| **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 worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework quiz  Slideshow  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Slideshow |
| 9 | 1 | 5/6 | **Assessment** | | End of chapter test Student Book  End 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz |
| 9 | 1 | 11/12 | 2.9 | Electron  structure | * 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher tier  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher tier  Video |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework quiz – higher tier  Video |
| 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 worksheet  Homework quiz  Slideshows |
| 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher tier  Slideshow  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher tier  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher tier  Video |
| 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 worksheet  Homework quiz  Video |
| 9 | 3 | 1/2 | **Assessment** | | End of chapter test Student Book  End 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 worksheet  Homework quiz  Slideshow  Video |
| 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Slideshow  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Slideshow  Video |
| 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 worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow  Video |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher |
| 10 | 1 | 7/8 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect  End of teaching block test  End 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 10 | 1 | 11/12 | **Assessment** | | End of chapter test Student Book  End 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework 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 starter  Homework worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Video |
| 10 | 2 | 9/10 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect  End 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Video |
| 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 starter  Homework worksheet  Homework quiz  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework 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 worksheet  Homework 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Video |
| 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 worksheet  Homework quiz  Slideshow |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Homework quiz – higher  Slideshow |
| 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 worksheet  Homework quiz  Homework 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework quiz  Video |
| 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 worksheet  Homework 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 worksheet  Homework quiz  Video |
| 11 | 1 | 3/4 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect  End of teaching block test  End of year test  End of course test | | | |