_____.(Given, $K_f$(water = 2.0 K kg mol$^{-1}$, R = 0.8 dm$^3$ atm K$^{-1}$ mol$^{-1}$)

[*JEE Main-2020 (January)*]




**26.** The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following processes can explain this?

[*JEE Main-2020 (September)*]

(*a*) Osmosis (*b*) Reverse osmosis

(*c*) Diffusion (*d*) Dialysis

**27.** An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules

[*JEE Main-2020 (September)*]

(*a*) leaves the solution increases

(*b*) leaves the vapour increases

(*c*) leaves the vapour decreases

(*d*) leaves the solution decreases

**28.** If 250 cm$^3$ of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is _____ $\times 10^{-2}$ (to the nearest integer).

[*JEE Main-2020 (September)*]

**29.** Henry's constant (in kbar) for four gases α, β, γ and δ in water at 298 K is given below :

| | α | β | γ | δ |
|---|---|---|---|---|
| $K_H$ | 50 | 2 | $2\times10^{-5}$ | 0.5 |

(density of water = $10^3$ kgm$^{-3}$ at 298 K)

This table implies that

[*JEE Main-2020 (September)*]

(*a*) The pressure of a 55.5 molal solution of γ is 1 bar

(*b*) Solubility of γ at 308 K is lower than at 298 K

(*c*) α has the highest solubility in water at a given pressure

(*d*) The pressure of a 55.5 molal solution of δ is 250 bar

**30.** The osmotic pressure of a solution of NaCl is 0.10 atm and that of a glucose solution is 0.20 atm. The osmotic pressure of a solution formed by mixing 1 L of the sodium chloride solution with 2 L of the glucose solution is $x \times 10^{-3}$ atm. x is _____. (nearest integer)

[*JEE Main-2020 (September)*]

**31.** At 300 K, the vapour pressure of a solution containing 1 mole of n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-heptane in its pure state _____?

[*JEE Main-2020 (September)*]

**32.** For Freundlich adsorption isotherm, a plot of log (x/m) (y-axis) and log p (x-axis) gives a straight line. The intercept and slope for the line is 0.4771 and 2, respectively. The mass of gas, adsorbed per gram of adsorbent if the initial pressure is 0.04 atm, is _____ $\times 10^{-4}$ g. (log 3 = 0.4771)

[*JEE Main-2020 (September)*]

**33.** A set of solutions is prepared using 180 g of water as a solvent and 10 g of different nonvolatile solutes A, B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of A = 100 g mol$^{-1}$; B = 200 g mol$^{-1}$; C = 10,000 g mol$^{-1}$]

[*JEE Main-2020 (September)*]

(*a*) A > C > B

(*b*) C > B > A

(*c*) A > B > C

(*d*) B > C > A

**34.** The elevation of boiling point of 0.10 m aqueous $CrCl_3.xNH_3$ solution is two times that of 0.05 m aqueous $CaCl_2$ solution. The value of x is _____.

[**Assume** 100% ionisation of the complex and $CaCl_2$, coordination number of Cr as 6, and that all $NH_3$ molecules are present inside the coordination sphere]

[*JEE Main-2020 (September)*]

**35.** $C_6H_6$ freezes at $5.5^\circ C$. The temperature at which a solution of 10 g of $C_4H_{10}$ in 200 g of $C_6H_6$ freeze is $^\circ C$. (The molal freezing point depression constant of $C_6H_6$ is $5.12^\circ C/m$.)

[*JEE Main-2021 (February)*]

**36.** A 6.50 molal solution of KOH (aq.) has a density of $1.89 g cm^{-3}$. The molarity of the solution is $mol\ dm^{-3}$. (Round off to the Nearest Integer).

[Atomic masses: K : 39.0u; O : 16.0u; H : 1.0u ]

[*JEE Main-2021 (March)*]

## JEE-ADVANCED PREVIOUS YEAR'S

**1.** Mixture(s) showing positive deviation from Raoult's law at $35^0$C is(are)

**[*JEE Advanced-2016*]**

(*a*) carbon tetrachloride + methanol

(*b*) carbon disulphide + acetone

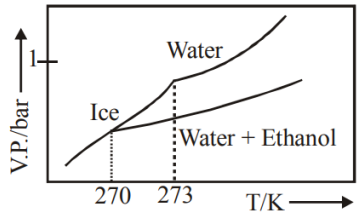
(*c*) benzene + toluene

(*d*) phenol + aniline

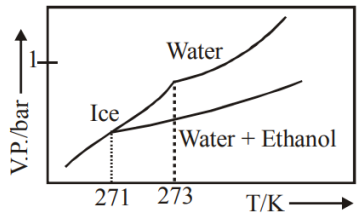
**2.** Pure water freezes at 273 K and 1 bar. The addition of 34.5g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as 2 K kg $mol^{-1}$.The figures shown below represent plots of capour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is 46 g $mol^{-1}$] Among the following the option representing change in the freezing point is

**[*JEE Advanced-2017*]**

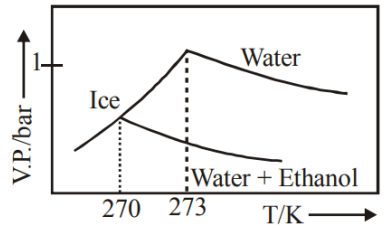
(*a*)



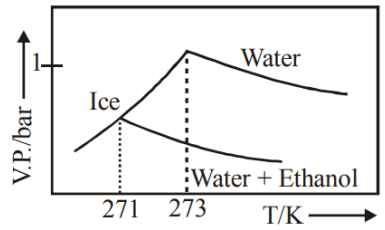

(*b*)




(*c*)

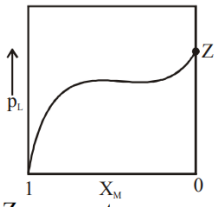



(*d*)




**3.** For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown is shown in the following figure. Here $x_L$ and $x_M$ represent mole fractions of L and M, respectively, in the solution. The correct statement(s) applicable to this system is (are)

**[*JEE Advanced-2017*]**




(*a*) The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed from $x_L = 0$ to $x_L = 1$

(*b*) Attractive intermolecular interactions between L-L in pure liquid L and M-M in pure liquid M are stronger than those between L-M when mixed in solution

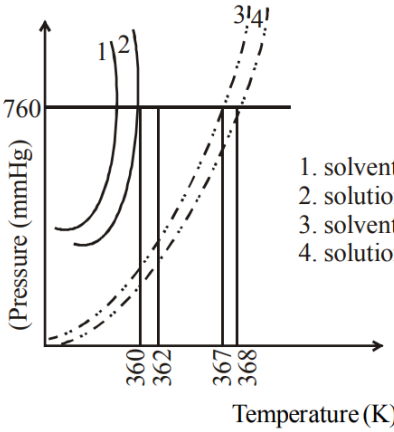
(*c*) The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $x_L \to 0$

(*d*) The point Z represents vapour pressure of pure liquid L and Raoult's law is obeyed when $x_L \to 1$

**4.** Liquids A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary solution of liquids A and B has vapour pressure 45 Torr. At the same temperature, a new solution of A and B having mole fractions xA and xB, respectively, has vapour pressure of 22.5 Torr. The value of xA/xB in the new solution is____. (**Given** that the vapour pressure of pure liquid A is 20 Torr at temperature T)

**[*JEE Advanced-2018*]**

**5.** The plot given below shows P¡VT curves (where P is the pressure and T is the temperature) for two solvents X and Y and isomolal solutions of NaCl in these solvents. NaCl completely dissociates in both the solvents.




1. solvent X
2. solution of NaCl in solvent X
3. solvent Y
4. solution of NaCl in solvent Y

On addition of equal number of moles a non-volatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is three times that of solvent Y. Solute S is known to undergo dimerization in these solvents. If the degree of dimerization is 0.7 in solvent Y, the degree of dimerization in solvent X is ___.

**[*JEE Advanced-2018*]**

6. On dissolving 0.5 g of a non-volatile non-ionic solute to 39 g of benzene, its vapor pressure decreases from 650 mm Hg to 640 mm Hg. The depression of freezing point of benzene (in K) upon addition of the solute is _____.

(Given data : Molar mass and the molal freezing point depression constant of benzene are 78 g $mol^{-1}$ and 5.12 K kg $mol^{-1}$, respectively) **[*JEE Advanced-2019*]**

7. Liquids **A** and **B** form ideal solution for all compositions of **A** and **B** at 25°C. Two such solutions with 0.25 and 0.50 mole fractions of **A** have the total vapor pressures of 0.3 and 0.4 bar, respectively. What is the vapor pressure of pure liquid **B** in bar?

**[*JEE(Advanced)-2020*]**

# ANSWER KEY

## Topicwise Questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*c*) | **2.** (*c*) | **3.** (*a*) | **4.** (*b*) | **5.** (*a*) | **6.** (*a*) | **7.** (*c*) | **8.** (*a*) | **9.** (*a*) | **10.** (*c*) |
| **11.** (*b*) | **12.** (*d*) | **13.** (*b*) | **14.** (*c*) | **15.** (*b*) | **16.** (*d*) | **17.** (*d*) | **18.** (*b*) | **19.** (*a*) | **20.** (*a*) |
| **21.** (*c*) | **22.** (*d*) | **23.** (*d*) | **24.** (*c*) | **25.** (*d*) | **26.** (*c*) | **27.** (*b*) | **28.** (*c*) | **29.** (*c*) | **30.** (*a*) |
| **31.** (*d*) | **32.** (*b*) | **33.** (*b*) | **34.** (*b*) | **35.** (*a*) | **36.** (*a*) | **37.** (*a*) | **38.** (*a*) | **39.** (*d*) | **40.** (*b*) |
| **41.** (*d*) | **42.** (*b*) | **43.** (*c*) | **44.** (*d*) | **45.** (*a*) | **46.** (*c*) | **47.** (*d*) | **48.** (*c*) | **49.** (*d*) | **50.** (*b*) |
| **51.** (*b*) | **52.** (*a*) | **53.** (*c*) | **54.** (*c*) | **55.** (*c*) | **56.** (*b*) | **57.** (*d*) | **58.** (*a*) | **59.** (*d*) | **60.** (*c*) |
| **61.** (*b*) | **62.** (*b*) | **63.** (*d*) | **64.** (*c*) | **65.** (*a*) | **66.** (*d*) | **67.** (*b*) | **68.** (*c*) | **69.** (*a*) | **70.** (*a*) |
| **71.** (*c*) | **72.** (*a*) | **73.** (*a*) | **74.** (*a*) | **75.** (*c*) | **76.** (*d*) | **77.** (*d*) | **78.** (*c*) | **79.** (*d*) | **80.** (*a*) |
| **81.** (*a*) | **82.** (*b*) | **83.** (*c*) | **84.** (*a*) | **85.** (*c*) | **86.** (*b*) | **87.** (*c*) | **88.** (*c*) | **89.** (*d*) | **90.** (*b*) |
| **91.** (*c*) | **92.** (*d*) | **93.** (*c*) | **94.** (*b*) | **95.** (*b*) | **96.** (*c*) | **97.** (*b*) | **98.** (*d*) | **99.** (*b*) | **100.** (*c*) |
| **101.** (*b*) | **102.** (*c*) | **103.** (*a*) | **104.** (*c*) | **105.** (*a*) | **106.** (*b*) | **107.** (*a*) | **108.** (*c*) | **109.** (*a*) | **110.** (*d*) |
| **111.** (*d*) | **112.** (*a*) | **113.** (*b*) | **114.** (*d*) | **115.** (*c*) | **116.** (*a*) | **117.** (*a*) | **118.** (*a*) | **119.** (*a*) | **120.** (*c*) |

## Topicwise Questions 2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*d*) | **2.** (*c*) | **3.** (*d*) | **4.** (*b*) | **5.** (*d*) | **6.** (*b*) | **7.** (*a*) | **8.** (*c*) | **9.** (*c*) | **10.** (*a*) |
| **11.** (*c*) | **12.** (*a*) | **13.** (*c*) | **14.** (*b*) | **15.** (*d*) | **16.** (*d*) | **17.** (*c*) | **18.** (*d*) | **19.** (*a*) | **20.** (*c*) |
| **21.** (*a*) | **22.** (*c*) | **23.** (*c*) | **24.** (*b*) | **25.** (*b*) | **26.** (*a*) | **27.** (*a*) | **28.** (*b*) | **29.** (*b*) | **30.** (*b*) |
| **31.** (*b*) | **32.** (*b*) | **33.** (*a*) | **34.** (*d*) | **35.** (*b*) | **36.** (*a*) | **37.** (*b*) | **38.** (*b*) | **39.** (*a*) | **40.** (*b*) |
| **41.** (*a*) | **42.** (*b*) | **43.** (*c*) | **44.** (*c*) | **45.** (*c*) | **46.** (*c*) | **47.** (*a*) | **48.** (*d*) | **49.** (*a*) | **50.** (*c*) |
| **51.** (*b*) | **52.** (*a*) | **53.** (*c*) | **54.** (*c*) | **55.** (*c*) | **56.** (*a*) | **57.** (*a*) | **58.** (*d*) | **59.** (*b*) | |

## Learning Plus

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*c*) | **2.** (*b*) | **3.** (*c*) | **4.** (*c*) | **5.** (*b*) | **6.** (*b*) | **7.** (*c*) | **8.** (*d*) | **9.** (*b*) | **10.** (*b*) |
| **11.** (*c*) | **12.** (*a*) | **13.** (*d*) | **14.** (*c*) | **15.** (*a*) | **16.** (*c*) | **17.** (*b*) | **18.** (*a*) | **19.** (*d*) | **20.** (*a*) |
| **21.** (*b*) | **22.** (*d*) | **23.** (*a*) | **24.** (*b*) | **25.** (*d*) | **26.** (*c*) | **27.** (*d*) | **28.** (*b*) | **29.** (*b*) | **30.** (*b*) |
| **31.** (*b*) | **32.** (*d*) | **33.** (*c*) | **34.** (*c*) | **35.** (*a*) | **36.** (*b*) | **37.** (*a*) | **38.** (*d*) | **39.** (*c*) | **40.** (*a*) |
| **41.** (*a*) | **42.** (*a*) | **43.** (*a*) | **44.** (*b*) | **45.** (*d*) | **46.** (*a*) | **47.** (*c*) | **48.** (*d*) | **49.** (*c*) | **50.** (*d*) |
| **51.** (*d*) | | | | | | | | | |

## Learning Plus 2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*a*) | **2.** (*d*) | **3.** (*c*) | **4.** (*b*) | **5.** (*c*) | **6.** (*b*) | **7.** (*a*) | **8.** (*b*) | **9.** (*b*) | **10.** (*a*) |
| **11.** (*c*) | **12.** (*d*) | **13.** (*a*) | **14.** (*a*) | **15.** (*b*) | **16.** (*b*) | **17.** (*a*) | **18.** (*b*) | **19.** (*b*) | **20.** (*b*) |
| **21.** (*b*) | **22.** (*a*) | **23.** (*b*) | **24.** (*d*) | **25.** (*a*) | **26.** (*c*) | **27.** (*a*),(*b*) | **28.** (*c*),(*d*) | **29.** (*a*),(*b*) | **30.** (*a*),(*c*) |
| **31.** (*c*) | **32.** (*c*) | **33.** (*d*) | **34.** (*b*) | **35.** (*d*) | **36.** (*b*) | **37.** (*c*) | **38.** (*d*) | **39.** (*b*) | **40.** (*b*) |

## Multiconcept MCQs

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*a*) | **2.** (*a*) | **3.** (*a*) | **4.** (*b*) | **5.** (*b*) | **6.** (*c*) | **7.** (*c*) | **8.** (*b*) | **9.** (*b*) | **10.** (*a*) |
| **11.** (*b*) | **12.** (*d*) | **13.** (*c*) | **14.** (*a*) | **15.** (*c*) | **16.** (*a*) | **17.** (*a*) | **18.** (*b*) | **19.** (*a*) | **20.** (*c*) |
| **21.** (*c*) | **22.** (*b*) | **23.** (*b*),(*d*) | **24.** (*a*) | **25.** (*a*, *b*) | **26.** (*d*) | | | | |

## Advanced Level Multiconcept Questions

### MCQ/COMPREHENSION/STATEMENT/MATCHING

**1.** (*a*,*c*,*d*) **2.** (*a*,*b*,*c*) **3.** (*a*,*c*) **4.** (*a*,*c*,*d*) **5.** (*a*,*b*,*c*) **6.** (*a*,*b*,*c*) **7.** (*b*,*d*) **8.** (*b*,*d*) **9.** (*a*,*b*,*c*) **10.** (*a*,*b*)

**11.** (*a*,*c*) **12.** (*b*) **13.** (*c*) **14.** (*a*) **15.** (*b*) **16.** (*a*) **17.** (*b*) **18.** (*a*)-q,s, (*b*)-q,s, (*c*)-q,s (*d*)-q,s

**19.** (*a*)-Q, (*b*)-P, (*c*)-R **20.** (*a*)-p,s,r, (*b*)-p,q,t, (*c*)-p, (*d*)-p,q,t **21.** ($V_{final} = 5.V_{original}$) **22.** 2048 g/mol

**23.** 64.0 g/mol **24.** (0.1) **25.** (3) **26.** (3)

## NEET Past Years Questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*d*) | **2.** (*b*) | **3.** (*d*) | **4.** (*b*) | **5.** (*d*) | **6.** (*b*) | **7.** (*c*) | **8.** (*a*) | **9.** (*a*) | **10.** (*c*) |
| **11.** (*c*) | **12.** (*b*) | **13.** (*b*) | **14.** (*b*) | **15.** (*c*) | **16.** (*a*) | **17.** (*c*) | **18.** (*a*) | **19.** (*d*) | **20.** (*b*) |
| **21.** (*c*) | **22.** (*d*) | **23.** (*a*) | **24.** (*c*) | | | | | | |

## JEE Mains & Advanced Past Years Questions

### JEE-MAIN PREVIOUS YEAR'S

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** (*c*) | **2.** (*d*) | **3.** (*b*) | **4.** (*a*) | **5.** (*d*) | **6.** (*a*) | **7.** (*b*) | **8.** (*b*) | **9.** (*d*) | **10.** (*a*) |
| **11.** (*c*) | **12.** (*c*) | **13.** (*a*) | **14.** (*b*) | **15.** (*c*) | **16.** (*c*) | **17.** (*c*) | **18.** (*d*) | **19.** (*c*) | |
| **20.** 4.95 to 4.97 | | **21.** (*b*) | **22.** 14.00 to 14.00 | | **23.** 1.74 to 1.76 | | **24.** 10.00 to 10.00 | | |
| **25.** 0.217 to 2.23 | | **26.** (*a*) | **27.** (*d*) | **28.** (177) | **29.** (*b*) | **30.** (167.00) | **31.** (600) | **32.** (48.00) | **33.** (*c*) |
| **34.** (5.00) | **35.** [1] | **36.** [9] | | | | | | | |

### JEE-ADVANCED PREVIOUS YEAR'S

**1.** (*a*,*b*) **2.** (*a*) **3.** (*b*,*d*) **4.** (19) **5.** (0.05) **6.** (1.02 or 1.03) **7.** (0.20)

# BOARD Past Year Questions

## Short Answer Type Questions-I (2 Marks each)

**Q. 1**. State Henry's law. Calculate the solubility of CO2 in water at 298K under 760 mm Hg. (KH for CO2 in water at 298 K is 1.25 × 106 mm Hg) **[CBSE Outside Delhi Set-1, 2020]**

**Q. 2**. State Henry's law and write its two applications. **[CBSE Delhi Set-3 2019]**

**Q. 3**. Calculate the molality of ethanol solution in which the mole fraction of water is 0.88.

**Q. 4**. Calculate the molarity of NaOH solution obtained by dissolving 2g of NaOH in 50 ml of its solution.

**Q. 5**. State Raoult's law for a solution containing volatile components. What is the similarity between Raoult's law and Henry's law? **[CBSE, Delhi Set 1 & 2, 2020]**

**Q. 6**. State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obey Raoult's law at all concentrations. **[CBSE, Delhi Set-1, 2019]**

**Q. 7**. Write two differences between ideal solutions and non-ideal solutions. **[CBSE, Delhi Set 2, 2019]**

**Q. 8**. Give reasons:
(a) A decrease in temperature is observed on mixing ethanol and acetone.
(b) Potassium chloride solution freezes at a lower temperature than water. **[CBSE, Outside Delhi, 2019]**

**Q. 9**. Give reasons:
(a) An increase in temperature is observed on mixing chloroform and acetone.
(b) Aquatic animals are more comfortable in cold water than in warm water. **[CBSE, Outside Delhi Set 3, 2019]**

**Q. 10**. Define the following terms:
(i) Ideal solution (ii) Molarity (M) **[CBSE, Delhi Set 2, 2017]**

**Q. 11**. What is meant by positive deviations from Raoult's law? Give an example. What is the sign of $\Delta_{mix}H$ for positive deviation?

OR

Define azeotropes. What type of azeotrope is formed by positive deviation from Raoult's law? Give an example. **[CBSE Delhi 2015]**

**Q. 12**. The experimentally determined molar mass for what type of substances is always lower than the true value when water is used as solvent. Explain. Give one example of such a substance which does not show a large variation from the true value.

**Q. 13**. Why a mixture of carbon disulphide and acetone shows positive deviation from Raoult's law? What type of azeotrope is formed by this mixture?

**Q. 14**. State Raoult's law for a solution containing volatile components. What is the similarity between Raoult's law and Henry's law?

**Q. 15**. A glucose solution which boils at 101.04°C at 1 atm. What will be relative lowering of vapour pressure of an aqueous solution of urea which is equimolal to given glucose solution? (Given: $K_b$ for water is 0.52 K kg $mol^{-1}$ )

**Q. 16**. Give reasons:
(a) Cooking is faster in pressure cooker than in cooking pan.
(b) Red Blood Cells (RBC) shrink when placed in saline water but swell in distilled water. **[CBSE OD Set-1 2019]**

**Q. 17**. Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g $mol^{-1}$ ) in 250 g of water. ($K_f$ of water = 1.86 K kg $mol^{-1}$ ) **[CBSE D/OD, 2018]**

**Q. 18**. Define the following terms:
(i) Colligative properties (ii) Molality (m) **[CBSE D/OD, 2017]**

**Q. 19**. Define the following terms:
(i) Abnormal molar mass (ii) Van't Hoff factor (i) **[CBSE Delhi set 3, 2017]**

**Q. 20**. Explain why on addition of 1 mol glucose to 1 litre water the boiling point of water increases.

**Q. 21**. A 1.00 molar aqueous solution of trichloroacetic acid ($CCl_3COOH$) is heated to its boiling point. The solution has the boiling point of 100.18°C. Determine the van't Hoff factor for trichloroacetic acid. ($K_b$ for water = 0.512 K kg $mol^{-1}$).

**Q. 22**. 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.

**Q. 23**. Which of the following solutions has higher freezing point? 0.05 M $Al_2(SO_4)_3$ , 0.1 M $K_3[Fe(CN)_6]$ Justify.

**Q. 24**. 18 g of glucose, $C_6H_{12}O_6$ (Molar Mass = 180 g $mol^{-1}$) is dissolved in 1 kg of water in a saucepan. At what temperature will this solution boil? ($K_b$ for water = 0.52 K kg $mol^{-1}$, boiling point of pure water = 373.15 K)

**Q. 25**. What are colligative properties? Write the colligative property which is used to find the molecular mass of macromolecules.

**Q. 26**. Define the following terms:
(a) Ideal solution
(b) Osmotic pressure.

**Q. 27**. Calculate the boiling point elevation for a solution prepared by adding 10 g $CaCl_2$ to 200 g of water, assuming that $CaCl_2$ is completely dissociated. ($K_b$ for water = 0.512 K kg $mol^{-1}$ ; Molar mass of $CaCl_2$ = 111 g $mol^{-1}$ )

## Short Answer Type Questions-II **(3 marks each)**

**Q. 1**. (i) What is the relationship between Molarity and Normality?
(ii) One litre of Water at N.T.P. dissolves 0.08 g of nitrogen. Calculate the amount of nitrogen that can be dissolved in four litres of water at 0° C and at a pressure of 1520 mm.

**Q.2**. Calculate the concentration of a solution that is obtained by mixing 300 g of 25% solution $NH_4NO_3$ with 150 g of 40% solution of $NH_4NO_3$.

**Q. 3**. (a) Define mole fraction
(b) 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.

**Q. 4**. (a) Define vapour pressure of the liquid.

(b) (i) Gas (A) is more soluble in water than Gas (B) at the same temperature. Which one of the two gases will have the higher value of $K_H$ (Henry's constant) and why ?

(ii) In non-ideal solution, what type of deviation shows the formation of maximum boiling azeotropes ?

**Q. 5.** The vapour pressure of pure liquids A and B at 400 K are 450 and 700 mm Hg respectively. Find out the composition of liquid mixture if total pressure at this temperature is 600 mm Hg. **[CBSE Comptt. Delhi 2017]**

**Q. 6**. In aqueous solution containing 20% by weight of liquid 'A' (Mol.wt = 140) has vapour pressure of 160 mm at 57˚ C. Find the vapour pressure of pure A, if that of water is 150 mm at this temperature.

**Q. 7**. A 0.01 m aqueous solution of $AlCl_3$ freezes at – 0.068˚ C. Calculate the percentage of dissociation.
[Given: $K_f$ for Water = 1.68 K kg $mol^{-1}$] **[CBSE Delhi Set 1 & 2, 2020]**

**Q. 8**. The freezing point of a solution containing 5g of benzoic acid (M = 122 g $mol^{-1}$) in 35g of benzene is depressed by 2.94 K. What is the percentage association of benzoic acid if it forms a dimer in solution? ($K_f$ for benzene = 4.9 K kg $mol^{-1}$) **[CBSE Outside Delhi Set 1, 2020]**

**Q. 9**. A 4% solution w/W of sucrose (M = 342g $mol^{-1}$) in water has a freezing point of 271.15K. Calculate the freezing point of 5% glucose (M = 180 g $mol^{-1}$) in water. (Given: Freezing point of pure water = 273.15 K)
**[CBSE Delhi Set 1, 2019]**

**Q. 10.** A solution containing 1.9 g per 100 mL of KCI (M = 74.5 g $mol^{-1}$) is isotonic with a solution containing 3 g per 100 mL of urea (M = 60 g $mol^{-1}$). Calculate the degree of dissociation of KCI solution. Assume that both the solutions have same temperature. **[CBSE OD Set 2, 2019]**

**Q. 11**. Give reasons for the following:
(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.
(b) Aquatic animals are more comfortable in cold water than in warm water.
(c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.
**[CBSE Delhi/OD 2018]**

**Q. 12.** A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K. Given: (Molar mass of sucrose = 342 g $mol^{-1}$ ) (Molar mass of glucose = 180 g $mol^{-1}$ ) **[CBSE Delhi/OD2017]**

**Q. 13**. Calculate the boiling point of solution when 4 g of $MgSO_4$ (M = 120 g $mol^{-1}$) was dissolved in 100 g of water, assuming $MgSO_4$ undergoes complete ionization. ($K_b$ for water = 0.52 K kg $mol^{-1}$)

**Q. 14.** A solution of glucose (molar mass = 180 g $mol^{-1}$) in water has a boiling point of 100.20°C. Calculate the freezing point of the same solution. Molal constants for water $K_f$ and $K_b$ are 1.86 K kg $mol^{-1}$ and 0.512 K kg $mol^{-1}$ respectively. **[CBSE Foreign Set-1, 2, 3 2017]**

**Q. 15**. Calculate the boiling point of solution when 2 g of $Na_2SO_4$ (M = 142 g $mol^{-1}$) was dissolved in 50 g of water, assuming $Na_2SO_4$ undergoes complete ionization. **[CBSE OD Set-2 2017]**

**Q. 16**. 45 g of ethylene glycol ($C_2H4O_2$) is mixed with 600 g of water. Calculate

(i) the freezing point depression and

(ii) the freezing point of the solution

(Given : $K_f$ of water = 1.86 K kg $mol^{-1}$) **[CBSE Comptt. Delhi 2015]**

**Q. 17**. A solution is prepared by dissolving 10 g of non-volatile solute in 200 g of water. It has a vapour pressure of 31.84 mm Hg at 308 K. Calculate the molar mass of the solute. (Vapour pressure of pure water at 308 K = 32 mm Hg) **[CBSE OD 2015]**

**Q. 18.** 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of 1.62 K. Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated). (Given: Molar mass of benzoic acid= 122 g $mol^{-1}$, $K_f$ for benzene = 4.9 K kg $mol^{-1}$) **[CBSE Delhi, 2015]**

# Long Answer Type Questions **(5 marks each)**

Q. 1. (i) 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 $CH_3CN$.
(ii) Commercially available concentrated hydrochloric acid contains 38% HCl by mass and has density 1.19g $cm^{-3}$. What is the molarity of this solution?

Q. 2. Concentration terms such as mass percentage, ppm, mole fraction and molality are independent of temperature, however molarity is a function of temperature. Explain.

Q.3. 4.0 g of NaOH are contained in one decilitre of solution. Calculate the following:
(i) Molality fraction of NaOH
(ii) Molarity of NaOH
(iii) Molality of NaOH
Density of solution = 1.038 g/$cm^3$

Q. 1. (a) 30 g of urea (M = 60 g $mol^{-1}$) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.
(b) Write two differences between ideal solutions and non-ideal solutions. **[CBSE OD Set-1, 2 & 3, 2017]**

Q. 1. (i) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K. Given: (Molar mass of sucrose = 342 g $mol^{-1}$ ) (Molar mass of glucose = 180 g $mol^{-1}$ ) **[CBSE Delhi Set-1, 2, 3 2017]**
(ii) Define the term: Molality (m) **[CBSE OD Set-1, 2, 3 2017]**

Q. 2. (a) Calculate the freezing point of solution when 1.9 g of MgCl2 (M = 95 g $mol^{-1}$) was dissolved in 50 g of water, assuming MgCl2 undergoes complete ionization. ($K_f$ for water = 1.86 K kg $mol^{-1}$)
(b) (i) Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why?
(ii) What happens when the external pressure applied becomes more than the osmotic pressure of solution?

Q. 3. (a) When 2.56 g of sulphur was dissolved in 100 g of $CS_2$, the freezing point lowered by 0.383 K. Calculate the formula of sulphur ($S_X$). ($K_f$ for $CS_2$ = 3.83 K kg $mol^{-1}$, Atomic mass of Sulphur = 32 g $mol^{-1}$).
(b) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing :
(i) 1.2% sodium chloride solution?
(ii) 0.4% sodium chloride solution?