KS3 SCIENCE · CHEMISTRY

Metals and reactivity revision sheet

Name _____

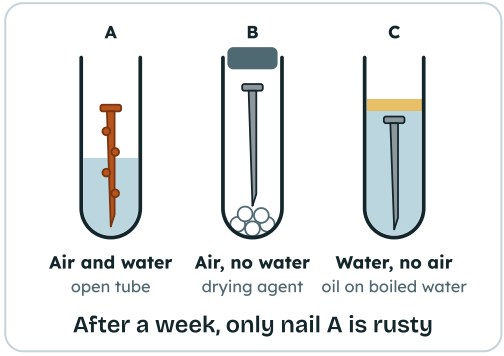
1. Metals and oxygen



magnesium + oxygen → magnesium oxide

carbon + oxygen → carbon dioxide

- **Oxidation** is a reaction in which a substance combines with oxygen. The product is an **oxide**.
- **Metal oxides are basic.** They are bases, so they neutralise acids.
- **Most non-metal oxides are acidic.** Carbon dioxide and sulfur dioxide dissolve in water to make acids.
- Magnesium burns with a bright white flame. Copper only turns black. Gold does not react.
- **Rusting** is a slow oxidation of iron. It needs oxygen and water together.



After a week, only nail A is rusty

2. Metals with water and acids



metal + water → metal hydroxide + hydrogen

metal + acid → salt + hydrogen

METALS	IN COLD WATER	IN DILUTE ACID
Potassium, sodium, calcium	React. Potassium is the fastest	React very fast. Potassium and sodium are far too dangerous to try
Magnesium, zinc, iron	Very slow, or nothing to see	Fizz: magnesium fast, zinc steadily, iron slowly
Copper, silver, gold	No reaction	No reaction

- The bubbles are **hydrogen**. The faster a metal fizzes, the more **reactive** it is.
- The salt is named after the metal and the acid. Hydrochloric acid makes chlorides. Sulfuric acid makes sulfates. So zinc + sulfuric acid → zinc sulfate + hydrogen.

3. The reactivity series

Most reactive

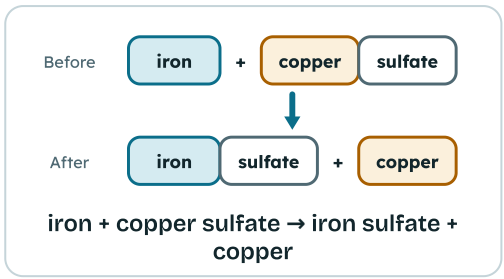
- **Potassium**
- **Sodium**
- **Calcium**
- **Magnesium**
- **Aluminium**
- **Carbon**
- **Zinc**
- **Iron**
- **Lead**
- **Hydrogen**
- **Copper**
- **Silver**
- **Gold**

Least reactive

- The **reactivity series** is a list of metals in order, from the most reactive to the least reactive.
- **Top:** potassium, sodium and calcium react with cold water.
- **Middle:** the metals from magnesium down to lead react with dilute acid.
- **Bottom:** copper, silver and gold do not react with water or with dilute acid. Gold is found in the ground as the metal itself.
- **Carbon and hydrogen are not metals.** They are in the list as markers. Carbon sits between aluminium and zinc. Hydrogen sits between lead and copper: the metals above it react with dilute acids.
- To place a new metal, compare its reactions. A metal that fizzes in acid but does not react with cold water belongs between calcium and copper.
- To remember the order: **P**lease **S**top **C**alling **M**e **A** **C**areless **Z**ebra. **I**nstead **L**earn **H**ow **C**opper **S**aves **G**old.

4. Displacement reactions

- In a **displacement** reaction, a more reactive metal takes the place of a less reactive metal in a compound.
- An iron nail in copper sulfate solution: brown copper coats the nail, and the blue solution fades to pale green.
- It only works one way. Copper in iron sulfate solution does nothing, because copper is less reactive than iron.
- To predict: find both metals in the series. There is a reaction only if the metal you add is higher than the metal in the compound.
- Metal oxides can be displaced too: aluminium + iron oxide → aluminium oxide + iron.



iron + copper sulfate → iron sulfate + copper



5. Extracting metals

- An **ore** is a rock with enough of a metal compound in it to be worth mining for the metal.

PLACE IN THE SERIES	METHOD	WHY
Above carbon: potassium down to aluminium	**Electrolysis**: electricity splits the compound	Carbon cannot displace these metals. Electricity costs a lot
Below carbon: zinc, iron, lead, copper	Heat the metal oxide with **carbon**	Carbon is more reactive, so it displaces the metal
Gold	No reaction needed	It is so unreactive that it is found as the metal itself

iron oxide + carbon → iron + carbon dioxide

Losing oxygen is called **reduction**.



6. Ceramics, polymers and composites

MATERIAL	WHAT IT IS	PROPERTIES	USED FOR
Ceramic	Pottery, porcelain, brick, glass	Hard, brittle, very high melting point, does not conduct electricity	Tiles, bricks, mugs
Polymer	Very long chain molecules. Poly(ethene), PVC, rubber	Light, flexible, easy to mould, does not conduct electricity	Bags, bottles, the covering on cables
Composite	Two or more materials combined. Reinforced concrete, fibreglass (GRP), MDF	Some of the properties of each material in it	Bridges and buildings, boat hulls, furniture

- In reinforced concrete, the concrete takes the squashing and the steel bars take the stretching.

Key words

Pictures are illustrations made for this sheet, not real photographs.

Oxidation: a reaction in which a substance combines with oxygen

Acidic oxide: an oxide that makes an acid in water, such as carbon dioxide

Reactivity series: a list of metals in order of how reactive they are

Displacement: a more reactive metal takes the place of a less reactive one in a compound

Extraction: separating a metal from its compound

Ceramic: a hard, brittle material with a very high melting point

Oxide: a compound of an element with oxygen

Rusting: the slow reaction of iron with oxygen and water

Hydrogen: the gas made when a metal reacts with water or an acid

Unreactive: hardly ever takes part in chemical reactions

Reduction: a reaction in which a substance loses oxygen

Polymer: a material made of very long chain molecules

Basic oxide: an oxide that neutralises acids, such as a metal oxide

Reactivity: how readily a substance reacts

Salt: the compound made, with hydrogen, when a metal reacts with an acid

Ore: a rock with enough metal compound in it to be worth extracting the metal

Electrolysis: using electricity to split a compound into its elements

Composite: a material made by combining two or more materials