PETIT SEMINAIRE HIGHER SECONDARY SCHOOL – PUDUCHERRY

UNIT – 9 SOLUTIONS

STD: X   SELF – EVALUATION

I. Choose the best answer:

1. A solution is a ------- mixture. **(A)** Homogeneous
2. The number of components in a binary solution is --------- **(A)** 2
3. Which of the following is the universal solvent? **(C)** Water
4. A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called --------- **(A)** Saturated solution
5. Identify the non aqueous solution - **(D)** Sulphur in carbon di sulphide
6. When pressure is increased at constant temperature the solubility of gases in liquid ---- **(B)** increases
7. Solubility of NaCl in 100 ml water is 36 g. If 25 g of salt is dissolved in 100 ml of water how much more salt is required for saturation - **(B)** 11g
8. A 25% alcohol solution means - **(C)** 25 ml alcohol in 75 ml of water
9. Deliquescence is due to - **(A)** Strong affinity to water
10. Which of the following is hygroscopic in nature? - **(C)** Silica gel

II. Fill in the blanks:

1. The component present in lesser amount in a solution is called <u>Solute</u>
2. Example for liquid in solid type solution is <u>Amalgam (Mercury with Sodium)</u>
3. Solubility is the amount of solute dissolved in <u>100g</u> of solvent.
4. Polar compounds are soluble in <u>Polar</u> solvents.
5. Volume percentage decreases with increases in temperature because <u>of Expansion of liquid</u>

III. Match the following:

S.No	Column 1	Column 2
1	Blue Vitriol	$CuSO_4.5H_2O$
2	Gypsum	$CaSO_4.2H_2O$
3	Deliquescence	NaOH
4	Hygroscopic	CaO

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IV. True or False (If false give the correct statement):

1. Solutions which contain three components are called binary solutions. - False

Correct Statement: Solutions which contains two components are called binary solution. (or) Solutions which contain three components are called ternary solutions.

2. In a solution the component which is present in lesser amount is called solvent. - False

Correct statement: In a solution the component which is present in lesser amount is called solute. (or) In a solution the component which is present in higher amount is called solvent.

3. Sodium chloride dissolved in water forms a non- aqueous solution. - False

Correct statement: Sodium chloride dissolved in water forms an aqueous solution.

4. The molecular formula of green vitriol is $MgSO_4.7H_2O$ - False

Correct statement: The molecular formula of green vitriol is $FeSO_4.7H_2O$ (or) The molecular formula of epsom salt is $MgSO_4.7H_2O$

5. When silica gel is kept open, it absorbs moisture from the air, because it is hygroscopic in nature. - True

V. Short answers questions:

1. Define the term: Solution.

   Solution is a homogeneous mixture of two or more substances.

   Solute (Lesser amount) + Solvent (higher amount) → solution.

2. What is meant by binary solution?

   A solution must at least be consisting of two components (a solute and a solvent). Such solutions which are made of one solute and one solvent (two components) are called binary solutions.

   Ex: Salt + water → Salt solution

3. Give an example each (i) gas in liquid (ii) solid in liquid (iii) solid in solid (iv) gas in gas

S.No	Solutions	Example
1	Gas in liquid	Soda water
2	Solid in liquid	Sodium chloride in water
3	Solid in solid	Copper dissolved in gold (alloys)

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4	Gas in gas	Mixture of Helium – oxygen gases

4. What is aqueous and non – aqueous solution? Give an example.

Aqueous solution:

(i) The solution in which water acts as a solvent is called aqueous solution. Ex: Common salt in water, Sugar in water, Copper sulphate in water.

Non – aqueous solution:

(ii) The solution in which any liquid, other than water, acts as a solvent is called non – aqueous solution.

Ex: Sulphur dissolved in carbon disulphide, Iodine dissolved in carbon tetra chloride.

5. Define Volume percentage?

It is defined as the percentage by volume of solute (in ml) present in the given volume of the solutions.

Volume percentage =

$$\frac{\text{volume of the solute}}{\text{volume of the solute+volume of the solvent}} \times 100$$

$$\text{Volume percentage} = \frac{\text{volume of the solute}}{\text{volume of the solution}} \times 100$$

6. The aquatic animals live more in cold region why?

Aquatic animals live more in cold regions because, more amount of dissolved oxygen is present in the water of cold regions. This shows that the solubility of oxygen in water is more at low temperatures.

7. Define hydrated salt?

A hydrated salt is a crystalline salt molecule that is loosely attached to a certain number of water molecules.

The number of water molecules found in the crystalline substance is called water of crystallization. Such salts are called hydrated salts. Ex: copper sulphate pentahydrate, Gypsum (calcium sulphate dehydrate).
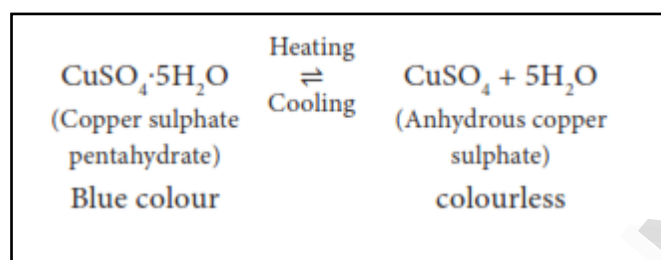
8. A hot saturated solution of copper sulphate forms crystals as it cools.

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Why?

The number of water molecules in blue vitriol is five. So its water of crystallization is 5.

When blue coloured copper sulphate crystals are gently heated, it loses its five water molecules and become colourless anhydrous copper sulphate.

$$CuSO_4 \cdot 5H_2O \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} CuSO_4 + 5H_2O$$

(Copper sulphate pentahydrate)   (Anhydrous copper sulphate)

Blue colour   colourless

Then add a few drops of water or allow it to cool, the colourless anhydrous salt again turns back into blue coloured hydrated salt.

9. Classify the following substances into deliquescent, hygroscopic. Conc. Sulphuric acid, Silica gel, Copper sulphate pentahydrate, Gypsum salt, Calcium chloride.

Hygroscopic	Deliquescent
Conc. Sulphuric acid, Silica gel	Copper sulphate pentahydrate, Gypsum salt, Calcium chloride.

VI. Long Answers Questions:

1. Write notes on (i) saturated solution (ii) unsaturated solution.

(i) Saturated Solution:

A solution in which no more solute can be dissolved in a definite amount of the solvent at a given temperature is called saturated solution. Ex: 36 g of NaCl in 100g of water at 25°C forms saturated solution. Further addition of NaCl, leave it undissolved.

Note: If we increase temperature it is possible to dissolve some more grams of solute in a solvent.

(ii) Unsaturated solution:

It is one that contains less solute (possible to add some more solute particle) than that of the saturated solution at a given temperature. Ex: 10g or 20g or 30g of NaCl in 100g of water at 25°C forms an unsaturated solution.

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2. Write notes on various factors affecting solubility.

There are three main factors which govern the solubility of a solute. They are:

(i) Nature of the solute and solvent (ii) Temperature (iii) Pressure

(i) Nature of the solute and solvent:

- The nature of the solute and solvent plays an important role in solubility.

- Although water dissolves an enormous variety of substances, both ionic and covalent, it doesn't dissolve everything.

- Solubility is like dissolve like, unlike dissolve unlike, that means, a polar compound and dissolves readily in polar solvent like water, Non – polar compounds are soluble in non – polar solvents.

- Ex: common salt (NaCl) is a polar compound and dissolve readily in polar solvent like water and Fat is Non – polar compound dissolved in non – polar solvent like ether.

(ii) Temperature:

- Solubility of solids in liquid: Solubility of a solid solute in a liquid solvent increases with increases in temperature.

- In endothermic process, solubility increases with increase in temperature. Ex: Dissolution of glucose.

- In exothermic process, solubility decreases with increase in temperature. Ex: Dissolution of detergent powder, dilution of concentrated acid.

- Solubility of gases in liquid: Solubility of gases in liquid decrease with increase in temperature.
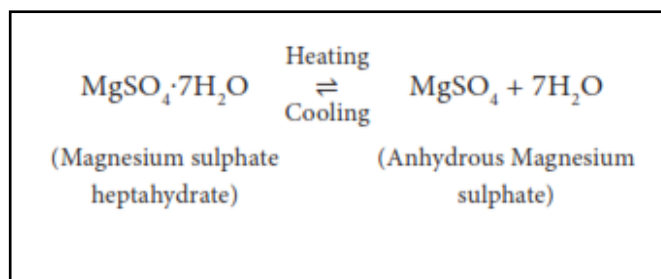
(iii) Pressure:

- Effect of pressure is observed only in the case of solubility of a gas in a liquid. When the pressure is increased, the solubility of a gas in liquid increases.

- The common example for solubility of gases in liquids are carbonated beverages, i.e soft drinks, household cleaners containing aqueous solution of ammonia, formalin – aqueous solution of formaldehyde, etc.

3. a) What happens when $MgSO_4.7H_2O$ is heated? Write the appropriate equation.

   When magnesium sulphate heptahydrate crystals are gently heated, it loses

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seven water molecules, and becomes anhydrous magnesium sulphate.

$$MgSO_4 \cdot 7H_2O \underset{Cooling}{\overset{Heating}{\rightleftharpoons}} MgSO_4 + 7H_2O$$
(Magnesium sulphate   (Anhydrous Magnesium
heptahydrate)   sulphate)

Then add few drops of water or allow it to cool, the colourless anhydrous salt again turns back into hydrated salt.

(b) Define solubility?

Solubility is defined as the number of grams of a solute that can be dissolved in 100g of a solvent to form its saturated solution at a given temperature and pressure.

$$\text{Solubility} = \frac{\text{Mass of the solute}}{\text{Mass of the solvent}} \times 100$$

4. in what way hygroscopic substances differ from deliquescent substances.

S.No	Hygroscopic substances	Deliquescence substances
1	When exposed to the atmosphere at ordinary temperature, they absorb moisture and do not dissolve.	When exposed to the atmospheric air at ordinary temperature, they absorb moisture and dissolve.
2	Hygroscopic substances do not change its physical state on exposure to air.	Deliquescent substances change its physical state on exposure to air.
3	Hygroscopic substances may be amorphous solids or liquids.	Deliquescent substances are crystalline solids.

5. A solution is prepared by dissolving 45 g of sugar in 180 g of water. Calculate the mass percentage of solute.

$$\text{Mass percentage} = \frac{\text{Mass of the solute}}{\text{Mass of the solute+Mass of the solvent}} \times 100$$

$$\text{Mass percentage} = \frac{45}{45+180} \times 100$$

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$$= 0.2 \times 100$$

Mass percentage = 20%

6. 3.5 litres of ethanol is present in 15 litres of aqueous solution of ethanol. Calculate volume percent of ethanol solution.

$$\text{Volume percentage} = \frac{\text{Volume of the solute}}{\text{Volume of the solution}} \times 100$$

$$\text{Volume percentage} = \frac{3.5}{15} \times 100$$
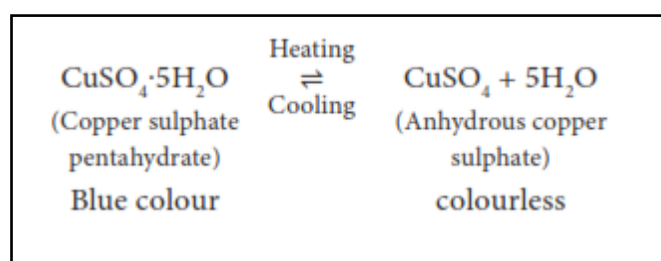
$$= 0.2333 \times 100$$

Volume percentage = 23.33%

VII. HOT Question:

1. Vinu dissolves 50 g of sugar in 250 ml of hot water, Sarath dissolves 50 g of same sugar in 250 ml of cold water. Who will get faster dissolution of sugar? and why?

   - Vinu get faster dissolution of sugar. Because dissolution of sugar is a endothermic process.
   - In endothermic process solubility increase with increase in temperature. Vinu dissolves sugar in hot water, so faster it dissolves.

2. 'A' is a blue coloured crystalline salt. On heating it loses blue colour and to give 'B'. When water is added, 'B' gives back to 'A'. Identify A and B, write the equation.

   A − Copper sulphate pentahydrate

   B − Copper sulphate

- When blue coloured copper sulphate crystals are gently heated, it loses its five water molecules and become colourless anhydrous copper sulphate.

$$\underset{\substack{\text{(Copper sulphate}\\\text{pentahydrate)}\\\text{Blue colour}}}{CuSO_4 \cdot 5H_2O} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \underset{\substack{\text{(Anhydrous copper}\\\text{sulphate)}\\\text{colourless}}}{CuSO_4 + 5H_2O}$$

- Then add a few drops of water or allow it to cool, the colourless anhydrous salt again turns back into blue coloured hydrated salt.

3. Will the cool drinks give more fizz at top of the hills or at the foot? Explain.

- The cool drinks give more fizz at top of the hills.

- They give more fizz at top of hills because solubility of gas is low at altitude and hence the carbon dioxide is less soluble in cold drinks at altitude and give more fizz.

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