

Week 1	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Historical development of atomic structure</li> <li>2. Modern idea of atomic structure</li> <li>3. Isotopes</li> <li>4. Electronic structure of ions</li> <li>5. Relative isotopic masses</li> <li>6. Calculation of relative atomic masses</li> <li>7. Relative formula/molecular masses</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe how the model of the atom has changed over the years and continues to do so.</li> <li>• Understand that scientific knowledge is always evolving.</li> <li>• Describe how new theories are accepted by scientists.</li> <li>• Describe protons, neutrons and electrons</li> <li>• Explain the term <i>isotope</i>.</li> <li>• Deduce the atomic structure in atoms and ions.</li> <li>• Explain why <math>^{12}\text{C}</math> is used as the standard measurement of relative masses.</li> <li>• Define the terms <i>relative isotopic mass</i> and <i>relative atomic mass</i>.</li> <li>• Calculate relative atomic masses.</li> <li>• Work out relative molecular masses and relative formula masses.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.1.1</li> <li>• 1.1.2</li> <li>• 1.1.3</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.1.1 Atoms</b></p> <ul style="list-style-type: none"> <li>• Atomic structure</li> </ul>			

Week 2	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. The mole concept and the Avogadro constant</li> <li>2. Empirical and molecular formulae and their calculation</li> <li>3. The molar volume for gases</li> <li>4. Concentrations of solutions in <math>\text{mol dm}^{-3}</math></li> <li>5. Writing and balancing chemical equations</li> <li>6. Calculations from balanced chemical equations</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain the terms: <i>amount of substance</i>; <i>mole</i>; and <i>the Avogadro constant</i>.</li> <li>• Define and use the term <i>molar mass</i>.</li> <li>• Carry out calculations involving masses using the amount of substance in moles.</li> <li>• Explain the terms <i>empirical formula</i> and <i>molecular formula</i>.</li> <li>• Calculate empirical and molecular formulae.</li> <li>• Calculate the amount of substance in moles using gas volumes.</li> <li>• Calculate the amount of substance in moles using solution volume and concentration.</li> <li>• Describe a solution's concentration using the terms <i>concentrated</i> and <i>dilute</i>.</li> <li>• Construct balanced equations for known and unknown reactions given the reactants and products.</li> <li>• Deduce the quantities of reactants and products from balanced equations.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.1.4–9</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 1: Finding the relative atomic mass of an unknown metal by gas collection</li> <li>• Practical Activity 9: Finding the relative molecular mass of washing soda by titration</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.1.2 Moles and Equations</b></p> <ul style="list-style-type: none"> <li>• The Mole</li> <li>• Writing chemical formulae from ions and chemical equations</li> <li>• Empirical and molecular formulae</li> <li>• Calculation of reacting masses</li> </ul> <p><b>1.1.2 Moles and Equations</b></p> <ul style="list-style-type: none"> <li>• Moles and gases</li> </ul>			

Week 3	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Common acids, bases and alkalis and their formulae</li> <li>2. Definitions in terms of ions present in solution</li> <li>3. Salt formation including ammonium salts</li> <li>4. Water of crystallisation including calculation of formulae</li> <li>5. How to assign oxidation numbers</li> <li>6. The use of electron transfer and change in oxidation number in redox reactions</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Know the formulae of common acids and bases.</li> <li>• State that an acid releases <math>H^+</math> ions in aqueous solution.</li> <li>• State that common bases are metal oxides, metal hydroxides and ammonia.</li> <li>• State that an alkali is a soluble base that releases <math>OH^-</math> ions in aqueous solution.</li> <li>• State that a salt is produced when the <math>H^+</math> ion of an acid is replaced by a metal ion or <math>NH_4^+</math>.</li> <li>• Describe the reactions of an acid with carbonates, bases and alkalis to form a salt.</li> <li>• Understand that a base readily accepts <math>H^+</math> ions from an acid.</li> <li>• Explain the terms: <i>anhydrous</i>, <i>hydrated</i>, and <i>water of crystallisation</i>.</li> <li>• Calculate the formula of a hydrated salt using percentage composition, mass composition or experimental data.</li> <li>• Assign oxidation numbers to atoms in elements, compounds and ions.</li> <li>• Understand that a Roman numeral can</li> </ul>	<ul style="list-style-type: none"> <li>• 1.1.10–12</li> <li>• 1.1.14–15</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 2: Finding the percentage of water of crystallisation in hydrated iron(II) sulfate</li> <li>• Practical Activity 3 (and 5): Investigating the reactions of metals, bases, alkalis and carbonates with acids</li> <li>• Practical Activity 4: Making a salt from an acid and a base</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.1.2 Moles and Equations</b></p> <ul style="list-style-type: none"> <li>• Acids and bases</li> <li>• Moles and solutions and acids and bases</li> </ul> <p><b>1.1.4 Redox</b></p> <ul style="list-style-type: none"> <li>• Oxidation number</li> </ul>			

be used to indicate oxidation states.

- Write formulae using oxidation numbers.
- Describe oxidation and reduction in terms of electron transfer and oxidation number.
- Recognise that metals form positive ions by losing electrons – increasing their oxidation number.
- Recognise that non-metals form negative ions by gaining electrons – decreasing their oxidation number.
- Describe redox reactions of metals with either dilute hydrochloric or sulfuric acid.
- Interpret and make predictions from equations regarding oxidation numbers and electron loss/gain.

Week 4	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Explain the purpose and method of titrations.</li> <li>2. Students carry out titrations.</li> <li>3. Use the results to calculate the unknown concentration.</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Perform acid-base titrations.</li> <li>• Carry out structured calculations.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.1.13</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 6: Finding the concentration of a solution of sodium carbonate by titration</li> <li>• Practical Activity 7: Finding the concentration of a solution of sodium hydroxide by titration</li> </ul>
		<b>OCR Scheme of Work topic outlines</b>	
		<p><b>1.1.2 Moles and Equations</b></p> <ul style="list-style-type: none"> <li>• Moles and solutions and acids and bases</li> </ul>	

Week 5	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Ionisation energies – definitions, factors that affect them, and the use of subsequent ionisation energies as the evidence for shells</li> <li>2. The shapes and arrangement of s- and p-orbitals</li> <li>3. Sub-shells – their order of filling and capacity</li> <li>4. Electronic configurations for the first 36 elements using both the <math>1s^2</math> notation and the up and down arrows</li> <li>5. The s-, p- and d-blocks</li> <li>6. Electronic configurations of ions</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Define first ionisation energy and subsequent ionisation energies.</li> <li>• Explain the factors that influence ionisation energies.</li> <li>• Predict the number of electrons in each shell as well as the element's group using successive ionisation energies.</li> <li>• State the number of electrons that can fill the first four shells of an atom.</li> <li>• Define an orbital.</li> <li>• Describe the shapes of s- and p-orbitals.</li> <li>• State the number of orbitals and electrons in the s, p and d sub-shells.</li> <li>• Describe the relative energies of s-, p- and d-orbitals for the first three shells and of the 4s- and 4p-orbitals.</li> <li>• Deduce the electronic structures of atoms and ions for the first 36 elements.</li> <li>• Classify elements into s-, p- and d-blocks.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.2.1–4</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.2.1 Electron Structure</b></p> <ul style="list-style-type: none"> <li>• Ionisation energies</li> <li>• Electrons: electronic energy levels, atomic orbitals, electron configuration</li> <li>• Electronic configurations</li> </ul>			

Week 6	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>The stable electronic structures of the noble gases</li> <li>Explain briefly covalent and ionic bonding.</li> <li>Predict the type of bonding between pairs of elements.</li> <li>Dot-and-cross diagrams for NaCl, MgO and CaCl<sub>2</sub> including the charges on the ions</li> <li>The giant ionic lattice structure in NaCl</li> <li>State and explain the melting points, conduction of electricity and solubility in water of ionic compounds.</li> <li>Link outer electron structure to corresponding group in the Periodic Table.</li> <li>Predict the formula of ions for each group in the Periodic Table.</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>State that noble gases have a stable electron configuration.</li> <li>Describe the different types of chemical bonding.</li> <li>Predict the type of bonding from the elements involved.</li> <li>Describe ionic bonding as the electrostatic attraction between oppositely charged ions.</li> <li>Draw dot-and-cross diagrams for ionic compounds.</li> <li>Describe structures with ionic bonding as giant ionic lattices.</li> <li>State and explain the properties associated with giant ionic lattices.</li> <li>Predict ionic charge from an element's position in the Periodic Table.</li> <li>State the formulae for the ions: NO<sub>3</sub><sup>-</sup>; CO<sub>3</sub><sup>2-</sup>; SO<sub>4</sub><sup>2-</sup>; and NH<sub>4</sub><sup>+</sup>.</li> </ul>	<ul style="list-style-type: none"> <li>1.2.5–7</li> <li>1.2.15</li> </ul>	<ul style="list-style-type: none"> <li>Practical Activity 10: Investigating the relationship between bonding, structure and physical properties in substances</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.2.2 Bonding and Structure</b></p> <ul style="list-style-type: none"> <li>Ionic Bonding</li> </ul>			

Week 7	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>Define covalent bonding including multiple bonds.</li> <li>Draw dot-and-cross diagrams for simple molecules – e.g. H<sub>2</sub>, Cl<sub>2</sub>, HCl, H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>4</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>.</li> <li>Dative covalent bonding as in the ammonium ion</li> <li>Dot-and-cross diagrams for some molecules that do not obey the octet rule – e.g. BF<sub>3</sub> and SF<sub>6</sub></li> <li>Electron pair repulsion theory</li> <li>The shapes and bond angles in some simple molecules and ions</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>Describe a covalent bond as a shared pair of electrons.</li> <li>Describe single and multiple covalent bonding.</li> <li>Use dot-and-cross diagrams to represent covalent bonding.</li> <li>Describe dative covalent bonding.</li> <li>Describe examples of compounds that do not obey the octet rule.</li> <li>Explain how the shape of a simple molecule is determined.</li> <li>State that lone pairs of electrons repel more than bonding pairs.</li> <li>Explain and predict the shapes of – and bond angles in – molecules and ions.</li> <li>Describe the structures of simple covalent molecules.</li> <li>Explain the physical properties of simple covalent compounds.</li> </ul>	<ul style="list-style-type: none"> <li>1.2.8–10</li> <li>1.2.16</li> </ul>	<ul style="list-style-type: none"> <li>Practical Activity 10: Investigating the relationships between bonding, structure and physical properties in substances</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.2.2 Bonding and structure</b></p> <ul style="list-style-type: none"> <li>Covalent bonding and dative covalent (coordinate) bonding</li> <li>Shapes of simple molecules and ions</li> </ul>			

Week 8	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Electronegativity and the idea of polar bonds</li> <li>2. The range of intermolecular forces</li> <li>3. Instantaneous dipoles (van der Waals' forces) as the weakest of the intermolecular forces</li> <li>4. Permanent dipoles</li> <li>5. Hydrogen bonds as the strongest of the intermolecular forces</li> <li>6. The nature of hydrogen bonds</li> <li>7. The anomalous properties of water and their explanation in terms of hydrogen bonding</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe electronegativity as an atom attracting bonding electrons in a covalent bond.</li> <li>• Explain how a permanent dipole polarity can result in a polar bond.</li> <li>• Describe intermolecular forces as permanent and instantaneous dipoles (van der Waals' forces).</li> <li>• Describe hydrogen bonding between molecules containing –OH and –NH groups.</li> <li>• Describe and explain the anomalous properties of water resulting from hydrogen bonding.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.2.11–13</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 10: Investigating the relationship between bonding, structure and physical properties of substances</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.2.2 Bonding and structure</b></p> <ul style="list-style-type: none"> <li>• Electronegativity and bond polarity</li> <li>• Intermolecular forces</li> </ul>			

Week 9	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Metallic bonding – the particles and forces present and the resulting properties</li> <li>2. Giant covalent structures and their properties – typified by diamond and graphite</li> <li>3. The link between bonding and structure and the properties of these compounds</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Recall that ionic bonding results in a giant structure.</li> <li>• Describe metallic bonding as the attraction of positive ions to delocalised electrons.</li> <li>• Describe giant metallic lattices.</li> <li>• Describe the structure of giant covalent lattices.</li> <li>• Describe and predict physical properties for different structures and bonding.</li> <li>• Deduce the types of structure and bonding from given information.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.2.9</li> <li>• 1.2.14</li> <li>• 1.2.17</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 10: Investigating the relationship between bonding, structure and physical properties of substances</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.2.2 Bonding and Structure</b></p> <ul style="list-style-type: none"> <li>• Metallic bonding</li> <li>• Bonding and physical properties</li> <li>• Bonding review</li> </ul>			

Week 10	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Historical development of the Periodic Table</li> <li>2. MendeléeV's contribution to the modern Periodic Table</li> <li>3. The arrangement of elements in the Periodic Table</li> <li>4. Periodicity using ionisation energies, atomic radii and boiling points</li> <li>5. Trends down a group using ionisation energies and atomic radii</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe early attempts to order the elements.</li> <li>• Appreciate that scientific knowledge is not absolute.</li> <li>• Understand how advances in scientific knowledge are accepted.</li> <li>• Understand the work of MendeléeV and others in developing the modern Periodic Table.</li> <li>• Describe the Periodic Table in terms of order, periods and groups.</li> <li>• Explain how periodicity shows a repeating pattern across different periods.</li> <li>• Explain how elements in a group have similar properties because they have similar outer electron structure.</li> <li>• Describe the variation in electron structures across Periods 2 and 3.</li> <li>• Explain that ionisation energy depends on atomic radius, electron shielding and nuclear charge.</li> <li>• Describe the variation in first ionisation energies and atomic radii across a period and down a group.</li> <li>• Describe and explain the variation in melting and boiling points for the elements in Periods 2 and 3.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.3.1–5</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.3.1 Periodicity</b></p> <ul style="list-style-type: none"> <li>• The structure of the Periodic Table in terms of Groups and Periods</li> <li>• Periodicity of physical properties of elements</li> </ul>			

Week 11	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Reactions of the elements with water and oxygen</li> <li>2. The trend in reactivity explained</li> <li>3. Reactions interpreted in terms of redox</li> <li>4. Reactions of the compounds of Group 2</li> <li>5. Uses of the compounds of Group 2 – linked to structure and bonding</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the redox reactions of the Group 2 elements Mg to Ba with oxygen and water.</li> <li>• Explain the trend in reactivity of Group 2 elements down the group.</li> <li>• Describe the effect of water on Group 2 oxides.</li> <li>• Describe the thermal decomposition of Group 2 carbonates.</li> <li>• Interpret and make predictions from the properties of Group 2 elements &amp; compounds.</li> <li>• Explain the uses of Group 2 hydroxides.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.3.6–7</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 11: Investigating the reactions of the Group 2 elements</li> <li>• Practical Activity 12: Investigating the reactions of Group 2 compounds</li> <li>• Practical Activity 13: Investigating the thermal decomposition of the Group 2 carbonates</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<b>1.3.2 Group 2</b>			

Week 12	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Describe and explain the trends in boiling points.</li> <li>2. Reactions of the halogens, including displacement reactions – including the use of oxidation numbers</li> <li>3. Explain the trend in reactivity based on displacement reactions.</li> <li>4. Uses of chlorine – including treating drinking water</li> <li>5. The tests for halide ions</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain the trend in boiling points down the group.</li> <li>• Explain the trend in reactivity down the group.</li> <li>• Describe and interpret – using oxidation numbers – the reactions of chlorine with (i) water and (ii) sodium hydroxide solution.</li> <li>• Interpret and make predictions from the properties of the Group 7 elements and their compounds.</li> <li>• Contrast the benefits and risks of chlorine’s use in water treatment.</li> <li>• Describe the tests for halide ions using silver nitrate solution followed by aqueous ammonia.</li> </ul>	<ul style="list-style-type: none"> <li>• 1.3.8–9</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 14: Investigating halogen displacement reactions</li> <li>• Practical Activity 15: Testing for halide ions</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>1.3.2 Group 7</b> including</p> <ul style="list-style-type: none"> <li>• Characteristic reactions of halide ions</li> </ul>			

Week 13	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. The names, molecular and displayed formulae of the first 10 alkanes</li> <li>2. Alkanes as: saturated; hydrocarbons; and homologous series</li> <li>3. Cycloalkanes and branched alkanes and their names</li> <li>4. Names and structures of alkenes – another homologous series</li> <li>5. Other homologous series and their functional groups</li> <li>6. Types of formulae and calculation of empirical and molecular formulae</li> <li>7. Structural isomerism</li> <li>8. Stereoisomerism (<i>E/Z</i> isomerism)</li> <li>9. Types of reaction and reactant</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Use the terms: <i>homologous series</i>; and <i>functional group</i>.</li> <li>• State that alkanes and cycloalkanes are saturated hydrocarbons.</li> <li>• Explain the tetrahedral shape around each carbon atom in an alkane.</li> <li>• State the names of the first 10 members of the alkane homologous series.</li> <li>• Understand and be able to use the IUPAC rules of nomenclature for naming alkanes and other compounds with functional groups.</li> <li>• Understand and use the following formulae: empirical; molecular; general; displayed; structural; and skeletal.</li> <li>• Draw and understand skeletal formulae for complex molecules and functional groups.</li> <li>• Describe structural isomers, stereoisomers and <i>E/Z</i> isomerism – including cis-trans isomerism.</li> <li>• Determine possible structural formulae and/or stereoisomers from a molecular formula.</li> <li>• Describe the different types of covalent bond fission – homolytic and heterolytic.</li> <li>• Describe the terms: <i>nucleophile</i>; <i>electrophile</i>; <i>radical</i>; <i>addition</i>; and <i>substitution</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.1.1–8</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.1.1 Basic concepts and 2.1.2 Alkanes</b></p> <ul style="list-style-type: none"> <li>• Representing formulae of organic compounds</li> <li>• Isomerism</li> <li>• Functional groups and naming of organic compounds</li> </ul>			

Week 14	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Separating crude oil into fractions and their uses</li> <li>2. The bonding in – and tetrahedral nature of – alkanes</li> <li>3. The physical properties of alkanes</li> <li>4. The complete/incomplete combustion of alkanes</li> <li>5. The substitution reactions of alkanes – with mechanism</li> <li>6. The use of alkanes as fuels</li> <li>7. Cracking, reforming and isomerising to produce better fuels</li> <li>8. The dangers of over-reliance on non-renewable fossil fuels</li> <li>9. The need to develop alternative fuels</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• State that a hydrocarbon is a compound of carbon and hydrogen only.</li> <li>• Explain the use of crude oil as a source of hydrocarbons.</li> <li>• Explain that the hydrocarbons in crude oil are separated using fractional distillation.</li> <li>• Explain the trend in boiling points in alkanes in terms of van der Waals' forces.</li> <li>• Describe the combustion of alkanes.</li> <li>• Explain the incomplete combustion of alkanes.</li> <li>• Describe the use of catalytic cracking to obtain more useful alkanes and alkenes.</li> <li>• Describe further processing to form branched alkanes and cyclic hydrocarbons.</li> <li>• Contrast the value of fossil fuels with an over-reliance on non-renewable fossil fuel reserves and with increased carbon dioxide levels, leading to global warming and climate change.</li> <li>• Explain the importance of developing renewable plant bases fuels such as alcohols and biodiesel.</li> <li>• Describe – with mechanism and limitations – the substitution reactions of alkanes.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.1.9–12</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 16: Cracking paraffin oil</li> <li>• Practical Activity 17: Comparing the reactions of alkanes and alkenes with bromine</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.1.1 Basic concepts and 2.1.2 Alkanes</b></p> <ul style="list-style-type: none"> <li>• Substitution reactions of alkanes</li> <li>• Hydrocarbons from crude oil</li> <li>• Hydrocarbons as fuels</li> </ul>			

Week 15	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Alkenes as another homologous series</li> <li>2. The formulae of common alkenes – including structural isomers</li> <li>3. The pi-bond in alkenes</li> <li>4. <i>E/Z</i> isomerism in alkenes revisited</li> <li>5. The trigonal shape of the carbons around the double bond</li> <li>6. The addition reactions of alkenes</li> <li>7. Bromine as the test for unsaturation</li> <li>8. The mechanism for electrophilic addition to alkenes</li> <li>9. The hardening of vegetable oils to form margarine</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Understand that alkenes and cycloalkenes are unsaturated hydrocarbons.</li> <li>• Explain the overlap of adjacent p-orbitals to form a pi-bond.</li> <li>• Explain the trigonal planar shape around each carbon making up a C=C bond.</li> <li>• Describe addition reactions of alkenes with hydrogen, halogens, hydrogen halides and steam.</li> <li>• Describe the use of bromine as a test for unsaturation.</li> <li>• Define an electrophile as an electron pair acceptor.</li> <li>• Describe the mechanism of electrophilic addition in alkenes.</li> <li>• Describe how heterolytic fission leads to electrophilic addition in alkenes using bromine as an example.</li> <li>• Outline the use of alkenes in the manufacture of margarine by catalytic hydrogenation of unsaturated vegetable oils.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.1.13–17</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 17: Comparing the reactions of alkanes and alkenes with bromine</li> <li>• Practical Activity 18: Extracting limonene from citrus peel</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.1.3 Alkenes</b></p> <ul style="list-style-type: none"> <li>• Properties of alkenes</li> <li>• Addition reactions of alkenes</li> <li>• Industrial importance of alkenes</li> </ul>			

Week 16	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Revising knowledge of addition polymers from GCSE</li> <li>2. Simple addition polymers such as ethene as both an equation and the repeat unit of the polymer</li> <li>3. Other addition polymers</li> <li>4. Working backwards from the repeat unit of the polymer to the monomer</li> <li>5. Why the disposal of polymers in our waste is not a good idea</li> <li>6. Alternative things to do with waste polymers</li> <li>7. The future – biodegradable and compostable polymers</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Outline the use of alkenes in the formation of a range of polymers using unsaturated monomer units.</li> <li>• Describe the addition polymerisation of alkenes.</li> <li>• Deduce the repeat unit of an addition polymer obtained from a given monomer.</li> <li>• Identify the monomer that would produce a given section of an addition polymer.</li> <li>• Describe some of the uses for certain polymers.</li> <li>• Outline how waste polymers are recycled, separated and processed.</li> <li>• Explain how polymers undergo combustion for energy production.</li> <li>• Explain how polymers are used as a feedstock in cracking for producing plastics and other chemicals.</li> <li>• Outline the role of chemists in minimising environmental damage by removal of toxic waste and development of biodegradable and compostable polymers.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.1.17–20</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.1.3 Alkenes</b></p> <ul style="list-style-type: none"> <li>• Polymers from alkenes</li> <li>• Industrial importance of alkenes</li> </ul>			

Week 17	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Alcohols as another homologous series</li> <li>2. The industrial methods for manufacturing ethanol</li> <li>3. Physical properties of ethanol – linked to hydrogen bonding</li> <li>4. Primary, secondary and tertiary alcohols</li> <li>5. The combustion and oxidation of alcohols</li> <li>6. The esterification of alcohols</li> <li>7. The elimination of water from alcohols</li> <li>8. The uses of ethanol and methanol</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the industrial production of ethanol from (i) sugars and (ii) ethene.</li> <li>• Outline the uses of ethanol and methanol.</li> <li>• Explain the water solubility and relatively low volatility of ethanol in terms of hydrogen bonding.</li> <li>• Classify alcohols into primary, secondary and tertiary.</li> <li>• Describe the combustion of alcohols.</li> <li>• Describe the oxidation of primary and secondary alcohols.</li> <li>• Outline the resistance to oxidation of tertiary alcohols.</li> <li>• Describe the esterification of alcohols.</li> <li>• Describe the elimination reaction of alcohols to form alkenes.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.2.1–4</li> </ul> <p><b>OCR Scheme of Work topic outlines</b></p> <p><b>2.2.1 Alcohols</b></p> <ul style="list-style-type: none"> <li>• Properties and preparation of ethanol</li> <li>• Reactions of alcohols</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 19: Fermenting glucose</li> <li>• Practical Activity 20: Oxidising ethanol to ethanal</li> <li>• Practical Activity 21: Oxidising ethanol to ethanoic acid</li> <li>• Practical Activity 22: Elimination of water from cyclohexanol</li> <li>• Practical Activity 23: Making esters from alcohols and carboxylic acids</li> </ul>

Week 18	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Structural and general formulae for halogenoalkanes</li> <li>2. The polar nature of the C–X bond</li> <li>3. The alkaline hydrolysis of halogenoalkanes</li> <li>4. The mechanism for the alkaline hydrolysis of halogenoalkanes</li> <li>5. Explain the rate of hydrolysis of halogenoalkanes</li> <li>6. Uses of halogenoalkanes</li> <li>7. The environmental problems caused by CFCs</li> <li>8. The moral responsibility for scientists to produce alternatives to CFCs</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the structure, general formula and uses of halogenoalkanes.</li> <li>• Describe and explain the nature of the C–X bond and its susceptibility to nucleophilic attack.</li> <li>• Define the term <i>nucleophile</i> as an electron pair donor.</li> <li>• Describe the hydrolysis of halogenoalkanes as a nucleophilic substitution reaction.</li> <li>• Describe the mechanism of nucleophilic substitution in the hydrolysis of primary halogenoalkanes with hot aqueous alkali.</li> <li>• Explain the rates of hydrolysis of halogenoalkanes in terms of the relative enthalpies of the C–X bond.</li> <li>• Outline the uses of chloroethene and tetrafluoroethene in the production of the plastics PVC and PTFE.</li> <li>• Explain why CFCs were first developed and their consequent effect on the ozone layer.</li> <li>• Outline the role of green chemistry in minimising damage to the environment by promoting alternatives to CFCs.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.2.5–7</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 24: Comparing the rates of hydrolysis of halogenoalkanes</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.2.2 Halogenoalkanes</b></p> <ul style="list-style-type: none"> <li>• Substitution reactions of halogenoalkanes</li> <li>• The ozone layer</li> <li>• Uses of halogenoalkanes</li> </ul>			

Week 19	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Percentage yield calculations</li> <li>2. The concept of atom economy as one factor in sustainable development</li> <li>3. Atom economy calculations</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Perform calculations to determine the percentage yield of a reaction.</li> <li>• Define the <i>atom economy</i> of a reaction.</li> <li>• Explain that addition reactions have an atom economy of 100%, whereas substitution reactions are less efficient.</li> <li>• Carry out calculations to determine the atom economy of a reaction.</li> <li>• Describe the benefits of developing chemical processes with a high atom economy in terms of fewer waste materials.</li> <li>• Explain that a reaction may have a high percentage yield but a low atom economy.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.2.8–9</li> </ul>	<p><b>OCR Scheme of Work topic outlines</b></p> <p><b>2.1.1 Basic conceptions and 2.1.2 Alkanes</b></p> <ul style="list-style-type: none"> <li>• Percentage yields and atom economy</li> </ul>

Week 20	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Infrared spectroscopy</li> <li>2. Identification of functional groups from given infrared spectra</li> <li>3. Mass spectrometry</li> <li>4. The use of given mass spectra to determine relative molecular mass</li> <li>5. The use of fragmentation patterns in given mass spectra to suggest structures for organic compounds</li> <li>6. Use of mass spectra of elements to determine isotopic abundances and hence relative atomic masses</li> <li>7. The use of both spectral techniques to identify organic compounds</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• State that absorption of infrared radiation causes covalent bonds to vibrate.</li> <li>• Identify absorption peaks in an infrared spectrum.</li> <li>• State that modern breathalysers measure ethanol levels by analysis using infrared spectroscopy.</li> <li>• Using C=O and O–H absorptions, identify alcohols, aldehydes, ketones and carboxylic acids.</li> <li>• Outline the early developments in mass spectrometry.</li> <li>• Outline the use of mass spectrometry in the determination of relative isotopic masses and for identifying elements.</li> <li>• Interpret mass spectra of elements in terms of isotopic abundances.</li> <li>• Use the molecular ion peak in an organic molecule's mass spectrum to determine its molecular mass.</li> <li>• Explain that a mass spectrum is essentially a molecule's fingerprint that can be identified using a spectral database.</li> <li>• Suggest the identity of the major fragment ions in a given mass spectrum.</li> <li>• Use molecular ion peaks and fragmentation peaks to identify structures.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.2.10–14</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.2.3 Modern analytical techniques</b></p> <ul style="list-style-type: none"> <li>• Mass spectrometry</li> <li>• Infrared spectroscopy</li> </ul>			

Week 21	Learning Outcomes	Student book links	Practical activity links
<ul style="list-style-type: none"> <li>This is a summary of the mechanisms met so far during the AS chemistry course. Some groups will appreciate the bringing together of all the mechanisms and types of reactant, while others will not need it.</li> <li>It is also an opportunity to apply the mechanisms that they already know to new situations, such as different reacting species.</li> </ul>	Students should be able to: <ul style="list-style-type: none"> <li>Describe the three common mechanisms required for AS chemistry.</li> </ul>	<ul style="list-style-type: none"> <li>2.2.15</li> </ul>	
		<b>OCR Scheme of Work topic outlines</b>	
		<b>2.1.1 Basic concepts and 2.1.2 Alkanes</b> <ul style="list-style-type: none"> <li>Substitution reactions of alkanes</li> </ul> <b>2.1.3 Alkenes</b> <ul style="list-style-type: none"> <li>Addition reactions of alkenes</li> </ul> <b>2.2.2 Halogenoalkanes</b> <ul style="list-style-type: none"> <li>Substitution reactions of halogenoalkanes</li> </ul>	

Week 22	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. The idea that energy is always conserved</li> <li>2. The concepts of enthalpy and enthalpy change</li> <li>3. Exothermic and endothermic reactions – explained in terms of enthalpy change</li> <li>4. Examples of exothermic and endothermic reactions</li> <li>5. Enthalpy profile diagrams – including activation energy</li> <li>6. The definitions – with examples and equations</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Understand that energy is conserved.</li> <li>• Explain that all chemical reactions are accompanied by enthalpy changes.</li> <li>• Explain that enthalpy change can be exothermic or endothermic.</li> <li>• Describe the importance of oxidation as an exothermic reaction.</li> <li>• Describe that endothermic reactions require an input of heat energy.</li> <li>• Construct a simple enthalpy profile diagram for a reaction.</li> <li>• Explain the term <i>activation energy</i> using enthalpy profile diagrams.</li> <li>• Define and use the terms: <i>standard conditions</i>; <i>enthalpy change of reaction</i>; <i>enthalpy change of formation</i>; and <i>enthalpy change of combustion</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.3.1–4</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.3.1 Enthalpy changes</b></p> <ul style="list-style-type: none"> <li>• Enthalpy changes: <math>\Delta H</math> of reaction, combustion and formation</li> <li>• Bond enthalpies</li> </ul>			

Week 23	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. The experimental determination of enthalpy changes such as displacement and neutralisation</li> <li>2. Using the results to calculate the enthalpy changes</li> <li>3. The experimental determination of enthalpies of combustion</li> <li>4. Using the results to calculate the enthalpy changes</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Calculate enthalpy changes directly from appropriate experimental results.</li> <li>• Calculate an enthalpy change of combustion from experimental results.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.3.5–6</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 25: Finding the enthalpy change for the reaction between zinc and copper sulfate using a direct method of calculation</li> <li>• Practical Activity 26: Finding and comparing the enthalpy change of combustion of alcohols</li> <li>• Practical Activity 27: Finding the enthalpy change for the decomposition of potassium hydrogencarbonate indirectly using Hess' law</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.3.1 Enthalpy changes</b></p> <ul style="list-style-type: none"> <li>• Enthalpy changes: <math>\Delta H</math> of reaction, combustion and formation</li> </ul>			

Week 24	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Average bond enthalpies</li> <li>2. Reactions in terms of breaking and making bonds</li> <li>3. Calculating enthalpy changes from bond enthalpies</li> <li>4. Hess' law and enthalpy cycles</li> <li>5. Using enthalpies of combustion to calculate enthalpies of reaction</li> <li>6. Using enthalpies of formation to calculate enthalpies of reaction</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain exothermic and endothermic reactions in terms of the enthalpy changes associated with the making and breaking of chemical bonds.</li> <li>• Define and use the term <i>average bond enthalpy</i>.</li> <li>• Calculate an enthalpy change of reaction from average bond enthalpies.</li> <li>• Use Hess' law to construct enthalpy cycles.</li> <li>• Use enthalpy changes of formation in calculations to determine an enthalpy change of reaction indirectly.</li> <li>• Determine an enthalpy change of reaction from an unfamiliar enthalpy cycle.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.3.7–9</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 27: Finding the enthalpy change for the decomposition of potassium hydrogencarbonate indirectly using Hess' law</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.3.1 Enthalpy changes</b></p> <ul style="list-style-type: none"> <li>• Hess' law and enthalpy cycles</li> </ul>			

Week 25	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Definition of the rate of a reaction</li> <li>2. The collision theory</li> <li>3. Concentration of a solution</li> <li>4. Pressure of a gas</li> <li>5. Catalysts</li> <li>6. The advantage to industry and the environment of using catalysts.</li> <li>7. Catalysts – atom economy and waste</li> <li>8. Enzymes</li> <li>9. Boltzmann distribution</li> <li>10. Effect of catalysts on activation energy</li> <li>11. Temperature</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Describe the effect of concentration changes on the rate of a reaction.</li> <li>• Explain why an increase in the pressure of a gas increases the rate of the reaction.</li> <li>• State that a catalyst speeds up a reaction without being used up by the overall reaction.</li> <li>• Using enthalpy profile diagrams, explain how a catalyst increases the rate of a reaction.</li> <li>• Understand that catalysts affect conditions, often needing lower temperatures, reducing the energy costs and emissions resulting from the combustion of fuels.</li> <li>• Explain that catalysts allow different reactions to be used, with better atom economy and less waste.</li> <li>• State that catalysts have great economic importance.</li> <li>• Understand that catalysts are often enzymes operating close to room temperatures and pressures.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.3.10–13</li> </ul>	<ul style="list-style-type: none"> <li>• Practical 28: Monitoring the rate of a reaction by collecting a gas</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.3.2 Rates and equilibrium</b></p> <ul style="list-style-type: none"> <li>• Simple collision theory</li> <li>• The Boltzmann distribution</li> <li>• Catalysts</li> </ul>			

	<ul style="list-style-type: none"> <li>• Explain the Boltzmann distribution and its relationship with activation energy.</li> <li>• Use the Boltzmann distribution to explain qualitatively the effect of temperature on rates of reactions.</li> <li>• Interpret catalytic behaviour in terms of the Boltzmann distribution.</li> </ul>		
<b>Week 26</b>	<b>Learning Outcomes</b>	<b>Student book links</b>	<b>Practical activity links</b>
<ol style="list-style-type: none"> <li>1. Dynamic equilibrium</li> <li>2. Le Chatelier's principle</li> <li>3. Effect of pressure, concentration and temperature on systems at equilibrium</li> <li>4. Optimum conditions – the balance between rate, yield and cost, e.g. in the Haber process</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain that dynamic equilibrium occurs when the rates of the forward and reverse reaction are equal.</li> <li>• State le Chatelier's principle.</li> <li>• Apply le Chatelier's principle to deduce the qualitative effect of a change in concentration or pressure on a homogeneous system in equilibrium.</li> <li>• Apply le Chatelier's principle to deduce the qualitative effect of a change in temperature on a homogeneous system in equilibrium.</li> <li>• Explain, from given data, the importance in the chemical industry of a compromise between chemical equilibrium and reaction rate.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.3.14–15</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Activity 29: Investigating the qualitative effect of temperature on equilibrium</li> <li>• Practical Activity 30: Investigating the qualitative effect of concentration on equilibrium</li> </ul>
<b>OCR Scheme of Work topic outlines</b>			
		<b>2.3.2 Rates and equilibrium</b>	
		<ul style="list-style-type: none"> <li>• Dynamic equilibrium and le Chatelier's principle</li> </ul>	

Week 27	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. The greenhouse effect and global warming</li> <li>2. The evidence that global warming is a world problem</li> <li>3. Possible methods of storing carbon dioxide</li> <li>4. The role of chemists in providing evidence of environmental problems and of suggesting viable solutions</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain that infrared radiation is absorbed by C=O, O–H and C–H bonds in CO<sub>2</sub>, H<sub>2</sub>O and CH<sub>4</sub> respectively, and that this contributes to global warming.</li> <li>• Explain that the greenhouse effect of a given gas is dependent both on its atmospheric concentration and its ability to absorb infrared radiation.</li> <li>• Explain the importance of controlling global warming caused by the increase in greenhouse gases.</li> <li>• Outline the role played by chemists in providing evidence that global warming is occurring.</li> <li>• Understand the role of chemists in measuring progress against initiatives such as the Kyoto protocol.</li> <li>• Outline how chemists investigate solutions to problems like global warming such as</li> </ul>	<ul style="list-style-type: none"> <li>• 2.4.1–3</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.4.1 Chemistry of the air</b></p> <ul style="list-style-type: none"> <li>• The greenhouse effect</li> </ul>			

	<p>carbon capture and storage.</p> <ul style="list-style-type: none"> <li>• Understand the removal of waste carbon dioxide as a liquid injected deep into the oceans.</li> <li>• Outline carbon dioxide storage in deep geological formations by reaction with metal oxides to form stable carbonate minerals.</li> </ul>		
<b>Week 28</b>	<b>Learning Outcomes</b>	<b>Student book links</b>	<b>Practical activity links</b>
<ol style="list-style-type: none"> <li>1. The purpose of the ozone layer</li> <li>2. The natural equilibrium that maintains the ozone layer and absorbs harmful radiation</li> <li>3. The current damage to the ozone layer</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain that ozone is continually being formed and broken down in the stratosphere by ultraviolet radiation.</li> <li>• Using equilibria, describe how ozone concentration is maintained in the ozone layer, including the role of ultraviolet radiation.</li> <li>• Outline the role of ozone in the absorption of harmful ultraviolet radiation and the resulting benefit to life on Earth.</li> <li>• Understand that radicals from CFCs and NO<sub>x</sub> may catalyse the breakdown of ozone.</li> </ul>	<ul style="list-style-type: none"> <li>• 2.4.4–5</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
		<b>2.4.1 Chemistry of the air</b>	
		<ul style="list-style-type: none"> <li>• Ozone layer</li> <li>• Controlling air pollution</li> </ul>	

Week 29	Learning Outcomes	Student book links	Practical activity links
<ol style="list-style-type: none"> <li>1. Pollution caused by car engines</li> <li>2. Catalytic converters</li> <li>3. Heterogeneous catalysis</li> <li>4. Monitoring air pollution</li> <li>5. Sustainability</li> <li>6. Unexpected side effects</li> <li>7. International cooperation</li> <li>8. The beneficial uses of carbon dioxide</li> </ol>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Explain the formation of CO, NO<sub>x</sub> and unburned hydrocarbons from the internal combustion engine.</li> <li>• State the environmental concerns relating to the toxicity of these molecules and their contribution to low-level ozone and photochemical smog.</li> <li>• Outline how a catalytic converter decreases toxic emissions via adsorption, reaction and desorption.</li> <li>• Outline the use of infrared spectroscopy in monitoring air pollution.</li> <li>• Describe the principles of chemical sustainability.</li> <li>• Discuss issues of sustainability.</li> <li>• Explain that apparent benefits may be offset by unexpected and detrimental side effects.</li> <li>• Understand the importance of</li> </ul>	<ul style="list-style-type: none"> <li>• 2.4.6–8</li> </ul>	
<b>OCR Scheme of Work topic outlines</b>			
<p><b>2.4.1 Chemistry of the air</b></p> <ul style="list-style-type: none"> <li>• Green chemistry</li> </ul>			

establishing international cooperation to promote the reduction of pollution levels.

- Discuss some of the ways of reducing CO<sub>2</sub> emissions into the environment.
- Outline some of the positive benefits of using CO<sub>2</sub> as a substitute for more harmful materials.