NEET Important Questions with Solutions from Solutions

Q.1. Sugar dissolved in water is a______ type of solution.

A) solid in solid

B) solid in gas

C) solid in liquid

D) gas in solid

Answer: solid in liquid

Solution: A solution is a homogeneous mixture of two components, the solute and the solvent. The physical state of the solution is always the physical state of the solvent.

Sugar is a solid solute and water is a liquid solvent. The solution of sugar in water is known as a solid in a liquid solution.

Q.2. An alloy is a homogeneous mixture of_____.

A) a metal and a non-metal

B) two or more metals

C) two or more metals with non-metals

D) all of these

Answer: all of these

Solution: Alloys are homogeneous mixtures of two or more metals. In few alloys, non-metals like carbon, phosphorous and silicone may be present.

For example, brass is an alloy of two metals, that is, copper and zinc.

Steel is an alloy of two metals and a non-metal, that is, iron, chromium and carbon.

Silicon steel is an alloy of a metal and a non-metal, that is, iron and silicone.

Q.3. The mole fraction of nitrogen, in a mixture of $7 \text{ g of } N_2 \text{ and } 16 \text{ g of } O_2$ is________.

A) 0.5

B) 0.75

C) 0.66

D) 0.33

Answer: 0.33

Solution: Moles of $N_2 = \frac{\text{mass of } N_2}{\text{molecular mass of } N_2}$

Moles of $N_2 = \frac{7}{28} = \frac{1}{4}$ mol

Moles of $O_2 = \frac{\text{mass of } O_2}{\text{molecular mass of } O_2}$

Moles of $O_2 = \frac{16}{32} = \frac{1}{2}$ mol

Total moles in the mixture $= \frac{1}{4} + \frac{1}{2} = \frac{3}{4}$ moles

Mole fraction of $N_2 = \frac{\text{moles of } N_2}{\text{total moles in mixture}}$

Mole fraction of $N_2 = \frac{1}{4} \times \frac{4}{3} = \frac{1}{3} = 0.33$

Q.4. The mole fractions of the two components of a solution have a sum of_______.

A) more than one

B) less than one

C) exactly one

D) hundred

Answer: exactly one

Solution: Let there be two components in a solution with the number of moles n_1 & n_2.

Now, the total moles in the mixture $= n_1 + n_2$

Mole fraction of the first component $x_1 = \frac{\text{moles of first component}}{\text{total moles in mixture}}$

$x_1 = \frac{n_1}{n_1+n_2}$

Mole fraction of the second component $x_2 = \frac{\text{moles of second component}}{\text{total moles in mixture}}$

$x_2 = \frac{n_2}{n_1+n_2}$

Now, sum of the mole fractions of both the components$x_1 + x_2 = \frac{n_1}{n_1+n_2} + \frac{n_2}{n_1+n_2} = \frac{n_1+n_2}{n_1+n_2} = 1$

Q.5. The mole fraction of a solvent in a solution is 0.8. The mole fraction of the solute will be_______.

A) 0.2

B) 0.4

C) 0.8

D) 0.6

Answer: 0.2

Solution: Let the moles of the solute and solvent be n_1 & n_2, respectively.

Now, total moles in the solution $= n_1 + n_2$

Mole fraction of the solute $x_1 = \frac{\text{moles of solute}}{\text{total moles in solution}}$

$x_1 = \frac{n_1}{n_1+n_2}$

Mole fraction of the solvent $x_2 = \frac{\text{moles of solvent}}{\text{total moles in solution}}$

$x_2 = \frac{n_2}{n_1+n_2}$

Now, sum of the mole fractions of both the components $x_1 + x_2 = \frac{n_1}{n_1+n_2} + \frac{n_2}{n_1+n_2} = \frac{n_1+n_2}{n_1+n_2} = 1$

Now, if mole fraction of the solvent $x_2 = 0.8$

So, mole fraction of the solute $x_1 = 1 - x_2 = 1 - 0.8 = 0.2$

Q.6. When $NaCl$ is added to a carbonated soft drink, the solubility of CO_2 in the drink______.

A) remains the same

B) increases

C) decreases

D) increases initially and then decreases slowly

Answer: decreases

Solution: In cold drinks, CO_2 gas is dissolved in water. When $NaCl$ is added to a cold drink, the solubility of CO_2 decreases in water because Na^+ and Cl^- ions are excessively hydrated by water molecules as compared to CO_2 gas molecules. So, CO_2 molecules escape from the cold drink.

Q.7. The solubility of a gas increases in a liquid with _______.

A) increase in temperature

B) reduction in gas pressure

C) decrease in temperature

D) amount of liquid taken

Answer: decrease in temperature

Solution: The following factors affect the solubility of a gas in liquids:

(1) Nature of the gas: Polar gases are more soluble in polar liquids and non-polar gases are more soluble in non-polar liquids.

(2) Partial pressure of the gas: As the partial pressure of a gas increases, its solubility in a liquid increases.

(3) Temperature: As the temperature increases, the solubility of a gas in a liquid decreases.

(4) The presence of a soluble salt: The presence of a more soluble salt decreases the solubility of gas in a liquid.

Q.8. The properties that depend only on the number of solute particles and NOT on its nature are called as______properties.

A) physical

B) chemical

C) colligative

D) intensive

Answer: colligative

Solution: Certain properties of solutions depend on the number of solute particles present in the solution only. These properties are called colligative properties.

Colligative properties of solutions do not depend on the nature of the solute particles like size, charge, colour, etc.

Colligative properties are:

(1) Relative lowering of the vapour pressure of the solution.

(2) Elevation in the boiling point of the solution.

(3) Depression in the freezing point of the solution.

(4) Osmotic pressure of the solution

Q.9. Which of the following is a colligative property?

A) Conductance of a solution

B) Surface tension of a solution

C) Elevation of boiling point of a solution

D) Radioactivity of a solution

Answer: Elevation of boiling point of a solution

Solution: Certain properties of solutions depend on the number of solute particles present in the solution only. These properties are called colligative properties.

Colligative properties of solutions do not depend on the nature of the solute particles like size, charge, colour, etc.

Colligative properties are:

(1) Relative lowering of the vapour pressure of the solution.

(2) Elevation in the boiling point of the solution.

(3) Depression in the freezing point of the solution.

(4) Osmotic pressure of the solution.

Q.10. The vapour pressure of a solution of a non-volatile solute is always_______.

A) equal to the vapour pressure of pure solvent

B) higher than vapour pressure of pure solvent

C) lower than vapour pressure or pure solvent

D) constant

Answer: lower than vapour pressure or pure solvent

Solution: When a non-volatile solute is added in a volatile solvent, the escaping tendency of the volatile solvent molecules decreases.

Now, fewer vapours of volatile solvent will form and the vapour pressure of the solution will be less than the vapour pressure of the volatile solvent.

From Raoult's law:

$P_s \ \alpha \ x_2$ (Mole fraction of the solvent)

$P_s = P^0 x_2$

Q.11. Which of the following is INCORRECT?

A) Vapour pressure of a liquid increases with increase in temperature.

B) Boiling point of a liquid is a temperature at which vapour pressure of liquid becomes equal to external pressure.

C) Vapour pressure of a solution is lower than the vapour pressure of the pure solvent

D) The relative lowering of vapour pressure is directly proportional to the mole fraction of the solvent

Answer: The relative lowering of vapour pressure is directly proportional to the mole fraction of the solvent

Solution: When a non-volatile solute is added in a volatile solvent, the escaping tendency of the volatile solvent molecules decreases.

Now, fewer vapours of volatile solvent will form and the vapour pressure over the solution will be less than the vapour pressure of the volatile solvent.

From Raoult's law:

$P_s \ \alpha \ x_2$ (Mole fraction of the solvent)

$P_s = P^0 x_2$

Since $x_1 + x_2 = 1$

$P_s = P^0 (1 - x_1)$

Relative lowering of the vapour pressure $\left(\frac{P^0 - P_s}{P^0}\right) = x_1$ (mole fraction of the solute)

Q.12. The vapour pressure at equilibrium of a liquid in a closed vessel depends on______

A) pressure

B) concentration

C) temperature

D) volume

Answer: temperature

Solution: The vapour pressure of any volatile liquid is defined as the equilibrium vapour pressure.

$\text{Liquid} \rightleftharpoons \text{Vapours} \ ; \ \Delta H > 0$

The equilibrium constant for a given equilibrium is $K_p = P_{vapour}$, which is a temperature dependent constant.

Since the reaction is endothermic in nature, the equilibrium vapour pressure increases on increasing the temperature.

Q.13. Vapour pressure of a solution is______.

A) directly proportional to the mole fraction of the solvent

B) inversely proportional to the mole fraction of the solute

C) inversely proportional to the mole fraction of the solvent

D) directly proportional to the mole fraction of the solute

Answer: directly proportional to the mole fraction of the solvent

Solution: When a non-volatile solute is added to a volatile solvent, the escaping tendency of the molecules of the volatile solvent decreases.

According to Raoult's law, the vapour pressure of a solution is directly proportional to the mole fraction of the solvent.

$P_s \ \alpha \ x_2$

$P_s = P^0 x_2$

P_s =Vapour pressure of the solution

P^0 =Vapour pressure of the solvent

x_2 =Mole fraction of the solvent

Q.14. An ideal solution is that which_____over the entire range of the concentration.

A) shows positive deviation from Raoult's law

B) shows negative deviation from Raoult's law

C) obeys Raoult's law

D) Both (A) and (B)

Answer: obeys Raoult's law

Solution: An ideal solution must obey the Raoult's law for any composition (concentration) and temperature.

For an ideal solution:

(1) There must not be any heat change during mixing of the solute and the solvent.

(2) There must not be any volume change during the mixing of the solute and the solvent.

(3) The force of cohesion among the molecules of liquids must be equal to the force of adhesion among the molecules of the solution.

Q.15. $K_b$is given by _____

A) $\frac{\Delta T_b \times W_2 \times M_2}{1000 \times W_1}$

B) $\frac{W_2 \times 1000}{\Delta T_b \times W_1 \times M_2}$

C) $\frac{\Delta T_b \times W_1 \times M_2}{1000 \times W_2}$

D) $\frac{W_1 \times 1000}{\Delta T_b \times W_2 \times M_2}$

Answer: $\frac{\Delta T_b \times W_1 \times M_2}{1000 \times W_2}$

Solution: When a non-volatile solute is added to a volatile solvent, the elevation in its boiling point is directly proportional to the molality of the solution.

$\Delta T_b \ \alpha \ \text{molality}$

$\Delta T_b = K_b \times \text{molality}$

K_b =Molal elevation constant

W_1 and W_2 are weights of the solvent and the solute respectively in gram and M_2 is the molecular mass of the solute.

Molality, $m = \frac{W_2 \times 1000}{M_2 \times W_1}$

So, $K_b = \frac{\Delta T_b \times W_1 \times M_2}{1000 \times W_2}$

Q.16. Unit of boiling point elevation constant (K_b) is______

A) kg mol^{-1}

B) k mol^{-1}

C) g mol^{-1}

D) K kg mol^{-1}

Answer: K kg mol^{-1}

Solution: When a non-volatile solute is added to a volatile solvent, the elevation in its boiling point is directly proportional to the molality of the solution.

$\Delta T_b \ \alpha \ \text{molality}$

$\Delta T_b = K_b \times \text{molality}$

K_b =Molal elevation constant

The unit for ΔT_b is K and the unit for molality is mol kg^{-1}, so the unit of K_b will be K kg mol^{-1}

Q.17. A temperature at which the vapour pressure of a solid is equal to the vapour pressure of liquid is called ______.

A) elevation of boiling point

B) freezing point

C) boiling point

D) depression of freezing point

Answer: freezing point

Solution: A temperature where solid and liquid equilibrium exist is known as freezing point.

In phase diagram, liquid and solid line meet at the freezing point, so, at freezing point, the vapour pressure of solid and liquid is same.

Q.18. The molar mass of the solute, by using depression of freezing point may be calculated using the formula,______.

A) $M_2 = \frac{K_f W_2 1000}{\Delta T_f m}$

B) $M_2 = \frac{K_f W_1 1000}{\Delta T_f W_2}$

C) $M_2 = \frac{T_f W_2 1000}{K_f W_1}$

D) $M_2 = \frac{K_f W_2 1000}{\Delta T_f W_1}$

Answer: $M_2 = \frac{K_f W_2 1000}{\Delta T_f W_1}$

Solution: When a non-volatile solute is added to a volatile solvent, the depression in its freezing point is directly proportional to the molality of the solution.

$\Delta T_f \ \alpha \ \text{molality}$

$\Delta T_f = K_f \times \text{molality}$

K_f =Molal depression constant

W_1 and W_2 are the weights of the solvent and the solute respectively in gram and M_2 is the molecular mass of the solute.

Molality, $m = \frac{W_2 \times 1000}{M_2 \times W_1}$

So, $M_2 = \frac{K_f W_2 1000}{\Delta T_f W_1}$

Q.19. In cold countries, ethylene glycol is added to the water in the radiators of cars during winter. This results in_______.

A) lowering of freezing point

B) reducing the viscosity

C) lowering of boiling point

D) making water a better conductor of electricity

Answer: lowering of freezing point

Solution: Addition of a non-volatile solute to a volatile solvent decreases its vapour pressure, hence the freezing point of the solvent also decreases.

Ethylene glycol is much less volatile than water, so in order to prevent the freezing of water in the radiators of the cars, in cold countries, ethylene glycol is added to the water.

Q.20. A membrane which allows the solvent molecules but NOT the solute molecules to pass through it is called as______.

A) semipermeable membrane

B) permeable membrane

C) fitter membrane

D) porous membrane

Answer: semipermeable membrane

Solution: A membrane which allows volatile solvent molecules to pass through it, but not the non-volatile solute molecules, is called as the semipermeable membrane.

The examples of the semipermeable membrane are plant cell wall or animal cell wall, parchment paper, cellophane, etc.

Q.21. A solution having a higher osmotic pressure than another solution is called a_______.

A) hypotonic solution

B) isotopic solution

C) isotonic solution

D) hypertonic solution

Answer: hypertonic solution

Solution: Osmotic pressure is the external pressure, which is applied to the semipermeable membrane to stop the osmosis through it.

Osmotic pressure, $\pi = \mathrm{CRT}$, where,

C =Concentration of solution

T =Temperature of solution

R =Gas constant

A solution having a higher osmotic pressure than another solution is called as a hypertonic solution.

Q.22. If two solutions separated by a semi-permeable membrane have the same osmotic pressure, they are called_______solutions.

A) hypertonic

B) hypotonic

C) isotonic

D) saturated

Answer: isotonic

Solution: Osmotic pressure is external pressure, when applied on a semi-permeable membrane, stops the phenomenon of osmosis.

Osmotic pressure, $\pi = \mathrm{CRT}$,

where C is the concentration, T is the temperature of the solution and R is the gas constant.

If two solutions separated by a semi-permeable membrane, have the same osmotic pressure, they are called isotonic solutions.

Q.23. The Van't Hoff factor will be the highest for______.

A) sodium chloride

B) magnesium chloride

C) sodium phosphate

D) urea

Answer: sodium phosphate

Solution: The Van't Hoff's factor for the given electrolytes can be determined by their ionisation.

Sodium chloride,

$NaCl \rightarrow Na^{+} + Cl^{-}$; $i = 2$

Magnesium chloride,

$MgCl_2 \rightarrow Mg^{2+} + 2\ Cl^{-}$; $i = 3$

Sodium phosphate,

$Na_3PO_4 \rightarrow 3\ Na^{+} + PO_4^{3-}$; $i = 4$

Urea (NH_2CONH_2) is a non electrolyte, so $i = 1$.

Q.24. The degree of dissociation(α) of a weak electrolyte A_xB_y is related to the Van't Hoff factor (i) by the expression________.

A) $\alpha = \frac{i-1}{(x+y-1)}$

B) $\alpha = \frac{i-1}{(x+y+1)}$

C) $\alpha = \frac{(x+y-1)}{i-1}$

D) $\alpha = \frac{(x+y+1)}{i-1}$

Answer: $\alpha = \frac{i-1}{(x+y-1)}$

Solution: For the weak electrolyte A_xB_y, having the degree of ionisation α, the Van't Hoff factor can be determined as follows

$A_xB_y \rightarrow x\ A^{y+} + y\ B^{x-}$

$1-\alpha \qquad x\alpha \qquad y\alpha$

The total number of particles after dissociation or the Van't Hoff factor, $i = 1 - \alpha + x\alpha + y\alpha$

$i = 1 + \alpha(x + y - 1)$

$\alpha = \frac{i-1}{(x+y-1)}$

Q.25. $5\ cm^3$ of acetone is added to $100\ cm^3$ of water, then the vapour pressure of the solution _______.

A) will be equal to the vapour pressure of pure water

B) will be less than the vapour pressure of pure water

C) will be greater than the vapour pressure of pure water

D) will be very large

Answer: will be greater than the vapour pressure of pure water

Solution: Acetone is more volatile liquid than water. When acetone is added to water, the volatility of mixture will increase, since acetone's presence weakens the hydrogen bonding of water molecules, hence more vapours will form.

The mixture is also a non-ideal solution with positive deviation.

The vapour pressure of such solution will be greater than the vapour pressure of pure water.

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