Chemistry Knowledge Organiser
C5 - Chemical changes

Key Terms	Definitions
Oxidation	The loss of electrons from an atom OR when an atom gains an oxygen atom
Reduction	The opposite to oxidation, when an atom gains electrons OR when an atom loses an oxygen atom
REDOX Reaction	A reaction where one atom is oxidised and another atom is reduced

Reactions of Metals

When a metal reacts with water it produces a metal hydroxide and **hydrogen gas.**

The more reactive the metal is**,** the more vigorous the reaction. For example:

Lithium + Water → Lithium Hydroxide + Hydrogen

You see a similar pattern for the reaction between metals and acids however the products in these reactions are different, in this case you will make a salt and water, the salt will depend on the type of acid that you have used.

Lithium + Hydrochloric Acid → Lithium Chloride + Water

If sulphuric acid is used the salt made will be a sulphate, if nitric acid is used the salt will be a nitrate**.**

Metals also react with oxygen to form metal oxides; in this reaction the metal donates electrons to the oxygen. This means the metal is **oxidised as it has lost electrons. The oxygen is reduced as it has gained electrons.**

Extraction of Metals

A metal ore is a compound found in rock, dug out of the ground, that contains enough metal that it is **economical** to extract it. For example, magnesium oxide. In order for us to use the magnesium we need to **extract** it from the oxide.

Metals more reactive than carbon are extracted from their ore using **electrolysis**.

Metals which are less reactive than carbon are extracted from their ore using **reduction** (by adding carbon). Reduction is the removal of oxygen as seen in the example.

Example: Iron Oxide + Carbon → Iron + Carbon Dioxide

The least reactive metals such as gold and silver are found on their own— they do not form a compound. This means they do not need to be extracted from their ore.

Other methods of extraction

The amount of some metals is running out, this means people are finding new ways to extract metals like copper.

Phytomining uses plants to absorb copper from the soil, the plants are then burnt and the copper extracted.

Bioleaching involves using bacteria to make a l**eachate** that contains metal compounds.

Scrap iron can also be used to **displace copper** from a solution.

Oxidation Reactions

When working out whether a reaction is oxidation or reduction: in terms of electrons, remember OILRIG. This stands for oxidation is loss and reduction is gain.

HT - Oxidation Reactions of Acids

When an acid reacts with a metal a salt and hydrogen are produced. For example the symbol the symbol equation for an acid reacting with lithium is:

$$2Li + 2HCl \rightarrow 2LiCl + H_2$$

In this reaction, lithium has been oxidised because it has lost an electron to form a **+1 ion** and hydrogen has been reduced from a +1 ion to a **hydrogen molecule.**

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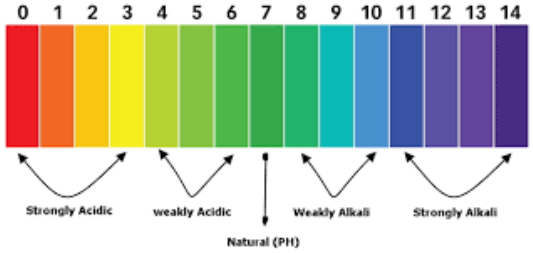
Acid	A substance which forms H+ ions in aqueous solution
Alkali	A substance which forms OH- ions when dissolved: these are soluble bases
Neutralisation	A reaction between an acid and an alkali making a salt and water
Strong Acid	An acid which totally dissociates in water
Base	A substance that can neutralise an acid to make a salt and water

Acids and Alkalis

Acids produce hydrogen ions (**H^+) in aqueous** solutions. Aqueous solutions of alkalis contain **hydroxide ions (OH^-).**

We measure the acidity of a substance using the **pH scale which runs from 0-14** between 0 and 6 the substances are acidic, 7 is neutral and between 8 and 14 is alkaline. The pH scale is a logarithmic scale: a decrease of 1 on the pH scale makes a substance **10 times more acidic.**



The pH scale is a measure of H^+ concentration: the lower the pH the higher the concentration of H^+ ions.

Neutralisation

To work out the names and formulae of salts you will need to know the names and formulae of the common acids

Acid	Name of salt	Ion that forms salt
Hydrochloric	Chloride	Cl^-
Sulphuric Acid	Sulphate	SO_4^{2-}
Nitric Acid	Nitrate	NO_3^{1-}

Neutralisation

When an acid reacts with an alkali a salt and water are produced. The ionic equation for the reaction of an **acid and an alkali is:**

$H^+ + OH^- \rightarrow H_2O$

Neutralisation

When an acid reacts with an alkali it will produce salt and water, below are the general equations for different types of neutralisation reaction: **Metal oxide+ Acid → Salt + Water**

Copper oxide +Hydrochloric Acid→ Copper chloride +Water

$CuO + HCl \rightarrow CuCl_2 + H_2O$

Metal carbonate + acid → Salt +Water + Carbon Dioxide

Magnesium Carbonate + Sulphuric Acid → Salt +Water +Carbon Dioxide

$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

Metal Hydroxide + Nitric Acid → Sodium Nitrate + Water

Sodium Hydroxide + Nitric Acid→ Sodium Nitrate + Water

$NaOH_+ + HNO_3 \rightarrow NaNO_3 + H_2O$

Some of the reactants (for example copper oxide) are insoluble but these can still carry out a neutralisation reaction. We call these **bases** not **alkalis.**

HT - Strong and Weak Acids

Acids can be defined as either a **strong or weak acid** a strong acid is one which fully dissociates in water for example hydrochloric acid

$HCl \rightarrow H^+ + Cl^-$

A weak acid is defined as one which only partially dissociates in water.

Strong acids are **not the same** as concentrated acids. Concentration is the number of particles in a given volume and not how much they dissociate.