

Box 1: Keywords

Word	Definition
Acid	A solution with a pH value less than 7
Ceramic	A compound such as a metal silicate or oxide that is hard, strong and has a high melting point
Composite	A mixture of materials with properties that are a composition of those of the materials in it
Displacement reaction	A reaction in which a more reactive metal displaces a less reactive metal from its compound
Material	The different types of stuff that things are made from
Metal	Most elements are metals. They are good conductors of energy and electricity
Polymer	A substance made up of very long molecules
Reactivity series	A list of metals from most to least reactive
Salt	A compound in which the hydrogen atoms of an acid are replaced by atoms of a metal element

Box 2: Metals and acid

- If a metal reacts with an acid, it produces a salt and hydrogen gas.

$$\text{metal} + \text{acid} \rightarrow \text{salt} + \text{hydrogen}$$
- All acid compounds have hydrogen in them.
- When the hydrogen is replaced by a metal, the compound is called a salt.

For example, sulfuric acid has the formula H_2SO_4 . Copper sulfate has the formula CuSO_4 – it is a salt because the copper has taken the place of the hydrogen in sulfuric acid.

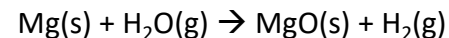
Box 3: Metals and water or steam

- Very reactive metals like sodium will react with cold water to produce a metal hydroxide and hydrogen gas.

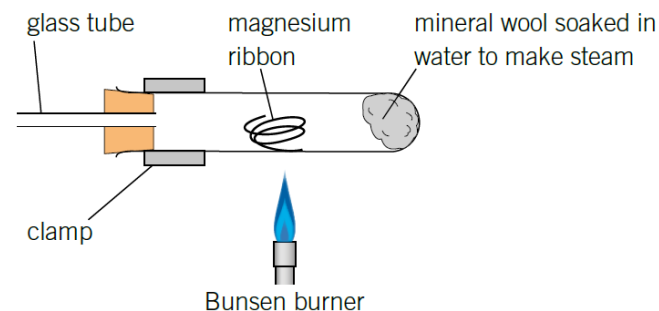
$$\text{sodium} + \text{water} \rightarrow \text{sodium hydroxide} + \text{hydrogen}$$

$$2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{H}_2\text{(g)}$$
- Other metals like magnesium only react with steam, and produce a metal oxide and hydrogen.

magnesium + steam $\rightarrow$ magnesium oxide + hydrogen



- Magnesium can be reacted with steam using the following experimental set-up.





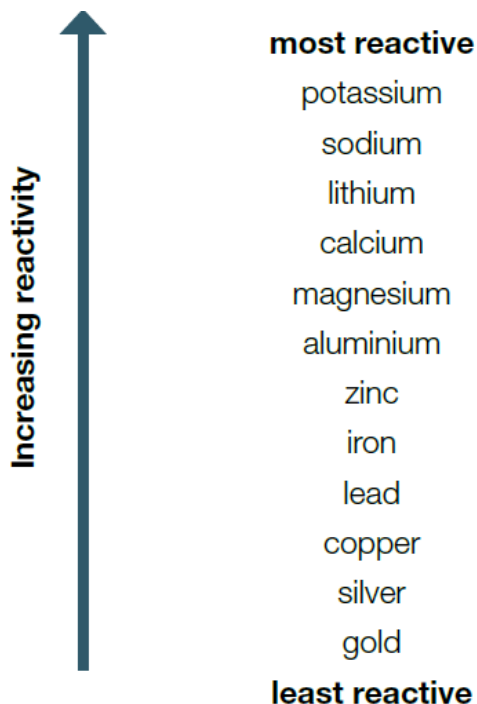
Box 5: Displacement reactions

A **displacement reaction** occurs when a more reactive element takes the place of a less reactive element in a compound. In metals, this means that the more reactive metal will become a compound, and the less reactive one an element.

For example, iron is more reactive than copper so:

copper sulfate + iron $\rightarrow$ copper + iron sulfate

The iron has displaced the copper from its compound. The solution changes from blue to pale green and the metal changes from grey



Box 6: Metals and oxygen

Many metals will react with oxygen from the air to produce a metal oxide. Often, they will need to be heated before they can react.

Metal	Reaction with oxygen
magnesium	burns vigorously
zinc	burns less vigorously
iron	burns
lead	do not burn; when heated, form layer of oxide on surface
copper	
gold	no reaction

Box 7: Materials

A **ceramic** is a hard, brittle material that is made by firing a material, such as clay, at a high Metal extraction temperature. Ceramics also have similar chemical properties to each other. They do not react with water, acids, or alkalis.

A **polymer** is a substance with very long molecules. There are many polymers. Different polymers have different properties. Their properties make them suitable for their uses. Natural polymers include wool and rubber. Synthetic polymers include polyester and nylon.

A **composite** is a mixture of materials. Each material has different properties. The composite has properties that are a combination of the properties of the materials that are in it.

Box 8: Cross curricular links