Knowledge Organiser: Year 8 Chemical Reactions Part I

Conservation of mass

In a chemical reaction, there is no change in mass because the total number of atoms stays the same.

If the mass appears to have gone up, one of the reactants was a gas.

If the mass appears to have gone down, one of the products was a gas.

Chemical & Physical Reaction

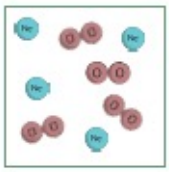
Chemical changes happen when chemical reactions occur. They involve the formation of new chemical elements or compounds.
E.g. Iron will react with oxygen to form Iron Oxide (rust).

Physical changes do not lead to new chemical substances forming. In a physical change, a substance simply changes physical state. E.g. A solid to a liquid.

Mixtures

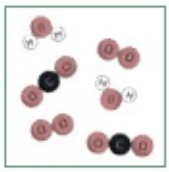
A mixture is a substance consisting of two or more substances not chemically combined together. You can have mixtures of elements, mixtures of compounds or mixtures containing both.

In a particle diagram of a mixture, not all of the molecules shown will be touching each other or be joined by sticks representing the bonds.



mixture of elements

mixture of compounds



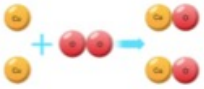
mixture of elements and compounds

Oxidation Reactions

In an oxidation reaction, a substance gains oxygen. Metals and non-metals can take part in oxidation reactions.

Metals react with oxygen in the air to produce metal oxides. For example, copper reacts with oxygen to produce copper oxide when it is heated in the air.

Copper + Oxygen → Copper Oxide
$2Cu + O_2 \rightarrow 2CuO$



Thermal Decomposition

Some compounds break down when heated, forming two or more products from one reactants.
Many metal carbonates can break down easily when it is heated:
Copper Carbonate → Copper Oxide + Carbon Dioxide

Copper carbonate is green, copper oxide is black. We can test for carbon dioxide using limewater. Limewater is colourless, but turns cloudy when carbon dioxide is bubbled through it.

What are combustion reactions?

Fuels burn in chemical reactions. Burning is also called **combustion**. In a combustion reaction, a substance reacts with oxygen, and energy is transferred to the surroundings as heat and light.

The fuel methane is a compound of carbon and hydrogen. Its chemical formula is CH_4. When it burns, it reacts with oxygen from the air. The reaction makes two products, carbon dioxide and water:

methane + oxygen → carbon dioxide + water

The particle diagram below represents this reaction. It shows that one molecule of methane reacts with two molecules of oxygen to make one molecule of carbon dioxide and two molecules of water.

Petrol is a mixture of compounds. Most of its compounds consist of atoms of hydrogen and carbon. Petrol makes mainly carbon dioxide and water when it burns in car engines.

Elements

An element is a substance that cannot be broken down into other substances. The smallest part of an element that can exist is an atom.

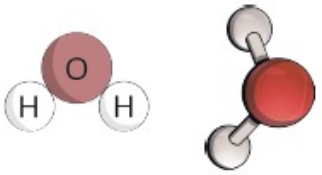
Each element is represented by a symbol. The first letter of the symbol is always capitalised, any following letters are lower case.

The symbols for the elements are arranged on the periodic table.

Compounds

A compound is a substance made when two or more elements are chemically bonded together.

A compound can be represented by a diagram. The atoms are shown touching each other or joined by a stick that represents a bond.



Water is a compound made from one oxygen atom and two hydrogen atoms. Its formula is H_2O.

Compound Formulae

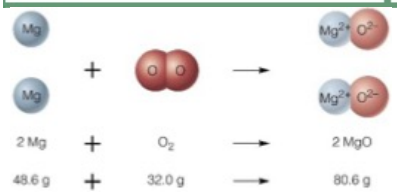
The formula of a compound tells you:

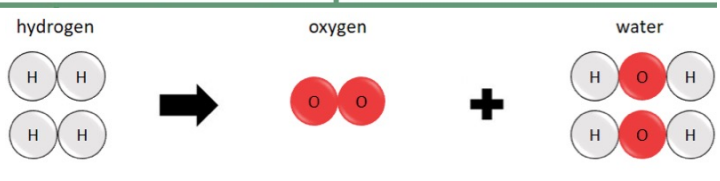
- which elements the compound is made from.
- how many atoms of each element there are.

Carbon dioxide has the formula CO_2.

CO_2 — C is the symbol for carbon. There are no subscript numbers after the C, so we know there is only one atom of carbon in the compound.

CO_2 — O is the symbol for oxygen. There is a subscript 2 after the O, so we know there are two atoms of oxygen in the compound.





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How do we use Knowledge Organisers in Chemistry

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Term	Topic/s	Year group
1	Chemical Reactions Part I	8

Tier 2 'unlocking' language	Tier 3 subject relevant language
Reactant	Oxidation
Product	Aqueous
Molecule	Combustion
Thermal	Decompose
Chemical	Reversibility
Balancing	Formulae
Rearrangement	Conservation
Equations	Precision

Knowledge Organiser: Year 8 – Acids and Alkalis

Acids and alkalis

Acids and **alkalis** are special solutions which are chemical opposites to each other.

If a solution is between acid and alkaline it is **neutral**.

Acids and alkalis can be:

concentrated

Lots of acid/alkali particles for the amount of water.

dilute

A small number of acid/alkali particles in the same amount of water.

Acids and alkalis are **corrosive**

This means that they can cause burns if they get on your skin.

Acids and alkalis can be extremely dangerous, depending on the type of acid/alkali and its concentration.

As a general rule the more concentrated the solution, the more dangerous it can be.

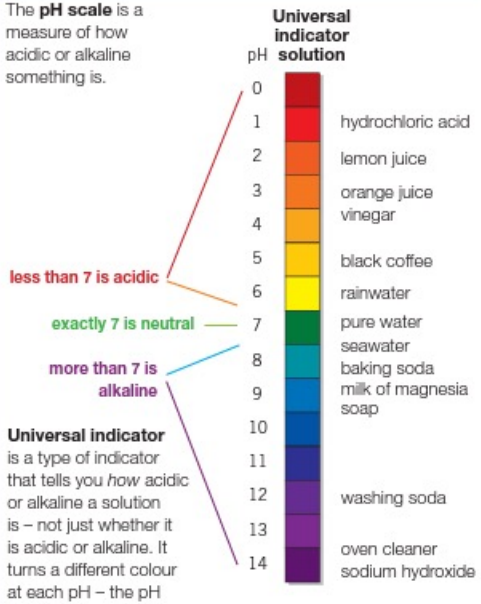
Indicators

If you want to know if something is acidic or alkaline, you need to use an **indicator**. Indicators contain a dye that turns different colours in acidic and alkaline solutions.

Litmus paper is a type of indicator. It can be either **pink** paper or **blue** paper.

- in acid – **blue** paper turns **pink**
- in alkali – **pink** paper turns **blue**

The **pH scale** is a measure of how acidic or alkaline something is.



Universal indicator is a type of indicator that tells you *how* acidic or alkaline a solution is – not just whether it is acidic or alkaline. It turns a different colour at each pH – the pH scale shows the colours of universal indicator in solutions of different pH.

Reactions with acids

When an acid reacts with a metal element or compound a **salt** is formed. The hydrogen atoms of the acid are replaced with atoms of the metal element.

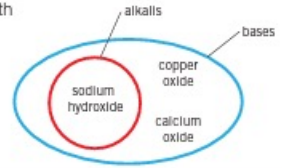
$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

zinc + sulfuric acid → zinc sulfate + hydrogen

A **base** is a compound that can react with an acid to make a neutral solution.

This is called **neutralisation**.

Bases that are soluble in water are alkalis.



Neutralisation reactions produce water and a salt.

acid + base → salt + water

for example,

sodium hydroxide + hydrochloric acid → sodium chloride + water

copper oxide + sulfuric acid → copper sulfate + water

Metals can also react with acids, but they produce a salt and hydrogen gas.

for example,

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Naming salts

The name of the metal comes first, for example, **magnesium** chloride.

Different acids produce different types of salt:

- hydrochloric acid produces metal **chlorides**
- sulfuric acid produces metal **sulfates**
- nitric acid produces metal **nitrates**

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

acid alkali base concentrated corrosive dilute indicator litmus neutral neutralisation pH scale salt universal indicator

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Term	Topic/s	Year group
2	Acids and Alkalis	8

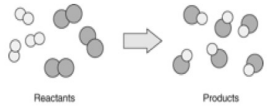
Tier 2 'unlocking' language	Tier 3 subject relevant language
Acid	Ions
Alkali	Neutralisation
Reactant	PH
Strong	Equation
Weak	Oxidised
Concentration	Reduced
Dilute	Base
Scale	Logarithmic

Knowledge Organiser: Year 8 – The Periodic Table

Episode 1 - Dalton's atomic theory

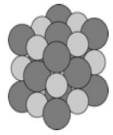
Dalton's theory stated that:

- All matter is made up of tiny particles called atoms.
- Atoms are indestructible, and cannot be created, or destroyed.
- The atoms in an element are all identical.
- In compounds, each atom of an element is always joined to a fixed number of atoms of the other elements.
- During chemical reactions, atoms rearrange, to make new substances. For example:



No atoms are lost or gained so the mass of the reactants is equal to the mass of the products.


Atoms of an element


Atoms in a compounc

The properties of a substance are what it looks like or what it does. There are two types of properties:

- **chemical properties** (e.g. flammability, pH, reaction with acid)
- **physical properties** (e.g. melting point, boiling point, density).

EPISODE 3 - THE PERIODIC TABLE arranges the elements so that elements with similar properties are in the same vertical group

	group number																
	1	2											3	4	5	6	7	0
Period 1								H										He
Period 2	Li	Be											B	C	N	O	F	Ne
Period 3	Na	Mg											Al	Si	P	S	Cl	Ar
Period 4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Period 5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Period 6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Period 7	Fr	Ra																

- Vertical columns = groups
- Horizontal rows = periods
- Metals = left side of the stepped line

GROUP 1 ELEMENTS (ALKALI METALS)

Li
Na
K
Rb
Cs
Fr

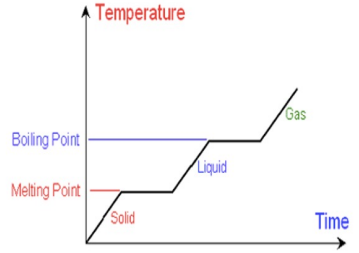
Properties of group 1 elements

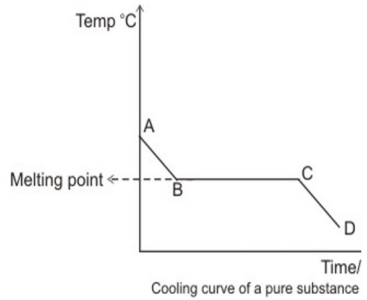
Good conductors of electricity and heat
Shiny when freshly cut
Soft (can be cut with a knife)
Very reactive
Relatively low boiling/ melting points
Low densities
Stored under oil (away from air and water)

Trends

- Melting point decreases as you go down the group.
- Reactivity increases (gets more vigorous) as you go down the group.

EPISODE 5 – Physical properties: heating and cooling curves





Cooling curve of a pure substance

EPISODE 2 – Elements, their symbols, how to form and name compounds

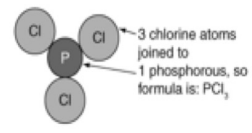
Every chemical symbol starts with a capital letter, with the second letter written in lower case.

nitrogen = **N** lithium = **Li**

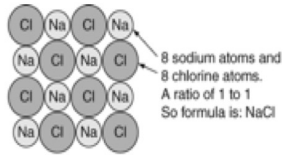
sulfur = **S** copper = **Cu**

chlorine = **Cl** iron = **Fe**

CHEMICAL FORMULA - tells you the number of atoms of each element that are joined in its molecules, or the ratio of atoms of each element in the compound.



Phosphorous chloride
PCl_3



Sodium chloride
NaCl

NAMING COMPOUNDS

- Compounds made up of oxygen and another element have two-word names. The second word is oxide.
  (e.g. alumininum + oxygen → aluminium oxide)
- In any compound of a metal with a non-metal, the end of the name of the non-metal becomes –ide.
  (e.g. sodium + chlorine → sodium chloride)

Number of Atoms	Prefix
1	mono-
2	di-
3	tri-

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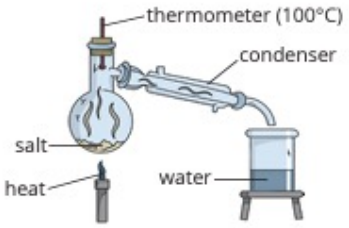
Term	Topic/s	Year group
3	Periodic Table	8

Tier 2 'unlocking' language	Tier 3 subject relevant language
Periods	Boiling Point
Groups	Melting Point
Elements	Displacement
Molecules	Inert
Bonding	Halogen
Structure	Noble
Reactivity	Distinction
Organised	Atomic Mass

Knowledge Organiser: Year 8 Separating Substances

KEYWORD	DEFINITION
Chromatogram	An image obtained from a chromatogram.
Chromatography	A technique to separate mixtures of liquids (often coloured) that are soluble in the same solvent.
Dissolve	The complete mixing of a solute with a solvent to make a solution.
Distillation	A technique that uses evaporation and condensation to obtain a solvent from a solution.
Filtrate	The liquid or solution that collects in the container after the mixture has passed through the filter paper.
Filtration	A way of separating pieces of solid that are mixed with a liquid or solution by pouring through filter paper.
Insoluble	Cannot dissolve in a given substance.
Mixture	A mixture is made up of two or more pure substances that are mixed (not chemically joined) together.
Pure substance	A single material with no other substances mixed with it.
Residue	The solid that collects in the filter paper during filtration.
Saturated solution	A solution in which no more solute can dissolve.
Solubility	The maximum mass of solute that dissolves in a certain volume or mass of solvent.
Solubility curve	A graph showing the change in solubility of a substance with temperature.
Soluble	Can dissolve in a given solvent.
Solute	The solid or gas that is dissolved in a liquid.
Solvent	A substance (normally a liquid) that dissolves another substance.

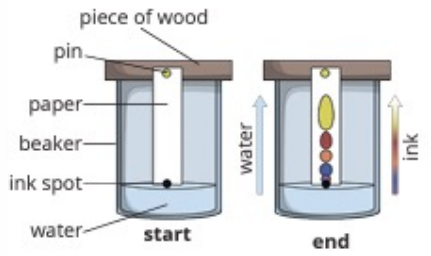
Distillation



This method is used to separate a solvent from a solution. It can separate the same type of solution as in evaporation, e.g. salt water, but retrieving the other component of the mixture.

As the water is **heated** and evaporates from the flask, it flows upwards and into the **condenser**. The condenser is surrounded by cool water which causes the water vapour to **condense** back into a liquid, this flows down the tube and into the beaker. The water collected in the beaker is **distilled water**.

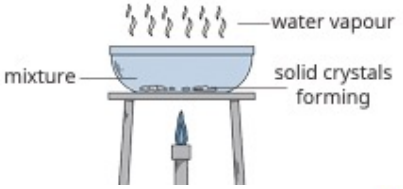
Chromatography



Chromatography can be used to separate, for example, different dyes in ink. The colours are separated because they have varying **solubilities**.

The separate inks are carried different distances up the **stationary phase** (filter paper) by the **mobile phase** (solvent).

Evaporation



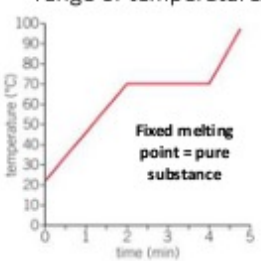
Filtration

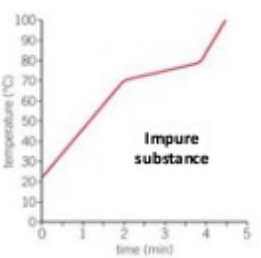
This method is used to separate an **insoluble solid** from a **liquid**. The solution is passed through a filter paper and a funnel.

The **residue** remains in the filter paper, and the part which passes through the filter is called the **filtrate**. A mixture of sand and water can be separated by filtration.

PURE SUBSTANCES AND MIXTURES

- Chemists make mixtures suitable to specific purposes (e.g. toothpaste and paint); they work out the best amounts of each substance to add to the mixture.
- A pure substance has a fixed melting and boiling point.
- An impure substance (mixture) will melt/boil over a range of temperatures.





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Filter	Distillation
Condense	Chromatography
Evaporate	Crystallisation
Purity	Solubility
Dissolving	Solvent
Residue	Solute
Mixture	Filtrate
Elements	Saturated