

Scheme of work – Cambridge IGCSE[®] Chemistry (US) 0439

Unit 9: Amount of substance

Recommended prior knowledge

Students should have a good understanding of the Periodic Table and Bonding and Structure.

Context

This unit builds on ideas from earlier units and lays the foundations for Unit 10.

Outline

This unit begins with the introduction the writing chemical formula and balancing equations. These ideas can be linked with the importance of calculating reacting quantities especially for industrial scale preparations. The unit gives students opportunities to investigate percentage yield and percentage purity in their practical work, which can be linked to its importance in chemical economics. This unit is cross-referenced to assessment objectives A1–5, B1–7, C1–3 and Unit 2.

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

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4(S)	Determine the formula of an ionic compound from the charges on the ions present	<p>Students can be given a list of ions encountered in IGCSE and rules for writing chemical formula. They can construct correct chemical formulae from ions [link to Unit 2].</p> <p>The charges on ions should be linked with the group number of the element in the Periodic Table.</p> <p>They can be introduced to the idea of using brackets when more than one of a complex ion is present.</p>	<p>www.bbc.co.uk/schools/ks3bitesize/science/chemical_material_behaviour/compounds_mixtures/revise4.shtml</p>

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4	Deduce the formula of a simple compound from a model or a diagrammatic representation	This can be linked with organic molecules but also include examples from suitable pictures of giant ionic structures. Students need to be able to use both molecular and full structural formulae. [Link to Unit 8].	
4(S)	Construct equations with state symbols	Introduce the four state symbols (s), (l), (g) and (aq). This should be linked to all theoretical and experimental work during the course. Extension to ionic equations [link with Unit].	
4(S)	Deduce the balanced equation for a chemical reaction, given relevant information	The information could be masses or amounts of material that react together.	
4	Define <i>relative atomic mass</i> , A_r	All atoms are compared to the standard atom, carbon-12.	
4	Define <i>relative molecular mass</i> , M_r , as the sum of the relative atomic masses (<i>relative formula mass</i> or M_r will be used for ionic compounds) (Calculations involving reacting masses in simple proportions may be set. Calculations will not involve the mole concept.)	Students can use A_r 's to calculate the relative molecular mass from the molecular formula. Use of mini-whiteboards, bingo and crossword activities could be used.	Various worksheets on calculations: www.chemsheets.co.uk/
4.1(S)	Define the <i>mole</i> and the <i>Avogadro constant</i>	Emphasise the idea of a mole being a particular number of specified particles. Students should be introduced to the terms 'stoichiometry', 'limiting reactant' and 'in excess' which may be used in calculations.	www.physics.nist.gov/cgi-bin/cuu/Value?na search_for=short

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.1(S)	<p>Use the molar gas volume, taken as 24 dm³ at room temperature and pressure</p>	<p>Students will need plenty of practice.</p> <p>An experiment reacting magnesium with dilute sulphuric acid can be used to find/use the molar gas volume.</p> <p>Demonstrate how to calculate the <i>A_r</i> of Lithium (Li + H₂O) or Calcium (Ca + H₂O). [Link to % purity later in this unit].</p>	<p>Various worksheets on calculations: www.chemsheets.co.uk/</p> <p><i>R. Norris & R. Stanbridge. Chemistry for IGCSE, Nelson Thornes, 2009, ISBN 9781408500187, p60 Fig 5.4.2</i></p>
4.1(S)	<p>Calculate stoichiometric reacting masses and volumes of gases and solutions, solution concentrations expressed in g/dm³ and mol/dm³.</p> <p>(Calculations involving the idea of limiting reactants may be set. Questions on the gas laws and the conversion of gaseous volumes to Different temperatures and pressures will not be set.)</p>	<p>Students will need plenty of practice.</p> <p>This can be linked back to the preparation of salts by titration e.g. preparation of sodium chloride.</p> <p>Students should also be competent at handling reactant mass data given in tonnes for industrial scale reactions e.g. preparation of salts for use as fertilisers.</p>	<p>Various worksheets on calculations: www.chemsheets.co.uk/</p> <p>www.practicalchemistry.org/experiments/titrating-sodium-hydroxide-with-hydrochloric-acid,129,EX.html</p>
4.1(S)	<p>Calculate empirical formulae and molecular formulae</p>	<p>Students will need plenty of practice.</p> <p>Suggested experiment: heating a coil of magnesium ribbon to complete oxidation in a crucible.</p> <p>This gives appropriate data if an accurate digital balance is available.</p>	<p>Various worksheets on calculations: www.chemsheets.co.uk/</p> <p>www.practicalchemistry.org/experiments/the-change-in-mass-when-magnesium-burns,207,EX.html</p>

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.1(S)	Calculate % yield and % purity	<p>% yield can be calculated by analysing the results for simple displacement reactions.</p> <p>% purity can be calculated by working out how much copper in a known mass of malachite or by using titration techniques to estimate, for example, the amount of iodine in a known mass of potassium iodate.</p> <p>Extension – Students can be introduced to the concept of atom economy and the benefits of designing processes with high atom economy. This could involve group work and presentations based on their findings.</p>	<p><i>R. Norris & R. Stanbridge. Chemistry for IGCSE, Nelson Thornes, 2009, ISBN 9781408500187, p62 Fig 5.5.1</i></p>