Chemical Tests

Flame tests

How to carry out a flame test: dip a clean piece of wire (nichrome or platinum) into concentrated hydrochloric acid and then into the sample of solid salt. Put the wire just in the ***non-luminous flame*** of a Bunsen burner and observe colour.

Li^+	Na^+	K^+	Ca^{2+}	Cu^{2+}
red flame	yellow flame	lilac flame	orange-red flame	blue-green flame

Cations (positive ions) may be identified by adding sodium hydroxide solution

Ion	Add NaOH(aq)	Precipitate
NH_4^+ ammonium	Characteristic smell of ammonia upon warming – gas turns moist red litmus blue	
Cu^{2+} copper(II)	Blue precipitate	$Cu(OH)_2$
Fe^{2+} iron(II)	Green precipitate	$Fe(OH)_2$
Fe^{3+} iron(III)	Orange-brown precipitate	$Fe(OH)_3$

Note: iron(II) salts may be oxidised by the air to iron(III), so the green precipitate may turn brown after a little while.

Any test looking for a precipitate must be carried out on a solution of the salt otherwise you will not be able to tell if a precipitate forms as there will already be solid present

Anions (negative ions)

Ion	Test	Result	Precipitate
Cl^- chlor*ide*	Add dilute nitric acid followed by silver nitrate solution	White precipitate	AgCl
Br^- brom*ide*	Add dilute nitric acid followed by silver nitrate solution	Cream precipitate	AgBr
I^- iod*ide*	Add dilute nitric acid followed by silver nitrate solution	Yellow precipitate	AgI
CO_3^{2-} carbonate	Add dilute hydrochloric acid then test any gas with limewater	Carbon dioxide produced – white precipitate with limewater	
SO_4^{2-} sulfate	Dilute hydrochloric acid followed by aqueous barium chloride	White precipitate	$BaSO_4$

In the tests for halides and sulfate ions acids is added before the reagent to react with any carbonate ions, which would also form a precipitate.

Note: you cannot use hydrochloric acid when testing for chloride/bromide/iodide as this contains chloride ions and will react with the silver nitrate solution to form a precipitate.

Test for gases

Hydrogen	apply lighted splint to end of test tube	squeaky pop
Oxygen	apply glowing splint	relights glowing splint
Chlorine	moist litmus paper	bleached
Ammonia	moist red litmus paper	turns blue
Carbon dioxide	bubble through limewater	white precipitate

Test for water

Add liquid to anhydrous copper(II) sulfate (white) – if water is present then colour changes from white to blue.

This test works for anything containing water – it gives a positive result for all aqueous solutions as they all contain water.

Physical test to show water is pure

Measure boiling point or freezing/melting point – if the substance boils at 100 ^oC or freezes at 0 ^oC it is pure water.