Chemistry Topic 8

Chemical Analysis	
Describe how to carry out a flame test.	Nichrome/platinum loop/wire dip in sample/place in roaring flame/ observe colour of the flame.
What is the main problem with flame tests?	If a sample containing a mixture of ions is used some flame colours can be masked.
What solution is used for the precipitate test?	Sodium hydroxide solution can be used to identify some metal ions (cations).
Sulfate test (SO_4^{2-})	Sulfate ions in solution produce a white precipitate with barium chloride solution in the presence of dilute hydrochloric acid.
Carbonate test (CO_3^{2-})	Carbonates react with dilute acids to form carbon dioxide gas. Carbon dioxide can be identified with limewater.
Halide test (Cl^-, Br^-, I^-)	Halide ions in solution produce precipitates with silver nitrate solution in the presence of dilute nitric acid. Silver chloride is white, silver bromide is cream and silver iodide is yellow.

Pure Substances and formulations	
Pure Substances	In chemistry, a pure substance is a single element or compound, not mixed with any other substance. Pure elements and compounds melt and boil at specific temperatures. Impure substances melt over a range.
Everyday pure substance	In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state, e.g. pure milk.
How to determine if a substance is pure	Pure elements and compounds melt and boil at specific temperatures. Impure substances melt over a range.
Advantages of Instrumental methods of chemical tests.	Accurate, sensitive, rapid
Flame Emission Spectroscopy	The sample is put into a flame and the light given out is passed through a spectroscope. The output is a line spectrum that can be analysed to identify the metal ions in the solution and measure their concentrations.

Flame Tests (Cations)		
Metal	Ion	Flame Colour
Lithium	Li^+	Crimson
Sodium	Na^+	Yellow
Potassium	K^+	Orange
Calcium	Ca^{2+}	Red
Copper	Cu^{2+}	Green

Precipitate Tests (Cations)		
Metal	Ion	Precipitate Colour
Magnesium	Mg^{2+}	White – (negative flame test)
Calcium	Ca^{2+}	White – (red flame test)
Aluminium	Al^{3+}	White (dissolves in excess NaOH)
Copper	Cu^{2+}	Blue
Iron (II)	Fe^{2+}	Green
Iron (III)	Fe^{3+}	Brown

Insoluble Precipitates:

copper sulfate + sodium hydroxide → sodium sulfate + copper hydroxide

$CuSO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + Cu(OH)_2(s)$

Required Practical

Gas Tests	
Oxygen	Glowing splint inserted into a test tube of the gas. The splint relights in oxygen.
Hydrogen	A burning splint held at the open end of a test tube of the gas. Burns rapidly with a pop sound.
Carbon Dioxide	Aqueous solution of calcium hydroxide (lime water). When carbon dioxide is shaken with or bubbled through limewater the limewater turns milky (cloudy).
Chlorine	When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white.

Method

Draw a pencil line 2cm from the bottom
Mark 5 spots in pencil equal distance along the line
Use a capillary tube, put a spot of each sample on the pencil dots
Add water to the beaker 1cm depth
Tape the paper to a glass rod, rest it on top of the beaker – do not allow the samples to go in the water
Allow the solvent to travel up the paper
Use a pencil to show the distance the water travels
Measure the distance the water has travelled
Measure the distance each sample has travelled
Calculate Rf

Chromatography: a separating technique.

Stationary phase (paper) and a mobile phase (solvent).
Separation depends on solubility and attraction to the paper(stationary phase).

The ratio of the distance moved by a compound (centre of spot from origin) to the distance moved by the solvent can be expressed as its Rf value:

$$Rf = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

Different compounds have different Rf values in different solvents, which can be used to help identify the compounds.
The compounds in a mixture may separate into different spots depending on the solvent but a pure compound will produce a single spot in all solvents.