Pearson Edexcel

International GCSE Chemistry (2017)

How to use the Scheme of Work

This Scheme of Work (SoW) has been made available on a word document rather than PDF, allowing you to edit the document in a way that suits your teaching style and learner needs.

International GCSEs have 120 - 140 guided learning hours. .

**Guidance provided within the course planners, schemes of work and lesson plans are suggested approaches which can be adapted by centres to suit their particular context.**

**The following SoW is based on 2 hours of teaching time per week over 60 weeks** **and reflects how centres could use time for practical activities; you should edit this planner to suit your teaching approach.**

The course planner, in the *Getting Started Guide,* provides a high level view of how you could approach the topics to cover the specification content across two years.

The columns in this lesson plan indicate:

* An overview of the time allocated to lessons
* Which section of the specification this lesson (or group of lessons) relates to
* The learning outcomes of those lessons.
* The activities and resources that could be used to support the teaching of this lesson
* Transferable skills support, see below for further information

Why transferable skills?

In recent years, higher education institutions and global employers have consistently flagged the need for students to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

To support the design of our qualifications, we have mapped them to a transferable skills framework. The framework includes cognitive, intrapersonal skills and interpersonal skills and each skill has been interpreted for each specification to ensure they are appropriate for the subject.  Further information on transferable skills is available on the website.  Pearson materials, including this scheme of work will support you in identifying and developing these skills in students.

In the final two columns of this scheme of work we have indicated which transferable skills are explicitly assessed, and also where there are opportunities for them to be developed through teaching. Our intention is that teachers can use these columns to increase opportunities for transferable skills development in learners.

Other course planning support

You will find other support for planning the course in the Teacher Support Materials. There are free downloadable resources that you can access [here](hhttps://qualifications.pearson.com/en/qualifications/edexcel-international-gcses-and-edexcel-certificates/international-gcse-chemistry-2017.coursematerials.html#filterQuery=Pearson-UK:Category%2FTeaching-and-learning-materials).

Teaching resource exemplars

The scheme of work contains suggestions for resources that you can use to support your teaching. These are suggestions only of material you may find useful and you are encouraged to use a wide range of resources that suit the needs of your students.

Other teaching resources

* Student Books – full colour textbooks matched to the specification.
* ActiveBook – a digital copy of the Student Book in the back of every copy.

Further details can be found at [www.pearsonschools.co.uk](http://www.pearsonschools.co.uk). Search for this title: Edexcel IGCSE Chemistry Student Book.

Edexcel Subject Advisors

Pearson has a team of specialist subject advisors available to help you with the implementation of this specification. You can contact them by:

* Email: [Teaching](mailto:Teaching)Science@pearson.com
* Telephone: UK: 020 7010 2190. International: +44 20 7010 2190
* Twitter: [@PearsonSciences](https://twitter.com/@PearsonSciences)

Health and safety

The practicals and experiments suggested within this scheme of work are those we believe are not banned or restricted in any way and are still currently used in most schools and colleges. The International GCSE encourages experimental work with the assessment of investigative skills being made in the written examinations.

We advise teachers and technicians to discuss the merits of the suggested practicals when deciding which to carry out and how they will be carried out. For example, will it be demonstrated by the teacher or technician, or conducted by students themselves, either individually or in small groups, under the guidance and direction of the teacher?

You may have ideas for practical work that we have not suggested but would work equally well.

As in all practical work, a risk assessment is expected as part of good health and safety practice in all centres and we understand that many schools and colleges refer to the CLEAPSS service: <http://www.cleapss.org.uk/> for guidance and support in conducting science practical work.

Websites

There are links to relevant websites in this scheme of work. In order to ensure that the links are up to date, that the links work, and that the sites are not inadvertently linked to sites that could be considered offensive, we also have made the links available on our website at [www.pearsonhotlinks.co.uk](http://www.pearsonhotlinks.co.uk/). If you find that a link from the scheme of work no longer works, please go to the pearsonhotlinks site to report it.  Please note: some of the BBC websites might not be available to certain international schools.

Edexcel International GCSE in Chemistry (2017)

| Week | Content coverage | Learning outcomes | Exemplar activities | Exemplar resources | Which transferable skills are explicitly assessed through examination | Which transferable skills could also be  acquired through teaching and delivery |
| --- | --- | --- | --- | --- | --- | --- |
| **1** | **Section 1: Principles of chemistry**  (a) States of matter | Students will be assessed on their ability to:  1.1 understand the three states of matter in terms of the arrangement, movement and energy of the particles  1.2 understand the interconversions between the three states of matter in terms of:   * the names of the interconversions * how they are achieved * the changes in arrangement, movement and energy of the particles   1.3 understand how the results of experiments involving the dilution of coloured solutions and diffusion of gases can be explained. | **Activity:**   * Model particle behaviour in the three states using trays of marbles; draw diagrams of the results.   **Demonstrations:**   * Diffusion of gases – ammonia and hydrogen chloride (RSC 65). * Bromine diffusing into a gas jar of air.   **Class practicals:**   * Diffusion in liquids (RSC 27). * Recording a heating curve for water, from ice to boiling point. | Edexcel International GCSE Chemistry Student Book: Pages 1–4  RSC Classic Chemistry Experiments Page 68  RSC Classic Chemistry Demonstrations Page 162 | Analysis | Analysis  Problem solving |
| **2** | **Section 1: Principles of chemistry**  (a) States of matter | Students will be assessed on their ability to:  1.4 know what is meant by the terms:   * solvent * solute * solution * saturated solution   **1.5C know what is meant by the term solubility in the units g per 100 g of solvent**  **1.6C understand how to plot and interpret solubility curves**  ***1.7C practical: investigate the solubility of a solid in water at a specific temperature.*** | **Activity:**   * Discussion about solutions holding different amounts of solute: tears, sea water and brine as three examples.   **Demonstrations:**   * Simple test tube comparison of solubility of three substances, e.g. potassium nitrate, sodium chloride and calcium hydroxide. * How does temperature affect solubility – what happens when hot, sweet tea cools down?   **Class practical:**   * The effect of temperature on solubility (RSC 98). | Doc Brown’s Chemistry page:  <http://www.docbrown.info/page01/AqueousChem/AqueousChem4.htm> | Reasoning | Reasoning  Adaptive learning  Productivity |
| **3** | **Section 1: Principles of chemistry**  (b) Elements, compounds and mixtures | Students will be assessed on their ability to:  1.14 know what is meant by the terms atom and molecule  1.8 understand how to classify a substance as an element, a compound or a mixture  1.9 understand that a pure substance has a fixed melting and boiling point, but that a mixture may melt or boil over a range of temperatures  1.10 describe these experimental techniques for the separation of mixtures:   * simple distillation * fractional distillation * filtration * crystallisation. | **Activities:**   * Drawing diagrams of apparatus used in fractional distillation. * Exercises in planning purification of a range of different mixtures.   **Demonstration:**   * Fractional distillation of aqueous alcohol.   **Class practicals:**   * Purification of an impure solid (RSC 99). | Edexcel International GCSE Chemistry Student Book: Pages 30-31, 89-90  RSC Classic Chemistry Experiments: Page 256 | Critical thinking | Critical thinking |
| **4** | **Section 1: Principles of chemistry**  (b) Elements, compounds and mixtures | Students will be assessed on their ability to:  1.10 describe these experimental techniques for the separation of mixtures: paper chromatography  1.11 understand how a chromatogram provides information about the composition of a mixture  1.12 understand how to use the calculation of Rf values to identify the components of a mixture  1.13 *practical: investigate paper chromatography using inks/food colourings.* | **Class practicals:**   * The chromatography of leaves (RSC 4). * ‘Smarties’ chromatography (RSC 71). | Edexcel International GCSE Chemistry Student Book: Page 91  RSC Classic Chemistry Experiments: Pages 9 and 179. | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **5** | **Section 1: Principles of chemistry**  (c) Atomic structure | Students will be assessed on their ability to:  1.15 know the structure of an atom in terms of the positions, relative masses and relative charges of subatomic particles  1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (*A*r)  1.17 be able to calculate the relative atomic mass of an element (*A*r) from isotopic abundances. | **Activities:**   * Complete table of properties of subatomic particles. * Given atomic number and mass number, make a model of a nucleus of an atom using polystyrene balls. * Given atomic numbers and mass numbers, find atomic structure of different isotopes.  Identify which atoms are isotopes, given data on their atomic structure. * Calculate the *A*r of a number of different elements given their percentage isotopic compositions. | Edexcel International GCSE Chemistry Student Book:  Pages 7-8, 176-178  **Video clips:**   * Atoms and Their Electrons: history of atomic theory * BBC TV documentaries: Atom and The Magic of Chemistry | Reasoning | Reasoning  Initiative |
| **6** | **Section 1: Principles of chemistry**  (a) States of matter  (b) Elements, compounds and mixtures  (c) Atomic structure | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **7** | **Section 1: Principles of chemistry**  (d) The Periodic Table | Students will be assessed on their ability to:  1.18 understand how elements are arranged in the Periodic Table:   * in order of atomic number * in groups and periods   1.19 understand how to deduce the electronic configurations of the first 20 elements from their positions in the Periodic Table  1.20 understand how to use electrical conductivity and the acid-base character of oxides to classify elements as metals or non-metals  1.21 identify an element as a metal or a non-metal according to its position in the Periodic Table  1.22 understand how the electronic configuration of a main group element is related to its position in the Periodic Table  1.23 understand why elements in the same group of the Periodic Table have similar chemical properties  1.24 understand why the noble gases (Group 0) do not readily react. | **Activities:**   * ActiveBook animation. * Make a model of an atom using paper and card, to show electrons, shells and the nucleus. * Draw electronic configurations of the first 20 elements. Cut out diagrams and arrange on a blank Periodic Table.   **Demonstration:**  Exploding balloons, to compare hydrogen and helium, density and combustion.  **Video clip:**   * Scientific Eye: Elements section on difference between hydrogen and helium. | Edexcel International GCSE Chemistry Student Book**:** Pages 8-11, 99-101  Atomic structure: ActiveBook Page 10, animation  CGP GCSE Chemistry Edexcel Workbook | Analysis  Interpretation | Analysis  Problem solving  Interpretation |
| **8** | **Section 1: Principles of chemistry**  (f) Ionic bonding | Students will be assessed on their ability to:  1.37 understand how ions are formed by electron loss or gain  1.38 know the charges of these ions:   * metals in Groups 1, 2 and 3 * non-metals in Groups 5, 6 and 7 * Ag+, Cu2+, Fe2+, Fe3+, Pb2+, Zn2+ * hydrogen (H+), hydroxide (OH–), ammonium (NH4+), carbonate (CO32–), nitrate (NO3-), sulfate (SO42–)   1.39 write formulae for compounds formed between the ions listed above  1.40 draw dot-and-cross diagrams to show the formation of ionic compounds by electron transfer, limited to combinations of elements from Groups 1, 2, 3 and 5, 6, 7 *only outer electrons need be shown.* | **Activities:**   * ActiveBook animation. * Predict the formulae of named compounds using a table of common ions. * Learn the formula and charge of ions: games, e.g. Ion Bingo. * Formula test.   **Class practical:**   * Observing a range of compounds and noting their formula and names, looking for patterns. | Edexcel International GCSE Chemistry Student Book**:** Pages 17-19  Games for learning formulae: RSC Inspirational Chemistry: Resources for Modern Curricula Chapter 2 | Analysis  Problem solving | Analysis  Problem solving  Interpretation |
| **9** | **Section 1: Principles of chemistry**  (f) Ionic bonding | Students will be assessed on their ability to:  1.41 understand ionic bonding in terms of electrostatic attractions  1.42 understand why compounds with giant ionic lattices have high melting and boiling points  1.43 know that ionic compounds do not conduct electricity when solid, but do conduct electricity when molten and in aqueous solution. | **Activities:**   * Draw dot and cross diagrams of electron transfer and ion formation for combinations of elements listed. Work out the formulae and name of the compounds formed. * Draw a cartoon of ionic bonding, e.g. when sodium met chlorine.   **Demonstration:**   * Combination of elements: aluminium with iodine, magnesium with sulfur.   **Class practical:**   * A compound from two elements (RSC 14): iron plus sulfur. | Edexcel International GCSE Chemistry Student Book: Pages 17, 25-27  RSC Classic Chemistry Experiments Page 35  **Video clip:**   * Atoms and Their Electrons: ionic bonding | Analysis | Analysis  Problem solving |
| **10** | **Section 1: Principles of chemistry**  (g) Covalent bonding | Students will be assessed on their ability to:  1.44 know that a covalent bond is formed between atoms by the sharing of a pair of electrons  1.45 understand covalent bonds in terms of electrostatic attractions  1.46 understand how to use dot-and-cross diagrams to represent covalent bonds in:   * diatomic molecules, including hydrogen, oxygen, nitrogen, halogens and hydrogen halides * inorganic molecules including water, ammonia and carbon dioxide * organic molecules containing up to two carbon atoms, including methane, ethane, ethene and those containing halogen atoms. | **Activities**:   * ActiveBook animation * Identifying different particles from diagrams of them. * Drawing dot and cross diagrams of molecules in the specification; drawing displayed formulae of the molecules. * Making models from displayed formulae. | Edexcel International GCSE Chemistry Student Book: Pages 13-17  Simple molecular substances: ActiveBook Page 15, animation  **Video clip:** Atoms and Their Electrons: covalent bonding | Analysis | Analysis  Problem solving |
| **11** | **Section 1: Principles of chemistry**  (g) Covalent bonding | Students will be assessed on their ability to:  1.47 explain why substances with a simple molecular structures are gases or liquids, or solids with low melting and boiling points *the term intermolecular forces of attraction can be used to represent all forces between molecules*  1.48 explain why the melting and boiling points of substances with simple molecular structures increase, in general, with increasing relative molecular mass  1.49 explain why substances with giant covalent structures are solids with high melting and boiling points  1.50 explain how the structures of diamond, graphite and C60 fullerene influence their physical properties, including electrical conductivity and hardness. | **Activities**:   * ActiveBook animation. * Identifying different particles from diagrams of them. * Drawing dot and cross diagrams of molecules in the specification; drawing displayed formulae of the molecules. * Making models from displayed formulae. | Edexcel International GCSE Chemistry Student Book: Pages 27-29 | Problem solving | Problem solving  Reasoning |
| **12** | **Section 1: Principles of chemistry**  (d) The Periodic Table  (f) Ionic bonding  (g) Covalent bonding | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **13** | **Section 2: Inorganic chemistry**  (a) Group 1 (alkali metals) | Students will be assessed on their ability to:  1.25 write word equations and balanced chemical equations (including state symbols):   * for reactions studied in this specification * for unfamiliar reactions where suitable information is provided   2.1 understand how the similarities in the reactions of these elements with water provide evidence for their recognition as a family of elements  2.2 understand how the differences between the reactions of these elements with air and water provide evidence for the trend in reactivity in Group 1  2.3 use knowledge of trends in Group 1 to predict the properties of other alkali metals  **2.4C explain the trend in reactivity in Group 1 in terms of electronic configurations.** | **Activities:**   * Watch a video about the Periodic Table. Answer comprehension questions about its development, structure and use. * Draw conclusions about patterns and trends in Group 1 from the results of the demonstration. * Draw dot and cross diagrams to explain the trend in reactivity in Group 1.   **Demonstration:**   * Reactions of the alkali metals (RSC 72). | Edexcel International GCSE Chemistry Student Book: Pages 36-39, 102-105  RSC Classic Chemistry Demonstrations Page 185  **Video clips:**   * Chemistry: a Volatile History (BBC), or * Mendeleev’s Dream (Channel 4) | Problem solving  Interpretation | Problem solving  Interpretation  Adaptive learning |
| **14** | **Section 2: Inorganic chemistry**  (b) Group 7 (halogens) | Students will be assessed on their ability to:  2.5 know the colours, physical states (at room temperature) and trends in physical properties of these elements    2.6 use knowledge of trends in Group 7 to predict the properties of other halogens  2.7 understand how displacement reactions involving halogens and halides provide evidence for the trend in reactivity in Group 7  **2.8C explain the trend in reactivity in Group 7 in terms of electronic configurations.** | **Activities:**   * Watch a video or demonstration, and note the trends in colour and room temperature state of halogens. * Deduce the reactivity series of the halogens from displacement experiments. * Deduce chemical, ionic and half equations from experimental results to identify redox behaviour in displacement reactions. * Deduce the likely properties of fluorine and astatine.   **Demonstration:**   * Reactions of chlorine, bromine and iodine with iron and with aluminium (RSC 77).   **Class practical:**   * Reactions of halogens (RSC 19). | Edexcel International GCSE Chemistry Student Book: Pages 105-109  RSC Classic Chemistry Experiments: Page 46  RSC Classic Chemistry Demonstrations: Pages 204–210 | Problem solving  Interpretation | Problem solving  Interpretation  Adaptive learning |
| **15** | **Section 2: Inorganic chemistry**  (c) Gases in the atmosphere | Students will be assessed on their ability to:  2.9 know the approximate percentages by volume of the four most abundant gases in dry air  2.10 understand how to determine the percentage by volume of oxygen in air using experiments involving the reactions of metals (e.g. iron) and non-metals (e.g. phosphorus) with air  2.11 describe the combustion of elements in oxygen, including magnesium, hydrogen and sulphur  2.14 *practical: determine the approximate percentage by volume of oxygen in air using a metal or a non-metal.* | **Activities:**   * Draw a pie chart showing the composition of dry unpolluted air. * Calculate the percentage volume of oxygen in air using given experimental data from different samples of air.   **Demonstration:**   * Using copper to measure the oxygen in air (Student Book Page 54).   **Class practicals:**   * Using iron to measure the oxygen in air (Student Book Page 55). * Preparation and properties of oxygen (RSC 11). | Edexcel International GCSE Chemistry Student Book: Pages 54-56  RSC Classic Chemistry Experiments: Page 25 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **16** | **Section 2: Inorganic chemistry**  (c) Gases in the atmosphere | Students will be assessed on their ability to:  2.12 describe the formation of carbon dioxide from the thermal decomposition of metal carbonates, including copper(II) carbonate  2.13 know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change. | **Activities:**   * Evaluate methods of producing carbon dioxide. * Research the large-scale production of carbon dioxide, explaining the demand for this gas.   **Demonstrations:**   * ‘Coke + Mentos’ demonstration. * The density of carbon dioxide (RSC 56).   **Class practicals:**   * The effect of heat on metal carbonates (RSC 66). * Reaction between carbon dioxide and water (RSC 30). | Edexcel International GCSE Chemistry Student Book: Pages 57-58, 122  RSC Classic Chemistry Experiments: Pages 76, 165  RSC Classic Chemistry Demonstrations: Page 141 | Analysis | Analysis  Personal and social responsibility |
| **17** | **Section 2: Inorganic chemistry**  (d) Reactivity series | Students will be assessed on their ability to:  2.15 understand how metals can be arranged in a reactivity series based on their reactions with:   * water * dilute hydrochloric or sulfuric acid   2.16 understand how metals can be arranged in a reactivity series based on their displacement reactions between:   * metals and metal oxides * metals and aqueous solutions of metal salts   2.17 know the order of reactivity of these metals: potassium, sodium, lithium, calcium, magnesium, aluminium, zinc, iron, copper, silver, gold  2.21 *practical: investigate reactions between dilute hydrochloric and sulfuric acids and metals (e.g. magnesium, zinc and iron).* | **Activities:**   * Use practical results (see below) plus additional evidence to place metals in a reactivity series. * Make predictions about the reactivity of a metal given its place in the reactivity series. * Make a poster showing what happens in a displacement reaction. * Use practical results to write chemical equations for displacement reactions. * Deduce ionic equations from given chemical equations for displacement reactions.   **Demonstrations:**   * The reaction between zinc and copper oxide (RSC 11). * Thermit reaction (RSC 74).   **Class practicals:**   * Reaction of metals with acids and with water. * Competition for oxygen (RSC 31). * Displacement reactions between metals and their salts (RSC 97). | Edexcel International GCSE Chemistry Student Book: Pages 60-66  RSC Classic Chemistry Demonstrations: Page 22  RSC Classic Chemistry Experiments: Page 79 and 249 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **18** | **Section 2: Inorganic chemistry**  (a) Group 1 (alkali metals)  (b) Group 7 (halogens)  (c) Gases in the atmosphere  (d) Reactivity series | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **19** | **Section 2: Inorganic chemistry**  (d) Reactivity series | Students will be assessed on their ability to:  2.18 know the conditions under which iron rusts  2.19 understand how the rusting of iron may be prevented by:   * barrier methods * galvanising * sacrificial protection   2.20 in terms of gain or loss of oxygen and loss or gain of electrons, understand the terms:   * oxidation * reduction * redox * oxidising agent * reducing agent, in terms of gain or loss of oxygen and loss or gain of electrons. | **Activities:**   * Draw conclusions from rusting experiments to compare effectiveness of different corrosion prevention methods. * Learn OILRIG (Oxidation Is Loss, Reduction Is Gain) or LEO says GER (Loss of Electrons is Oxidation, Gain of Electrons is Reduction) or make up a mnemonic to remember redox behaviour in terms of electron transfer.   .  **Class practical:**   * The causes of rusting (RSC 50). | Edexcel International GCSE Chemistry Student Book: Pages 61-62, 144-145  RSC Classic Chemistry Demonstrations Page 196  RSC Classic Chemistry Experiments Page 126  **Video clips:**   * Chemistry in Action: Iron and Steel * Scientific Eye: Materials and their Properties, Rust | Problem solving  Interpretation | Problem solving  Interpretation  Adaptive learning |
| **20** | **Section 2: Inorganic chemistry**  (e) Extraction and uses of metals | Students will be assessed on their ability to:  **2.22C know that most metals are extracted from ores found in the Earth’s crust and that unreactive metals are often found as the uncombined element**  **2.23C explain how the method of extraction of a metal is related to its position in the reactivity series, illustrated by carbon extraction for iron and electrolysis for aluminium**  **2.24C be able to comment on a metal extraction process, given appropriate information**  ***detailed knowledge of the processes used in the extraction of a specific metal is not required.*** | **Activities:**   * Make a poster about the chemical reactions in a blast furnace. * Draw and label a diagram of aluminium electrolysis. * Research the uses of aluminium and iron. Relate the uses to the properties of the metals. * Evaluate the advantages of recycling aluminium over extracting it from ore, given key facts about both processes.   **Demonstration:**   * The real reactivity of aluminium (RSC 18). | Edexcel International GCSE Chemistry Student Book: Pages 139-143  RSC Classic Chemistry Demonstrations Page 196  **Video clips:**   * Chemistry in Action: Iron and Steel * Scientific Eye: Materials and their Properties, Rust * Chemistry in Action: Aluminium | Critical thinking  Reasoning | Critical thinking  Reasoning  Adaptive learning |
| **21** | **Section 1: Principles of chemistry**  (h) Metallic bonding  Section 2: Inorganic chemistry  (e) Extraction and uses of metals | Students will be assessed on their ability to:  **1.52C know how to represent a metallic lattice by a 2-D diagram**  **1.53C understand metallic bonding in terms of electrostatic attractions**  **1.54C explain typical physical properties of metals, including electrical conductivity and malleability**  **2.25C explain the uses of aluminium, copper, iron and steel in terms of their properties *the types of steel will be limited to low-carbon (mild), high-carbon and stainless***  **2.26C know that an alloy is a mixture of a metal and one or more elements, usually other metals or carbon**  **2.27C explain why alloys are harder than pure metals.** | **Activities:**   * Watch ICT animation of metallic structure. * Draw diagrams to explain malleability and conductivity in metals.   **Class practical:**   * Growing metal crystals (RSC 46). | Edexcel International GCSE Chemistry Student Book: Pages 24-25, 143-144  RSC Classic Chemistry Experiments Page 116  Birchfield Interactive: Structure and Bonding Ages 14–16 | Critical thinking  Reasoning | Critical thinking  Reasoning  Adaptive learning |
| **22** | **Section 2: Inorganic chemistry**  (f) Acids, alkalis and titrations | Students will be assessed on their ability to:  2.28 describe the use of litmus, phenolphthalein and methyl orange to distinguish between acidic and alkaline solutions  2.29 understand how to use the pH scale, from 0–14, can be used to classify solutions as strongly acidic (0–3), weakly acidic (4–6), neutral (7), weakly alkaline (8–10) and strongly alkaline (11–14)  2.30 describe the use of universal indicator to measure the approximate pH value of an aqueous solution  2.31 know that acids in aqueous solution are a source of hydrogen ions and alkalis in aqueous solution are a source of hydroxide ions. | **Activities:**   * Complete a pH chart showing the pH of everyday substances. * Write a short magazine article entitled ‘What causes acidity’, using information on Pages 76–78 of the Student Book.   **Demonstrations:**   * Hydrogen chloride gas: demonstrating its effect on moist blue litmus paper and on dry blue litmus paper. * Solutions of HCl in methylbenzene and in water: testing the solutions with blue litmus paper.   **Class practical:**   * The pH scale (RSC 10). | Edexcel International GCSE Chemistry Student Book: Pages 70-71, 76-78  RSC Classic Chemistry Experiments Page 23  **Video clip:**   * Materials and their Properties: Acids and Alkalis | Analysis | Analysis  Reasoning |
| **23** | **Section 2: Inorganic chemistry**  (f) Acids, alkalis and titrations | Students will be assessed on their ability to:  2.32 know that alkalis can neutralise acids  **2.33C describe how to carry out an acid-alkali titration.** | **Activity:**   * Practice titration calculations.   **Class practical:**   * Titration of sodium hydroxide with hydrochloric acid (RSC 48). | Edexcel International GCSE Chemistry Student Book: Pages 209 - 214  RSC Classic Chemistry Experiments: Page 120 | Analysis  Decision making | Analysis  Decision making  Communication |
| **24** | **Section 2: Inorganic chemistry**  **(d) Reactivity series**  **(e) Extraction and uses of metals**  **(f) Acids, alkalis and titrations** | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **25** | **Section 2: Inorganic chemistry**  **(g) Acids, bases and salt preparations** | Students will be assessed on their ability to:  2.34 know the general rules for predicting the solubility of ionic compounds in water:   * common sodium, potassium and ammonium compounds are soluble * all nitrates are soluble * common chlorides are soluble, except those of silver and lead(II) * common sulfates are soluble, except for those of barium, calcium and lead(II) * common carbonates are insoluble, except for those of sodium, potassium and ammonium * common hydroxides are insoluble except for those of sodium, potassium and calcium (calcium hydroxide is slightly soluble)   2.35 understand acids and bases in terms of proton transfer  2.36 understand that an acid is a proton donor and a base is a proton acceptor  2.37 describe the reactions of hydrochloric acid, sulfuric acid and nitric acid with metals, bases and metal carbonates (excluding the reactions between nitric acid and metals) to form salts  2.38 know that metal oxides, metal hydroxides and ammonia can act as bases, and that alkalis are bases that are soluble in water. | **Activities:**   * Write chemical equations for the preparation of given soluble salts. * Learn solubility rules for a solubility quiz. * Predict whether given salts are soluble or insoluble in water. * Given the name of a soluble salt, suggest methods for preparing it.   **Class practical:**   * Reaction between a metal oxide and dilute acid (RSC 39). | Edexcel International GCSE Chemistry Student Book: Pages 71-75, 81-84  RSC Classic Chemistry Experiments: Page 99. | Analysis | Analysis  Reasoning |
| **26** | **Section 2: Inorganic chemistry**  (g) Acids, bases and salt preparations | Students will be assessed on their ability to:  2.39 describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an insoluble reactant  **2.40C describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an acid and alkali**  2.42 *practical: prepare a sample of pure, dry hydrated copper(II) sulfate crystals starting from copper(II) oxide.* | **Activity:**   * Write up the experimental method of the salt preparation experiments: draw diagrams of the apparatus used.   **Class practical:**   * Reaction between a metal oxide and dilute acid (RSC 39). | Edexcel International GCSE Chemistry Student Book: Pages 84-85 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **27** | **Section 2: Inorganic chemistry**  (g) Acids, bases and salt preparations | Students will be assessed on their ability to:  **2.41C describe an experiment to prepare a pure, dry sample of an insoluble salt, starting from two soluble reactants**  **2.43C *practical: prepare a sample of pure, dry lead(II) sulfate.*** | **Activities:**   * Write up the experimental method of the salt preparation experiments: draw diagrams of the apparatus used. * Write chemical and ionic equations for the preparation of given insoluble salts. * Given the name of an insoluble salt, suggest methods for preparing it.   **Class practical:**   * Forming a salt that is insoluble in water (RSC 47). | Edexcel International GCSE Chemistry Student Book: Pages 85-87  RSC Classic Chemistry Experiments: Pages 99 and 118 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **28** | **Section 2: Inorganic chemistry**  (h) Chemical tests | Students will be assessed on their ability to:  2.44 describe tests for these gases:   * hydrogen * oxygen * carbon dioxide * ammonia * chlorine   2.45 describe how to carry out a flame test  2.46 know the colours formed in flame tests for these cations:   * Li+ is red * Na+ is yellow * K+ is lilac * Ca2+ is orange-red * Cu2+ is blue-green. | **Activities:**   * Write chemical and ionic equations for reactions encountered in ion tests. * Suggest the identity of unknown substances, given ion test results.   **Class practicals:**   * Testing salts for anions and cations (RSC 80). * Tests to identify gases. | Edexcel International GCSE Chemistry Student Book: Pages 92-94  RSC Classic Chemistry Experiments Page 203 | Analysis | Analysis  Reasoning |
| **29** | **Section 2: Inorganic chemistry**  (h) Chemical tests | Students will be assessed on their ability to:  2.47 describe tests for these cations:   * NH4+ using sodium hydroxide solution and identifying the gas evolved * Cu2+, Fe2+ and Fe3+ using sodium hydroxide solution   2.48 describe tests for these anions:   * Cl–, Br– and I– using acidified silver nitrate solution * SO42– using acidified barium chloride solution * CO32– using hydrochloric acid and identifying the gas evolved   2.49 describe a test for the presence of water using anhydrous copper(II) sulphate  2.50 describe a physical test to show whether a sample of water is pure. | **Activity:**   * Research and present methods for determining the purity of water, and how water can be purified.   .  **Class practicals:**   * Testing salts for anions and cations (RSC 80). * Measuring the boiling point of water. | Edexcel International GCSE Chemistry Student Book: Pages 93, 94-96  RSC Classic Chemistry Experiments Page 203 | Analysis | Analysis  Reasoning |
| **30** | **Section 2: Inorganic chemistry**  (g) Acids, bases and salt preparations  (h) Chemical tests | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **31** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Students will be assessed on their ability to:  1.26 calculate relative formula masses (including relative molecular masses) (*M*r) from relative atomic masses (*A*r)  1.27 know that the mole (mol) is the unit for the amount of a substance  1.28 understand how to carry out calculations involving amount of substance, relative atomic mass (*A*r) and relative formula mass (*M*r). | **Activities:**   * ICT drag and drop exercises, learning games and quizzes. * ActiveBook animation. * Exercises: calculating *Ar* from isotopic abundance. * Drawing displayed formulae of molecules and calculating the *M*r. * Exercises to calculate number of moles from a given mass and mass from a given number of moles.   **Demonstration:**   * Weighing out one mole of different substances: reinforcing that all these masses contain the same number of particles. | Edexcel International GCSE Chemistry Student Book: Pages 176-181  Finding the relative formula mass: ActiveBook: Page 178, animation  Birchfield Interactive: Quantitative Chemistry Ages 14–16 | Analysis | Analysis  Reasoning |
| **32** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Students will be assessed on their ability to:  1.29 calculate reacting masses using experimental data and chemical equations  1.30 calculate percentage yield  1.31 understand how the formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water of crystallisation. | **Activity:**   * Exercises using equations and the mole concept to predict mass of product or mass of reactant.   **Class practicals:**   * Change in mass when magnesium burns (RSC 67). * The determination of relative atomic mass (RSC 17). * To find the formula of hydrated copper(II) sulfate. | Edexcel International GCSE Chemistry Student Book: Pages 184, 187-189, 193  RSC Classic Chemistry Experiments: Pages 41, 131 and 169  Birchfield Interactive: Quantitative Chemistry Ages 14–16 | Analysis | Analysis  Reasoning |
| **33** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Students will be assessed on their ability to:  1.32 know what is meant by the terms empirical formula and molecular formula  1.33 calculate empirical and molecular formulae from experimental data  1.36 *practical:* *know how to determine the formula of a metal oxide by combustion (e.g. magnesium oxide) or by reduction (e.g. copper(II) oxide).* | **Activities:**   * Working out empirical formulae from mass or % by mass data. * Converting empirical formulae to molecular formulae given molecular mass data.   **Class practical:**   * Finding the formula of an oxide of copper (RSC 90). | Edexcel International GCSE Chemistry Student Book: Pages 182-184  RSC Classic Chemistry Experiments Page 233  Birchfield Interactive: Quantitative Chemistry Ages 14–16 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **34** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Students will be assessed on their ability to:  **1.34C understand how to carry out calculations involving amount of substance, volume and concentration (in mol/dm3) of solution.** | **Activities:**   * Exercises in calculating concentration given mass and solution volume. * Exercises in calculating mass, given concentration and solution volume. * Reacting mass calculations involving solutions.   **Demonstration:**   * Estimating the concentration of domestic bleach (RSC 59). | Edexcel International GCSE Chemistry Student Book: Pages 209 - 214  RSC Classic Chemistry Demonstrations: Page 147 | Analysis | Analysis  Reasoning |
| **35** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Students will be assessed on their ability to:  **1.35C understand how to carry out calculations involving gas volumes and the molar volume of a gas (24** **dm3 and 24** **000** **cm3 at room temperature and pressure (rtp)).** | **Activities:**   * Exercises using equations and the mole concept to predict volume of gaseous product or reactant. * Exercises calculating reacting quantities using gas molar volume.   **Class practical:**   * The volume of 1 mole of hydrogen gas (RSC 68). | Edexcel International GCSE Chemistry Student Book: Pages 189-192  RSC Classic Chemistry Experiments: Pages 41  RSC Classic Chemistry Experiments: Page 171  Birchfield Interactive: Quantitative Chemistry Ages 14–16 | Analysis | Analysis  Reasoning |
| **36** | **Section 1: Principles of chemistry**  (e) Chemical formulae, equations and calculations | Consolidation and assessment | * Revision exercises * End of section tests |  |  |  |
| **37** | **Section 3: Physical chemistry**  (a) Energetics | Students will be assessed on their ability to:  3.1 know that chemical reactions in which heat energy is given out are described as exothermic, and those in which heat energy is taken in are described as endothermic  3.2 describe simple calorimetry experiments for reactions such as combustion, displacement, dissolving and neutralisation  3.3 calculate the heat energy change from a measured temperature change using the expression *Q* = *m*cΔ*T*  3.4 calculate the molar enthalpy change (Δ*H*) from the heat energy change, *Q.* | **Activity:**   * Complete exercises, identifying whether a reaction is exo- or endothermic given ∆*H*.   **Class practicals:**   * Exothermic or endothermic? (RSC 22). * Heats of reaction (RSC 84). * Thermometric titration (RSC 45). * Calculating ∆*H* from practical results. | Edexcel International GCSE Chemistry Student Book: Pages 120-122, 204-207  RSC Classic Chemistry Experiments: Pages 54, 114 and 215 | Analysis | Analysis  Reasoning |
| **38** | **Section 3: Physical chemistry**  (a) Energetics | Students will be assessed on their ability to:  **3.5C draw and explain energy level diagrams to represent exothermic and endothermic reactions**  **3.6C know that bond-breaking is an endothermic process and that bond-making is an exothermic process**  **3.7C use bond energies to calculate the enthalpy change during a chemical reaction.** | **Activities:**   * Draw energy level diagrams for exothermic and endothermic reactions. * Complete exercises, identifying whether a reaction is exo- or endothermic given ∆*H*.   **Class practical:**   * Exercises in calculating ∆*H*, for given chemical reactions given bond enthalpy data. | Edexcel International GCSE Chemistry Student Book: Pages 121-123, 202-204 | Analysis | Analysis  Reasoning |
| **39** | **Section 3: Physical chemistry**  (a) Energetics | Students will be assessed on their ability to:  *3.8 practical: investigate temperature changes accompanying some of the following types of change:*   * *salts dissolving in water* * *neutralisation reactions* * *displacement reactions* * *combustion reactions .* | **Class practicals:**   * Comparing the heat energy produced by combustion of various alcohols (RSC 85). | Edexcel International GCSE Chemistry Student Book: Pages 204-207  RSC Classic Chemistry Experiments: Page 219 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **40** | **Section 4: Organic chemistry**  (a) Introduction | Students will be assessed on their ability to:  4.1 know that a hydrocarbon is a compound of hydrogen and carbon only  4.2 understand how to represent organic molecules using empirical formulae, molecular formulae, general formulae, structural formulae and displayed formulae  4.3 know what is meant by the terms homologous series, functional group and isomerism. | **Activities:**   * Use molecular models to derive displayed and molecular formulae. * ActiveBook PowerPoint. | Edexcel International GCSE Chemistry Student Book: Pages 163, 149-150, 156-157  Hydrocarbons: ActiveBook: Page 158, PowerPoint | Critical thinking  Problem solving | Critical thinking  Problem solving  Adaptive learning |
| **41** | **Section 4: Organic chemistry**  (a) Introduction | Students will be assessed on their ability to:  4.4 understand how to name compounds relevant to this specification using the rules of International Union of Pure and Applied Chemistry (IUPAC) nomenclature - *students will be expected to name compounds containing up to six carbon atoms*  4.5 understand how to write the possible structural and displayed formulae of an organic molecule given its molecular formula  4.6 understand how to classify reactions of organic compounds as substitution, addition and combustion*. Knowledge of reaction mechanisms is not required.* | **Activities:**   * Make models of alkanes. * Use molecular models to find the isomers of pentane, draw their displayed formulae. | Edexcel International GCSE Chemistry Student Book: Pages 150-154 | Critical thinking  Problem solving | Critical thinking  Problem solving  Adaptive learning |
| **42** | **Section 3: Physical chemistry**  (a) Energetics  Section 4: Organic chemistry  (a) Introduction | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **43** | **Section 4: Organic chemistry**  (b) Crude oil | Students will be assessed on their ability to:  4.7 know that crude oil is a mixture of hydrocarbons  4.8 describe how the industrial process of fractional distillation separates crude oil into fractions  4.9 know the names and uses of the main fractions obtained from crude oil: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen  4.10 know the trend in colour, boiling point and viscosity of the main fractions. | **Activities:**   * BP video: fill in quiz comprehension sheet to find facts about fractions. * Complete a diagram of a fractionating tower, detailing chain length, boiling point and use of each fraction. * Write a description of how the process of fractional distillation works.   **Demonstrations:**   * The fractional distillation of crude oil. * Viscosity and combustion of the fractions. | Edexcel International GCSE Chemistry Student Book: Pages 163 - 164  BP: Refining and Products from Crude Oil | Interpretation | Interpretation  Adaptive learning |
| **44** | **Section 4: Organic chemistry**  (b) Crude oil | Students will be assessed on their ability to:  4.11 know that a fuel is a substance that, when burned, releases heat energy  4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air  4.13 understand why carbon monoxide is poisonous, in terms of its effect on the capacity of blood to transport oxygen; *references to haemoglobin are not required*  4.14 know that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming oxides of nitrogen  4.15 explain how the combustion of some impurities in hydrocarbon fuels results in the formation of sulfur dioxide  4.16 understand how sulfur dioxide and oxides of nitrogen oxides contribute to acid rain. | **Activities:**   * Write chemical equations for combustion reactions. * ActiveBook animations. * Research news articles about carbon monoxide poisoning incidents. * Produce a gas safety advertisement, explaining the cause and dangers of incomplete combustion. * Watch a film about climate change then participate in an in-class debate on the issues raised in the film.   **Demonstration:**   * The products of combustion of methane (RSC 38).   **Class practical:**   * Combustion (RSC 16). | Edexcel International GCSE Chemistry Student Book: Pages 157, 57  Combustion, carbon monoxide poisoning: ActiveBook: Page 157, four animations  RSC Classic Chemistry Experiments: Page 40  Carbon monoxide – the silent killer: RSC Inspirational Chemistry: Resources for Modern Curricula Page 43 | Interpretation | Interpretation  Personal and social responsibility |
| **45** | **Section 4: Organic chemistry**  (b) Crude oil | Students will be assessed on their ability to:  4.17 describe how long-chain alkanes are converted to alkenes and shorter-chain alkanes by catalytic cracking (using silica or alumina as the catalyst and a temperature in the range of 600–700 ºC)  4.18 explain why cracking is necessary, in terms of the balance between supply and demand for different fractions. | **Activities:**   * Watch BP video then answer comprehension questions on the importance of catalytic cracking. * Use molecular models to explain why alkenes are formed during catalytic cracking. * Use chemical equations in cracking reactions to predict a product or reactant.   **Class practicals:**   * Cracking hydrocarbons (RSC 96). * Testing for unsaturation with bromine water. | Edexcel International GCSE Chemistry Student Book: Pages 166-167  RSC Classic Chemistry Experiments: Page 247  BP: Refining and Products from Crude Oil | Interpretation | Interpretation  Communication |
| **46** | **Section 3: Physical chemistry**  (b) Rates of reaction | Students will be assessed on their ability to:  3.9 describe experiments to investigate the effects of changes in surface area of a solid, concentration of a solution, temperature and the use of a catalyst on the rate of a reaction  3.10 describe the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas, temperature and the use of a catalyst on the rate of a reaction  3.11 explain the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas and temperature on the rate of a reaction in terms of particle collision theory  3.15 *practical: investigate the effect of changing the surface area of marble chips and of changing the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid.* | **Activities:**   * Draw graphs to show the effect of concentration on rate of reaction. * Deduce a trend from the graph, e.g. ‘doubling concentration doubles rate’. * Draw particle pictures to illustrate surface area and concentration effects. * Write a particle theory explanation for the effects of surface area and of concentration on reaction rate.   **Demonstration:**   * Clock reaction (RSC 23).   **Class practicals:**   * Rate of reaction – the effects of concentration and temperature (RSC 29). * The effect of temperature of reaction rate (RSC 64). * The effect of concentration of reaction rate (RSC 65). * The effect of changing surface area on the rate of a reaction. | Edexcel International GCSE Chemistry Student Book: Pages 41-46  RSC Classic Chemistry Experiments Pages 73, 160 and 163, RSC Classic Chemistry Demonstrations Page 50  Multimedia Science School 11–16 Edition: Particle animation  Birchfield Interactive: Rates of Reaction Ages 14–16 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **47** | **Section 3: Physical chemistry**  (b) Rates of reaction | Students will be assessed on their ability to:  3.12 know that a catalyst is a substance that increases the rate of a reaction, but is chemically unchanged at the end of the reaction    3.13 know that a catalyst works by providing an alternative pathway with lower activation energy  **3.14C draw and explain reaction profile diagrams showing ΔH and activation energy**  3.16 *practical: investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution.* | **Activities:**   * Draw reaction profile diagrams to illustrate the effect of a catalyst. * View ActiveBook animation of a catalytic converter as an example of the function of a catalyst. * Use interactive animation software to visualise collision theory. Students may write an account of what they observe using animation software. (Multimedia Science School).   **Demonstrations:**   * Catalysts for the thermal decomposition of potassium chlorate. * Demonstration of a liquid siphon to illustrate the concept of activation energy.   **Class practical:**   * Catalysis (RSC 58). | Edexcel International GCSE Chemistry Student Book: Pages 46-50  Catalytic converter: ActiveBook Page 44, animation  RSC Classic Chemistry Experiments: Pages 73, 145  RSC Classic Chemistry Demonstrations Page 245  Multimedia Science School 11–16 Edition: Particle animation  Birchfield Interactive: Rates of Reaction Ages 14–16 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **48** | **Section 4: Organic chemistry**  (b) Crude oil  Section 3: Physical chemistry  (b) Rates of reaction | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **49** | **Section 3: Physical chemistry**  (c) Reversible reactions and equilibria | Students will be assessed on their ability to:  3.17 know that some reactions are reversible and this is indicated by the symbol ⇌ in equations  3.18 describe reversible reactions such as the dehydration of hydrated copper(II) sulfate and the effect of heat on ammonium chloride. | **Activity:**   * ICT quizzes and games to reinforce understanding of concepts.   **Demonstration:**   * The equilibrium between ICl and ICl3 (RSC 4).   **Class practicals:**   * Heating copper(II) sulfate (RSC 53). * Heating ammonium chloride. | Edexcel International GCSE Chemistry Student Book: Pages 125-127  RSC Classic Chemistry Demonstrations: Page 7  RSC Classic Chemistry Experiments: Page 134  Birchfield Interactive: Reversible reactions Ages 14–16 | Analysis | Analysis  Problem solving |
| **50** | **Section 3: Physical chemistry**  (c) Reversible reactions and equilibria | Students will be assessed on their ability to:  **3.19C know that a reversible reaction can reach dynamic equilibrium in a sealed container**  **3.20C know that the characteristics of a reaction at dynamic equilibrium are:**   * **the forward and reverse reactions occur at the same rate** * **the concentrations of reactants and products remain constant**   **3.21C understand why a catalyst does not affect the position of equilibrium in a reversible reaction**  **3.22C predict, with reasons, the effect of changing either pressure or temperature on the position of equilibrium in a reversible reaction; *references to Le Chatelier's principle are not required.*** | **Activities:**   * ICT quizzes and games to reinforce understanding of concepts. * Exercises in predicting the shift in position of equilibrium when conditions are altered. * ActiveBook animation.   **Demonstration:**   * The baling experiment: baling water from one tank to another to demonstrate dynamic equilibrium being established in a closed system. | Edexcel International GCSE Chemistry Student Book: Pages 125-129  Reversible reactions and equilibria: ActiveBook: Page 125, animation  RSC Classic Chemistry Demonstrations: Page 7 | Analysis | Analysis  Problem solving |
| **51** | **Section 4: Organic chemistry**  (c) Alkanes | Students will be assessed on their ability to:  4.19 know the general formula for alkanes  4.20 explain why alkanes are classified as saturated hydrocarbons  4.21 understand how to draw the structural and displayed formulae for alkanes with up to five carbon atoms in the molecule, and to name the unbranched-chain isomers  4.22 describe the reactions of alkanes with halogens in the presence of ultraviolet radiation, limited to mono-substitution;  *knowledge of reaction mechanisms is not required.* | **Activities:**   * Complete a table showing the name, molecular formula, structural formula and displayed formula of each of the first five unbranched-chain alkanes. * Write a chemical equation, using displayed formulae for the bromination of methane.   **Demonstration:**   * The photochemical reaction of bromine vapour with methane. | Edexcel International GCSE Chemistry Student Book: Pages 156-157 | Analysis | Analysis  Problem solving  Adaptive learning |
| **52** | **Section 4: Organic chemistry**  (d) Alkenes | Students will be assessed on their ability to:  4.23 know that alkenes contain the functional group >C=C<  4.24 know the general formula for alkenes  4.25 explain why alkenes are classified as unsaturated hydrocarbons  4.26 understand how to draw the structural and displayed formulae for alkenes with up to four carbon atoms in the molecule, and name the unbranched-chain isomers; *knowledge of cis/trans or E/Z notation is not required*  4.27 describe the reactions of alkenes with bromine, to produce dibromoalkanes  4.28 describe how bromine water can be used to distinguish between an alkane and an alkene. | **Activities:**   * Complete a table showing the name, molecular formula, structural formula and displayed formula of each the first four unbranched-chain alkenes. * Write an account of observations from practical (see below), and write chemical equations to explain observations.   **Class practical:**   * Testing for alkenes using bromine water. | Edexcel International GCSE Chemistry Student Book: Pages 158-159 | Analysis | Analysis  Problem solving  Adaptive learning |
| **53** | **Section 4: Organic chemistry**  (e) Alcohols | Students will be assessed on their ability to:  **4.29C know that alcohols contain the functional group −OH**  **4.30C understand how to draw structural and displayed formulae for methanol, ethanol, propanol (*propan-1-ol only*) and butanol (*butan-1-ol only*), and name each compound; *the names propanol and butanol are acceptable***  **4.31C know that ethanol can be oxidised by:**   * **burning in air or oxygen (complete combustion)** * **reaction with oxygen in the air to form ethanoic acid (microbial oxidation)** * **heating with potassium dichromate(VI) in dilute sulfuric acid to form ethanoic acid**   **4.32C know that ethanol can be manufactured by:**   * **reacting ethene with steam in the presence of a phosphoric acid catalyst at a temperature of about 300 ºC and a pressure of about 60–70 atm** * **the fermentation of glucose, in the absence of air, at an optimum temperature of about 30 ºC and using the enzymes in yeast**   **4.33C understand the reasons for fermentation, in the absence of air, and at an optimum temperature.** | **Activities:**   * Complete a table showing the name, molecular formula, structural formula and displayed formula of each the first four unbranched-chain alcohols. * List the advantages and disadvantages of each method of ethanol production. * ActiveBook PowerPoint. * Research uses of ethanol and link each use to the appropriate production method. * Read and discuss news articles about ‘gasohol’ and biofuels. * Balance equations for the production, combustion and dehydration of ethanol.   **Demonstrations:**   * Fermentation. * Dehydrating ethanol (RSC 98).   **Class practical:**   * The properties of alcohols (RSC 79). | Edexcel International GCSE Chemistry Student Book: Pages 159-161  Alcohols and their properties: ActiveBook: Page 159, PowerPoint  RSC Classic Chemistry Demonstrations: Page 275  RSC Classic Chemistry Experiments: Page 201 | Analysis | Analysis  Problem solving  Adaptive learning |
| **54** | **Section 3: Physical chemistry**  (c) Reversible reactions and equilibria  Section 4: Organic chemistry  (c) Alkanes  (d) Alkenes  (e) Alcohols | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |
| **55** | **Section 4: Organic chemistry**  (f) Carboxylic acids | Students will be assessed on their ability to:  **4.34C know that carboxylic acids contain the functional group**    **4.35C understand how to draw structural and displayed formulae for unbranched-chain carboxylic acids with up to four carbon atoms in the molecule, and name each compound**  **4.36C describe the reactions of aqueous solutions of carboxylic acids with metals and metal carbonates**  **4.37C know that vinegar is an aqueous solution containing ethanoic acid.** | **Activities:**   * Complete a table showing the name, molecular formula, structural formula and displayed formula of each the first four unbranched-chain carboxylic acids. * Discussion of where carboxylic acids are found: vinegar, bee or ant stings, milk, fruit.… * Reactions of carboxylic acids – less or more reactive than other laboratory acids. * Balance equations for the reactions of ethanoic acid.   **Demonstration:**   * Oxidation of ethanol to form ethanoic acid.   **Class practicals:**   * The acidic reactions of ethanoic acid (Nuffield: practicalchemistry.org). * The properties of ethanoic acid (RSC 78). | Edexcel GCSE (9-1) Chemistry student book: Pages 182-183  RSC Classic Chemistry Experiments: Page 199 | Analysis | Analysis  Problem solving  Adaptive learning |
| **56** | **Section 4: Organic chemistry**  (g) Esters | **Students will be assessed on their ability to:**  **4.38C know that esters contain the functional group**    **4.39C know that ethyl ethanoate is the ester produced when ethanol and ethanoic acid react in the presence of an acid catalyst**  **4.40C understand how to write the structural and displayed formulae of ethyl ethanoate**  **4.41C understand how to write the structural and displayed formulae of an ester, given the name or formula of the alcohol and carboxylic acid from which it is formed and vice versa**  **4.42C know that esters are volatile compounds with distinctive smells and are used as food flavourings and in perfumes**  **4.43C practical: prepare a sample of an ester such as ethyl ethanoate.** | **Activities:**   * Discussion of where esters are found: flavourings, odorants. * Review naming system used. * How an ester forms: loss of H from acid and OH from alcohol to form water. * Write chemical equations for the reaction of ethanol with ethanoic acid using molecular formulae, structural formulae and displayed formulae.   **Demonstration:**   * Preparation of an ester – one of the most instantly recognisable by smell is methyl salicylate (or methyl 2-hydroxybenzoate).   **Class practical:**   * Making esters from alcohols and acids (Nuffield: practicalchemistry.org). | Doc Brown’s Chemistry page:  http://www.docbrown.info/page04/OilProducts10b.htm | Analysis | Analysis  Problem solving  Adaptive learning |
| **57** | **Section 4: Organic chemistry**  (h) Synthetic polymers | Students will be assessed on their ability to:  4.44 know that an addition polymer is formed by joining up many small molecules called monomers  4.45 understand how to draw the repeat unit of an addition polymer, including poly(ethene), poly(propene), poly(chloroethene) and (poly)tetrafluroethene  4.46 understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa  4.47 explain problems in the disposal of addition polymers, including:   * their inertness and inability to biodegrade * the production of toxic gases when they are burned   **4.48C know that condensation polymerisation, in which a dicarboxylic acid reacts with a diol, produces a polyester and water**  **4.49C understand how to write the structural and displayed formula of a polyester, showing the repeat unit, given the formulae of the monomers from which it is formed including the reaction of ethanedioic acid and ethanediol:**  **4.50C know that some polyesters, known as biopolyesters, are biodegradable.** | **Activities:**   * Exercises in drawing the repeat unit of polymers and identifying the monomer given a polymer’s repeat unit. * Researching the uses and environmental impact of addition and condensation polymers, and linking these to the polymers’ properties.   **Demonstrations:**   * The nylon rope trick (RSC 64). * Making rayon (RSC 91).   **Class practicals:**   * Identifying polymers (RSC 12). * Addition polymerisation (RSC 95). | Edexcel International GCSE Chemistry Student Book: Pages 169-173  RSC Classic Chemistry Experiments: Pages 27 and 245  RSC Classic Chemistry Demonstrations: Pages 159 and 256 | Analysis | Analysis  Problem solving  Adaptive learning |
| **58** | **Section 1: Principles of chemistry**  (i) Electrolysis | Students will be assessed on their ability to:  1.51 know that covalent compounds do not usually conduct electricity  **1.55C understand why covalent compounds do not conduct electricity**  **1.56C understand why ionic compounds conduct electricity only when molten or in aqueous solution**  **1.57C know that anion and cation are terms used to refer to negative and positive ions respectively.** | **Activities:**   * Watch ICT animation of conduction in metal and in an electrolyte, and note differences. * Draw diagrams of conduction in metals and in electrolytes. * Plan an experiment to distinguish between electrolyte and non-electrolyte.   **Class practicals:**   * Testing the conductivity of metals, ionic and covalent substances. * Chemistry and electricity (RSC 15). * Migration of ions (RSC 34). | Edexcel International GCSE Chemistry Student Book: Pages 158-159  RSC Classic Chemistry Experiments: Pages 37 and 87  Birchfield Interactive: Electrolysis and its applications Ages 14–16 | Analysis  Reasoning | Analysis  Reasoning  Interpretation |
| **59** | **Section 1: Principles of chemistry**  (i) Electrolysis | Students will be assessed on their ability to:  **1.58C describe experiments to investigate electrolysis, using inert electrodes, of molten compounds (including lead(II) bromide) and aqueous solutions (including sodium chloride, dilute sulfuric acid and copper(II) sulfate) and to predict the products**  **1.59C write ionic half-equations representing the reactions at the electrodes during electrolysis and understand why these reactions are classified as oxidation or reduction**  **1.60C *practical: investigate the electrolysis of aqueous solutions.*** | **Activities:**   * Draw diagrams showing ions present, product and the ionic half- equation at each electrode for the electrolysis experiments. * ActiveBook animation.   **Demonstration:**   * The electrolysis of molten lead bromide.   **Class practical:**   * The electrolysis of copper(II) sulfate solution (RSC 92). | Edexcel International GCSE Chemistry Student Book: Pages 112-118  RSC Classic Chemistry Demonstrations: Page 238  RSC Classic Chemistry Experiments: Page 238 | Interpretation  Executive function | Interpretation  Decision making  Executive function  Responsibility  Teamwork |
| **60** | **Section 4: Organic chemistry**  (f) Carboxylic acids  (g) Esters  (h) Synthetic polymers  **Section 1: Principles of chemistry**  (i) Electrolysis | Consolidation and assessment | * Revision exercises * End of section test |  |  |  |