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## Teaching Plan

### Unit 5: Chemicals for a Purpose

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The following plan is based on 12 weeks at 5 hours per week. The learning activities are suggestions only. Teachers may wish to develop alternative strategies. The plan should be read alongside the unit specification, and in particular the assessment evidence grid which for reference is reproduced at the end of this document.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
1	5.2.1: Organics and inorganics (AO1) <ul style="list-style-type: none"><li>• discuss the difference in properties between ionic and covalent compounds</li><li>• find and use data about properties in order to classify compounds as ionic or covalent</li><li>• evaluate the use of a compound in terms of its properties</li><li>• write formulae for listed inorganic compounds used and made in industry</li></ul>	Teacher and candidate revision of ionic and covalent bonding and the physical properties (solubility, melting points and boiling points) resulting from the forces between atoms, ions and molecules in these compounds. Use given and researched data on the physical properties of compounds to describe the bonding as ionic or covalent. Use the physical properties of given compounds to explain their uses. Deduce and list the formulae of those inorganic compounds listed in the specification.	Teacher hand out notes and/or resource based introduction notes. Suitable GCSE/AS textbooks

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2 and 3	5.2.1: Organics and inorganics (AO1) <ul style="list-style-type: none"> <li>draw and recognise the structural formulae of simple alkanes and alkenes, benzene, alcohols and esters</li> <li>know the range of uses of the typical organic compounds listed</li> <li>state examples of two inorganic and two organic compounds, describing their properties and resulting uses</li> </ul>	Teacher introduction to homologous series and the deduction of the structural formulae of the listed organic compounds. Research common uses for the listed organic compounds. Assignment 5.1 List four examples of chemical compounds (two inorganic and two organic) together with properties and uses relevant to these properties.	Teacher hand out notes. Suitable textbooks at Level 3 Molecular models Assignment Brief 5.1 (Useful Chemical Compounds) and reference material, both paper based and electronic, for this exercise.

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4	<p>5.2.2: The Chemistry of Oil Products (AO1)</p> <ul style="list-style-type: none"> <li>• give examples and uses of some chemical products from petrochemicals, e.g. esters, polyesters, addition polymers and detergents</li> <li>• describe the differences between soap and detergents in terms of the raw materials used to make them, and the action of each when they are used</li> <li>• explain the action of a detergent (an anionic surfactant) in terms of hydrophobic and hydrophilic regions of the molecule</li> <li>• research and discuss why detergent products, such as washing powder, have other additives – to include bleaches, fluorescents, phosphates and enzymes.</li> </ul>	<p>Research into petroleum chemistry to find examples and uses of the compounds listed.</p> <p>Discuss and describe the difference in the chemistry of soap and detergents in terms of how they are made and their mode of action.</p> <p>Demonstrate and explain the action of soap and detergents with hard and soft water.</p> <p>Practical work with commercial products e.g. washing powders, to test the listed claims of the manufacturers.</p>	<p>Candidate based research using book and electronic resources.</p> <p>Use of video, DVD and other commercially produced audiovisual resources.</p> <p>Material obtained from companies involved in the manufacture and uses of soaps and detergents.</p>

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5 and 6	<p>5.2.2: The Chemistry of Oil Products (AO1)</p> <ul style="list-style-type: none"> <li>describe the reaction that happens during addition polymerisation and outline how it is carried out on an industrial scale to manufacture e.g. polyethene, polystyrene and PTFE</li> <li>discuss the chemistry of polyethene, polystyrene, PVC and PTFE in terms of their formulae, structure, properties and uses.</li> </ul>	<p>Theory and research into the chemistry of addition polymerization and the conditions used to make polyethene, polystyrene and PTFE in industry. Formulae, physical and chemical properties of polyethene, polystyrene, PVC and PTFE and their consequent uses.</p> <p>Assignment:</p> <p>Choose a polymer or a detergent and research its chemistry as outlined in the assessment grid.</p>	<p>Teacher produced materials and candidate based research using book and electronic resources.</p> <p>Use of video, DVD and other commercially produced audiovisual resources.</p> <p>Material obtained from companies involved in the petroleum and polymer industries.</p> <p>Assignment task sheets and reference material, both paper based and electronic, for this exercise.</p> <p>Some of this material could be cross-linked to Unit 1.</p>

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
7	<p>5.2.3: Manufacturing Processes (AO2)</p> <ul style="list-style-type: none"> <li>explain how catalysts work</li> <li>describe the following processes that use catalysts: cracking, reforming and addition polymerisation</li> <li>explain that different catalysts are used to produce different products in addition polymerisation e.g. LDPE and HDPE</li> <li>evaluate the importance of these catalysed processes in terms of the usefulness of the products they produce</li> <li>discuss how the catalysts increase efficiency and lower energy costs.</li> </ul>	<p>Theory and research into the various catalysts used in the listed addition polymerisation processes in the petrochemical industry.</p> <p>The relative economics of these reactions and other catalysed reactions with or without the catalyst e.g. the Haber Process and the Contact process.</p>	<p>Teacher produced materials and candidate based research using book and electronic resources.</p> <p>Use of video, DVD and other commercially produced audiovisual resources.</p> <p>Material obtained from companies involved in the petroleum and polymer industries.</p> <p>Material obtained from companies involved in bulk production of inorganic chemicals.</p>
8	<p>5.2.3 Manufacturing Processes (AO2)</p> <ul style="list-style-type: none"> <li>differences between homogeneous and heterogeneous catalysts and an outline of the advantages and disadvantages of each.</li> </ul>	<p>Research into the advantages and disadvantages of each type of catalyst using a number of different industrial processes that use catalysts.</p> <p>Practical work to illustrate different catalytic systems, e.g. the effectiveness of different metal oxides in catalysing the decomposition of hydrogen peroxide into oxygen and water.</p> <p>The effect of various aqueous transition metal ions on the rate of the reaction between aqueous iodide ions and aqueous persulphate ions.</p>	<p>Candidate based research in industrial processes that use catalysts both from paper based and electronic sources.</p> <p>Worksheets, apparatus and chemical appropriate to the catalytic system being studied in the laboratory.</p>

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
9	5.2.3: Manufacturing processes (AO2) <ul style="list-style-type: none"> <li>research and evaluate the conditions of chemical processes by considering the advantages and disadvantages of a process for making a chemical product</li> <li>outline two industrial processes that use catalysts including the conditions, raw materials and the usefulness of the products obtained.</li> </ul>	Research into chemical processes to evaluate the broader implications of the process. Consideration should be given to the economic and environmental factors as well as health and safety issues. Assignment: Provide an account of two industrial processes that use catalysts in the manufacture of the product(s) and giving the required information listed in the assessment grid.	A continuing use of the resources obtained in Week 8. Assignment task sheets and reference material, both paper based and electronic, for this exercise.

Week number	Specification Unit Reference and Assessment Objectives	Suggested Learning Activities	Resources
10 to 12	<p>5.2.4: Preparation and Analysis of a Chemical Product (AO3)</p> <ul style="list-style-type: none"> <li>research an appropriate method to prepare a small sample of a chemical for research and testing</li> <li>carry out a full risk assessment</li> <li>use ratio, proportion and percentages to work out amounts of substances</li> <li>use the chemical equation to work out the theoretical yield</li> <li>adapt the method to maximise the yield</li> <li>purify the product by recrystallisation or distillation</li> <li>calculate the percentage yield and evaluate the method used</li> <li>research and use appropriate techniques to purify and check the purity of the product.</li> </ul>	<p>Assignment: Research a method and prepare a particular compound according to the required details in the assessment grid. Suggestion: Aspirin</p>	<p>Paper and electronic resources detailing the compound to be made. These should include the details necessary to carry out this assignment. Use of classwork notes for similar preparations. Chemical catalogues or Health and Safety handbooks that list the hazards of the materials used and prepared in this assignment. Link with Unit 1 (aspirin) preparation could be also used here.</p>

The assessment evidence grid from the unit specification is reproduced on the following pages.

Unit 5: Chemicals for a purpose				
What you need to do:				
<p><b>You need to provide</b> evidence of your knowledge, understanding and investigation into chemicals for a purpose <b>[50 marks]</b>.  This evidence needs to include:</p> <p><b>AO1:</b> a description of <b>two</b> examples of <b>inorganic</b> and <b>two</b> examples of <b>organic</b> chemical products, discussing their uses, properties and chemical structure – your description needs to include more detail about <b>one</b> example of a product made from oil to show how its structure and chemistry relate directly to its use <b>[21]</b>;</p> <p><b>AO2:</b> a discussion of the <b>two</b> industrial processes that produce <b>two</b> different chemical products – at least <b>one</b> process needs to involve the use of a catalyst, whose action you need to explain – you need to evaluate each process by discussing its advantages and disadvantages, and by clearly explaining the importance of the products it produces <b>[10]</b>;</p> <p><b>AO3:</b> a sample and account of the preparation of a product that has been synthesised, purified and analysed for purity in the laboratory <b>[19]</b>.</p>				
How you will be assessed:				
Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO1	You will give <b>four</b> examples of chemical compounds ( <b>two</b> inorganic and <b>two</b> organic) giving their formulae;  <b>[0 1]</b>	you will give <b>four</b> examples of chemical compounds ( <b>two</b> inorganic and <b>two</b> organic), appropriate formulae are shown, e.g. full structural and you have presented data systematically to show the properties of the compounds, e.g. using charts, tables and graphs;  <b>[2 3]</b>	you will represent the <b>four</b> examples ( <b>two</b> inorganic and <b>two</b> organic) using full formulae and give detailed data about properties and uses, presenting them systematically using a wide range of presentation techniques, e.g. tables, pie charts and graphs.  <b>[4 5]</b>	
	You will present clearly the uses and properties of the compounds;  <b>[0 1]</b>	you have attempted to link the properties of the compounds to their uses;  <b>[2 3]</b>	a full discussion will show how properties depend on structure and how uses depend on properties for each compound.  <b>[4 5]</b>	
	You will research the chemistry of <b>one</b> of the examples, e.g. a polymer or detergent;  <b>[0 1 2 3 4 5]</b>	you will research and give a more detailed account of the chemistry of <b>one</b> of the examples, e.g. a polymer or detergent, showing the main, relevant reactions and some use made of appropriate scientific terminology;  <b>[6 7 8]</b>	you will fully research and give an account of the chemistry of <b>one</b> of the examples, e.g. a polymer or detergent, with full detail of structures of the substances involved; the reactions involved will be fully explained with additional researched detail throughout and good use made of appropriate scientific terminology.  <b>[9 10 11]</b>	
				<b>/21</b>



Unit 5: Chemicals for a purpose (continued)				
Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO2	You will give an outline of <b>two</b> industrial chemical processes showing the conditions, raw materials and products; the usefulness of the products will be identified; [0 1]	you will give a more detailed description of <b>two</b> processes, including equations where appropriate; [2 3]	you will produce a fully researched, very detailed account of <b>two</b> processes, explaining all reactions fully. [4 5]	/10
	You will include a description of the role of the catalyst and identify some advantages and disadvantages of each process; [0 1]	you will discuss the role of the catalyst more fully and include a discussion about the advantages and disadvantages of the processes; [2 3]	you will give a full account of the chemistry of catalysis and the evaluation will show a sophisticated understanding of the potential social, economic and environmental impacts of the processes. [4 5]	
AO3	You will research and present a workable method with a safe risk assessment; [0 1 2]	you will research a more detailed method showing details of all apparatus and quantities used and include a workable risk assessment; [3 4]	you will research and produce a very detailed method and give a full description of each stage of the preparation, purification and analysis of the product and include a full, detailed risk assessment which shows selectivity in the information presented. [5 6]	/19
	You will present the method and results coherently using tables and diagrams; [0 1 2 3]	you will record and present observations systematically with some processing of data; [4 5]	you will record, present and process accurately all measurements systematically using a range of methods, e.g. prose, numbered lists, tables and graphs. [6 7]	
	You will show an awareness that the yield can be increased by changing the conditions; [0 1 2]	you will make workable suggestions about increasing the yield; [3 4]	you will evaluate systematically the method of the preparation. [5 6]	
Total mark awarded:				/50