Chemical Reactions

Identifying a Chemical Reaction

We can identify a chemical reaction by observing at least **one** of the following:

- A colour change
- A solid formed (Precipitation reaction)
 - A gas given off /smell (Effervescence reaction)
- An energy change (Exothermic = heat given out, endothermic = heat taken in)



Chemical and Physical Changes

A <u>chemical change</u> (chemical reaction) always makes a new product(s). Chemical reactions are **very difficult to reverse**. Burning is an example of a chemical reaction.

A <u>physical change</u> involves only a change in state and is very **easy to reverse**. No new substances are made. Changes of state are examples of physical changes:



Some examples of chemical and physical changes are shown below:

Description	Chemical reaction	Physical change
Neutralising a wasp sting with vinegar	\checkmark	
Ice melting		\checkmark
Salt dissolving		\checkmark
Starch forming in green plants	\checkmark	
Steam forming on cold windows		\checkmark
Petrol burning in a car	\checkmark	

Chemical Reactions

A chemical reaction always involves the formation of <u>new substances</u>. The chemical present at the start are called the <u>reactants</u> and the new substances formed are called the <u>products</u>.

Example: When potassium is mixed with water a purple solution of potassium hydroxide is produced and hydrogen gas is given off and catches fire.

Reactants: potassium and water

<u>Products</u>: potassium hydroxide and hydrogen



Word Equations

A word equation is a simple way of showing a chemical reaction. The **reactants** are shown on the left hand side and the **products** are shown on the right hand side.

The reactants are separated from each other by a <u>plus</u> sign and the products are separated from each other by a <u>plus</u> sign. There should be an <u>arrow</u> in the middle.

Examples: When sodium is mixed with water, a purple alkaline solution of sodium hydroxide is produced and hydrogen gas is evolved.

Sodium + water — sodium hydroxide + hydrogen

When hydrogen and oxygen combine they produce hydrogen oxide and a large quantity of energy.

Hydrogen + oxygen ---- hydrogen oxide (water)

Speeding up a chemical reactions

Chemists often want to speed up chemical reactions.

To do this they decrease the particle size, increase the temperature, increase the concentration or use a catalyst.

- The smaller the particle size, the bigger its surface area and the faster its reaction.
- The higher the temperature, the faster the reaction.
- The higher the concentration, the faster the reaction.

A <u>catalyst</u> is a chemical which changes the speed of a chemical reaction, but does not get used up itself.

Some Chemical Reactions

Reactions with Oxygen

When a metal reacts with oxygen, a metal oxide is produced.

Metal + Oxygen — Metal oxide

<u>Metals and Acid</u> Most metals react with acid (except gold, silver, and copper) **Metal + Acid — Salt + Hydrogen**

<u>Metals and Water</u> Most metals react with water (except gold, silver, and copper) **Metal + Water — Salt + Hydrogen**

<u>Summary:</u>

Using the above experiments, we can work out an order of how <u>reactive</u> metals are. This is called the <u>reactivity series</u>.

Metal	Reaction with	Reaction with acid	Reaction with
	oxygen		water
Potassium	Very fast	Very very fast	Reacts vigorously
Sodium		reaction	
Lithium			
Calcium	Reacts	Very fast reaction	
Magnesium			Reacts slowly
Calcium			
Aluminium			
Zinc		Reacts slowly	Reacts slowly with
Iron			hot water
Tin			
Lead			
Copper	Doesn't react	Doesn't react	Doesn't react
Silver			
Gold			

The Reactivity series

Displacement Reactions

A metal will displace another metal from solution if the solid metal is higher in the reactivity series than the metal solution.

Calcium +copper sulphate solution _____ Zinc + lead chloride solution _____ Copper + magnesium chloride solution _____ Calcium sulphate solution and copper zinc chloride solution + lead No reaction

Extraction of Metals

Metals are found in the Earth's crust, usually combined with other elements, as <u>ores</u>. Metals are extracted from their ores by different methods.

<u>Gold</u>

Gold is found uncombined in the earth's crust. The pure metal is separated by panning.

Silver and mercury

Silver and mercury are found as ores (silver oxide and mercury oxide). These ores need <u>heat</u> to separate the ore into its two elements.

<u>Copper</u>

Copper ore is heated with <u>carbon (a reducing agent)</u> and the pure metal obtained.

Zinc, iron, tin and lead

These chemicals are heated in a **blast furnace**.

Calcium, Magnesium and Aluminium

These metals are extracted from their ores by electrolysis.