

Prior Knowledge Review: Reactions of Acids

Answer the questions below.

1. Calculate the M_r of sulfuric acid (H₂SO₄). H=1, S=32, O=16

$$(2 \times 1) + 32 + (4 \times 16) = 98$$

2. Calculate the percentage by mass of hydrogen in sulfuric acid.

$$\% \text{ by mass} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100$$

$$\% \text{ by mass} = \frac{2}{98} \times 100$$

$$\% \text{ by mass} = 2.04 \%$$

3. Name another acid.

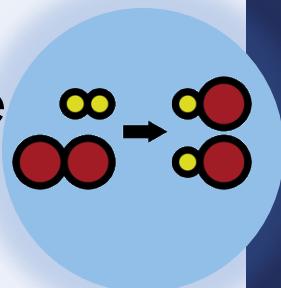
Hydrochloric acid, nitric acid, ethanoic acid, citric acid, carbonic acid

4. State the pH range of acids.

Less than 7, pH 1-6

5. State the colour that Universal Indicator would turn in an alkaline solution.

Purple/blue



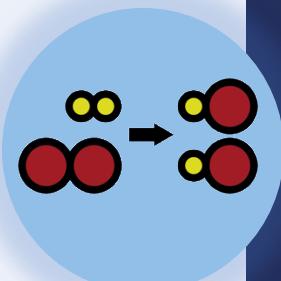
Prior Knowledge Review: Reactions of Acids

Do Now:

1. Calculate the M_r of sulfuric acid (H_2SO_4). H=1, S=32, O=16
2. Calculate the percentage by mass of hydrogen in sulfuric acid.
3. Name another acid.
4. State the pH range of acids.
5. State the colour that Universal Indicator would turn in an alkaline solution.

Drill:

1. State the chemical formula for water.
2. State the chemical formula for carbon dioxide.
3. Use calculations to show whether water or carbon dioxide contains a greater percentage by mass of oxygen.

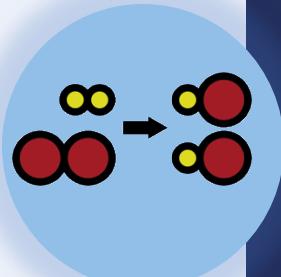


Prior Knowledge Review: Reactions of Acids

Read Now:

Acids can be neutralised by alkalis (which are usually soluble metal hydroxides, like sodium hydroxide) and bases (which are insoluble metal hydroxides, like calcium hydroxide, metal oxides, like copper oxide and metal carbonates, like potassium carbonate). The reaction between an acid and a metal or a metal compound always produces a salt. If an acid reacts with a metal oxide or hydroxide, a salt and water are formed and if an acid reacts with a metal carbonate, a salt, water and carbon dioxide are formed. Sodium chloride is one example of a salt, but a salt is any compound made from a reaction between a metal and an acid.

1. Define a salt.
2. Write a general equation for a reaction between an acid and a metal oxide.
3. Write a general equation for a reaction between an acid and a metal hydroxide.
4. Write a general equation for a reaction between an acid and a metal carbonate.
5. Give an example of a salt.



Prior Knowledge Review: Reactions of Acids

C4.3.9

Science
Mastery

C4.3.1 Prior Knowledge Review

C4.3.2 (HT) Introducing the Mole

C4.3.3 (HT) Mole Calculations

C4.3.4 PKR: Concentration

C4.3.5 TIF: Calculating Concentration

C4.3.6 TIF: Calculating an Unknown Concentration

C4.3.7 (HT) Amounts of Substances in Equations

C4.3.8 (HT) Limiting Reactants

➤ **C4.3.9 PKR: Reactions of Acids**



C4.3.10 Acids, Alkalies and Neutralisation

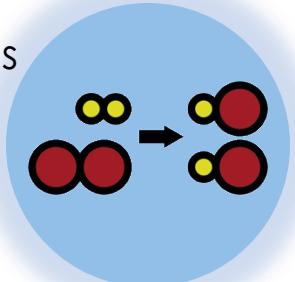
C4.3.11 TIF: Acid-Alkali Titration

C4.3.12 TIF: Acid-Alkali Titration Analysis

C4.3.13 TIF: Titration Calculations

C4.3.14 (HT) Strong and Weak Acids

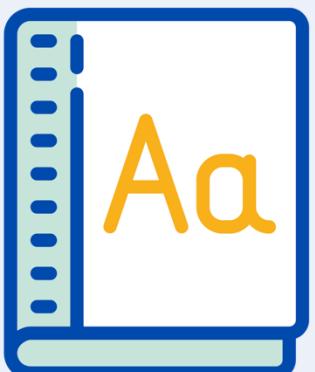
C4.3.15 TIF: Volumes of Gases



Following this lesson, students will be able to:

- Write word equations for reactions with acids
- Use reactants to name salts
- Predict the products of chemical reactions

Key Words:



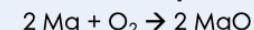
acid base alkali
neutralisation chemical formula

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the **pre-unit quiz**.

- The teacher should customise this slide as needed, to facilitate
 - **reteach, explanation, demonstration or modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
 - **practise** answering specific questions or of key skills.
 - **redrafting** or **improving** previous work.

Answer the questions below.



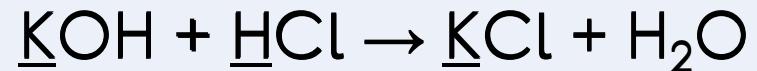
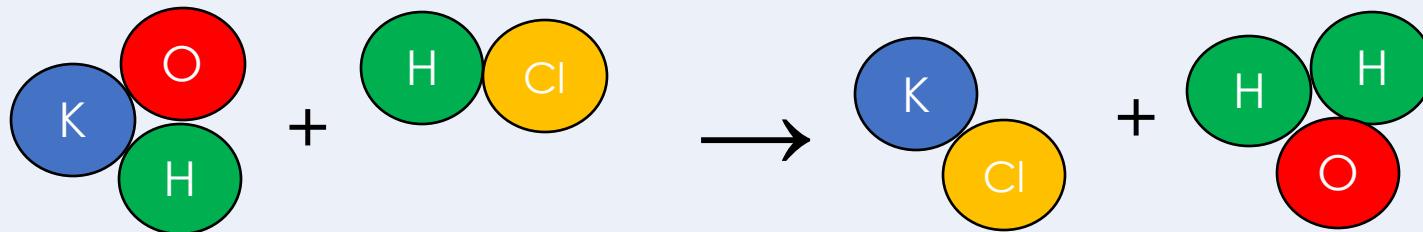
48 g of magnesium burns in 100 g of oxygen.

1. Calculate the number of moles of magnesium present.
 A. 0.5 mol
 B. 1 mol
 C. 2 mol
2. Calculate the number of moles of oxygen present.
 A. 6.25 mol
 B. 3.125 mol
 C. 0.32 mol
3. Which is the limiting reactant?
 A. Mg
 B. O₂
 C. MgO

What happens in a neutralisation reaction?

A **salt** is formed when the hydrogen in an acid is replaced by a metal.

Potassium hydroxide + hydrochloric acid → Potassium chloride + water salt



The '**H**' in 'HCl' is **replaced** with the '**K**' from 'KOH'.

The **OH** from the alkali and **H** from the acid form **H₂O** (water).

How many ways can neutralisation happen?

Alkalies/Bases

They react with acids to produce **salt** and **water**.

These can be metal oxides or metal hydroxides.



Metal Carbonates

A metal carbonate is a compound containing a **metal**, **carbon** and **oxygen**. They react with acids to produce a **salt**, **water** and **carbon dioxide**.



Did you know?
Calcium carbonate can be found in rocks as a mineral.



How many ways can neutralisation happen?

A **base** is a substance that can react with acids and neutralise them. Most are **insoluble**.

Examples of **bases**: copper oxide (CuO), zinc oxide (ZnO)

Alkalis are **soluble bases**.

Examples of **alkalis**: sodium hydroxide (NaOH), potassium hydroxide (KOH)

Carbonates are **bases**, they are insoluble and neutralise acids to make salt, water and carbon dioxide.

Examples of **carbonates**: copper carbonate (CuCO3), calcium carbonate (CaCO3)

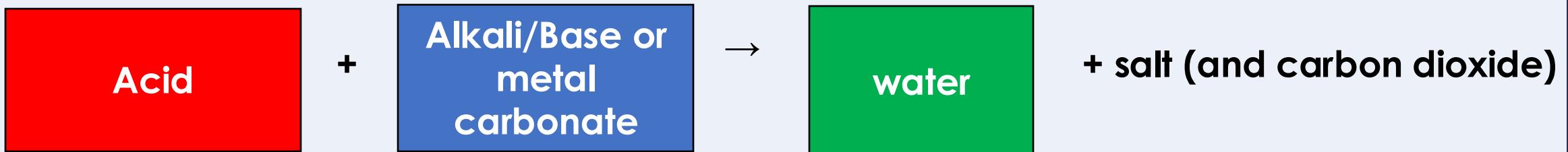
Neutralisation reactions

Acid + alkali → salt + water

Acid + base → salt + water

Acid + metal carbonate → salt + water + carbon dioxide

These are neutralisation reactions because:



Acid + metal reactions are **not** neutralisation reactions.

Naming salts

Hydrochloric acid produces **chloride** salts

e.g. hydrochloric acid + sodium hydroxide → **sodium chloride** + water

Nitric acid produces **nitrate** salts e.g. sodium nitrate

e.g. nitric acid + sodium hydroxide → **sodium nitrate** + water

Sulfuric acid produces **sulfate** salts e.g. sodium sulfate

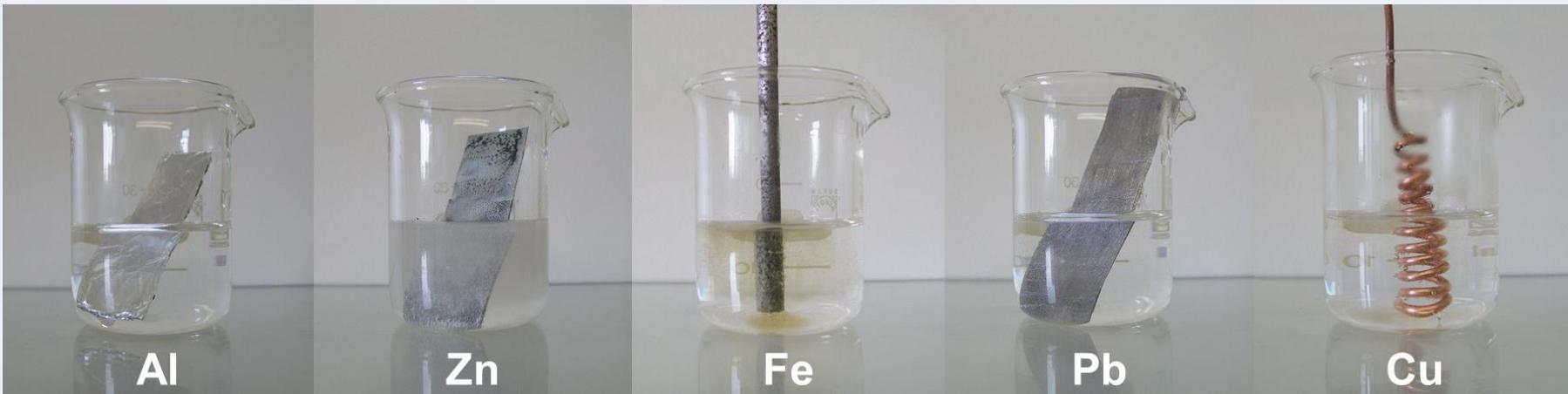
e.g. sulfuric acid + sodium hydroxide → **sodium sulfate** + water

Acids and Metals

Acids react with metals to product **salt** and **hydrogen**.

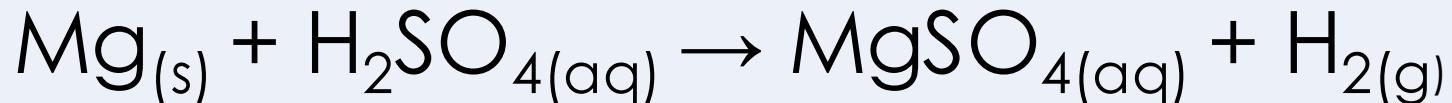


Magnesium + hydrochloric acid → magnesium chloride + hydrogen



(HT) Writing ionic equations

Look at this chemical equation:



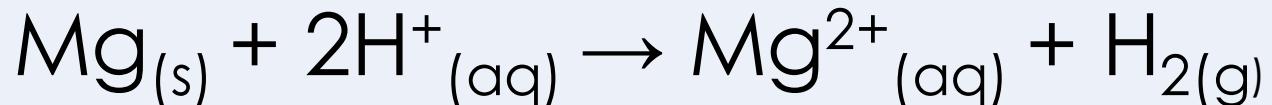
Use your
list of ions
handout to
help!

We can use **2 steps** to write this as an ionic equation:

Step 1: Split up the aqueous (aq) substances into their ions



Step 2: Delete the spectator ions (the ones that appear on both sides)



(HT) Writing ionic equations

The equation for the reaction between zinc and hydrochloric acid is as follows:



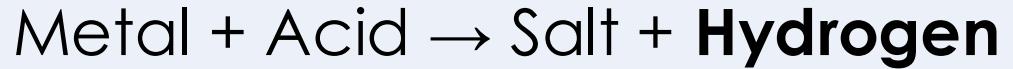
1. Write an ionic equation for this reaction



2. Explain which species is reduced in this reaction.

Hydrogen is reduced in this reaction because it gains electrons

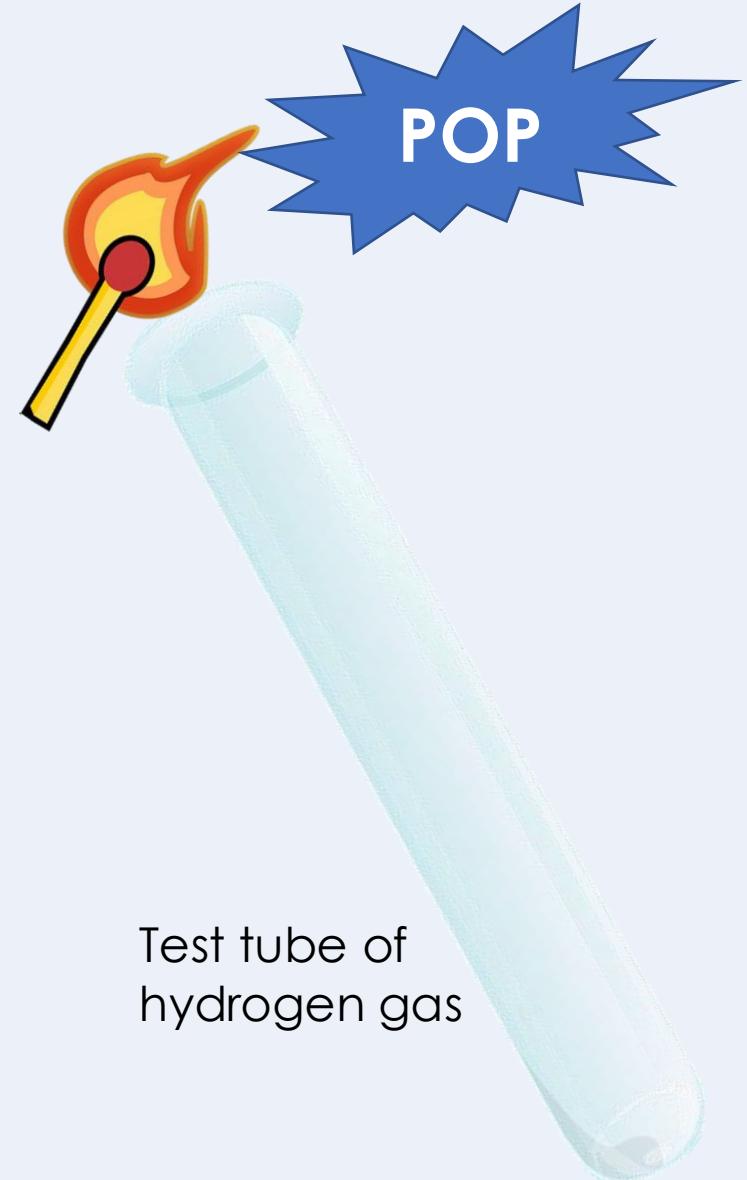
Testing for Gases



The test for hydrogen uses a **burning splint** held at the open end of a test tube of the gas.

Hydrogen burns rapidly with a pop sound.

This is called the **squeaky pop test**.



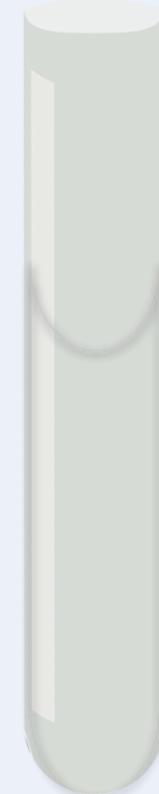
Test tube of
hydrogen gas

Testing for Gases

Metal Carbonate + Acid → Salt + Water + **Carbon dioxide**

The test for carbon dioxide gas uses a solution of **calcium hydroxide** (also called **limewater**).

When carbon dioxide is shaken with or bubbled through limewater, the limewater turns **milky** (cloudy).



Turns milky



Which statements do you agree with?

Sam: Reaction between acid and metal carbonates forms bubbles due to oxygen being released

Jo: Alkalies are bases

Houria: Carbonate salts are formed when acid reacts with metal carbonates

Maysa: Acids reacting with metals are an example of neutralisation

A student has samples copper carbonate, copper oxide and copper.

How could they use chemical tests to prove which is which?

- What would they expect if they reacted a sample of each with an acid?
- What chemicals could be used to test for the products of these reactions?
- What would a positive test result be?



Complete the equations below:

1. Acids + alkali/base → Salt + water
2. Acids + metal carbonate → Salt + water + carbon dioxide
3. Hydrochloric acid + lithium oxide → Lithium chloride + water
4. Nitric acid + magnesium hydroxide → Magnesium nitrate + water
5. Sulfuric acid + copper carbonate → Copper sulfate + water
+ carbon dioxide
6. Hydrochloric acid + calcium carbonate → Calcium chloride + water
+ carbon dioxide

Drill

1. State the general equation for the reaction between an acid and an alkali.
2. State the general equation for the reaction between an acid and a metal carbonate.
3. State the general equation for the reaction between an acid and a metal.
4. Describe a positive test for hydrogen.
5. Describe a positive test for carbon dioxide.
6. True or false: the reaction between an acid and a metal is an example of neutralisation.

Drill answers

1. Acid + alkali → salt + water
2. Acid + metal carbonate → salt + water + carbon dioxide
3. Acid + metal → salt + hydrogen
4. A lit splint burns with a squeaky pop
5. Limewater turns milky/cloudy
6. False

Check for understanding

Answer the questions below.

1. Name the salt that would be produced when hydrochloric acid reacted with potassium hydroxide.
 - A. Potassium hydride
 - B. Potassium chloride
 - C. Potassium chlorine
2. The products of which reaction would give a positive squeaky pop test?
 - A. Nitric acid + calcium oxide
 - B. Nitric acid + calcium carbonate
 - C. Nitric acid + calcium
3. Which of these is not a neutralisation reaction?
 - A. Acid + metal
 - B. Acid + metal hydroxide
 - C. Acid + metal carbonate

Lesson C4.3.9

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link](#)
or by emailing sciencemastery@arkonline.org
Thank you!