

IGCSE Co-ordinated Sciences 0654

Unit 14: C11 Fertilisers, C12 Dyes and Drugs, C13 Colloids

Recommended Prior Knowledge

Students should be familiar with the writing of word and symbol equations.

Context

This Unit has links with salt formation in topics C9 and solubility in topic C8.

Outline

The need for fertilisers to grow crops is linked to a study of the properties of ammonia and to the Haber process. The development of dyes and drugs from natural sources is followed. The properties and uses of colloids are studied.

AO	Learning outcomes	Suggested Teaching activities	Learning resources
ABC	<p>Know that ammonia is an alkaline gas.</p> <p>Know the effect of ammonia on damp litmus paper (see notes for use in qualitative analysis).</p>	<p>Students should test a solution of ammonia in water with Universal indicator paper and determine the pH of the solution by use of a colour chart. They should also test the solution with litmus paper.</p> <p>A small quantity of gaseous ammonia may be prepared in a test tube and tested with damp Universal indicator paper and damp litmus paper.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 7.</p> <p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward</p>
ABC		<p>Students may interpret information presented in the form of tables and charts.</p> <p>The properties of ammonia (solubility, alkaline character and reaction with acids) may be demonstrated.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.</p> <p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward</p> <p>http://www.infoplease.com</p> <p>http://www.mda.state.mn.us/spills/am</p>

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AB	Know that fertilisers contain inorganic ions which supply plants with elements they need, including nitrogen, phosphorus and potassium.	<p>Students could make a fertiliser such as ammonium phosphate or ammonium nitrate and cost the process. This gives further experience of the techniques of filtration, evaporation, etc and provides further experience in the use of formulae.</p> <p>The contents labels of garden fertiliser bags may be examined to see which compounds are used to supply essential minerals. Example label provided on web link.</p>	<p>monia/properties.htm <i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.</p> <p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward</p> <p>http://www.rhs.org.uk/advice/profiles0306/fertiliserlabel.asp</p>
ABC	<p>Know the test for the ammonium ion by warming with sodium hydroxide solution.</p> <p>Know the test for the nitrate ion by reduction with aluminium.</p>	<p>Students should carry out tests for ammonium and nitrate ions on suitable compounds. They may be given 'unknown' compounds to identify. (<i>Notes for use in Qualitative Analysis</i> are reproduced in the question paper for the Practical Test.)</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 7.</p> <p><i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward</p> <p>Ion tests: http://www.broadeducation.com/html/emos/absorbchem/testingions/page.htm</p>
AB	Be able to distinguish between ammonia and ammonium salts.	Students should write formulae for a range of ammonium salts.	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.</p>
AB	Understand equations which describe the chemical changes involved in the manufacture of ammonia, nitric acid and sulphuric acid.	<p>A flow diagram, such as that on the revision centre website, may be used to show the production of ammonia by the Haber process.</p> <p>Students can use animations on the BBC site to change conditions and observe how this affects the process.</p> <p>The ausetute website has graphs that students can interpret.</p> <p>Students should be able to interpret graphs and tables related to the manufacture of both ammonia and nitric acid. For higher grades, students should be encouraged to apply their chemical knowledge of catalysis and rates of reaction to these processes.</p>	<p><i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.</p> <p>http://revisioncentre.co.uk</p> <p>http://www.asetute.com</p> <p>http://www.bbc.co.uk/schools/gcsebitesize/chemistry/usefulproductsair/haber_higherrev1.shtml</p>

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A	Know the meaning of the term <i>nitrogen fixation</i> and appreciate that the chemical basis of the nitrogen problem is the inert nature of gaseous nitrogen.	Emphasis may be placed on the difficulty encountered by early chemists in making ammonia in industrial quantities. This can be related to the inert nature of gaseous nitrogen. The term nitrogen fixation may be applied with reference to action of bacteria e.g. in leguminous plants.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.
AB	Understand the effect of catalysts in the synthesis of ammonia, nitric and sulphuric acids.	The effect of catalysts in the reactions in these processes should be studied and related to the economics of manufacture of these compounds.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15.
ABC	Know that leaching of nitrates from the soil is a problem, while leaching of phosphates and potassium salts is not.	The relative insolubility of phosphate salts compared with the solubility of nitrates could be investigated with references to simple precipitation reactions. Students may study photographs showing eutrophication.	<i>IGCSE Chemistry</i> by B Earl and LCR Wilford, Chapter 15. <i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward Eutrophication: http://en.wikipedia.org/wiki/eutrophication http://www.pioneerthinking.com/naturaldyes.html
ABC	Know that many natural dyes may be obtained from plants and that modern dyes are synthetic.	Students may investigate the dyeing of fabrics. If possible based on locally available plant materials. Use first web link to help plan dyeing experiment. Dyeing with indigo brings in ideas of oxidation and reduction. Fastness of dyes could be discussed as well as mordanting. Students may carry out experiments to test for fastness. Students may use the websites to gather data on the history of dyeing for written or oral presentation,	http://www.dyesonline.net http://www.straw.com http://www.abdn.ac.uk <i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward
ABC	Know that natural colouring matter, such as chlorophyll, may be	Students should carry out paper chromatography of an extraction from plant material.	<i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward

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	separated by the technique of paper chromatography.		
ABC	Know that the melting and the boiling point of a substance are affected by impurities.	For higher grades, students could investigate the effect of salt on the freezing point of water.	<i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward
AB	Know the meaning of the terms <i>drug</i> , <i>analgesic</i> and <i>chemotherapy</i> .	Aspirin or digitalis could be used as examples to show how drugs can be discovered in plants and modified to make them more effective.	http://www.bayeraspirin.com http://www.ch.ic.ac.uk/vchemlib/mim/bristol/digitalis/digitalis_text.htm
	Know that drugs are often discovered as a result of studying chemicals from plants.	Students could be asked to use the website to prepare material on the history of aspirin for an oral presentation.	
		Problems of drug abuse could be mentioned.	
AB	Know the importance of purity in food and drugs.	The consequences of toxic impurities in food and drugs may be emphasised. This could be reinforced by using appropriate newspaper or magazine articles.	
ABC	Know that a colloid consists of one substance finely dispersed in another and know the meaning of the words <i>sol</i> , <i>gel</i> and <i>emulsion</i> .	Investigations on light scattering, Brownian motion and (for higher grades) the effect of adding ions to coagulate colloidal particles should give students a chance to observe the behaviour of colloids. Examples of the colloidal states which are familiar to students should be chosen wherever possible (e.g. smoke, mist, paint, milk, creams).	<i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward
		The funsci website contains details of simple experiments.	http://www.funsci.com/fun3_en/exper2/exper2.htm#colloids
		Students can use this and the other websites to prepare either a written or	http://www.wpbschoolhouse.btinternet.co.uk/page01/AqueousChem/AqueousChem.htm

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		oral presentation.	http://bengu-pc2.njit.edu/trp-chem/chemistry/Solutions/Col.html http://www.funsci.com
A	Know that colloidal systems are not transparent.	A range of colloids can be demonstrated e.g. mist, smoke, milk, paint.	
AB	Understand that colloidal systems are not transparent because they scatter light rays.	An explanation for the observed property should be given.	http://en.wikipedia.org/wiki/colloid
ABC	Appreciate the purpose of emulsifiers.	Making an emulsion such as a cream used as a base for cosmetics or medical preparations introduces one of the practical techniques used to prepare colloids.	<i>Teaching and Assessing Practical Skills in Science</i> by Dave Hayward http://www.emulsifiers.org/index.php
AB	Understand, in simple terms, the action of emulsifiers.	Students can use the website to research information to explain the action of emulsifiers.	http://en.wikipedia.org/wiki/emulsifier