

- Renewable
- Lots of energy
- Common element
- Disadvantages
 - Expensive
 - High pressure
 - Explosive/flammable
 - Hydrogen is manufactured using fossil fuels

Topic 6- Groups in the periodic table

Elements in the periodic table are split into groups depending on the column (period) they are in. Elements are arranged by number of electrons in the outer shell.

Group 1- Alkali metals

- Properties
 - Soft
 - Low melting points
 - Dull
- Reactions with water
 - Lithium
 - Small fizzing
 - Disappears
 - Sodium
 - Fizzes rapidly
 - Moves around surface
 - May burn with orange flame
 - Potassium
 - Moves around surface rapidly
 - Lilac flame
 - May explode
 - Hydrogen ignites immediately
- Order of reactivity: alkali metals

Li	least reactive
Na	hard to lose 1 electron
K	
Rb	
Cs	most reactive
	loses 1 electron easily

- Each additional shell shields electrons from attraction of the nucleus
- Less strength of bond

Group 7- Halogens

	Chlorine	Bromine	Iodine
Colour	Gas	Liquid	Solid

Physical state	Yellow-green	Red-brown	Purple
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- Further down the table, the higher the melting point
 - Gases to solids
- Further down the table, the darker the element

Chemical test: Chlorine

- Sharp, choking smell
- Damp blue litmus turns red then bleaches white
- Damp starch-iodine paper turns blue black

Halogen reactions:

- Halogens and metals
 - Forms salts called metal halides
 - sodium + chlorine → sodium chloride
- Hydrogen halides
 - One part halogen, one part hydrogen
 - Dissolve in water to become acidic solutions
- Halogens in aqueous solution
 - The most reactive halogen displaces and becomes part of the solution
 - Solution turns colour of displaced solid
- Displacement reactions
 - Same as above
 - Redox because halogens gain electrons, halides lose electrons
 - $\text{Ie Br}_2 + 2\text{I}^- \rightarrow \text{I}_2 + 2\text{Br}^-$
Bromine gains electrons- reduced
Iodide loses electrons- oxidised

Becomes less reactive as it goes down table

- Each additional shell shields electrons from attraction of the nucleus
- Needs to gain 1 electron and has less force of attraction as it goes down the table

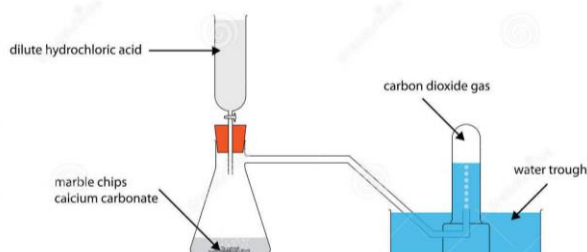
Group 0- Noble gases

- Chemically inert
 - Has a full outer shell
- Uses
 - Lightbulb
 - Inertness
 - Non-flammable
 - Balloons

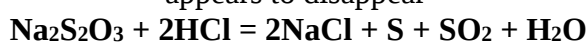
- Low density
 - Non-flammable
- Physical properties
 - Low boiling point
 - Low density
 - Colourless
 - Non-metals

Topic 7- Rates of reaction and energy changes

Laboratory Preparation of Carbon Dioxide



- Marble chips and hydrochloric acid
 - Put a small pile of marble chips in the bottom of a conical flask
 - Drip hydrochloric acid onto it
 - Gas travels down tube, into upside down test tube in water trough
 - CO₂ collects in the top
- $$2\text{HCl} + \text{CaCO}_3 = \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$$
- Sodium thiosulphate and hydrochloric acid
 - Put a small amount of sodium thiosulphate in a conical flask
 - Put the flask on a piece of paper with a cross on it
 - Add hydrochloric acid
 - Wait for sulphur to be formed and turn the liquid cloudy, so the cross appears to disappear

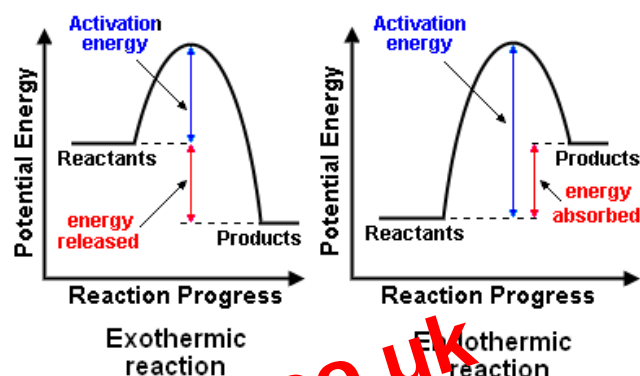


- Rate of reaction
 - Measure mass before and after
 - Reactant
 - Product

$\text{Rate of reaction} = \frac{\text{change in mass}}{\text{time taken}}$

- Reactions
 - Occur when particles collide
 - Increase with increase in:
 - Frequency of collisions
 - Energy of collisions
 - Catalyst- substance that speeds up rate of reaction without altering products, without changing chemically or in mass
 - Catalyst lowers activation energy
 - Creates alternate pathway
 - Enzymes are biological catalysts
 - Used to produce alcoholic drinks

- Changes in energy
- Exothermic
 - Give out energy to surroundings
 - Ie
 - Neutralisation
 - Respiration
 - Combustion
 - Making of bonds
- Endothermic
 - Take in energy from surroundings
 - Ie
 - Electrolysis
 - Thermal decomposition
 - Photosynthesis
 - Breaking of bonds



Exo = $-\Delta H$

Endo = $+\Delta H$

Energy change = $\frac{\text{total (bond breaking)}}{\text{Total (bond making)}}$

Topic 8- Fuels and Earth science

Hydrocarbons- only hydrogen and carbon

Crude oil:

- Complex mixture of hydrocarbons
- Contains molecules where carbon atoms are in chains or rings
- Important source of useful substances
 - Fuels
 - Feedstock for petrochemical
- Finite

Fractional distillation:

- Separates all parts of crude oil
- Industrial fractional distillation
 - The higher the tower, the cooler the temperature
- When condensed, liquid is siphoned off separately
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Heat changes in chemical reactions