| **This 3-Year Scheme of Work offers a flexible approach for KS4. The suggested timings are based on three science lessons per fortnight (assuming a two week timetable of two lessons one week and one lesson 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 second term of Year 11 to allow time for revision and GCSE examinations in the summer term.**  **Please note that some of these lessons only require partial coverage or are shorter than others and therefore sometimes there are more than three lessons in a fortnight. 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 | * Use data to predict the states of substances. * Explain the changes of state. * Use state symbols in chemical equations. | C1.1a–c | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 9 | 1 | 1/2 | 1.2 | Changing ideas about atoms | * Learn how models of the atom changed as scientists gathered more data. * Consider the data Rutherford and Marsden collected. * Link their data to our model of the atom. | C1.2a | Worksheets 1, 2 and 3; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 1 | 1/2 | 1.3 | Modelling the atom | * Explore the structure of atoms. * Consider the sizes of atoms. * Explore the way atomic radius changes with position in the periodic table. | C1.2b | Worksheet; Technician’s notes; Presentation; Graph plotter | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 3/4 | 1.4 | Key concept: Sizes of particles and orders of magnitude | * Identify the scale and measurements of length. * Explain the conversion of small lengths to metres. * Explain the relative sizes of electrons, nuclei and atoms. | C1.2c | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 9 | 1 | 3/4 | 1.5 | Relating charges and masses | * Compare protons, neutrons and electrons. * Find out why atoms are neutral. * Relate the number of charged particles in atoms to their position in the periodic table. | C1.2d | Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 3/4 | 1.6 | Subatomic particles | * Find out what the periodic table tells us about each element’s atoms. * Learn what isotopes are. * Use symbols to represent isotopes. | C1.2e | Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 1 | 5/6 | 1.7 | Maths skills: Standard form and making estimates | * Consider the sizes of particles. * Use numbers in standard form to compare sizes. * Use numbers in standard form in calculations. | CM1.2 | Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 1 | 5/6 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect | | | |
| **Chapter 2: Elements, compounds and mixtures (28 lessons)** | | | | | | | | |
| 9 | 1 | 5/6 | 2.1 | Key concept: 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. | C2.1a, b | Practical sheets 1 and 2; Worksheets 1 and 2; Technician’s notes 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 7/8 | 2.2 | Relative formula mass | * Review the differences between the isotopes of an element. * Distinguish between the mass of an atom and the relative atomic mass of an element. * Use relative atomic masses to calculate relative formula masses. | C2.1c | Worksheets 1, 2 and 3; Technician’s notes; Presentation | 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. * Suggest suitable separation and purification techniques for mixtures. | C2.1d | Worksheets 1 and 2; Practical sheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 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. | C2.1e | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 9/10 | 2.5 | Chromatography | * Explain how to set up chromatography paper. * Distinguish pure from impure substances. * Interpret chromatograms and calculate Rf values. | C2.1f–k | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  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 Rf values. | PAG | Practical sheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework qu Quick starter  Homework worksheet  Homework quiz iz |
| 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. | CM2.1 | Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 11/12 | 2.8 | Comparing metals and non-metals | * Review the physical properties of metals and non-metals. * Compare the oxides of metals and of non-metals. * Make predictions about unknown metals and non-metals. | C2.2a | Worksheet; Practical sheet; Technician’s notes; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 11/12 | 2.9 | Electron structure | * Find out how electrons are arranged in atoms. * Use diagrams and symbols to show which energy levels they occupy. * Relate each element’s electron configuration to its position in the periodic table. | C2.2c | Worksheets 1, 2 and 3; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 1 | 11/12 | 2.10 | Metals and non-metals | * Explore the links between electron configurations of elements and their properties. * Find out what happens to the outer electrons when metals react. * Draw diagrams to show how ions form. | C2.2b | Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 1/2 | 2.11 | Chemical bonds | * 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. | C2.2d–h | Worksheets 1 and 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. |  | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 1/2 | 2.13 | Ionic compounds | * Identify ionic compounds from structures. * Explain the limitations of diagrams and models. * Work out the empirical formula of an ionic compound. |  | Practical sheet; Worksheets 1, 2 and 3; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 9 | 2 | 3/4 | 2.14 | Properties of ionic compounds | * Describe the properties of ionic compounds. * Relate their melting points to forces between ions. * Explain when ionic compounds can conduct electricity. |  | Practical sheets 1 and 2; Worksheet; Technician’s notes 1 and 2 | Quick starter  Homework worksheet  Homework quiz  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. |  | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 3/4 | 2.16 | Covalent bonding | * Identify single bonds in molecules and structures. * Draw dot-and-cross diagrams for small molecules. * Deduce molecular formulae from models and diagrams. |  | Worksheets 1 and 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. |  | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 9 | 2 | 5/6 | 2.18 | Polymer structures | * Recognise polymers from their unit formulae. * Explain why some polymers can stretch. * Explain why some plastics do not soften on heating. |  | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 9 | 2 | 5/6 | 2.19 | Metallic bonding | * Describe that metals form giant structures. * Explain how metal ions are held together. * Explain the delocalisation of electrons. |  | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 7/8 | 2.20 | Properties of metals and alloys | * Identify metal elements and their properties, and metal alloys. * Describe the purpose of a tin–lead alloy. * Explain why alloys have different properties to those of elements. |  | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow 1  Slideshow 2 |
| 9 | 2 | 7/8 | 2.21 | Key concept: The outer electrons | * Review the patterns in the periodic table. * Compare the trends in Group 1 and 7. * Relate these trends to the number of outer electrons and the sizes of atoms. |  | Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 2 | 7/8 | **Assessment** | | End of teaching block test Collins Connect |  |  |  |
| 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. * Use the periodic table to make predictions. | C2.2i | Worksheets 1, 2 and 3; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 9/10 | 2.23 | Developing the periodic table | * Find out how the periodic table has changed over the years. * Explore Mendeleev’s role in its development. * Consider the accuracy of Mendeleev’s predictions. |  | Worksheets 1 and 2; Technician’s notes; Presentation | 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 in diamond. * Explain why diamond differs from graphite. | C2.3a–f | Worksheet | Quick starter  Homework worksheet  Homework quiz  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. |  | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 11/12 | 2.26 | Fullerenes and graphene | * Describe the structure of graphene. * Explain the structure and uses of the fullerenes. * Explain the structure of nanotubes. |  | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 2 | 11/12 | 2.27 | Nanoparticles, their properties and uses | * Relate the sizes of nanoparticles to atoms and molecules. * Explain that there may be risks associated with nanoparticles. * Evaluate the use of nanoparticles for a specific purpose. | C2.3g–j | Worksheets 1, 2 and 3; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 9 | 3 | 1/2 | 2.28 | Maths skills: Using ratios in  mixture, empirical formulae and  balanced equations | * Consider ways of comparing the amounts of gases in the atmosphere. * Review what balanced symbol equations show. * Compare the yields in chemical reactions. | CM1 | Worksheets 1and 2  Technician’s notes  Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 1/2 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect | | | |
| **Chapter 3: Chemical reactions (27 lessons)** | | | | | | | | |
| 9 | 3 | 1/2 | 3.1 | Elements and compounds | * Identify symbols of elements from the periodic table. * Recognise the properties of elements and compounds. * Identify the elements in a compound. | C3.1a | Worksheets 1 and 2; Practical sheet; Technician notes | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 3/4 | 3.2 | Atoms, formulae and equations | * Learn the symbols of the first 20 elements in the periodic table. * Use symbols to describe elements and compounds. * Use formulae to write equations. | C3.1b, c | Worksheets 1, 2 and 3; Practical sheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 9 | 3 | 3/4 | 3.3 | Moles | * Describe the measurements of amounts of substances in moles. * Calculate the amount of moles in a given mass of a substance. * Calculate the mass of a given number of moles of a substance. | C3.1g–i | Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 9 | 3 | 3/4 | 3.4 | Key concept: Conservation of mass and balanced equations | * Explore ideas about the conservation of mass. * Consider what the numbers in equations stand for. * Write balanced symbol equations. | Key Concept  C3.1d–f | Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 9 | 3 | 5/6 | 3.5 | Key concept: Amounts in chemistry | * Use atomic masses to calculate formula masses. * Explain how formula mass relates to the number of moles. * Explain how the number of moles relates to other quantities. | Key Concept | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 5/6 | 3.6 | Mass changes when gases are in reactions | * Find out how mass can be gained or lost during a reaction. * Find the mass of carbon dioxide released per gram of copper carbonate decomposed. * Assess the accuracy of our measurements. | C3.1j | Worksheet; Practical sheet; Technician’s notes; Presentations 1 and 2; Graph plotter | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 5/6 | 3.7 | Using moles to balance equations | * 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. | C3.1k | Worksheet | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 7/8 | 3.8 | Key concept: Limiting reactants and molar masses | * Recognise when one reactant is in excess. * Consider how this affects the amount of product made. * Explore ways of increasing the amount of product. | Key Concept | Technician’s notes; Practical sheet; Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 9 | 3 | 7/8 | 3.9 | Amounts of substances in equations | * 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. | C3.1l | Worksheet | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 7/8 | 3.10 | Endothermic and exothermic reactions | * Explore the temperature changes produced by chemical reactions. * Consider how reactions are used to heat or cool their surroundings. * Investigate how these temperature changes can be controlled. | C3.2a | Technician’s notes; Practical sheet; Worksheet; Graph plotters 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 9 | 3 | 9/10 | 3.11 | Reaction profiles | * Use diagrams to show the energy changes during reactions. * Show the difference between exothermic and endothermic reactions using energy profiles. * Find out why many reactions start only when energy or a catalyst is added. | C3.2b, c | Technician’s notes; Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 3 | 9/10 | 3.12 | Energy change of reactions | * Identify the bonds broken and formed during a chemical reaction. * Consider why some reactions are exothermic and others are endothermic. * Use bond energies to calculate overall energy changes. | C3.2d | Technician’s notes; Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 3 | 9/10 | 3.13 | Maths skill: 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. | CM3.2 | Practical sheet; Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 9 | 3 | 11/12 | 3.14 | Oxidation and reduction in terms of electrons | * Observe some reactions between metal atoms and metal ions. * Learn to write ionic equations and half equations. * Classify half equations as oxidation or reduction. | C3.3a, b | Technician’s notes; Practical sheet; Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 9 | 3 | 11/12 | 3.15 | Key concept: Electron transfer, oxidation and reduction | * Review ion formation. * Classify half equations as oxidation or reduction. * Review patterns in reactivity. | Key Concept  C3.3c | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 9 | 3 | 11/12 | 3.16 | Neutralisation of acids and salt production | * React an acid and an alkali to make a salt. * Predict the formulae of salts. * Write balanced symbol equations. | C3.3d | Technician’s notes; Practical sheet; Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 1 | 1/2 | 3.17 | Soluble salts | * React an acid and a metal to make a salt. * Predict the formulae of salts. * Write balanced symbol equations and half equations. |  | Technician’s notes; Practical sheet; Worksheets 1 and 2; Presentation and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 1 | 1/2 | 3.18 | Reaction of metals with acids | * React an acid and a metal to make a salt. * Predict the formulae of salts. * Write balanced symbol equations and half equations. |  | Technician’s notes; Practical sheet; Worksheets 1 and 2; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 1/2 | 3.19 | Practical: Preparing a pure, dry sample of a soluble salt from an insoluble oxide or carbonate | * React a carbonate with an acid to make a salt. * Describe each step in the procedure. * Determine the purity of the product. | PAG | Technician’s notes; Practical sheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 3/4 | 3.20 | pH and neutralisation | * Estimate the pH of solutions. * Identify weak and strong acids and alkalis. * Investigate pH changes when a strong acid neutralises a strong alkali. | C3.3g–k | Technician’s notes 1, 2 and 3; Practical sheet; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 3/4 | 3.21 | Strong and weak acids | * Explore the factors that affect the pH of an acid. * Find out how the pH changes when an acid is diluted. * Find out how the concentrations of solutions are measured. |  | Worksheet | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 1 | 3/4 | 3.22 | Maths skill: Make order of magnitude calculations | * Explore the factors that affect the acidity of rain. * Find out how acid concentrations are compared. * Explore the link between hydrogen ion concentration and pH. | CM3.3 | Technician’s notes; Practical sheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 5/6 | 3.23 | Practical: Investigate the variables that affect temperature changes in reacting solutions, such as, acid plus metals, acid plus carbonates, neutralisations, displacement of metals | * Devise a hypothesis. * Devise an investigation to test your hypothesis. * Decide whether the evidence supports your hypothesis. | PAG | Technician’s notes; Practical sheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 5/6 | 3.24 | The process of electrolysis | * Explore what happens when a current passes through a solution of ions. * Find out what an electrolyte is and what happens when it conducts electricity. * Find out how electricity decomposes compounds. | C3.4a | Technician’s notes; Practical sheet; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 10 | 1 | 5/6 | 3.25 | Electrolysis of molten ionic compounds | * Look in detail at the electrolysis of lead bromide. * Communicate the science behind the extraction of elements from molten salts. * Write balanced half equations for electrolysis reactions. | C3.4b | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 7/8 | 3.26 | Electrolysis of aqueous solutions | * Investigate the products formed when copper sulfate is electrolysed. * Predict what products other solutions will give. * Write half equations for reactions at electrodes. | C3.4c–e | Technician’s notes; Worksheet; Practical sheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 7/8 | 3.27 | Practical: Investigating what happens when aqueous solutions are electrolysed using inert electrodes | * Devise a hypothesis. * Devise an investigation to test your hypothesis. * Decide whether the evidence supports your hypothesis. | PAG | Technician’s notes; Practical sheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 7/8 | **Assessment** |  | End of chapter test Student Book  End of chapter test Collins Connect  End of teaching block test Collins Connect  End of year test Collins Connect | | | |
| **Chapter 4:** **Predicting and identifying reactions and products (12 lessons)** | | | | | | | | |
| 10 | 1 | 9/10 | 4.1 | Exploring Group 0 | * Explore the properties of noble gases. * Find out how the mass of their atoms affects their boiling points. * Relate their chemical properties to their electronic structures. | C4.1a, b | Worksheet; Graph plotter 1; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 1 | 9/10 | 4.2 | Exploring Group 1 | * Explore the properties of Group 1 metals. * Compare their reactivity. * Relate their reactivity to their electronic structures. |  | Worksheets 1, 2 and 3; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 9/10 | 4.3 | Exploring Group 7 | * Explain why Group 7 non-metals are known as ‘halogens’. * Compare their reactivity. * Relate their reactivity to their electronic structures. |  | Worksheets 1, 2 and 3; Technician’s notes 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 1 | 11/12 | 4.4 | Transition metals | * Compare the properties of transition metals with those of Group 1 metals. * Explore the uses of transition metals. * Find out why they can form compounds with different colours. | C4.1c | Worksheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 1 | 11/12 | 4.5 | Reaction trends and predicting reactions | * Review the patterns in the periodic table. * Compare the trends in Group 1 and Group 7. * Relate these trends to the way atoms form ions. | C4.1d | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 1 | 11/12 | 4.6 | Reactivity series | * Compare the reactivity of metals. * Observe some reactions between metal atoms and metal ions. * Consider why some metals are more reactive than others. | C4.1e, f | Practical sheet; Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 2 | 1/2 | 4.7 | Tests 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. | C4.2a | Practical sheet; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 1/2 | 4.8 | Metal hydroxides | * Recognise the precipitate colour of metal hydroxides. * Explain how to use sodium hydroxide to test for metal ions. * Write balanced equations for producing insoluble metal hydroxides. | C4.2b–d | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 2 | 1/2 | 4.9 | Tests for anions | * Identify the tests for carbonates. * Explain the tests for halides and sulfates. * Identify anions and cations from the results of tests. |  | Practical sheets 1 and 2; Worksheet; Technician’s notes 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 3/4 | 4.10 | Flame tests | * Carry out flame-test procedures. * Identify the colours of flames of ions. * Identify species from the results of the tests. | C4.2e | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 3/4 | 4.11 | Instrumental methods | * Identify advantages of instrumental methods compared with the chemical tests. * Describe some instrumental techniques. * Explain the data provided by instrumental techniques. | C4.2f, g | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow  Video |
| 10 | 2 | 3/4 | 4.12 | Practical: Use chemical tests to identify the ions in unknown single ionic compounds | * Describe how to carry out experiments safely using the correct manipulation of apparatus for the qualitative analysis of ions. * Make and record observations using flame tests and precipitation methods. * Identify unknown ions in chemical compounds. | PAG | Practical sheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 5/6 | **Assessment** |  | End of chapter test Student Book  End of chapter test Collins Connect | | | |
| **Chapter 5: Monitoring and controlling chemical reactions (20 lessons)** | | | | | | | | |
| 10 | 2 | 5/6 | 5.1 | Concentration of solutions | * Relate mass, volume and concentration. * Calculate the mass of solute in solution. * Relate concentration in mol/dm3 to mass and volume. | C5.1a–c | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 5/6 | 5.2 | Using concentrations of solutions | * Describe how to carry out titrations. * Calculate concentrations in titrations in mol/dm3 and in g/dm3. * Explain how the concentration of a solution in mol/dm3 is related to the mass of the mass of the solute and the volume of the solution. |  | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 2 | 7/8 | 5.3 | Practical: Finding the reacting volumes of solutions of acid and alkali by titration | * Use an acid to neutralise a known volume of alkali. * Use a burette to determine the volume of an acid needed. * Use the results to determine the concentration of an alkali. |  | Technician’s notes; Practical sheet; Presentation and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 7/8 | 5.4 | Amounts of substance in volumes of gases | * Explain that the same amount of any gas occupies the same volume at room temperature and pressure (rtp). * Calculate the volume of a gas at rtp from its mass and relative formula mass. * Calculate the volumes of gases from a balanced equation and a given volume of a reactant or product. | C5.1d–f | Practical sheet 3.12;  Worksheet 3.12;  Technician’s notes 3.12 | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 2 | 7/8 | 5.5 | Key Concept: Percentage yield | * Calculate the percentage yield from the actual yield. * Identify the balanced equation needed for calculating yields. * Calculate theoretical product amounts from reactant amounts. | Key Concept  C5.1g, h | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 2 | 9/10 | 5.6 | Atom economy | * Identify the balanced equation of a reaction. * Calculate the atom economy of a reaction to form a product. * Explain why a particular reaction pathway is chosen. | C5.1i–k | Worksheets 1 and 2. | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 9/10 | 5.7 | Maths skills: Change the subject of an equation | * Use equations to demonstrate conservation. * Rearrange the subject of an equation. * Carry out multi-step calculations. | CM5.1 | Worksheet | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 2 | 9/10 | 5.8 | Measuring rates | * Measure the volume of gas given off during a reaction. * Use the results to measure the reaction rate. * Explore how the rate changes during the reaction. | C5.2a | Technician’s notes; Practical sheet; Worksheet; Presentation 1 and 2; Graph plotter 1 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 11/12 | 5.9 | Calculating rates | * Find out how to calculate rates of reaction. * Use graphs to compare reaction rates. * Use tangents to measure rates that change. | C5.2b | Technician’s notes; Practical sheet; Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 2 | 11/12 | 5.10 | Factors affecting rates | * Measure the time taken to produce a specific amount of product. * See how a reactant’s temperature or concentration can affect this time. * Investigate the effect of breaking up a solid reactant into smaller pieces. | C5.2c | Technician’s notes; Practical sheet; Worksheets 1 and 2; Graph plotter 1; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 2 | 11/12 | 5.11 | Collision theory | * Find out about the collision theory. * Use collision theory to make predictions about reaction rates. * Relate activation energies to collision theory. | C5.2d | Worksheets 1 and 2; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 1/2 | 5.12 | Catalysts | * Investigate catalysts. * Find out how catalysts work. * Learn how they affect activation energy. | C5.2f–i | Technician’s notes; Practical sheet; Worksheet | Quick starter  Homework worksheet  Homework quiz  Videos |
| 10 | 3 | 1/2 | 5.13 | Factors increasing the rate | * Interpret graphs. * Consider what determines the reaction rate. * Explore the effect of changing the amounts of reactants used. | C5.2e | Technician’s notes; Practical sheet; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 3 | 1/2 | 5.14 | 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 | * Devise a hypothesis. * Devise an investigation to test a hypothesis. * Decide whether the evidence supports a hypothesis. | PAG | Technician’s notes; Practical sheets 1 and 2; Presentations 1 and 2; Graph plotter 1 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 3/4 | 5.15 | Reversible reactions and energy changes | * Investigate reversible reactions. * Explore the energy changes in a reversible reaction. * Find out how reaction conditions affect reversible reactions. | C5.3a | Technician’s notes; Practical sheet; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 3/4 | 5.16 | Equilibrium | * Recognise reactions that can reach equilibrium. * Find out what happens to the reactants and products at equilibrium. * Use Le Chatelier’s principle to make predictions. | C5.3b | Technician’s notes; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 3/4 | 5.17 | Changing concentration and equilibrium | * Distinguish between reactants and products. * Explore how changing their concentrations affects reversible reactions. * Use Le Chatelier’s principle to make predictions about changing concentrations. | C5.3c | Technician’s notes; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 5/6 | 5.18 | Changing temperature and equilibrium | * Distinguish between exothermic and endothermic forward reactions. * Explore how changing the temperature affects reversible reactions. * Use Le Chatelier’s principle to make predictions about changing temperatures. |  | Technician’s notes; Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 5/6 | 5.19 | Changing pressure and equilibrium | * Recognise the number of product and reactant molecules in a reaction. * Explore how changing the pressure affects reversible reactions. * Use Le Chatelier’s principle to make predictions about changing pressures. |  | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 5/6 | 5.20 | Maths skills: Use the slope of a tangent as a measure of rate of change | * Practice drawing graphs. * Use graphs to compare reaction rates. * Use tangents to measure rates that change. | CM5.3 | Worksheets 1 and 2; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 3 | 7/8 | **Assessment** |  | End of chapter test Student Book  End of chapter test Collins Connect  End of teaching block test Collins Connect | | | |
| **Chapter 6: Global Challenges (42 lessons)** | | | | | | | | |
| 10 | 3 | 7/8 | 6.1 | Extraction of metals | * Find out where metals come from. * Extract iron from its oxide using carbon. * Consider how other metals are extracted from their ores. | C6.1a, b | Technician’s notes; Practical sheet; Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 3 | 7/8 | 6.2 | Using electrolysis to extract metals | * Review the connection between the reactivity series and the ways metals are extracted. * Consider how aluminium is extracted from aluminium oxide. * Learn the oxidation and reduction reactions involved. |  | Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 10 | 3 | 9/10 | 6.3 | Alternative methods of metal extraction | * Describe the process of phytomining. * Describe the process of bioleaching. * Evaluate alternative biological methods of metal extraction. | C6.1c | Practical sheet; Worksheets 1 and 2; Technician’s notes. | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 9/10 | 6.4 | The Haber process | * Apply principles of dynamic equilibrium to the Haber process. * Use graphs to explain the trade off with rate and equilibrium. * Explain how commercially used conditions relate to cost. | C6.1d–g | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 9/10 | 6.5 | Production and use of NPK fertilisers | * Describe how to make a fertiliser in the laboratory. * Explain how fertilisers are produced industrially. * Compare the industrial production with laboratory preparation. | C6.1h | Practical sheet; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 11/12 | 6.6 | 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. | C6.1i–l | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 10 | 3 | 11/12 | 6.7 | 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. |  | Worksheets 1 and 2. | Quick starter  Homework worksheet  Homework quiz  Video |
| 10 | 3 | 11/12 | 6.8 | Alloys as useful materials | * Describe the composition of common alloys. * Interpret the composition of other alloys from data. * Evaluate the uses of other alloys. | C6.1m | Worksheets 1, 2 and 3 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 1/2 | 6.9 | Corrosion and its prevention | * Show that air and water are needed for rusting. * Describe experiments and interpret results on rusting. * Explain methods for preventing corrosion. | C6.1n, o | Practical sheets 1 and 2; Worksheets 1 and 2; Technician’s notes 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 1/2 | 6.10 | Ceramics, polymers and composites | * Compare quantitatively properties of materials. * Compare glass, ceramics, polymers, composites and metals. * Select materials by relating their properties to uses. | C6.1p | Worksheets 1, 2 and 3 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 1/2 | 6.11 | Maths skill: Translate information between graphical and numerical form | * Represent information from pie charts numerically. * Represent information from graphs numerically. * Represent numeric information graphically. | CM6.1 | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 3/4 | 6.12 | Function groups and homologous series | * Identify the first four hydrocarbons in the alkane series. * Name the first four compounds in homologous series. * Identify the functional group of a series. | C6.2a, C6.2b | Worksheet | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 3/4 | 6.13 | Structure and formulae of alkenes | * Describe the difference between an alkane and an alkene. * Draw the displayed structural formulae for the first four members of the alkenes. * Explain why alkenes are called unsaturated molecules. |  | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 3/4 | 6.14 | Reaction of alkenes | * Describe the addition reactions of alkenes. * Draw the full displayed structural formulae of the products alkenes make. * Explain how alkenes react with hydrogen, water and the halogens. |  | Practical sheet; Worksheets 1 and 2; Technician's notes | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 5/6 | 6.15 | Alcohols | * Recognise alcohols from their name or from given formulae. * Describe the conditions used for the fermentation of sugar using yeast. * Write balanced chemical equations for the combustion of alcohols. |  | Practical sheets 1 and 2; Worksheets 1 and 2; Technician's notes | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 5/6 | 6.16 | Carboxylic acids | * Describe the reactions of carboxylic acids. * Recognise carboxylic acids from their formulae. * Explain the reaction of ethanoic acid with an alcohol. |  | Practical sheet; Worksheets 1 and 2; Technician's notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 5/6 | 6.17 | Addition polymerisation | * Recognise addition polymers and monomers from diagrams. * Draw diagrams of the formation of a polymer from an alkene. * Relate the repeating unit of the polymer to the monomer. | C6.2a–g | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 7/8 | 6.18 | Condensation polymerisation | * Explain the basic principles of condensation polymerisation. * Explain the role of functional groups in producing a condensation polymer. * Explain the structure of the repeating units in a condensation polymer. |  | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 7/8 | 6.19 | Amino acids | * Describe the functional group of an amine. * Identify the two functional groups of an amino acid. * Explain how different amino acids build proteins. |  | Worksheet | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 7/8 | 6.20 | DNA and other naturally occurring polymers | * Describe the components of natural polymers. * Explain the structure of proteins and carbohydrates. * Explain how a molecule of DNA is constructed. | C6.2h, i | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 9/10 | 6.21 | Crude oil, hydrocarbons and alkanes | * Describe why crude oil is a finite resource. * Identify the hydrocarbons in the series of alkanes. * Explain the structure and formulae of the alkanes. | C6.2l–o | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 9/10 | 6.22 | 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. | C6.2j, k | Practical sheet; Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 9/10 | 6.23 | 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. |  | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 1 | 11/12 | 6.24 | 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. |  | Practical sheet;  Worksheet Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Slideshow 1  Slideshow 2 |
| 11 | 1 | 11/12 | 6.25 | Cells and batteries | * Make simple cells and measure their voltages. * Consider the importance of cells and batteries. * Find out how larger voltages can be produced. | C6.2p | Technician’s notes; Practical sheet; Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 1 | 11/12 | 6.26 | Fuel cells | * Find out how fuel cells work. * Compare and contrast the uses of hydrogen fuel cells, batteries and rechargeable cells. * Learn what reactions take place inside hydrogen fuel cells. | C6.2q | Technician’s notes; Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 1/2 | 6.27 | Key concept: 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. | Key Concept | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 1/2 | 6.28 | Maths skills: Visualise and represent 3D models | * Use 3D models to represent hydrocarbons. * Use 3D models to represent polymers. * Use 3D models to represent large biological molecules. | CM6.2 | Worksheets 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 1/2 | 6.29 | Proportions of gases in the atmosphere | * Review the composition of the atmosphere. * Measure the percentage of oxygen in the atmosphere. * Consider why it stays the same. | C6.3a | Worksheets 1 and 2; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 3/4 | 6.30 | The Earth’s early atmosphere | * Explore the origins of the Earth’s atmosphere. * Consider the evidence that ideas about the early atmosphere are based on. * Consider the strength of the evidence these ideas are based on. |  | Worksheet | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 3/4 | 6.31 | How oxygen increased | * Explore the processes that changed the oxygen concentration in the atmosphere. * Consider the role of algae. * Consider why oxygen levels in the atmosphere didn’t rise when oxygen was first produced. | C6.3b | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 11 | 2 | 3/4 | 6.32 | Greenhouse gases | * Review the greenhouse effect. * Explain how greenhouse gases trap heat. * Consider the consequences of adding greenhouse gases to the atmosphere. | Key concept  C6.3c–f | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 5/6 | 6.33 | Human activities | * Consider the factors that affect the quality of scientific reports. * Consider the reliability of computer models. * Find out what peer review involves. |  | Worksheet; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 5/6 | 6.34 | Global climate change | * Explore the consequences of climate change. * Consider the risks to human health. * Judge the seriousness of these consequences. |  | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 11 | 2 | 5/6 | 6.35 | Carbon footprint and its reduction | * Find out what a carbon footprint is. * Consider factors that contribute to our carbon footprints. * Explore ways of reducing our carbon footprints. |  | Worksheet; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 7/8 | 6.36 | Limitations on carbon footprint reduction | * Review the uncertainties about carbon emissions. * Consider factors which limit our ability to reduce our carbon footprints. * Decide which factors are most important. |  | Worksheets 1 and 2; Presentation | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 7/8 | 6.37 | Atmospheric pollutants from fuels | * Explore the products formed when fuels burn. * Distinguish between complete and incomplete combustion. * Write equations for complete and incomplete combustion. |  | Worksheets 1, 2, 3 and 4; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Slideshow |
| 11 | 2 | 7/8 | 6.38 | Properties and effects of atmospheric pollutants | * Review the hazards associated with air pollutants. * Investigate correlations between pollutant emissions and deaths from asthma. * Consider whether these support the hypothesis that air pollution makes asthma worse. |  | Worksheets 1 and 2; Presentations 1 and 2 | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 9/10 | 6.39 | Potable water | * Distinguish between potable water and pure water. * Describe the differences in treatment of ground water and salty water. * Explain what is needed to provide potable water for all. | C6.3g–j | Worksheets 1, 2 and 3; Technician’s notes | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 9/10 | 6.40 | Waste water treatment | * Explain how waste water is treated. * Describe how sewage is treated. * Compare the ease of treating waste, ground and salt water. |  | Worksheets 1, 2 and 3 | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 9/10 | 6.41 | 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. * Carry out a procedure to produce potable water from salt solution. * Evaluate methods and suggest possible improvements and further investigations. | PAG | Practical sheets 1 and 2; Worksheet; Technician’s notes | Quick starter  Homework worksheet  Homework quiz |
| 11 | 2 | 11/12 | 6.42 | Maths skills: Use ratios, fractions and percentages | * Consider ways of comparing the amounts of gases in the atmosphere. * Review what balanced symbol equations show. * Compare the yields in chemical reactions. | CM6.3 | Worksheets 1 and 2; Technician’s notes; Presentation | Quick starter  Homework worksheet  Homework quiz  Video |
| 11 | 2 | 11/12 | **Assessment** | | End of chapter test Student Book  End of chapter test Collins Connect  End of teaching block test Collins Connect  End of year test Collins Connect  End of course test Collins Connect | | | |