C5 Metals and reactivity
Knowledge organiser

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Salts

Salts are substances which are formed when an acid reacts with a metal or metal compound. The name of the salt produced depends on the metal and the acid involved in the reaction.

Different acids form different types of salts:

- Hydrochloric acids form chloride
- Sulphuric acids form sulphates
- Nitric acids form nitrates

Metal acid reaction:

metal + acid ➡ salt + …….
iron + sulphuric acid ➡ iron sulphate + ……..

Metal carbonate reaction:

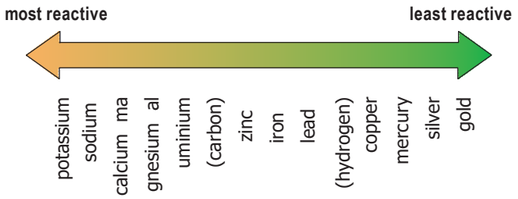
metal carbonate + acid ➡ salt + …….
calcium carbonate + nitric acid ➡ calcium nitrate + …….

Neutralisation reactions (one from year 7):

Metal hydroxide + acid ➡ salt + ……
sodium hydroxide + hydrochloric acid ➡ sodium chloride + ……

The reactivity series

- The **reactivity series** describes how reactive different metals are compared to one another
- The higher the metal is in the reactivity series the more reactive it will be. This means that it will react much more vigorously.



- Carbon and hydrogen are in the reactivity series so that you can see their relative reactivity. Metals higher than carbon in the series must be extracted using **electrolysis**.

Metal reactions

When a metal reacts with an acid it will produce a salt and hydrogen gas, the fizzing that you see is the hydrogen gas being given off.

metal + acid ➡ salt + hydrogen
magnesium + hydrochloric acid ➡ magnesium chloride + hydrogen

When a metal **carbonate** reacts with an acid, a salt, water and carbon dioxide is given off.

Metal carbonate + acid ➡ salt + water + carbon dioxide
Sodium carbonate + sulphuric acid ➡ sodium sulphate + water + carbon dioxide

When a metal reacts with oxygen a metal **oxide** is formed, this process is known as **Oxidation.**

metal + oxygen ➡ metal oxide
aluminum + oxygen ➡ aluminum oxide

When a metal reacts with water it forms a metal **hydroxide** and hydrogen gas. The alkali (group 1) metals react most vigorously, giving off a brightly coloured flame.

metal + water ➡ metal hydroxide + hydrogen
sodium + water ➡ sodium hydroxide + hydrogen

A special oxidation reaction happens between iron and oxygen in the presence of water. This is called rusting.

Iron + water + oxygen ➡ hydrated iron oxide

When a more reactive metal reacts with a compound containing a less reactive metal, it can take it's place, this is known as a **displacement** reaction

- If the metal on it's own is higher in the **reactivity series** than the metal in the compound a reaction will take place
- If the metal on it's own is lower in the reactivity series than the metal in the compound, a reaction will not take place

Metal extraction

Unreactive metals such as gold are found in the Earth's crust as elements. However most metals are found combined with other elements to form compounds.

Most metals are extracted from **ore** found in the Earth's crust. An ore is a rock that contains enough of a metal or a metal compound that makes extracting it worthwhile.

If a metal is less reactive than carbon then heating the metal in a fire with carbon will cause the carbon to **displace** the metal from its compound.

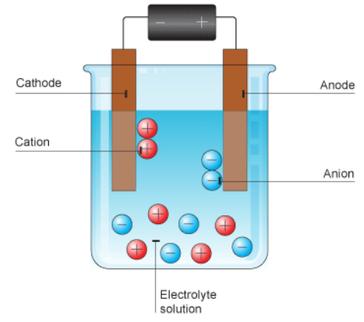
An example of this is the extraction of copper from it's ore Malachite.

- copper oxide + carbon ➡ copper + carbon dioxide

Electrolysis

When a metal is more reactive than carbon then extraction by heating with carbon does not work.

Electrolysis can be used instead to extract these metals from their compounds.



The metal compound is melted and electrical current is passed through. The metal ions are attracted to and form a layer on the cathode (the negative electrode).

Keyterms Make sure you can write definitions for these key terms.

acid acidic neutralisation oxide chemical carbonate reactivity reactivity series salt displacement hydroxide hydrochloric acid sulphuric acid nitric acid ore electrolysis