



3055 BA SANGAM COLLEGE

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WORKSHEET 10

School: Ba Sangam College

Subject: Chemistry

Year: 11

Name:

Strand	3 - Reactions
Sub strand	3.3 – Acids, Bases and Salt
Content Learning Outcome	<p>-Evaluate and present the percentage of water of crystallization in a hydrated salt.</p> <p>-State and illustrate the solubility rules of salts and use it to predict the formation of a precipitate.</p>

Preparation of Salts

1. Reaction of Acids

- Acid + Metal \rightarrow Salt + Hydrogen
E.g. $2\text{HCl} + \text{Zn} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- Acid + Insoluble bases \rightarrow Salt + Water
E.g. $2\text{HNO}_3 + \text{CuO} \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- Acid + Carbonate \rightarrow Salt + Water + Carbon dioxide
E.g. $\text{H}_2\text{SO}_4 + \text{CaCO}_3 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

Step of obtaining salt:

1. Dissolving

- Warm the acid.
- Add solute (base/carbonate/metal) till its saturated.
- Stir to dissolve till the solute dissolves.

2. Filtration

- Remove the solid (residue)
- Filtrate salt solution.
- Heat till saturation.

3. Crystallization

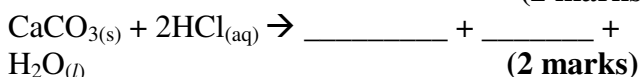
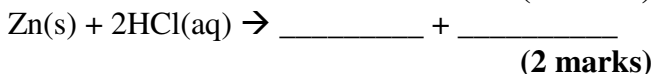
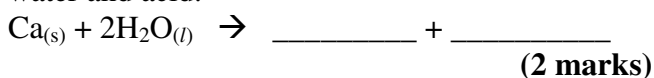
- allows the hot saturated solution to cool

4. Collecting the crystals

- Collect, filtrate the crystals and dry it using filter paper.

Exercise

Complete the following reactions of metals with water and acid.



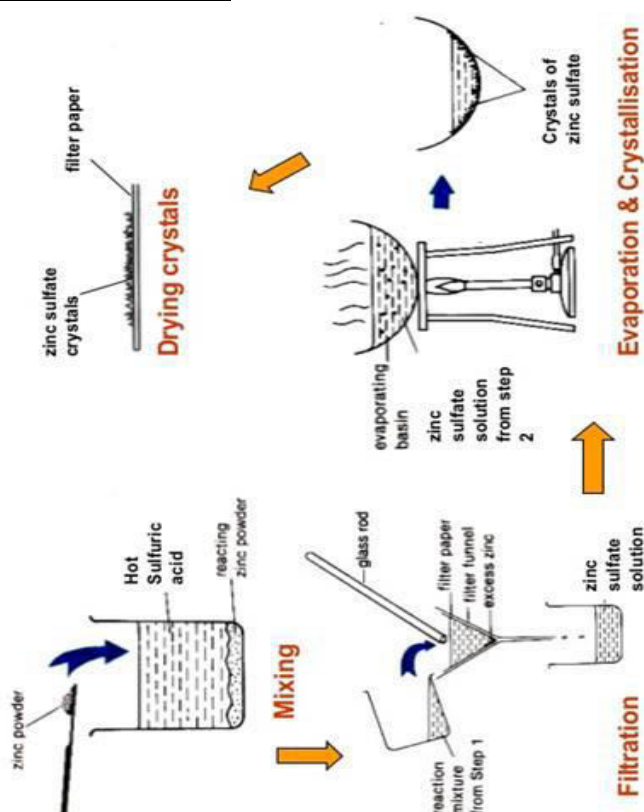
When solutions of silver nitrate (AgNO_3) and sodium chloride (NaCl) are mixed together, a precipitate is formed.

(i) Define precipitate. (1 mark)

(ii) Write a balanced net ionic equation for the reaction. (2 marks)

Example

Preparing Zinc sulphate crystals using H_2SO_4 and Zinc powder



2. Precipitation

- An insoluble salt can be made by mixing two solutions of soluble salts.
- 2 soluble salt mix to form precipitate (insoluble solute).
- Precipitate is filtrated (filter paper) and dried.

Water of Crystallization-amount of water present in the salt.

Anhydrous salt- salt that don't have water of crystallization.

Hydrated salt- salt that contains water of crystallization.

- ✓ Hydrated salt (heated) \rightarrow Anhydrous salt + Water vapour
- ✓ $\text{CuSO}_4 + 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Calculating the water of crystallization:

$$\text{W.O.C} = \frac{\text{Molecular mass of water}}{\text{Formular mass of hydrated sa}}$$

Example

Calculate the percentage w.o.c in CuSO_4

Solution

$$\begin{aligned} \text{W.O.C} &= \frac{\text{Molecular mass of water}}{\text{Formular mass of hydrated salt}} \times 100 \\ &= \frac{90}{250} \times \frac{100}{1} \\ &= 36\% \end{aligned}$$

Common hydrated salts:

- Sodium carbonate crystals (washing soda) - $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
- Barium iodide crystals - $\text{BaI}_2 \cdot 7\text{H}_2\text{O}$
- Magnesium sulphate crystals - $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$

Example

2. To determine the percentage water of crystallisation in a **hydrated compound**, 2.28 g sample of a hydrated compound was heated in a crucible to drive away the water and weighed. The compound was heated several times and reweighed until a mass of 1.11 g was obtained.

- (i) What is a **hydrated compound**?
A compound that contains water of crystallization.
- (ii) State the purpose of heating the compound several times and reweighing.
To ensure all water is driven off
- (iii) Calculate the percentage water of crystallisation in the hydrated compound.

$$\text{Mass of water lost} = 2.28 \text{ g} - 1.11 \text{ g} = 1.17 \text{ g}$$

% water of crystallisation =

$$\frac{\text{mass of water}}{\text{mass of hydrated copper sulphate}} \times 100\%$$

$$= \frac{1.17 \text{ g}}{2.28 \text{ g}} \times 100\%$$

$$= 51.5\%$$

3. Water of crystallisation is the number of water molecules, chemically combined in a definite molecular proportion, with the salt in its crystalline state.

- (i) Write the formula of calcium chloride hexahydrate.
 $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$
- (ii) 14.20 g of hydrated calcium chloride is heated until it loses all of its water. Its new mass is found to be 7.19 g. Calculate the percentage water of crystallisation in the hydrated calcium chloride.
Mass of water lost = 14.20 g - 7.19 g
= 7.01 g

$$\begin{aligned} \% \text{ water of crystallisation} &= \frac{\text{mass of water}}{\text{mass of hydrated copper sulphate}} \times 100\% \\ &= \frac{7.01 \text{ g}}{14.20 \text{ g}} \times 100\% \\ &= 49.4\% \end{aligned}$$

Exercises

1. What is the percentage water of crystallisation in the following compounds?









