Solution

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1. Number of components in a binary solution is?
    1. 2
    2. 4
    3. 3
    4. 1
2. Which among the following does not have any unit?
    1. Molality
    2. Molarity
    3. Mole Fraction
    4. None of the above
3. Vapour pressure of dilute aqueous solution of glucose is 730 mm of mercury at 373 K. The mole fraction of solute is?
    1. 1/10
    2. 3/76
    3. 1/76
    4. 3/28
4. With increase in pressure,
    1. Solubility of solids decreases
    2. Solubility of solids is not affected
    3. Solubility of gases increases
    4. Solubility of gases decreases
5. Which of the following substances dissolves in water?
    1. C_6H_6
    2. C_4H_{10}
    3. CH_4
    4. $C_6H_{12}O_6$
6. Which of the following is a method of expressing the concentration of a solution?
    1. Osmotic Pressure
    2. Lowering in freezing point
    3. Increase in boiling point
    4. Parts per million
7. A 0.0020 molal aqueous solution of an ionic compound CO(NH3)5(NO2)Cl freezes at -0.00732°C. Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be (k_f = -1.86°C molal^{-1})
    1. 1
    2. 2
    3. 3

4. 4

8. Which of the following shows negative deviation from Raoult's law?
    1. Water + Nitric Acid
    2. Benzene + Methanol
    3. Acetone + Benzene
    4. Methyl alcohol + Water
9. 30 mL of liquid R and 20 mL of liquid S are mixed to form a solution of 50 mL. Then the solution is _____?
    1. Non-ideal with positive deviation
    2. Non-ideal with negative deviation
    3. Ideal Solution (.)
    4. Cannot be predicted
10. PCl_5 (g) ⇌ PCl_3 (g) + Cl_2 (g). In the reaction, at equilibrium condition mole fraction of PCl_5 is 0.2 and mole fraction of Cl_2 is 0.4. What is the mole fraction of PCl_3?
    1. 0.5
    2. 0.6
    3. 0.4
    4. 0.3
11. In case an electrolyte dissociates in the solution, the van't hoff factor i is?
    1. >1
    2. <1
    3. 1
    4. >1 or <1
12. Dissolving 120 g of urea (molecular weight 60 g mol^{-1}) in 1000 g of water gave a solution of density 1.15 g mL^{-1}. The molarity of the solution is
    1. 1.78 M
    2. 2.00 M
    3. 2.05 M
    4. 2.22 M
13. Which has the highest freezing point at 1 atm?
    1. 0.1 molal NaCl solution
    2. 0.1 molal $BaCl_2$ solution
    3. 0.1 molal sugar solution
    4. 0.1 molal $FeCl_3$ solution
14. Which of the following conditions is not satisfied by an ideal solution?
    1. $\Delta H_{mix} = 0$
    2. $\Delta S_{mix} = 0$
    3. $\Delta V_{mix} = 0$
    4. Raoult's law is obeyed
15. A substance trimerizes when dissolved in a solvent. What is the Van't Hoff factor (assume 100% association)?

1. 1
2. 2
3. 3
4. 1/3

16. An azeotrope solution of two liquids has boiling point lower than that of either of them if it
    1. Shows a negative deviation from Raoult's law
    2. Shows a positive deviation from Raoutl's law
    3. Shows no deviation from Raoult's law
    4. Is saturated
17. Molarity of 900 g of water is?
    1. 50 M
    2. 55.5 M
    3. 5 M
    4. 5.55 M
18. Increase in the temperature of an aqueous solution will cause
    1. Decrease in molality
    2. Decrease in molarity
    3. Decrease in mole fraction
    4. Decrease in %w/w
19. Water boils at 96°C at a certain place. What is the amount of NaCl to be added to 1 L of water so that it boils at 100°C (K_b for water is 0.52°C $molal^{-1}$
    1. 450 g
    2. 125 g
    3. 225 g
    4. 250 g
20. An aqueous solution of methanol in water has vapour pressure
    1. Equal to that of water
    2. Equal to that of methanol
    3. More than that of water
    4. Less than that of water
21. If an aqueous solution of glucose is allowed to freeze, then crystals of which will separate out first?
    1. Water
    2. Glucose
    3. Both 1 and 2
    4. None of these
22. Henry's law constant for the solubility of N_2 gas in water at 298 K is 1.0 x 10^5 atm. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 mol of water at 298 K and 5 atm is
    1. 4.0×10^{-4}
    2. 4.0×10^{-5}

3. 5.0×10^{-4}
4. 4.0×10^{-6}

23. At 80°C, the vapour pressure of pure liquid A is 520 mm Hg and that of pure liquid B is 1000 mm Hg. If a mixture of solutions A and B boils at 80°C and 1 atm pressure, the amount of A in the mixture is (1 atm = 760 mm Hg)
    1. 52 mol%
    2. 34 mol%
    3. 48 mol%
    4. 50 mol%
24. A solution showing a large positive deviation from ideal behavior has
    1. Higher boiling point that both the components
    2. ΔH_{mix} is positive
    3. ΔH_{mix} is negative
    4. None of the above
25. Which of the following colligative properties can help to determine the molar mass of a protein with the greatest precision?
    1. Osmotic pressure
    2. Depression in freezing point
    3. Elevation in boiling point
    4. Relative lowering of vapour pressure
26. At a temperature, total vapour pressure in Torr of a mixture of volatile components A and B is given by $p = 120 - 75\ x_B$ hence vapour pressure of pure A and B, respectively (in Torr) are
    1. 120 and 75
    2. 120 and 195
    3. 75 and 45
    4. 120 and 45
27. The osmotic pressure of a decinormal solution of $BaCl_2$ at 27°C showing 80% degree of ionisation is
    1. 3.20 atm
    2. 4.20 atm
    3. 5.20 atm
    4. 6.40 atm
28. Which of the following statements is incorrect?
    1. Gibbs energy change of dissolution of a gas may be +ve or -ve
    2. Mole fraction of gas in the solution is directly proportional to the partial pressure of the gas above the solution
    3. Volume of gas dissolved measured at the pressure used is independent of the pressure of gas
    4. Solubility of gas is always an exothermic process

29. The values of observed and calculated molecular masses of calcium nitrate are , respectively, 65.6 g mol^{-1} and 164 g mol^{-1}. The degree of dissociation of calcium nitrate will be
    1. 25%
    2. 50%
    3. 75%
    4. 60%
30. Equal volumes of ethylene glycol (molar mass = 62 g mol^{-1}) and water (molar mass = 18 g mol^{-1}) are mixed. The depression in freezing point of water is (given kf of water = 1.86 K $molal^{-1}$ and specific gravity of ethylene glycol is 1.11)
    1. 0.0033 K
    2. 0.333 K
    3. 3.33 K
    4. 33.3 K
31. Vapour pressure of a dilute aqueous solution of glucose is 750 mm Hg at 373 K. The mole fraction of the solute is
    1. 1/10
    2. 1/(7.6)
    3. 1/35
    4. 1/76
32. Solutions which distill without change in composition liquid and vapour phase are called
33. Amorphous
34. Azeotropic mixture
35. Supersaturated
36. Ideal
37. Depression in freezing point of 0.01 molal aqueous acetic acid acid solution is found to be 0.02046°C. One molal urea solution freezes at -1.86°C. Assuming molarity equal to molality, pH of the acidic solution is
    1. 2
    2. 3
    3. 3.2
    4. 4.2
38. A 5% solution of cane sugar (molar mass = 342 g mol-1) is isotonic with a 1% solution of a substance X. The molecular weight of X is
    1. 34.2
    2. 171.2
    3. 68.4
    4. 136.8
39. The molal lowering of vapour pressure for water at 100°C will be
    1. 13.43 mm Hg

2. 1.343 mm Hg
3. 23.43 mm Hg
4. 234.3 mm Hg

40. Which will form maximum boiling azeotrope?
    1. $HNO_3 + H_2O$
    2. $C_2H_5OH + H_2O$
    3. $C_6H_6 + C_6H_5CH_3$
    4. None of the above
41. Which of the following statements is not correct for an ideal binary liquid solution AB (X_A = mole fraction of A in vapour phase; X_B = mole fraction of B in vapour phase)
    1. A plot between p_{total} and X_B is linear
    2. A plot between p_{total} and X_A is linear
    3. A plot between $1/p_{total}$ and X_A is linear
    4. A plot between p_{total} and $1/X_A$ is linear
42. If two substances A and B have $p°_A : p°_B = 1 : 2$ and have mole fraction in solution 1 : 2 and have mole fraction of A in vapours is
    1. 0.33
    2. 0.25
    3. 0.52
    4. 0.20
43. Van't Hoff factors x, y and z for association, dissociation and no change of solute in the solution, respectively, are in the order
    1. $x < y < z$
    2. $x > z > y$
    3. $x < z < y$
    4. $x > y > z$
44. There is 100 mL of 0.1 M KCl solution. To make it 0.2 M, we have to
    1. Evaporate 50 mL of the solution
    2. Add 0.01 mol of KCl
    3. Use both 1 and 2
    4. Use neither 1 nor 2
45. A substance is deliquescent if its vapour pressure
    1. Is less than that of water vapour in the air
    2. Is more than that of water vapour in the air
    3. Is equal to that of water vapour in the air
    4. Is equal to atmospheric pressure
46. A pressure cooker reduces cooking time because
    1. The heat is more evenly distributed
    2. The higher pressure tenderizes the food
    3. The boiling point of water inside the cooker is elevated
    4. The boiling point of water inside the cooker is depressed

47. The mass of glucose that should be dissolved in 50g of water in order to produce the same lowering of vapour pressure as produced by dissolving 1 g of urea in the same quantity of water is
    1. 1 g
    2. 3 g
    3. 6 g
    4. 8 g
48. Molarity of liquid HCl, if density of the solution is 1.17 g cm^{-3}, is
    1. 36.5
    2. 18.25
    3. 42.10
    4. 32.05
49. Van't Hoff factor for 0.1 M ideal solution is
    1. 1
    2. 0.1
    3. -0.01
    4. None of the above
50. Which of the following remains independent of temperature?
    1. Molality
    2. Molarity
    3. Formality
    4. Normality
51. The depression in freezing point for 1 M urea, 1 M glucose and 1 M NaCl are in the ratio
    1. 1 : 2 : 3
    2. 3 : 2 : 2
    3. 1 : 1 : 2
    4. None of the above
52. A liquid is in equilibrium with its vapour at its boiling point. On an average, the molecules in the two phases have equal
    1. Intermolecular force
    2. Potential energy
    3. Total energy
    4. Kinetic energy
53. When mercuric iodide is added to the aqueous solution of potassium iodide, the
    1. Freezing point rises
    2. Freezing point decreases
    3. Freezing point remains the same
    4. Boiling point doesn't change
54. Which of the following are homogeneous in nature? a) Ice b) Wood c) Soil d) Air

1. a and b
2. b and d
3. a and d
4. c and d

Answer

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1 . (1)

A binary solution is made by mixing two different species.

2. (3)

Mole fraction is the ratio of the number of moles of a particular component to the total number of moles of the solution. Therefore, it is unitless.

3. (2)

Vapour pressure of water = 760 mm

Vapour pressure of urea = 730 mm

We know,

$(P°-P)/P°$ = Mole fraction = $(760-730)/760 = 3/76$

4. (3)

According to Henry's law, solubility of gas is directly proportional to the pressure of the gas present above the solution's surface.

5. (4)

Glucose ($C_6H_{12}O_6$) dissolves in water as both are polar in nature (like dissolves like).

6. (4)

Parts per million is a method of expressing the concentration of a solution

7. (2)

$\Delta T_f = i \times k_f \times m$

0.00732 = i x 1.86 x 0.002

i = 1.967 ≅ 2

8. (1)

Water + Nitric Acid shows negative deviation from Raoult's law

9. (3)

30 mL + 20 mL = 50 mL

Final solution's volume is also 50 mL.

As the change in volume is zero, therefore it forms an ideal solution.

10. (3)

Mole fraction's sum is always equal to 1.

Mole fraction of PCl_5 + Mole fraction of Cl_2 + Mole fraction of PCl_3 = 1

0.4 + 0.2 + Mole fraction of PCl_3 = 1

Mole fraction of PCl_3 = 1 – 0.6 = 0.4

11. (1)

$$i = \frac{No.\ of\ molecules\ after\ association/dissociation}{No.\ of\ molecules\ before\ association/dissociation}$$

After dissociation, the number of molecules increases. Therefore i > 1

12. (3)

Total mass of the solution = Mass of urea given + Mass of water given = 1000 + 120 = 1120 g

$$\text{Moles of urea} = \frac{\textit{Given mass of urea}}{\textit{Molecular mass of urea}} = \frac{120}{60} = 2$$

$$\text{Volume of the solution} = \frac{\textit{Mass of the solution}}{\textit{Density of the solution}} = \frac{1120}{1.15} = 973.91 \text{ g mL}^{-1}$$

$$\cong 974 \text{ g mL}^{-1}$$

$$\text{Molarity} = \frac{2}{0.974} = 2.05 \text{ M}$$

13. (3)

As lowering of freezing point is a colligative property, the increase in number of particles will further lower the freezing point.

NaCl, $BaCl_2$ and $FeCl_3$ will dissociate into 2, 3 and 4 particles respectively (As they are strong electrolytes and have 100% dissociation). Glucose will not dissociate into anything.

Therefore, as the number of dissociated particles is the lowest in the glucose solution, it will have the highest freezing point and the FeCl3 solution will have the lowest freezing point.

14. (2)

An ideal solution obeys Raoult's law and has $\Delta H_{mix} = 0$ and $\Delta V_{mix} = 0$.

15. (4)

Van't Hoff factor (i) = 1 – a + (a/n)

As there is 100% dissociation, a = 1

n = 3, i = 1/3

16. (2)

In case of positive deviation from Raoult's law, the observed vapour pressure is higher than the ideal vapour pressure and boiling point of azeotrope becomes lower than either of pure liquid.

17. (2)

Volume of 900 g of water = 900 mL

Moles of water = $\frac{Given\ mass\ of\ water}{Molar\ mass\ of\ water} = \frac{900}{18}$=50 mol

Molarity = $\frac{50}{900}$ x 1000 = 55.5 M

18. (2)

Increase in temperature increases the volume. As molarity is inversely proportional to the volume, so there will be a decrease in the molarity.

19. (3)

$\Delta T_b = i \times k_b \times m$

$\Delta T_b = 100 - 96 = 4$

NaCl has i = 2

$4 = 2 \times 0.52 \times \frac{1000\ x\ w}{58.5\ x\ 1000} \Rightarrow w = 225\ g$

20. (3)

The vapour pressure of aq. methanol solution is more than H_2O and less than methanol. This is due to the solute-solvent interaction more due to the formation of H-bonds than methanol but less in water.

21. (1)

Freezing point is the temperature at which the liquid and the solid form of the substance are in equilibrium and have the same vapour pressure. Due to lower vapour pressure of the solution, the solid form of the solution separates out at a lower temperature. When solid is the solute, it's the solvent that freezes. Therefore, the water will separate first.

22. (1)

According to Henry's law,

$p = K_H x_{N2} \Rightarrow 0.8 \times 5 = 1 \times 10^{-5}\ x_{N2} \Rightarrow x_{N2} = 4 \times 10^{-5}$ (in 10 mol of water)

$4 \times 10^{-5} = \frac{xN2}{xN2 + 10} \Rightarrow x_{N2} = 4 \times 10^{-4}$

23. (4)

$P_{total} = p°_A x_A + p°_B x_B \Rightarrow 760 = 520x_A + p°_B(1-x_A) \Rightarrow x_A = 0.5$

24. (3)

A solution showing a large positive deviation from ideal behavior has ΔH_{mix} negative.

25. (1)

Osmotic pressure is used for the determination of molar mass of proteins as they are not stable at high temperature and polymers have poor stability.

26. (4)

$P_{total} = 120 - 75x_B = p°_A x_A + p°_B x_B$

But, xA = 1 – xB

$P_{total} = 120 - 75x_B = p°_A(1-x_B) + p°_B x_B = p°_A - (p°_A - p°_B)x_B$

$p°_A = 120$, $p°_B = 120 - 45 = 75$

27. (4)

$i = 1 + \alpha(n-1)$

$\alpha = 0.8$, $n=3$, $i=2.6$

Decinormal solution $\Rightarrow$ C = 0.1M

$\pi = i \times C \times R \times T$

$\pi = 2.6 \times 0.1 \times 0.082 \times 300 = 6.4$ atm

28. (1)

Dissolution of a gas is an exothermic process. Gibbs free energy of an exothermic process is always negative.

29. (3)

$$i = \frac{observed\ molecular\ mass}{calculated\ molecular\ mass} = \frac{65.6}{164} = 2.5 \quad \alpha = \frac{i-1}{n-1} = \frac{2.5-1}{3-1} = \frac{1.5}{2} = 0.75 \Rightarrow 75\%$$

30. (4)

Mass = Density x Volume

Mass(ethylene glycol) = 1.11 x V

Mass(water) = 1.00 x V

$$\text{Moles(ethylene glycol)} = \frac{1.11\,x\,V}{62}$$

$\Delta T_f = i \times k_f \times m$

$$\Delta T_f = 1.86 \times \frac{1.11\,x\,V}{62} \times \frac{1000}{1.00\,x\,V} = \frac{1.86\,x\,1.11\,x\,1000}{62} = 33.3\ K$$

31. (4)

$$\frac{P^\circ - P}{P^\circ} = X_{solute}$$

$$\frac{760 - 750}{760} = \frac{10}{760} = \frac{1}{76}$$

32. (2)

Solutions which distil without change in composition of liquid and vapour phase are called azeotropic mixtures.

33. (2)

$\Delta T_f = i \times k_f \times m$

Molarity = molality

$K_f = 1.86$

0.0204 = 1.86 x i x 0.01

i = 1.1

$CH3COOH \rightarrow CH3COO^- + H^+$

C(1-α) Cα Cα

i = 1 +α

α = 0.1

[H+] = Cα = 0.01 x 0.1 = 0.001

pH = -log[H+] = 3

34. (3)

5% solution means 5g of solute is present in 100g of water

Density of water is 1g/cm3 so 100 g of water is equal to 100mL of water

Mass of solute = 5g

Volume of solution = 100 mL

Molar mass of solute = 342g

For substance X, molar mass = M

Given mass of solute

As mentioned in the question, solution of X and solution of cane sugar are isotonic with each other, i.e,

$$\pi 1 = \pi 2$$

$$\frac{5 \times 1000}{342 \times 100} = \frac{1 \times 1000}{M \times 100}$$

$$\frac{5}{342} = \frac{1}{M}$$

$$M = \frac{342}{5} = 68.4 \text{ g}$$

35. (1)

Lowering of vapour pressure = X_A

1 molal aqueous solution means 1 mole of solute in 1000 mL of water

Density of water = 1g/mL

1 mL of water = 1 g

1000 mL of water = 1000 g

No. of moles of water = $55.56X_A$ = nA/(nA + nB) = 0.01768 atm or 13.43 mm Hg

36. (1)

$HNO_3 + H_2O$ is a maximum boiling azeotrope and shows negative deviation from Roult's law.

37. (c)

Plot between $1/p_{total}$ and X_A is linear is a wrong statement

38. (4)

$p°_A/p°_B = 1/2$

$p°_{A=1}$, $p°_B = 2$

$n_A = 1$, $n_B = 2$

$P_A = x_A \times p°_A = (⅓) \times 1 = ⅓$

$P_A = x_A \times p°_A = (⅔) \times 2 = 4/3$

$P_A = x_A \times P_T$

$$⅓ = x_A \times \left(\frac{1}{3}+\frac{4}{3}\right)$$

$$x_A = \frac{1/3}{5/3} = ⅕ = 0.2$$

39. (3)

Van't Hoff factor is the greatest for dissociation and lowest for association

40. (1)

$M_1V_1 = M_2V_2$

$100 \times 0.1 = X \times 0.2$

$X = 50$ mL

We have to reduce the volume of the solution by 50 mL. Therefore, it can be done by evaporating the solution.

41. (1)

A process by which a substance absorbs moisture from the atmosphere till it gets dissolved in the absorbed water and forms a solution is called deliquescence. It occurs only when vapour pressure is less than that of water vapour in the air.

42. (3)

The boiling point of water inside the cooker gets elevated due to which the cooking time reduces.

43. (3)

$(\Delta p)_{glucose} = (\Delta p)_{urea}$

$(x_B)_{glucose} = (x_B)_{urea}$

$$(\frac{nB}{nA})glucose = (\frac{nB}{nA})urea$$

$$\frac{wB}{50} \times \frac{18}{180} = \frac{1 \times 18}{50 \times 60}$$

$$w_B = 6\ g$$

44. (4)

Density = 1.17 g cm-3 = 1170 g/L

Molar mass of HCl = 36.5

$$\text{Molarity of solution} = \frac{Density\ in\ g/L}{molar\ mass} = \frac{1170}{36.5} = 32.05M$$

45. (1)

Non-electrolytes form ideal solution having van't hoff factor equal to 1

46. (1)

Molality depends inversely on mass which remains unchanged with the change in temperature.

47. (3)

$i_{urea} = 1$

$i_{glucose} = 1$

$i_{NaCl} = 2$

Ratio = 1 : 1 : 2

48. (4)

As temperature will be the same at the boiling points, kinetic energies will be the same as it is directly proportional to the temperature

49. (1)

As HgI reacts with KI to form $K_2[HgI_4]$, the number of ions decreases which decreases the van't hoff factor. This also results in the decrease of freezing point as it is directly proportional to the van't hoff factor. Thus, the freezing point is raised.

50. (3)

Air and ice are homogeneous in nature as they have the same amount of their components throughout.

Assertion And Reasoning

Codes

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false, but R is true

1. **Assertion (A)** The concentration of pollutants in water or atmosphere is often expressed in terms of PPM.

Reason (R) Concentration in parts per million can be expressed as mass to mass volume to volume and mass to volume.

2. **Assertion (A)** 0.1 M solution of KCl has greater osmotic pressure than 0.1 M solution of glucose at same temperature.

Reason (A) In solution KCl dissociates to produce more number of particles.

3. **Assertion (A)** When a solution is separated from the pure solvent by a semipermeable membrane, the solvent molecules pass through the it from pure solvent side to the solution side.

Reason (R) Diffusion of solvent occurs from a region of high concentration solution to a region of low concentration solution.

4. **Assertion (A)** In solution, amalgam of Mercury with sodium is an example of solid solutions.

Reason (A) Mercury is solvent and sodium is solute in the solution.

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

Reason (R) The volume of a solution changes with changes in temperature.

6. **Assertion (A)** Pressure have any effect on solubility of solids in liquid.

Reason (A) Solids and liquids are not incompressible.

7. **Assertion (A)** Elevation in boiling point is a colligative property.

Reason (R) Elevation in boiling point is directly proportional to molarity.

8. **Assertion (A)** Azeotropic mixtures are not formed only by non-ideal solutions and they may have boiling points either greater than both the components or less than both the components.

Reason (R) The composition of the vapour phase is not same as that of liquid phase of azeotropic mixture.

9. **Assertion (A)** At equilibrium, vapor phase will not be always reach in component which is more volatile.

Reason (R) The composition of vapour phase in equilibrium with the solution is not determined by the partial pressure of the components.

10. **Assertion (A)** An ideal solution obeys Henry's law.

Reason (R) In an ideal solution, solute-solute as well as solvents-solvent interaction are similar to solute-solvent interaction.

Answer

1. (d)

When a solute is present in trace quantities, it is convenient to express concentration in PPM.

2. (a)

KCl can dissociate in water but glucose does not. Due to dissociation of ions, solution exhibit higher colligative property.

3. (c)

With the semipermeable membrane in place, and if one compartment contains the pure solvent, this can never happen; no matter how much liquid flows through the membrane, the solvent in the right side will always be more concentrated that that in the left side.

4. (c)

Amalgam of mercury with sodium is an example of liquid in solid type solid solution. Here, mercury (liquid metal) acts as solute and sodium as solvent.

5. (a)

Molarity is the number of moles of solute dissolved per litre of solution. Molarity changes as temperature changes as the volume of the solution changes.

6. (a)

Liquid and solids exhibit practically no change of solubility with changes in pressure. Gases as might be expected , increase in solubility with an increase in pressure.

7. (c)

Elevation in boiling point is directly proportional to molality.

8. (b)

Non-ideal solutions with positive deviation, boils at a lower temperature than the components, while those with negative deviation, boil at a higher temperature.

9. (d)

At equilibrium, the vapor phase will always be rich in volatile components. The higher liquids vapor pressure is at a given temperature the higher its volatility and the lower the liquid's typical boiling point. The partial pressure of components determines the composition of the vapor phase in equilibrium with the solution.

10. (d)

An ideal solution obeys Raoult's law.

Case Study Based

1. Read the passage given below and answer the following questions

The vapour pressure of a solvent decreases when a non volatile component is dissolved in the liquid phase. The depression of the vapour pressure of the solution (at constant temperature) results in rise of the the boiling point of the solution (at constant pressure).

The elevation in boiling point being a colligative property, depends on the concentration of the dissolved particles and on the nature of solvent. In dilute solution it is observed to be relatively independent of the nature of the solute

Codes

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and but R is not a correct explanation of A

(c) A is true but R is false

(d) A is false, but R is true

i) **Assertion (A)** At boiling point, vapour pressure of a liquid is equal to the atmospheric pressure

Reason (R) Vapour pressure of a liquid decreases with a liquid

ii) **Assertion (A)** Blood cells collapse when suspended in saline water, having more concentration compared to fluid inside the blood cell

Reason (R) Solvent molecules always flow from higher concentration to lower concentration

iii) **Assertion (A)** When NaCl is added to water a depression in freezing point is observed

Reason (R) The lowering of the vapor pressure of a solution causes depression in the freezing point compared to the pure solvent

iv) **Assertion (A)** Colligative property is used to determine the molecular mass of particles

Reason (R) Colligative properties depend upon number of solute particles in solution irrespective of the nature

v) **Assertion (A)** Colloidal solution show colligative properties

Reason (R) Colloidal particles are large in size

2. Read the passage given below and answer the following question

At 298K, the vapour pressure of pure benzene. C_6H_6 is 0.256 bar and the vapour pressure of pure toluene $C_6H_5CH_3$ is 0.095 bar. Two mixtures are prepared as follows:

(I) 7.8g of C_6H_6 + 9.2g of toluene

(II) 3.9g of C_6H_6 + 13.8g of toluene

The following questions are multiple choice questions. Choose the most appropriate answer

i) The total vapour pressure (bar) of solution 1 is

1. 0.128
2. 0.174
3. 0.198
4. 0.258

ii) Which of the given solutions have higher vapour pressure

1. I
2. II
3. Both have equal vapour pressure

4. Cannot be predicted

iii) Mole fraction of benzene is vapour phase in solution I is

1. 0.128
2. 0.174
3. 0.734
4. 0.266

iv) Which of the following statement is/are correct

(a) Mole fraction of toluene in vapour phase is more in solution (I)

(b) More fraction of toluene in vapour phase is less than in solution (I)

(c) More fraction of benzene in vapour phase is less in solution (I)

1. Only b
2. Only a
3. a and c
4. b and c

v) Solution (I) is an example of a/an

1. Ideal solution
2. Non ideal solution with positive deviation
3. Non ideal solution with negative deviation
4. Can't be predicted

Answer

1. (i) b (ii) c (iii) a (iv) b (v) (b)
2. (i) 2 (ii) 1 (iii) 3 (iv) 1 (v) 1