



Oxidation **I**s **L**oss (of electrons) **R**eduction **I**s **G**ain (of electrons)

HT ONLY: Reactions between metals and acids are redox reactions as the metal donates electrons to the hydrogen ions. This displaces hydrogen as a gas while the metal ions are left in the solution.

Ionic half equations (HT only)

For displacement reactions

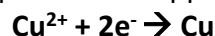
Ionic half equations show what happens to each of the reactants during reactions

For example:
The ionic equation for the reaction between iron and copper (II) ions is:
 $\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Fe}^{2+} + \text{Cu}$

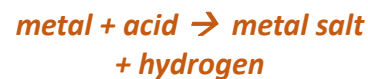
The half-equation for iron (II) is:



The half-equation for copper (II) ions is:



Reactions with acids

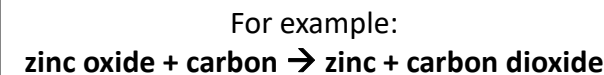


Acids react with some metals to produce salts and hydrogen.

Reactions of acids and metals

Extraction using carbon

Metals less reactive than carbon can be extracted from their oxides by reduction.



Unreactive metals, such as gold, are found in the Earth as the metal itself. They can be mined from the ground.

Oxidation and reduction in terms of electrons (HT ONLY)

Neutralisation of acids and salt production

Acid name

Salt name

Hydrochloric acid

Chloride

Sulfuric acid

Sulfate

Nitric acid

Nitrate



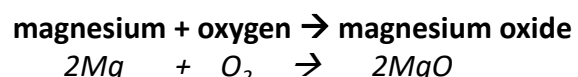
Neutralisation

Acids can be neutralised by alkalis and bases

An **alkali** is a soluble base e.g. metal hydroxide.
A **base** is a substance that neutralises an acid e.g. a soluble metal hydroxide or a metal oxide.

Metals and oxygen

Metals react with oxygen to form metal oxides



Reduction

This is when oxygen is removed from a compound during a reaction

e.g. metal oxides reacting with hydrogen, extracting low reactivity metals

Oxidation

This is when oxygen is gained by a compound during a reaction

e.g. metals reacting with oxygen, rusting of iron

Reactions of acids

AQA Chemical Changes 1

Reactivity of metals

The reactivity series

Metal oxides

Extraction of metals and reduction

Reactions with water

Reactions with acid

Group 1 metals

Reactions get more vigorous as you go down the group

Reactions get more vigorous as you go down the group

Group 2 metals

Do not react with water

Observable reactions include fizzing and temperature increases

Zinc, iron and copper

Do not react with water

Zinc and iron react slowly with acid. Copper does not react with acid.

Metals form positive ions when they react

The reactivity of a metal is related to its tendency to form positive ions

The reactivity series arranges metals in order of their reactivity (their tendency to form positive ions).

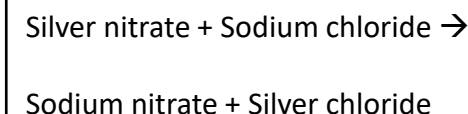
Carbon and hydrogen

Carbon and hydrogen are non-metals but are included in the reactivity series

These two non-metals are included in the reactivity series as they can be used to extract some metals from their ores, depending on their reactivity.

Displacement

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



potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt