

## IGCSE Chemistry: Chemical Analysis Techniques

### Whole Unit Overview

(Please note: (S) denotes material in the Supplement (Extended syllabus) only)

Learning Outcomes		Suggested Teaching Activities	Resources
2.1	Name appropriate apparatus for the measurement of time, temperature, mass and volume, including burettes, pipettes and measuring cylinders.	This should be linked to all experimental work conducted.	
2.2 (a)	Describe paper chromatography.	Experimental work can involve simple inks, dyes and food colourings. Non-permanent felt tipped pens work well.	<a href="http://www.personal.psu.edu/">http://www.personal.psu.edu/</a>
2.2 (a)	Interpret simple chromatograms.	Use $R_f$ values to compare the height of the spots on the chromatogram with advanced students.	
2.2 (a) (S)	Outline how chromatography techniques can be applied to colourless substances by exposing chromatograms to substances called locating agents.  (Knowledge of specific locating agents is <i>not</i> required.)	Experimental work can be extended to include separating a mixture of amino acids (using ninhydrin as a locating agent) and simple sugars.  <i>Link to Unit 9, Organic Chemistry 2.</i>	

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2.2 (a)	Identify substances and assess their purity from melting point and boiling point information.	This can be demonstrated by using water and dissolving sodium chloride or other salts in it. The use of salt on roads to melt ice could be mentioned in this context.	
2.2 (a)	Understand the importance of purity in substances in everyday life, e.g. foodstuffs and drugs.		Drug purity regulations – see in: <a href="http://www.cgmp.com/">http://www.cgmp.com/</a>
2.2 (b)	Describe methods of purification by the use of a suitable solvent, filtration, crystallisation, distillation (including use of a fractionating column).  (Refer to the fractional distillation of : crude oil (syllabus section 14.2), fermented liquor (syllabus section 14.6).	Typical solvents to use are water or ethanol. Demonstrate separation of iodine using cyclohexane.  Filtration is used in one of the salt preparation methods to remove excess solid.  Crystallisation is used in most salt preparations to obtain the final product.  Demonstrate the (partial) separation of ethanol from water by distillation. Demonstrate separation of 'petroleum fractions' from mixtures of hydrocarbons.	
2.2 (b)	Suggest suitable purification techniques, given information about the substances involved.	This may be linked to magnetic properties (less important) and varying solubilities (more important).	
11	Describe a chemical test for water	Use either anhydrous copper(II) sulphate (solid) or anhydrous cobalt(II) chloride (blue cobalt chloride paper).	

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<p>8.4</p>	<p>Describe the following tests to identify:</p> <p><i>aqueous cations;</i></p> <p>aluminium, ammonium, calcium, copper(II), iron(II), iron(III) and zinc, (using aqueous sodium hydroxide and aqueous ammonia as appropriate).</p> <p>(Formulae of complex ions are <i>not</i> required)</p> <p><i>anions;</i></p> <p>carbonate (by reaction with dilute acid and then limewater), chloride (by reaction under acidic conditions with aqueous silver nitrate), iodide (by reaction under acidic conditions with aqueous lead(II) nitrate), nitrate (by reduction with aluminium), sulphate (by reaction under acidic conditions with aqueous barium ions)</p> <p><i>gases;</i></p> <p>ammonia (using damp red litmus paper), carbon dioxide (using limewater), chlorine (using damp litmus paper), hydrogen (using lighted splint), oxygen (using a glowing splint).</p>	<p>This allows a great range of simple test tube reactions to be conducted.</p> <p>First, known samples can be used in experiments so that the students may find out the answers for themselves.</p> <p>Then the experiments can be made more challenging by using unknown samples of an ionic compound (or even a mixture) to enable students to develop analytical skills.</p>	<p>Summary sheet for these reactions:  <a href="http://www.rjclarkson.demon.co.uk/middle/salts.htm">http://www.rjclarkson.demon.co.uk/middle/salts.htm</a></p>
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7.1	Describe the effect of concentration, particle size, catalysts (including enzymes) and temperature on the speeds of reactions.	Simple test tube experiments using different sized marble chippings and hydrochloric acid of different concentrations give a quick visual impression of the factors affecting rate of reaction.	
7.1	Describe a practical method for investigating the speed of a reaction involving gas evolution.	Reactions can involve metals and dilute acids and carbonates and acids. Gas syringes (or measurement of displacement of water by gas in upturned measuring cylinder) can easily measure the volume of gas produced.  Measurement of mass decrease in reaction involving evolution of gas could also be demonstrated.	
7.1 (S)	Devise a suitable method for investigating the effect of a given variable on the speed of a reaction.	Particle size, concentration and temperature can easily be changed for both the above types of reaction.	
7.1 (S)	Interpret data obtained from experiments concerned with speed of reaction.	This allows the use of spreadsheets and graphing to plot volume vs. time data to determine the speed of a reaction.	
7.1 (S)	Describe and explain the effects of temperature and concentration in terms of collisions between reacting particles.	.	
7.1 (S)	Describe the effect of light on the speed of reactions.	Refer back to effect of light on silver chloride/ bromide (section 14.4 (S) Unit 4 Organic Chemistry 1). Experiments on darkening of slow photographic film in various light intensities	

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7.1	Describe the application of the above factors to the danger of explosive combustion with fine powders (e.g. flour mills) and gases (e.g. mines).	Custard powder explosion experiment in tin with tight fitting lid may be demonstrated.	
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