Topic 4 knowledge organiser
Qualitative tests

Flame Tests
Lithium Crimson red
Sodium orange
Potassium Lilac
Calcium brick red
Strontium red
Barium apple green

How to carry out a flame
Using nichrome wire, dip the wire into dilute Hydrochloric acid and then into the unknown sample. Place over a roaring blue Bunsen burner flame.

Testing for positive ions
Ammonium ions
Add dilute sodium hydroxide, ammonia gas evolved which turns red litmus blue.
Magnesium ions
Add dilute ammonia, a white precipitate forms which is insoluble in excess ammonia.

Testing for sulfates
Add dilute nitric acid followed by barium nitrate solution (or barium chloride) to the sample, a white precipitate is observed
$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$
Nitric acid is added at the start to remove any impurities that might interfere with the test.

Testing for carbonates
Add dilute hydrochloric acid the sample, effervescence is observed. Bubble any gas formed through limewater which will turn milky.
$2H^+(aq) + CO_3^{2-}(g) \rightarrow CO_2(g) + H_2O(l)$

Testing for halides ions I
Silver nitrate test
Add acidified (using dilute nitric acid) silver nitrate solution to the sample.
Chloride – white precipitate
Bromide – cream precipitate
Iodide – yellow precipitate
$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

Silver halide precipitate left to stand
If the silver halide precipitates from the test above are left to stand in light, the following changes occur
AgCl(s) – Precipitate turns purple
AgBr(s) – precipitate turns green
AgI(s) – no change, remains yellow

Silver halides – solubility	In Dilute NH_3	In Conc. NH_3
AgCl(s)	Soluble	Soluble
AgBr(s)	Insoluble	Soluble
AgI(s)	insoluble	insoluble

Testing for halides II – displacement reactions
Chlorine is a **stronger oxidising agent** than bromine & will displace bromine from its salts in a **displacement** reaction.
$Cl_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$
Bromine cannot displace chorine as it a **weaker oxidising** agent than chlorine.

HALOGEN	**Colour of pure element**	**Colour in solution (aq)**	**Colour in hexane**
Flourine	Yellow	Colourless	Colourless
Chlorine	Green	Colourless	Pale yellow
Bromine	Brown	Orange	brown
Iodine	Grey	brown	violet

The **hydrogen halides will react with ammonia gas** to produce white smoke of ammonium chloride:
$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$

Testing for halides III – reaction with conc. sulfuric acid
All the halides react with concentrated sulfuric acid to a varying degree depending on their strength as reducing agents.
Chloride – misty fumes of HCl observed
Bromide – misty fumes (HBr), Br_2 brown vapour, SO_2 choking gas.
Iodide - misty fumes (HI), I_2 purple vapour, SO_2 choking gas, H_2S rotten egg smell.