PART-I (SHORT QUESTIONS)

Q.2 Write short answers to any SIX (6) questions.

(i) Define solution. Give examples of gas, solid and liquid solutions.

Ans. Solution:

"A solution is a homogeneous mixture of two or more substances. One substance is called solvent and all others are called solutes."

Solution = Solvent + Solute(s)

Examples:

Following are some most common examples of solutions.

(1) Gas Solution:
The air we breath is a gas solution of several gases.

(2) Liquid Solution:
Sugar dissolved in water is an example of a liquid solution.

(3) Solid Solution:
The brass is a solid solution of Zn and Cu.

(ii) How the physical state of a solution is defined/determined?

Ans. Solutions are found in all three physical states i.e. solids, liquids and gases. The physical state of a solution depends upon the physical state of its solvent. Thus, the physical state of a solution can be determined as following:

(1) If solvent is a liquid, the physical state of a solution will be liquid.
e.g. air

(2) If solvent is a solid, its physical state will be solid.
e.g. sugar solution

(3) If solvent is a gas, the solution will be called gas solution.
e.g. dental amalgam

(iii) How can we distinguish between a solution and a pure liquid by ordinary physical methods?

Ans. The simplest way to distinguish between a solution and a pure liquid is *evaporation* phenomenon. The liquid which evaporates completely, leaving no residue, is a pure compound, while a liquid which leaves behind a residue on evaporation is a solution.

(iv) Why is a solution considered a mixture?

Ans. A solution is considered as a mixture because both the solutions and the mixtures constituents can be separated by physical means.

(v) Distinguish between the following pairs as compound or solution.

(a) Water and salt solution
(b) Vinegar and benzene
(c) Carbonated drink and acetone

Ans. (a) Water and salt solution **Solution**

(b) Vinegar and benzene **Solution**

(c) Carbonated drink and acetone **Solution**

(vi) What is an alloy? Why an alloy is considered as a mixture?

Ans. **Alloy:** *"Alloy is a mixture solid into solids".*

Example: Brass is a mixture of zinc (Zn) and copper (Cu).

Why an Alloy is Considered as a Mixture: Although an alloy cannot be separated by physical means, yet it is considered a mixture. It is due to the following two reasons:

(1) It shows the properties of its component.

(2) It has a variable composition.

(vii) Define solute and solvent with examples.

Ans. **Solute:** *"The component of a solution which is present in smaller quantity is called a solute."*

A solute is dissolved in a solvent to make a solution.

Examples: Salt solution is made by dissolving salt in water. So, in a salt solution, salt is a solute and water is solvent.

Solvent: *"The component of a solution which is present in large quantity is called a solvent."*

Solvent always dissolves solutes.

Examples: In soft drinks, water is solvent while other substances like sugar, salts and CO_2 are solutes.

(viii) Differentiate between saturated and unsaturated solution?

Ans. **Saturated Solution:**

"A solution containing maximum amount of a solute at given temperature is called a saturated solution."

Unsaturated Solution:

"A solution which contains lesser amount of solute than that which is required to saturate it at a given temperature, is called an unsaturated solution."

Such solutions have the capacity to dissolve more solute to become a saturated solution.

(ix) What is meant by supersaturated solution? How it can be prepared?

Ans. **Supersaturated Solution:**

"The solution that is more concentrated than a saturated solution is known as a supersaturated solution."

Preparation of a Supersaturated Solution :

Procedure:

An easy way to get a supersaturated solution is to prepare a saturated solution at high temperature. It is then cooled to a temperature where excess solute crystallizes out and leaves behind a supersaturated solution.

Example:

A saturated solution of sodium thiosulphate ($Na_2S_2O_3$) in water at 20°C has 20.9g of salt per 100 cm^3 of water. Less than this amount of salt per 100 cm^3 of water at 20°C will be an unsaturated solution. A solution having more amount than 20.9g of salt per 100 cm^3 of water at 20°C will be a supersaturated solution.

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Q.3 Write short answers to any FIVE (5) questions.

(i) Differentiate between a dilute and a concentrated solution. Give one example.

Ans. **Dilute Solution:**

'Dilute solutions are those which contain relatively small amount of dissolved solute in the solution."

Concentrated Solution: *"Concentrated solutions are those which contain relatively large amount of dissolved solute in the solution".*

Common Example:

Brine is a concentrated solution of common salt in water.

(ii) Define % m/m. What is meant by 10% m/m sugar solution?

Ans. **Percentage – mass/mass (% m/m) :**

"It is the number of grams of solute in 100 grams o solution."

Formula:

Calculation of this ratio is carried out by using the following formula:

$$\% \text{ by mass} = \frac{\text{mass of a solute (g)}}{\text{mass of a solute (g) + mass of a solvent (g)}} \times 100$$

$$\text{or \% by mass} = \frac{\text{mass of a solute (g)}}{\text{mass of a solution (g)}} \times 100$$

For example 10% m/m sugar solution means that 10g of sugar is dissolved in 90 g of water to make 100 g of solution.

(iii) How much water should be mixed with 18 cm^3 of alcohol so as to obtain 18% (v/v) alcohol solution?

Ans. **Formula:**

Calculation of this ratio is carried out by using the following formula:

$$\% \text{ v/v} = \frac{\text{volume of a alcohol}}{\text{volume of a solution}} \times 100$$

$$18 = \frac{18 cm^3}{\text{volume of a solution}} \times 100$$

$$\text{Volume of solution} = \frac{18 cm^3}{18} \times 100$$

$$\text{Volume of solution} = 100 \text{ cm}^3$$

Volume of solution

= Volume of a solute + Volume of a solvent

$100 \text{ cm}^3 = 18 cm^3 + \text{Volume of solvent}$

$\text{Volume of solvent} = 100 \text{ cm}^3 - 18 \text{ cm}^3$

$\text{Volume of solvent} = 82 \text{ cm}^3$

(iv) Define molarity. What is its formula?

Ans. **Molarity**

"Molarity is defined as number of moles of a solute dissolved in one dm^3 of solution."

It is represented by M.

Formula:

The equation used for the preparation of molar solution is as follows:

$$\text{Molarity (M)} = \frac{\text{mass of a solute (g)}}{\text{molar mass of a solute (gmol}^{-1}\text{)} \times \text{volume of a solution (dm}^3\text{)}}$$

$$\text{Molarity (M)} = \frac{\text{no. of moles of a solute}}{\text{volume of a solution (dm}^3\text{)}}$$

Molarity(M) =

(v) Why is the formula of solute necessary for the calculation of the molarity of the solution?

Ans. To calculate the molarity of the given solution, molar mass of a solute is necessary. This is because molar mass is used to convert the mass of solute into moles of solute.

(vi) Calculate the concentration % (w/w) of a solution which contains 2.5g of salt dissolved in 50g of water.

Solution:

$\text{Mass of solution} = 50 + 2.5 = 52.5\text{g}$

$$\% \text{ m/m} = \frac{\text{mass of a solute}}{\text{mass of a solution}} \times 100$$

$$= \frac{2.5}{52.5} \times 100$$

$\% \text{ m/m} = 4.76\%$

(vii) Which one of the following solution is more concentrated: 1 molar or 3 molar?

Ans. As amount of solute is increased, its concentration or molarity also increases.

That is why three molar (3M) solution is more concentrated than one molar (1M) solution.

(viii) Define solubility. What is the effect of temperature on solubility?

Ans. Solubility:

"The number of grams of the solute dissolved in 100g of solvent to prepare a saturated solution at a particular temperature is called solubility."

Effect of Temperature on Solubility

Temperature has major effect on the solubility of most of the solutes. Generally it seems that solubility increases with the increase of temperature, but it is not always true.

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Q.4 Write short answers to any FIVE (5) questions.

(i) Explain the general principle of "like dissolves like".

Ans. Principle of Like Dissolves Like:

The general principle of solubility is "like dissolves like". It can be explained as following:

(1) Polar substances are soluble in polar solvents.

Ionic solids and polar covalent compounds are soluble in water e.g., KCl, Na_2CO_3 $CuSO_4$, sugar, and alcohol are all soluble in water.

(2) Non-polar substances are not soluble in polar solvents.

Non-polar covalent compounds are not soluble in water such as ether, benzene, and petrol are insoluble in water.

(3) Non-polar covalent substances are soluble in non-polar solvents (mostly organic solvents).

Grease, paints, naphthalene are soluble in ether or carbon tetrachloride etc.

(iii) Which three events must happen before dissolution of a solute into a solvent?

Ans. Dissolution of a Solute into a Solvent:

To dissolve one substance (solute) in another substance (solvent) following three events must occur:

(1) Solute particles must separate from each other.

(2) Solvent particles must separate to provide space for solute particles.

(3) Solute and solvent particles must attract and mix up.

(iv) Explain the conditions under which the formation of a solution is possible?

Ans. For the formation of a solution, there are following two possibilities:

(1) If the new forces i.e. forces between solute-solvent particles overcome the solute-solute attractive forces, then the solute dissolves in a solvent and makes a solution.

(2) If the solvent-solvent forces are stronger than the solute-solute forces, in this case solution formation is also possible.

(v) What will happen if the solute-solute forces are stronger than those of solute-solvent forces?

Ans. If the solute-solute forces are stronger than those of solute-solvent forces, then solute remain insoluble and solution is not formed.

(vi) What is Tyndall effect? Why do suspensions and solutions do not show Tyndall effect, while colloids do?

Ans. Tyndall Effect:

"The scattering of light beam in different colours by the particles of a colloidal solution is called a Tyndall effect."

The particles of suspensions are so big that the light is blocked and is not scattered.

On the other hand the particles of solutions are so small that they can not scatter the rays of light.

That is why both suspensions and solutions do not show Tyndall effect. But the particles of colloids can scatter the rays of light and exhibit the Tyndall effect.

(vii) Write two/four characteristics of a colloid.

Ans. Characteristics of a Colloid:

(1) The particles are large consisting of many atoms, ions or molecules.

(2) A colloid appears to be a homogeneous but actually it is a heterogeneous mixture. Hence, they are not true solutions. Particles do not settle down for a long time, therefore, colloids are quite stable.

(3) Particles are large but can't be seen with naked eye.

(4) Although particles are big but they can pass through a filter paper.

(5) Particles scatter the path of light rays thus, emitting the beam of light i.e. exhibit the Tyndall effect.

(viii) Write two/four properties of a suspension.

Ans. Characteristics of a Suspension:

(1) The particles are of largest size. They are larger than 10^{-5}cm in diameter.

(2) Particles remain un-dissolved and form a heterogeneous mixture. Particles settle down after sometime.

(3) Particles are big enough to be seen with naked eye.

(4) Solute particles cannot pass through filter paper.

(5) Particles are so big that light is blocked and difficult to pass.

(ix) Classify the following into true solution and colloidal solution:

blood, starch solution, glucose solution, tooth paste, copper sulphate solution, silver nitrate solution.

Ans. Real Solution/True Solution:

Glucose solution, copper sulphate solution and silver nitrate solution.

Colloidal solution:

Blood and starch solution.

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PART-II (LONG/DESCRIPTIVE QUESTIONS)

Q.5 (a) What is a saturated solution and how it is prepared? **(4)**

(b) How many types of solutions can be prepared depending upon the nature of solute and solvent? **(3)**

Ans. (a) **See Chapter 6 Q.No.16**

(b) **See Chapter 6 Q.No.23**

Q.6 (a) What do you mean by percentage concentration? How it can be expressed in term of percentage composition by four different ways? **(4)**

(b) Calculate the molarity of a solution which is prepared by dissolving 28.4 g of Na_2SO_4 in 400 cm^3 of solution. **(3)**

Ans. (a) **See Chapter 6 Q.No.26**

(b) **See Chapter 6 Example No.2**

Q.7 (a) Define solubility. Which factors affect the solubility of a solute in a solvent? **(4)**

(b) Compare the characteristics of a solution, colloid and a suspension. **(3)**

Ans. (a) **See Chapter 6 Q.No.35**

(b) **See Chapter 6 Q.No.49**

Q.8 **(a)** Define Molarity. Write its formula to prepared a molar solution? **(4)**

(b) How much NaOH is required to prepared its 500cm^3 of 0.4M solution? **(3)**

Ans. **(a)** **See Chapter 6 Q.No.6**

(b) **See Chapter 6 Example No.6.3**

Q.9 **(a)** How a dilute molar solution is prepared from a concentrated solution of know molarity? **(4)**

(b) 12M H_2SO_4 solution is available in the laboratory. We need only 500 cm^3 of 0.1M solution, how it will be prepared? **(3)**

Ans. **(a)** **See Chapter 6 Q.No.7**

(b) **See Chapter 6 Exc. Q.No.6**

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PART-III (PRACTICAL QUESTIONS)

10. **(i)** **Is Na_2CO_3 (sodium carbonate) an acid or a base?** **(2)**

(ii) **What will you observe when Na_2CO_3 is added in vinegar?** **(3)**

Ans. **(i)** Na_2CO_3 is a base.

(ii) When sodium carbonate (Na_2CO_3) is added in vinegar solution, carbon dioxide gas is produced which turns lime water milky.

$$2CH_3COOH_{(aq)} + Na_2CO_{3(aq)} \longrightarrow 2CH_3COONa + CO_{2(g)} + H_2O_{(l)}$$

11. **(i)** **Caustic soda is known to be extremely deliquescent compound. What is meant by deliquescent?** **(2)**

(ii) **Commercially important compounds like sugar, urea and alums are crystallized by crystallization method. Name any two substances other than these that are purified by crystallization.** **(3)**

Ans. **(i)** Deliquescent compounds are those compounds which readily absorb moisture and carbon dioxide from the atmosphere.

Sodium hydroxide after absorbing moisture from the atmosphere is converted into liquid state. That is why it is called deliquescent compound.

(ii) **(a)** Potassium sulphate (K_2SO_4)

(b) Sodium chloride (NaCl)

12. **(i)** **What is carbonated water? What is the source of its acidity?** **(2)**

(ii) **Solubility changes with change in temperature and this fact is responsible for the crystallization of some solutes. From the following compounds, which compound can be crystallized in this way by using water as solvent? Also explain why the remaining compounds cannot be crystallized in this way?** **(3)**

(a) **$BaCO_3$** **(b)** **NaCl**

(c) **KNO_3**

Ans. **(i)** Carbonated water contains carbon dioxide which reacts with water to make carbonic acid. This carbonic acid is the source of acidity of carbonated water.

$$CO_{2(g)} + H_2O_{(l)} \longrightarrow H_2CO_{3(aq)}$$

(ii) **(a)** $BaCO_3$ is insoluble in water. Thus, it cannot be crystallized in this way.

(b) The solubility of NaCl is not much effected by temperature. Thus, it cannot be crystallized by this method.

(c) KNO_3 can be crystallized by this method. It is because the solubility of KNO_3 increases with increase in temperature and decreases with decreases in temperature. Thus, when its temperature decreases, it crystallizes.

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