Chemistry 8: Chemical analysis

Section 1: Purity and formulations

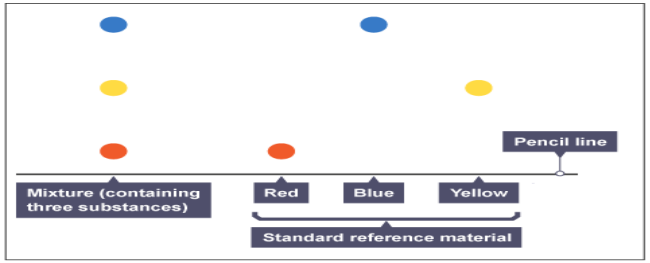
1 Pure substance	**Only contains one compound or element**
2 Melting and boiling point	**Pure substances melt and boil at a specific temperature. Impurities alter this and give a wider range.**
3 Formulations	Mixtures with exact amounts of components each with a specific purpose.

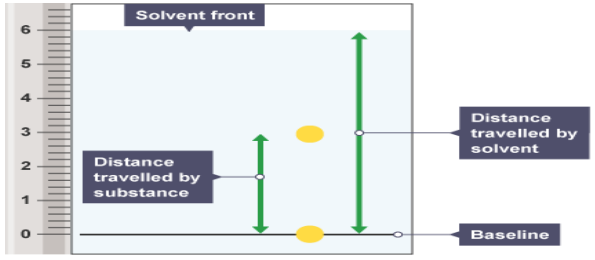
Section 2: Chromatography

Chromatography	**Used to separate the substances in a mixture.**
Mobile phase	**Where the molecules can move. This is always liquid or gas.**
Stationary phase	**Where the molecules can't move. This can be a solid or a thick liquid.**
Solubility	**Substances with high solubility will spend more time in mobile phase and travel further up the paper.**
Purity	**Pure substances will only ever produce one spot on a chromatogram.**
Rf Value	**Distance travelled by substance divided by distance travelled by solvent.**

Section 3: Tests for gases and anions

Chlorine gas	Bleaches damp litmus paper turning it white
Oxygen gas	Relights a glowing splint
Carbon dioxide gas	Turns limewater cloudy
Hydrogen gas	Gives off a squeaky pop if a lit splint is held next to a test tube of hydrogen
Carbonate (CO_3^{2-})	Add dilute acid to cause fizzing, connect to a test tube of limewater, turns cloudy as CO_2 produced
Sulfates (SO_4^{2-})	Add hydrochloric acid followed by barium chloride → White precipitate of Barium sulfate
Cl^-	$Ag^+ + Cl^-$ → AgCl(s) white precipitate
Br^-	$Ag^+ + Br^-$ → AgBr(s) cream precipitate
I^-	$Ag^+ + I^-$ → AgI(s) yellow precipitate





Tests for cations

Section 4: Flame tests

Metal	Colour
Lithium	**crimson**
Sodium	**Yellow**
Potassium	**Lilac**
Calcium	**Orange-red**
Copper	**Green**

Section 4:

Metal ions	Colour of precipitate With NaOH	Ionic equation
Ca^{2+}	**White**	$Ca^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Ca(OH)_{2(s)}$
Cu^{2+}	**Blue**	$Cu^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Cu(OH)_{2(s)}$
Fe^{2+}	**Green**	$Fe^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Fe(OH)_{2(s)}$
Fe^{3+}	**Brown**	$Fe^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Fe(OH)_{3(s)}$
Al^{3+}	**White but colourless with excess NaOH**	$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(s)}$
Mg^{2+}	**White**	$Mg^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Mg(OH)_{2(s)}$

Section 5: Instrumental methods

Advantages	Disadvantages
Very sensitive – can detect tiny amounts	More expensive
Very fast and tests can be automated	
Very accurate	

Section 5a Flame emission spectroscopy

Flame emission spectroscopy	Used to analyse metal ions in solutions to determine their concentration. The output is a line spectrum. Match the lines up in a mixture to identify the ions