| **This 3-Year Scheme of Work offers a flexible approach for KS4. The suggested timings are based on three lessons per fortnight (assuming a two week timetable of two lessons one week and one in the other) but can be tailored to suit the needs of a particular class or group of students. Lessons are assumed to be sessions of 40-60 minutes. The teaching scheme is scheduled to finish in the first term of Year 11 to allow time for revision and GCSE examinations.****The maths skills spreads are numbered as the last spread in a chapter but can be used at any appropriate point according to the needs of your students.** |
| --- |
| **Year** | **Term** | **Week** | **Student Book spread number** | **Lesson title** | **Learning objectives** | **OCR specification reference** | **Lesson resources (on CD ROM)** | **Collins Connect resources** |
| **Chapter 1: Particles (7 lessons)** |
| 9 | 1 | 1/2 | 1.1 | Three states of matter **(HT)** | * Use data to predict the states of substances
* Explain the changes of state.
* Use state symbols in chemical equations. **(HT)**
* Explain the limitations of the particle model. **(HT)**
 | C1.1 | Practical sheet 1.1, Worksheet 1.1.1, Worksheet 1.1.2, Technician’s notes 1.1 | Quick starter Homework worksheetHomework quizSlideshow |
| 9 | 1 | 1/2 | 1.2 | Changing ideas about atoms | * Describe how the atomic model has changed over time.
* Explain why the atomic model has changed over time.
* Understand that a theory is provisional until the next piece of evidence is available.
 | C1.2 | Worksheets 1.2.1, 1.2.2 and 1.2.3; Technician’s notes 1.2; Presentation1.2 | Quick starter Homework worksheetHomework quizSlideshowVideo |
| 9 | 1 | 1/2 | 1.3 | Modelling the atom **(HT)** | * Describe the atom as a positively charges nucleus surrounded by negatively charged electrons.
* Explain that most of the mass of an atom is in the nucleus.
* Explain that the nuclear radius is much smaller than that of the atom and most of the mass is in the nucleus. **(HT)**
 | C1.2 | Worksheet 1.3;Technician’s notes 1.3; Presentation 1.3 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 3/4 | 1.4 | Key concept: Sizes of particles and orders of magnitude | * Identify the scale of measurements of length.
* Explain the conversion of small lengths to metres.
* Explain the relative sizes of electrons, nuclei and atoms.
 | C1.2 | Worksheets 1.4.1 and 1.4.2; Technician’s notes 1.4; Practical sheet 1.4 | Quick starter Homework worksheetHomework quizVideo |
| 9 | 1 | 3/4 | 1.5 | Relating charges and masses | * Describe the structure of atoms.
* Recall the relative masses and charges of protons, neutrons and electrons.
* Explain why atoms are neutral.
 | C1.2 | Worksheet 1.5; Technician’s notes 1.5; Presentation 1.5 | Quick starter Homework worksheetHomework quizHomework quiz – higher tier |
| 9 | 1 | 3/4 | 1.6 | Subatomic particles | * Use the definitions of atomic number and mass number.
* Calculate the numbers of protons, neutrons and electrons in atoms.
* Calculate the numbers of subatomic particles in isotopes and ions.
 | C1.2 | Worksheets 1.6.1 and 1.6.2; Presentation1.6 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 5/6 | 1.7 | Maths skills: Standard form and making estimates | * Recognise numbers written in standard form.
* Convert decimals to standard form and vice versa.
* Make estimates without calculators so the answer in standard form seems reasonable.
 | C1.2 | Worksheet 1.7; Technician’s notes 1.7; Presentation 1.7 | Quick starter Homework worksheetHomework quizSlideshow |
| 9 | 1 | 5/6 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins Connect |
| **Chapter 2: Elements, compounds and mixtures (27 lessons)** |
| 9 | 1 | 5/6 | 2.1 | Key concepts: Pure substances | * Describe, explain and exemplify processes of separation.
* Suggest separation and purification techniques for mixtures.
* Distinguish pure and impure substances using melting point and boiling point data.
 | C2.1 | Practical sheets 2.1.1 and 2.1.2; Worksheets 2.1.1 and 2.1.2; Technician’s notes 2.1.1 and 2.1.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 7/8 | 2.2 | Relative formula mass | * Identify the relative atomic mass of an element from the periodic table.
* Calculate relative formula masses from relative atomic masses.
* Verify the law of conservation of mass in a balanced equation.
 | C2.1 | Worksheets 2.2.1, 2.2.2 and 2.2.3; Technician’s notes 2.2; Presentation 2.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 7/8 | 2.3 | Mixtures | * Recognise that all substances are chemicals.
* Understand that mixtures can be separated into their components.
* Explain that mixtures can be separated.
 | C2.1 | Practical sheet 2.3; Worksheets 2.3.1 and 2.3.2; Technician’s notes 2.3 | Quick starter Homework worksheetHomework quizHomework quiz – higher tier |
| 9 | 1 | 7/8 | 2.4 | Formulations | * Identify formulations given appropriate information.
* Explain the particular purpose of each chemical in a mixture.
* Explain how quantities are carefully measured for formulation.
 | C2.1 | Worksheets 2.4.1 and 2.4.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 9/10 | 2.5 | Chromatography **(HT)** | * Explain how to set up chromatography paper.
* Distinguish pure from impure substances.
* Interpret chromatograms and calculate *R*f values. **(HT)**
 | C2.1 | Practical sheet 2.5, Worksheet 2.5, Technician’s notes 2.5 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 9 | 1 | 9/10 | 2.6 | Practical: Investigate how paper chromatography can be used in forensic science to identify an ink mixture used in a forgery | * Describe the safe and correct manipulation of chromatography apparatus and how accurate measurements are achieved.
* Make and record measurements used in paper chromatography.
* Calculate *R*f values.
 | C2.1 | Practical sheets 2.6.1 and 2.6.2; Technician’s notes 2.6 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 9/10 | 2.7 | Maths skills: Use an appropriate number of significant figures | * Measure distances on chromatograms
* Calculate *Rf* values
* Record *Rf* values to an appropriate number of significant figures
 | C2.1 | Presentation 2.7 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 11/12 | 2.8 | Comparing metals and non-metals | * Recall a number of physical properties of metals and non-metals.
* Describe some chemical properties of metals and non-metals.
* Explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties.
 | C2.2 | Practical sheet 2.8; Technician’s notes 2.8; Worksheet 2.8; Presentations 2.8.1 and 2.8.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 11/12 | 2.9 | Electronstructure | * Explain how electrons occupy ‘shells’ in order.
* Describe the pattern of the electrons in shells for the first 20 elements.
 | C2.2 | Technician’s notes 2.9; Worksheets 2.9.1, 2.9.2 and 2.9.3 | Quick starter Homework worksheetHomework quiz |
| 9 | 1 | 11/12 | 2.10 | Metals and non-metals | * Know that metals are found on the left of the periodic table and non-metals on the right.
* Explain the differences between metals and non-metals based on their physical and chemical properties.
* Explain that metals form positive ions and non-metals do not.
 | C2.2 | Technician’s notes 2.10; Worksheets 2.10. and 2.10.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 1/2 | 2.11 | Chemical bonds **(HT)** | * Describe the three main types of bonding.
* Explain how electrons are used in the three main types of bonding.
* Explain how bonding and properties are linked. **(HT)**
 | C2.2 | Worksheets 2.11.1 and 2.11.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 1/2 | 2.12 | Ionic bonding | * Represent an ionic bond with a diagram.
* Draw dot and cross diagrams for ionic compounds.
* Work out the charge on the ions of metals from the group number of the element (1, 2, 6 and 7).
 | C2.2 | Practical sheet 2.12; Technician’s notes 2.12; Worksheet 2.12 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 1/2 | 2.13 | Ionic compounds **(HT)** | * Identify ionic compounds from structures.
* Explain the limitations of diagrams and models.
* Work out the empirical formula of an ionic compound. **(HT)**
 | C2.2 | Practical sheet 2.13; Technician’s notes 2.13; Worksheets 2.13.1, 2.13.2 and 2.13.3 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 3/4 | 2.14 | Properties of ionic compounds **(HT)** | * Describe the properties of ionic compounds.
* Relate their melting points to forces between ions.
* Explain when ionic compounds can conduct electricity. **(HT)**
 | C2.2 | Practical sheets 2.14.1 and 2.14.2; Worksheet 2.14; Technician’s notes 2.14.1 and 2.14.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierVideo |
| 9 | 2 | 3/4 | 2.15 | Properties of small molecules | * Identify small molecules from formulae.
* Explain the strength of covalent bonds.
* Relate the intermolecular forces to the bulk properties of a substance.
 | C2.2 | Worksheets 2.15.1 and 2.15.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierVideo |
| 9 | 2 | 3/4 | 2.16 | Covalent bonding | * Recognise substances made of small molecules from their formula.
* Draw dot and cross diagrams for small molecules.
* Deduce molecular formulae from models and diagrams.
 | C2.2 | Worksheets 2.16.1 and 2.16.2 | Quick starter Homework worksheetHomework quizVideo |
| 9 | 2 | 5/6 | 2.17 | Giant covalent structures | * Recognise giant covalent structures from diagrams.
* Explain the properties of giant covalent structures.
* Recognise the differences in different forms of carbon.
 | C2.2 | Practical sheet 2.17; Worksheets 2.17.1 and 2.17.2; Technician’s notes 2.17 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 5/6 | 2.18 | Polymer structures **(HT)** | * Identify polymers from diagrams showing their bonding and structure.
* Explain why some polymers can stretch.
* Explain why some plastics do not soften on heating. **(HT)**
 | C2.2 | Practical sheet 2.18; Worksheet 2.18; Technician’s notes 2.18 | Quick starter Homework worksheetHomework quizHomework quiz – higher tier |
| 9 | 2 | 5/6 | 2.19 | Metallic bonding **(HT)** | * Know that metals form giant structures.
* Explain how metal ions are held together.
* Explain the delocalisation of electrons. **(HT)**
 | C2.2 | Practical sheet 2.19; Worksheets 2.19.1 and 2.19.2; Technician’s notes 2.19 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierVideo |
| 9 | 2 | 7/8 | 2.20 | Properties of metals and alloys | * Identify metal elements and metal alloys.
* Describe the purpose of a lead-tin alloy.
* Explain why alloys are harder than pure metals due to the distortion of the layers of atoms.
 | C2.2 | Practical sheet 2.20; Worksheets 2.20.1 and 2.20.2; Technician’s notes 2.20 | Quick starter Homework worksheetHomework quizSlideshows |
| 9 | 2 | 7/8 | 2.21 | Key concept: The outer electrons | * Recognise when electrons transfer.
* Recognise when atoms share electrons.
* Predict when electrons are transferred most easily.
 | C2.2 | Technician’s notes 2.21; Worksheet 2.21; Presentation 2.21 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 7/8 | **Assessment** | End of teaching block test |  |  |  |
| 9 | 2 | 9/10 | 2.22 | The periodic table | * Explain how the electronic structure of atoms follows a pattern.
* Recognise that the number of electrons in an element’s atoms outer shell corresponds to the element’s group number.
* Explain that the electronic structures of transition metals position the elements into the transition metal block.
 | C2.2 | Worksheets 2.22.1, 2.22.2 and 2.22.3 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 9/10 | 2.23 | Developing the periodic table | * Describe the steps in the development of the periodic table.
* Explain how Mendeleev left spaces for undiscovered elements.
* Explain why the element order in the modern periodic table was changed.
* Explain how testing a prediction can support or refute a new scientific idea.
 | C2.2 | Technician’s notes 2.23; Worksheets 2.23.1 and 2.23.2; Presentation 2.23 | Quick starter Homework worksheetHomework quiz |
| 9 | 2 | 9/10 | 2.24 | Diamond | * Identify why diamonds are so hard.
* Explain how the properties relate to the bonding structure in diamond.
* Explain why diamond differs from graphite.
 | C2.3 | Worksheet 2.24 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierSlideshowVideo |
| 9 | 2 | 11/12 | 2.25 | Graphite | * Describe the structure and bonding of graphite.
* Explain the properties of graphite.
* Explain the similarity to metals.
 | C2.3 | Worksheets 2.25.1 and 2.25.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierVideo |
| 9 | 2 | 11/12 | 2.26 | Graphene and fullerenes | * Explain the properties of graphene by its structure and bonding.
* Recognise graphene and fullerenes from their bonding and structure.
* Describe the uses of fullerenes, including carbon nanotubes.
 | C2.3 | Worksheets 2.26.1 and 2.26.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher tierVideo |
| 9 | 2 | 11/12 | 2.27 | Maths skills: Using ratios in mixture, empirical formulae and balanced equations | * Use ratios, fractions and percentages to describe the composition of mixtures.
* Use ratios to determine the empirical formula of a compound.
* Explain how to balance equations in terms of numbers of atoms on both sides of the equation.
 | C2.3 | Worksheets 2.27.1 and 2.27.2; Technician’s notes 2.27; Presentation 2.27 | Quick starter Homework worksheetHomework quizVideo |
| 9 | 3 | 1/2 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins Connect |
| **Chapter 3: Chemical reactions (28 lessons)** |
| 9 | 3 | 1/2 | 3.1 | Elements and compounds | * Identify symbols of elements from the periodic table.
* Recognise compounds from their formula.
* Identify the elements in a compound.
 | C3.1 | Worksheets 3.1.1 and 3.1.2; Technician’s notes 3.1; Practical sheet 3.1 | Quick starter Homework worksheetHomework quizSlideshowVideo |
| 9 | 3 | 1/2 | 3.2 | Atoms, formulae and equations | * Explain that an element consists of the same type of atoms.
* Explain that atoms join together to make molecules.
* Explain how formulae represent elements and compounds.
 | C3.1 | Practical sheet 3.2; Technician’s notes 3.2; Worksheets 3.2.1, 3.2.2 and 3.2.3; Presentation 3.2 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 3/4 | 3.3 | Moles **(HT only)** | * Describe the measurements of amounts of substances in moles.
* Calculate the amount of moles in a given mass.
* Calculate the mass of a given number of moles.
 | C3.1 | Worksheets 3.3.1 and 3.3.2; Technician’s notes 3.3 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 3/4 | 3.4 | Key concept: Conservation of mass and balanced equations | * Explain the law of conservation of mass.
* Explain why a multiplier appears as a subscript in a formula.
* Explain why a multiplier appears in equations before a formula.
 | C3.1 | Worksheet 3.4; Technician’s notes 3.4; Presentation 3.4 | Quick starter Homework worksheetHomework quizSlideshowVideo |
| 9 | 3 | 3/4 | 3.5 | Test for gases | * Recall the tests for four common gases.
* Identify the four common gases using these tests.
* Explain why limewater can be used to detect carbon dioxide.
 | C3.1 | Practical sheet 3.5; Technician’s notes 3.5; Presentations 3.5 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 5/6 | 3.6 | Mass changes when gases are in reactions **(HT)** | * Explain any observed changes in mass in a chemical reaction.
* Identify the mass changes using a balanced symbol equation.
* Explain these changes in terms of the particle model.
 | C3.1 | Worksheet 3.6; Practical sheet 3.6; Technician’s notes 3.6; Presentations 3.6.1 and 3.6.2; Graph Plotter 3.6 | Quick starter Homework worksheetHomework quizSlideshow |
| 9 | 3 | 5/6 | 3.7 | Using moles to balance equations **(HT only)** | * Convert masses in grams to amounts in moles.
* Balance an equation given the masses of reactants and products.
* Change the subject of a mathematical equation.
 | C3.1 | Worksheet 3.7 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 5/6 | 3.8 | Key concept: Limiting reactants and molar masses **(HT only)** | * Identify which reactant is in excess.
* Explain the effect of a limiting quantity of a reactant on the amount of products.
* Calculate amount of products in moles or in grams.
 | C3.1 | Practical sheet 3.8; Worksheets 3.8.1 and 3.8.2; Technician’s notes 3.8; Presentation 3.8 | Quick starter Homework worksheetHomework quizSlideshowVideo |
| 9 | 3 | 7/8 | 3.9 | Amounts of substances in equations **(HT only)** | * Calculate the masses of substances in a balanced symbol equation.
* Calculate the masses of reactants and products from balanced symbol equations.
* Calculate the mass of a given reactant or product.
 | C3.1 | Worksheet 3.9 | Quick starter Homework worksheetHomework quizSlideshow |
| 9 | 3 | 7/8 | 3.10 | Maths skills: Change the subject of an equation **(HT)** | * Use equations to demonstrate conservation.
* Rearrange the subject of an equation. **(HT)**
* Carry out multi-step calculations. **(HT)**
 | CM5.1 | Worksheet 3.10 | Quick starter Homework worksheetHomework quizVideo |
| 9 | 3 | 7/8 | 3.11 | Key concept: Endothermic and exothermic reactions | * Identify exothermic and endothermic reactions from temperature changes.
* Evaluate the energy transfer of a fuel.
* Investigate the variables that affect temperature changes in reacting solutions.
 | C3.2 | Practical sheet 3.11; Worksheet 3.11; Technician’s notes 3.11; Graph plotters 3.11.1a, 3.11.1b, 3.11.2a and 3.11.2b | Quick starter Homework worksheetHomework quizSlideshow |
| 9 | 3 | 9/10 | 3.12 | Reaction profiles **(HT)** | * Draw simple reaction profiles (energy level diagrams).
* Use reaction profiles to identify reactions as exothermic or endothermic.
* Explain the energy needed for a reaction to occur and calculate energy changes. **(HT)**
 | C3.2 | Worksheets 3.12.1 and 3.12.2; Technician’s notes 3.12; Presentation 3.12 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 9 | 3 | 9/10 | 3.13 | Energy change of reactions | * Describe the energy changes during bond breaking and bond making.
* Explain how a reaction is endothermic or exothermic overall.
* Calculate the energy transferred in chemical reactions using bond energies.
 | C3.2 | Worksheets 3.13.1 and 3.13.2; Technician’s notes 3.13; Presentation 3.13 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 9/10 | 3.14 | Maths skills: Recognise and use expressions in decimal form | * Read scales in integers and using decimals.
* Calculate the energy change during a reaction.
* Calculate energy transferred for comparison.
 | C3.2 | Practical sheet 3.14; Worksheet 3.14; Technician’s notes 3.14 | Quick starter Homework worksheetHomework quiz |
| 9 | 3 | 11/12 | 3.15 | Oxidation and reduction in terms of electrons **(HT)** | * Use experimental results of displacement reactions to confirm the reactivity series.
* Write ionic equations for displacement reactions. **(HT)**
* Identify in a half equation which species are oxidised and which are reduced. **(HT)**
 | C3.3 | Practical sheet 3.15; Worksheet 3.15; Technician’s notes 3.15; Presentations 3.15.1 and 3.15.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 9 | 3 | 11/12 | 3.16 | Key concept: Electron transfer, oxidation and reduction **(HT)** | * Explain why atoms lose or gain electrons.
* Explain oxidation and reduction by electron transfer. **(HT)**
* Relate the ease of losing electrons to reactivity. **(HT)**
 | C3.3 | Worksheet 3.16; Presentation 3.16 | Quick starter Homework worksheetHomework quizVideo |
| 9 | 3 | 11/12 | 3.17 | Neutralisation of acids and salt production | * Describe ways that salts can be made.
* Predict products from given reactants.
* Deduce the formulae of salts from the formulae of common ions.
 | C3.3 | Practical sheet 3.17; Worksheets 3.17.1 and 3.17.2; Technician’s notes 3.17 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 1 | 1/2 | 3.18 | Soluble salts | * Describe how to make pure, dry samples of soluble salts.
* Explain how to name a salt.
* Derive a formula for a salt from its ions.
 | C3.3 | Practical sheet 3.18; Worksheets 3.18.1 and 3.18.2; Technician’s notes 3.18; Presentations 3.18.1 and 3.18.2 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 1 | 1/2 | 3.19 | Reaction of metals with acids **(HT)** | * Describe how to make salts from metals and acids.
* Write full balanced symbol equations for making salts.
* Use half equations to describe oxidation and reduction. **(HT)**
 | C3.3 | Practical sheet 3.19; Worksheets 3.19.1 and 3.19.2; Technician’s notes 3.19.1; Presentations 3.19.1 and 3.19.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 1 | 1/2 | 3.20 | Practical: Preparing a pure, dry sample of a salt from an insoluble oxide or carbonate **(HT)** | * Describe a practical procedure for producing a salt using a solid and an acid.
* Explain the apparatus, materials and techniques used for making the salt.
* Describe how to manipulate apparatus safely and accurately a measure melting point. **(HT)**
 | C3.3 | Practical sheet 3.20; Technician’s notes 3.20; Presentations 3.20.1 and 3.20.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 1 | 3/4 | 3.21 | pH and neutralisation | * Describe the use of universal indicator to measure pH.
* Use the pH scale to identify acidic or alkaline solutions.
* Recognise how the pH changes when a strong acid neutralises a strong alkali.
 | C3.3 | Practical sheet 3.21; Worksheet 3.21; Technician’s notes 3.21.1, 3.21.2 and 3.21.3; Presentation 3.21 | Quick starter Homework worksheetHomework quiz |
| 10 | 1 | 3/4 | 3.22 | Strong and weak acids **(HT only)** | * Explain weak and strong acids in terms of their degree of ionisation.
* Describe neutralisation by the effect on hydrogen ions and pH.
* Explain dilute and concentrated in terms of the amount of substance.
 | C3.3 | Worksheet 3.22; Technician’s notes 3.22; Presentation 3.22 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 1 | 3/4 | 3.23 | Maths skills: Make order of magnitude calculations **(HT only)** | * Use graphs and diagrams to apply the pH scale to acid rain distribution.
* Calculate the concentration of acids.
* Calculate the effect of hydrogen ion concentration on the numerical value of pH.
 | CM3.3 | Practical sheet 3.23; Technician’s notes 3.23; Presentation 3.23 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 1 | 5/6 | 3.24 | Practical: Investigating the variables that affect temperature changes in reacting solutions, such as acid plus metals, acid plus carbonates, neutralisations, displacement of metals **(HT)** | * Use scientific theories and explanations to develop hypotheses.
* Plan experiments to make observations and test hypotheses.
* Evaluate methods to suggest possible improvements and further investigations. **(HT)**
 | C3.3 | Practical sheet 3.24; Technician’s notes 3.24; Presentation3.24 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 1 | 5/6 | 3.25 | The process of electrolysis **(HT)**  | * Identify reactions at electrodes during electrolysis.
* Explain why a mixture is used and the anode needs constant replacement.
* Write and balance half equations for the electrode reactions. **(HT)**
 | C3.4 | Practical sheet 3.25; Worksheet 3.25; Technician’s notes 3.25; Presentation 3.25 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshowVideo |
| 10 | 1 | 5/6 | 3.26 | Electrolysis of molten ionic compounds **(HT)** | * Identify which ions migrate to the cathode and which to the anode.
* Explain how the ions of a molten electrolyte are discharged.
* Predict the products of electrolysis of molten binary compounds.
 | C3.4 | Worksheet 3.26; Presentation 3.26 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 1 | 7/8 | 3.27 | Electrolysis of aqueous solutions | * Explain the electrolysis of copper sulfate using inert electrodes.
* Predict the products of the electrolysis of aqueous solutions.
* Represent reactions at electrodes by half equations.
 | C3.4 | Practical sheet 3.27; Technician’s notes 3.27; Worksheet 3.27; Presentation 3.27 | Quick starter Homework worksheetHomework quiz |
| 10 | 1 | 7/8 | 3.28 | Practical: Investigating what happens when aqueous solutions are electrolysed using inert electrodes | * Use scientific theories and explanations to develop hypotheses.
* Plan experiments to make observations and test hypotheses.
* Apply a knowledge of the apparatus needed for electrolysis
* Make and record observations.
 | C3.4 | Practical sheet 3.28; Technician’s notes 3.28; Presentations 3.28.1 and 3.28.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 1 | 7/8 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins ConnectEnd of teaching block testEnd of year test |
| **Chapter 4: Predicting and identifying reactions and products (5 lessons)** |
| 10 | 1 | 9/10 | 4.1 | Exploring Group 0 | * Describe the unreactivity of the noble gases.
* Predict and explain the trends of the boiling points of the noble gases (going down the group).
* Explain how properties of the elements in Group 0 depend on their electron configurations.
 | C4.1 | Worksheet 4.1; Presentations 4.1.1 and 4.1.2; Graph plotter 4.1 | Quick starter Homework worksheetHomework quiz |
| 10 | 1 | 9/10 | 4.2 | Exploring Group 1 | * Explain why Group 1 metals are known as the alkali metals.
* Predict the properties of other Group 1 metals from trends down the group.
* Relate the properties of alkali metals to their electron configurations.
 | C4.1 | Worksheets 4.2.1, 4.2.2 and 4.2.3; Technician’s notes 4.2; Presentation 4.2 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 1 | 9/10 | 4.3 | Exploring Group 7 | * Recall that fluorine, chlorine, bromine and iodine are non-metal elements called halogens.
* Describe that they react vigorously with alkali metals.
* Construct balanced symbol equations for the reactions of metals with halogens.
 | C4.1 | Worksheets 4.3.1, 4.3.2 and 4.3.3; Technician’s notes 4.3.1 and 4.3.2; Presentation 4.3 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 1 | 11/12 | 4.4 | Reaction trends and predicting reactions | * Explain why the trends down the group in Group 1 and in Group 7 are different.
* Explain the changes across a period.
* Predict the reactions of elements with water, dilute acid and oxygen from their position in the periodic table.
 | C4.1 | Worksheet 4.4; Presentation 4.4 | Quick starter Homework worksheetHomework quiz |
| 10 | 1 | 11/12 | 4.5 | Reactivity series **(HT)** | * Describe the reactions, if any, of metals with water or dilute acids.
* Deduce an order of reactivity of metals based on experimental results.
* Explain how the reactivity is related to the tendency of the metal to form its positive ion. **(HT)**
 | C4.1 | Practical sheet 4.5; Worksheet 4.5; Technician’s notes 4.5; Presentations 4.5.1 and 4.5.2  | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 1 | 11/12 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins Connect |
| **Chapter 5: Monitoring and controlling chemical reactions (14 lessons)** |
| 10 | 2 | 1/2 | 5.1 | Measuring rates | * Explain how to measure the amount of gas given off in a reaction.
* Explain how to measure the rate of a reaction.
* Read data from graphs to interpret stages of a reaction.
 | C5.1 | Practical sheet 5.1; Worksheet 5.1; Technician’s notes 5.1; Presentations 5.1.1 and 5.1.2; Graph plotter 5.1 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 2 | 1/2 | 5.2 | Calculating rates **(HT)** | * Calculate the mean rate of a reaction.
* Draw and interpret graphs of reaction times.
* Draw tangents to the curves as a measure of the rate of reaction. **(HT)**
 | C5.1 | Practical sheet 5.2; Worksheet 5.2; Technician’s notes 5.2; Presentations 5.2.1 and 5.2.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 2 | 1/2 | 5.3 | Concentration of solutions **(HT)** | * Relate mass, volume and concentration.
* Calculate the mass of solute in solution.
* Relate concentration in mol/dm3 to mass and volume. **(HT)**
 | C5.1 | Practical sheet 5.3; Worksheet 5.3; Technician’s notes 5.3 | Quick starterHomework worksheetHomework quizSlideshow |
| 10 | 2 | 3/4 | 5.4 | Factors affecting rates | * Identify factors that affect the rates of reactions.
* Explain how changes of surface area affect rates.
* Explain how rates are affected by different factors.
 | C5.1 | Practical sheet 5.4; Worksheets 5.4.1 and 5.4.2; Technician’s notes 5.4; Presentation 5.4; Graph plotter 5.4 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 2 | 3/4 | 5.5 | Collision theory | * Describe a reaction by particles colliding.
* Explain the effects of changes of factors on rates of reaction using collision theory.
* Describe activation energy.
 | C5.1 | Worksheets 5.5.1 and 5.5.2;Presentations 5.5.1 and 5.5.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 2 | 3/4 | 5.6 | Catalysts | * Identify catalysts in reactions.
* Explain catalytic action.
* Explain activation energy.
 | C5.1 | Practical sheet 5.6; Worksheet 5.6; Technician’s notes 5.6 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 2 | 5/6 | 5.7 | Factors increasing the rate | * Analyse experimental data on rates of reaction.
* Predict the effects of changing conditions on rates of reactions.
* Use ideas about proportionality to explain the effect of a factor.
 | C5.1 | Practical sheet 5.7; Worksheet 5.7; Technician’s notes 5.7; Presentation 5.7 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 2 | 5/6 | 5.8 | Practical: Investigate how changes in concentration affect the rates of reactions by a method involving the production of a gas and a method involving a colour change **(HT)** | * Use scientific theories and explanations to develop a hypothesis.
* Plan experiments to test the hypothesis and check data.
* Make and record measurements using gas syringes.
* Evaluate methods and suggest improvements and further investigations. **(HT)**
 | C5.1 | Practical sheets 5.8.1 and 5.8.2;Technician’s notes 5.8; Presentations 5.8.1 and 5.8.2; Graph plotter 5.8 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 2 | 5/6 | 5.9 | Reversible reactions and energy changes **(HT)** | * Identify a reversible reaction.
* Explain how energy changes occur in reversible reactions.
* Consider changing the conditions of a reversible reaction. **(HT)**
 | C5.2 | Practical sheet 5.9; Worksheet 5.9; Technician’s notes 5.9; Presentation 5.9 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 2 | 7/8 | 5.10 | Equilibrium **(HT)** | * Describe how equilibrium is reached.
* Explain what happens to the forward and reverse reactions.
* Predict the effects of changes on systems at equilibrium. **(HT)**
 | C5.2 | Worksheet 5.10; Technician’s notes 5.10; Presentation 5.10 | Quick starter Homework worksheetHomework quiz |
| 10 | 2 | 7/8 | 5.11 | Changing concentration and equilibrium **(HT only)** | * Identify reactants and products in a reversible reaction.
* Explain how changing concentrations changes the position of equilibrium.
* Interpret data to predict the effect of a change in concentration.
 | C5.2 | Worksheet 5.11; Technician’s notes 5.11; Presentation 5.11 | Quick starter Homework worksheetHomework quiz |
| 10 | 2 | 7/8 | 5.12 | Changing temperature and equilibrium **(HT only)** | * Explain how exothermic reversible reactions behave.
* Explain how endothermic reversible reactions behave.
* Apply Le Chatelier’s principle to reactions in equilibrium.
 | C5.2 | Worksheets 5.12.1 and 5.12.2; Technician’s 5.12; Presentation 5.12 | Quick starter Homework worksheetHomework quiz |
| 10 | 2 | 9/10 | 5.13 | Changing pressure and equilibrium **(HT only)** | * Predict the effects of changes in pressure.
* Explain why these effects occur.
* Interpret data to predict the effect of a change in pressure.
 | C5.2 | Worksheet 5.13; Presentation 5.13 | Quick starter Homework worksheetHomework quiz |
| 10 | 2 | 9/10 | 5.14 | Maths skills: Use the slope of a tangent as a measure of rate of change | * Draw graphs from numeric data.
* Draw tangents to the curve to observe how the slope changes.
* Calculate the slope of the tangent to identify the rate of reaction.
 | C5.2 | Worksheets 5.14.1 and 5.14.2; Presentations 5.14.1 and 5.14.2 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 2 | 9/10 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins ConnectEnd of teaching block test |
| **Chapter 6: Global challenges (25 lessons)** |
| 10 | 2 | 11/12 | 6.1 | Extraction of metals **(HT)** | * Identify substances reduced by loss of oxygen.
* Explain how extraction methods depend on metal reactivity.
* Interpret or evaluate information on specific metal extraction processes. **(HT)**
 | C6.1 | Practical sheet 6.1; Worksheet 6.1; Technician’s notes 6.1; Presentation 6.1 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 2 | 11/12 | 6.2 | Using electrolysis to extract metals **(HT)** | * Explain the process of the electrolysis of aluminium oxide.
* Explain why a mixture is used and the anode needs constant replacement.
* Write half equations for the reactions at the electrodes. **(HT)**
 | C6.1 | Worksheet 6.2; Presentations 6.2.1 and 6.2.2 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 2 | 11/12 | 6.3 | Alternative methods of metal extraction **(HT only)** | * Describe the process of phytomining.
* Describe the process of bioleaching.
* Evaluate alternative biological methods of metal extraction.
 | C6.1 | Practical sheet 6.3; Worksheets 6.3.1 and 6.3.2; Technician’s notes 6.3 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 1/2 | 6.4 | Life cycle assessment and recycling | * Describe the components of a Life Cycle Assessment (LCA).
* Interpret LCAs of materials or products from information.
* Carry out a simple comparative LCA for shopping bags.
 | C6.1 | Worksheets 6.4.1 and 6.4.2 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 1/2 | 6.5 | Ways of reducing the use of resources | * Describe ways of recycling and reusing materials.
* Explain why recycling, reusing and reducing are needed.
* Evaluate ways of reducing the use of limited resources.
 | C6.1 | Worksheets 6.5.1 and 6.5.2 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 3 | 1/2 | 6.6 | Maths skills: Translate information between graphical and numerical form | * Represent information from pie charts numerically.
* Represent information from graphs numerically.
* Represent information from numeric form graphically.
 | C6.1 | Worksheets 6.6.1 and 6.6.2 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 3 | 3/4 | 6.7 | Crude oil, hydrocarbons and alkanes | * Describe how crude oil is used to provide modern materials.
* Explain how crude oil is separated by fractional distillation.
* Explain why the boiling points of the fractions are different.
 | C6.2 | Worksheets 6.7.1 and 6.7.2 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 3 | 3/4 | 6.8 | Fractional distillation and petrochemicals | * Describe how crude oil is used to provide modern materials.
* Explain how crude oil is separated by fractional distillation.
* Explain why the boiling points of the fractions are different.
 | C6.2 | Practical sheet 6.8; Worksheets 6.8.1 and 6.8.2; Technician’s notes 6.8 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 3 | 3/4 | 6.9 | Properties of hydrocarbons | * Describe how different hydrocarbon fuels have different properties.
* Identify the properties that influence the use of fuels.
* Explain how the properties are related to the size of the molecules.
 | C6.1 | Worksheets 6.9.1 and 6.9.2 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 3 | 5/6 | 6.10 | Intermolecular forces | * Identify the bonds within a molecule and the forces between molecules.
* Explain changes of state.
* Explain how polymer structure determines its ability to stretch.
 | C6.2 | Worksheets 6.10.1 and 6.10.2 | Quick starterHomework worksheetHomework quizVideo |
| 10 | 3 | 5/6 | 6.11 | Cracking and alkenes | * Describe the usefulness of cracking.
* Balance chemical equations as examples of cracking.
* Explain why modern life depends on the uses of hydrocarbons.
 | C6.1 | Practical sheet 6.11; Worksheet 6.11; Technician’s notes 6.11 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 5/6 | 6.12 | Proportions of gases in the atmosphere | * Identify the gases of the atmosphere.
* Recall the proportions of gases.
* Explain how the balance of the gases is maintained.
 | C6.2 | Worksheets 6.12.1 and 6.12.2; Technician’s notes 6.12.1 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 3 | 7/8 | 6.13 | The Earth’s early atmosphere | * Describe ideas about the Earth’s early atmosphere.
* Interpret evidence about the Earth’s early atmosphere.
* Evaluate different theories about the Earth’s early atmosphere.
 | C6.2 | Worksheet 6.13 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 7/8 | 6.14 | How oxygen increased | * Identify the process allowing oxygen levels to increase.
* Explain the role of algae in the composition of the atmosphere.
* Recall the equation for photosynthesis.
 | C6.3 | Worksheet 6.14; Presentation 6.14 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 7/8 | 6.15 | Key concept: Greenhouse gases | * Describe the greenhouse gases.
* Explain the greenhouse effect.
* Explain these processes as interaction of short and long radiation with matter.
 | C6.3 | Worksheet 6.15; Presentation 6.15 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 10 | 3 | 9/10 | 6.16 | Human activities | * Describe two activities that increase the amounts of carbon dioxide and methane in the atmosphere.
* Evaluate the quality of evidence in a report about global climate change.
* Recognise the importance of peer review and communicating results to a wide range of audiences.
 | C6.3 | Worksheet 6.16; Presentations6.16.1and 6.16.2 | Quick starter Homework worksheetHomework quizHomework quiz – higherVideo |
| 10 | 3 | 9/10 | 6.17 | Global climate change | * Describe four potential effects of global climate change.
* Discuss the scale and risk of global climate change.
* Discuss the environmental implications of climate change.
 | C6.3 | Worksheet 6.17; Presentation 6.17 | Quick starter Homework worksheetHomework quizSlideshow |
| 10 | 3 | 9/10 | 6.18 | Carbon footprint and its reduction | * Explain that the carbon footprint can be reduced by reducing emissions of carbon dioxide and methane.
* Describe how emissions of carbon dioxide can be reduced.
* Describe how emissions of methane can be reduced.
 | C6.3 | Worksheet 6.18; Presentation 6.18 | Quick starter Homework worksheetHomework quizVideo |
| 10 | 3 | 11/12 | 6.19 | Limitations on carbon footprint reduction | * Give reasons why actions to reduce levels of carbon dioxide and methane may be limited.
* Give reasons why methane is difficult to reduce.
 | C6.3 | Worksheets 6.19.1 and 6.19.2; Presentation 6.19 | Quick starter Homework worksheetHomework quiz |
| 10 | 3 | 11/12 | 6.20 | Atmospheric pollutants from fuels | * Describe how carbon monoxide, soot, sulphur dioxide and oxides of nitrogen are produced by burning fuels.
* Predict the products of combustion of a fuel knowing the composition of the fuel.
* Predict the products of combustion of a fuel knowing the conditions in which it is used.
 | C6.3 | Worksheets 6.20.1, 6.20.2, 6.20.3 and 6.20.4; Technician’s notes 6.20; Presentation 6.20 | Quick starter Homework worksheetHomework quizHomework quiz – higherSlideshow |
| 10 | 3 | 11/12 | 6.21 | Properties and effects of atmospheric pollutants | * Describe and explain the problems caused by increased amounts of oxides of carbon, sulphur and nitrogen as pollutants in the air.
* Describe and explain the effects of acid rain.
* Evaluate the role of particulates in damaging human health.
 | C6.3 | Worksheets 6.21.1 and 6.21.2; Presentations 6.21.1 and 6.21.2 | Quick starter Homework worksheetHomework quizHomework quiz – higher |
| 11 | 1 | 1/2 | 6.22 | Potable water | * Distinguish between potable water and pure water.
* Describe the differences in treatment of ground water and salty water.
* Give reasons for the steps used to produce potable water.
 | C6.3 | Worksheets 6.22.1, 6.22.2 and 6.22.3; Technician’s notes 6.22 | Quick starter Homework worksheetHomework quizVideo |
| 11 | 1 | 1/2 | 6.23 | Waste water treatment | * Explain how waste water is treated.
* Describe how sewage is treated.
* Compare the ease of treating waste, ground and salt water.
 | C6.3 | Worksheets 6.23.1, 6.23.2 and 6.23.3 | Quick starter Homework worksheetHomework quizVideo |
| 11 | 1 | 1/2 | 6.24 | Practical: Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation | * Describe how safety is managed, apparatus is used and accurate measurements are made.
* Recognise when sampling techniques need to be used and made representative.
* Evaluate methods and suggest possible improvements and further investigations.
 | C6.3 | Practical sheets 6.24.1 and 6.24.2; Worksheet 6.24; Technician’s notes 6.24 | Quick starter Homework worksheetHomework quiz |
| 11 | 1 | 3/4 | 6.25 | Maths skills: Use ratios, fractions and percentages | * Use fractions and percentages to describe the compositions of mixtures.
* Use ratios to determine the mass of products expected.
* Calculate percentage yields in chemical reactions.
 | C6.3 | Worksheets 6.25.1 and 6.25.2; Technician’s notes 6.25; Presentation 6.25 | Quick starter Homework worksheetHomework quizVideo |
| 11 | 1 | 3/4 | **Assessment** | End of chapter test Student BookEnd of chapter test Collins ConnectEnd of teaching block testEnd of year testEnd of course test |