Worksheet 1.1: Acids, Bases and Salts

ChemistrySheets

Specification: GCSE Chemistry (AQA 5.4.2 / Edexcel SC10 / OCR Gateway C4.1)

Core Concepts: Define acid, base, alkali, salt. Understand the pH scale and indicators. Describe neutralisation reactions and the reactions of acids with metals, metal oxides, metal hydroxides, and metal carbonates. Explain how to prepare soluble salts.

Section A: Key Terms & Definitions

1. Match the following key terms to their correct definitions.

a) **Acid**

b) **Base**

c) **Alkali**

d) **Salt**

e) **Neutralisation**

Definitions:

- **P:** A substance that produces hydroxide ions (OH^-) when dissolved in water.
- **Q:** A compound formed when the hydrogen ion of an acid is replaced by a metal ion or ammonium ion.
- **R:** A reaction between an acid and a base, forming a salt and water.
- **S:** A substance that produces hydrogen ions (H^+) when dissolved in water.
- **T:** A substance that neutralises an acid. It can be a metal oxide, metal hydroxide, or metal carbonate.

a) Acid: **S**

b) Base: **T**

c) Alkali: **P**

d) Salt: **Q**

e) Neutralisation: **R**

2. Complete the following sentences using appropriate chemical terms.

a) An acid is a substance that produces **hydrogen ions (H^+)** when dissolved in water.

b) An alkali is a soluble **base** that produces **hydroxide ions (OH^-)** when dissolved in water.

c) The reaction between an acid and a base is called **neutralisation**, which typically forms a **salt** and **water**.

d) The pH scale ranges from **0** to **14**. A solution with a pH of **7** is considered neutral.

Section B: Core Concepts & Explanations

1. Answer the following questions.

a) Define an acid and an alkali in terms of the ions they produce in aqueous solution.

Model Answer:
An acid is a substance that produces hydrogen ions (H^+) when dissolved in water. An alkali is a soluble base that produces hydroxide ions (OH^-) when dissolved in water.

b) Describe how the pH scale is used to indicate the strength of an acid or alkali.

Model Answer:
The pH scale ranges from 0 to 14. A pH of 7 is neutral. Values from 0 to less than 7 indicate acidity, with lower pH values meaning stronger acids. Values from greater than 7 to 14 indicate alkalinity, with higher pH values meaning stronger alkalis.

c) Explain what happens at the ionic level during a neutralisation reaction between an acid and an alkali.

Model Answer:
During neutralisation, hydrogen ions (H^+) from the acid react with hydroxide ions (OH^-) from the alkali. They combine to form water molecules (H_2O). The remaining ions form a salt.

d) Describe the general reaction of an acid with a metal carbonate, including any observable changes.

Model Answer:
When an acid reacts with a metal carbonate, it produces a salt, water, and carbon dioxide gas. The observable change is effervescence (fizzing or bubbling) due to the production of carbon dioxide gas. For example: Acid + Metal Carbonate → Salt + Water + Carbon Dioxide.

Section C: Exam Application & Extended Writing

1. The diagram below illustrates a method for preparing a soluble salt from an acid and an insoluble base.

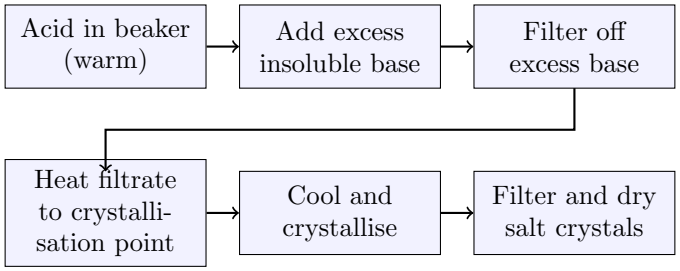

Figure 1: Preparation of a soluble salt from an acid and an insoluble base.

a) Explain the purpose of each of the following steps in the preparation of the pure, dry salt:

i) Adding excess insoluble base.

Model Answer:
Adding excess insoluble base ensures that all the acid has reacted, preventing any unreacted acid from contaminating the final salt product. This ensures complete neutralisation.

ii) Filtering the mixture after adding the base.

Model Answer:
Filtering removes the unreacted excess insoluble base from the solution. This ensures that only the soluble salt solution proceeds to the next steps, leading to a pure product.

b) Describe in detail how you would prepare a pure, dry sample of copper sulfate from dilute sulfuric acid and copper(II) oxide. Include all necessary steps and observations. (6 marks)

Model Answer:
(a) Add dilute sulfuric acid to a beaker and warm it gently.
(b) Add excess copper(II) oxide (a black insoluble base) to the warm acid, stirring continuously until no more dissolves and some solid remains at the bottom. The black copper(II) oxide will react to form a blue solution of copper sulfate.
(c) Filter the mixture to remove the unreacted excess copper(II) oxide. The filtrate will be a clear blue copper sulfate solution.
(d) Heat the copper sulfate solution gently in an evaporating basin to evaporate some of the water, concentrating the solution until the crystallisation point is reached (test by dipping a cold glass rod into the solution; crystals should form on it).
(e) Allow the concentrated solution to cool slowly at room temperature. Blue copper sulfate crystals will form as the solution cools.
(f) Filter the crystals from the remaining solution (mother liquor) and wash them with a small amount of cold distilled water.
(g) Dry the pure copper sulfate crystals between two pieces of filter paper or in a desiccator.