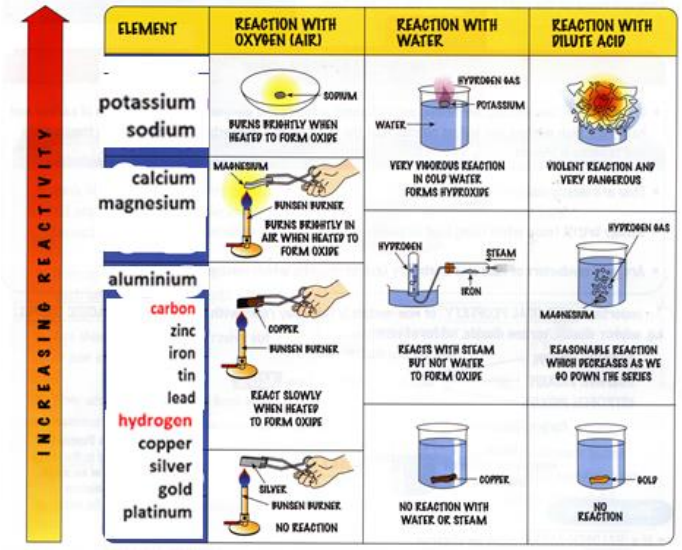
AQA Trilogy-Chemistry key terms – Chemical Changes

The reactivity series

Metals react with oxygen to produce metal oxides. The reactions are oxidation reactions because the metals gain oxygen.

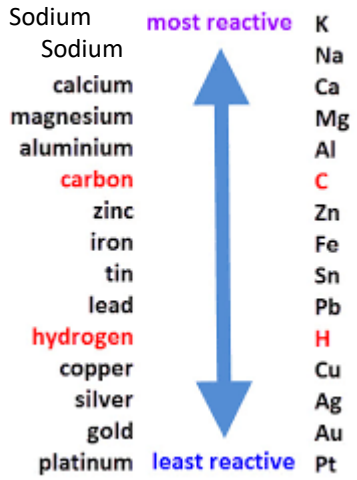
When metals react with other substances the metal atoms form positive ions.



Metals can be arranged in order of their reactivity in a reactivity series.

The metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper can be put in order of their reactivity from their reactions with water and dilute acids.

Metals at the top are most reactive. The reactivity of a metal is related to its tendency to form positive ions.



A more reactive metal can displace a less reactive metal from a compound.

Reduction is the loss of oxygen from a compound.
Oxidation is the gain of oxygen.

Extraction of metals and reduction

If the metal is **less reactive than carbon**, it can be cheaply extracted from the metal oxide by using the reduction with **carbon**. – forms CO_2 (greenhouse gas).

Unreactive metals are found on their own (e.g. gold). Most **metals are found in compounds** and must be separated from other elements first (e.g. O_2)

Acids

Acid + Metal ⟶ Salt + Hydrogen

For example:
Hydrochloric acid + Magnesium ⟶ Magnesium Chloride + Hydrogen

HT ONLY:
Acid + Metal ⟶ Salt + Hydrogen
Oxidation is the loss of electrons and happens to the non metal ion: $\mathbf{2Cl^- \rightarrow Cl2 + 2e^-}$
Reduction is the gain of electrons and happens to the metal ion $\mathbf{Mg^{2+} + 2e^- \rightarrow Mg}$

Acids are substances which produce H^+ ions when we add them to water.

Bases are substances that will neutralise acids. Metal oxides and hydroxides are bases

An alkali is a soluble hydroxide. Alkalis produce OH^- ions when we add them to water.

We can use the pH scale to show how acidic or alkaline a solution is.

AQA Trilogy-Chemistry key terms – Chemical Changes

In neutralisation reactions, hydrogen ions react with hydroxide ions to produce water. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$	Soluble salts can be made from the reaction between an acid and a base. Acid + Base ➞ Salt + Water To make salts from acid and alkali: mix acid and alkali solutions; use indicator to show when have completely reacted to produce a salt solution; crystallise solution to produce solid salt.
Soluble salts can also be made by reacting acids with insoluble substances like a) metals: Acid + Metal ➞ Salt + Hydrogen b) metal oxide: Acid + Metal oxide ➞ Salt + water c) hydroxides: Acid + Hydroxide ➞ Salt + water d) metal carbonates: Acid + Metal Carbonate ➞ Salt + Water + Carbon Dioxide To make salts from an insoluble base: add base to the acid until no more will react; filter to remove the excess solid; crystallise the salt solution to produce solid salt.	The salt made depends on the metal and the acid: Hydrochloric acid (HCl) produces chlorides. Nitric acid (HNO_3) produces nitrates. Sulfuric (H_2SO_4) acid produces sulfates.
The pH scale, from 0 to 14, is a measure of the acidity or alkalinity of a solution, and can be measured using universal indicator or a pH probe. pH 0-6 are acids (Red with UV indicator) pH is neutral (Green with UV indicator) pH 8-14 are alkalis (Blue with UV indicator)	HT ONLY A strong acid is completely ionised in aqueous solution. Examples of strong acids are hydrochloric, nitric and sulfuric acids. A weak acid is only partially ionised in aqueous solution. Examples of weak acids are ethanoic, citric and carbonic acids. For a given concentration of aqueous solutions, the stronger an acid, the lower the pH. As the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10.
Electrolysis	
Electrolysis breaks down a substance using electricity. The substance being electrolysed is called the electrolyte.	**Ionic compounds** can only be electrolysed when they are molten or in solution because their ions are **free** to move to the electrodes.
Positive ions move to the negative electrode (the cathode) and negative ions move to the positive electrode (the anode). Ions are discharged at the electrodes producing elements.	**HT ONLY:** **Reactions at electrodes can be represented by half equations, for example:** $2Cl^- \rightarrow Cl_2 + 2e^-$ $Na^+ + e^- \rightarrow Na$
Normally the metal ion is made at the cathode and non-metal ion produced at the anode. BUT … Hydrogen is produced at the cathode if the metal is more reactive than hydrogen. Oxygen is produced at the anode unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged.	Electrolysis is used to extract metals if they are too reactive to be extracted by reduction with carbon or if the metal reacts with carbon. Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current.

AQA Trilogy-Chemistry key terms – Chemical Changes

HT ONLY Reactions at electrodes can be represented by half equations, for example: $2H^+ + 2e^- \rightarrow H_2$ $4OH^- \rightarrow O_2 + 2H_2O + 4e$ $4OH - 4e^- \rightarrow O_2 + 2H_2O$	Molten aluminium oxide is electrolysed in to make aluminium metal. First the aluminium oxide is mixed with cryolite to lower its melting point. A carbon anode is used. The positive carbon electrode is replaced regularly as it reacts with the oxygen to form carbon dioxide. Aluminium forms at negative electrode. $\mathbf{Al^{3+} + 3e^- \rightarrow Al}$ Oxygen forms at positive electrode. $\mathbf{2O^{2-} \rightarrow O_2 + 4e^-}$
At the electrodes, negative ions lose electrons (they are **oxidised**) and positive ions gain electrons (they are **reduced**)	When we electrolyse brine (salty water) we produce three products- **chlorine gas, hydrogen gas and sodium hydroxide solution** (an alkali)