# International GCSE Chemistry to GCE Chemistry – Specification mapping

The purpose of this document is to demonstrate the overlap between International GCSE and GCE. For an effective progression through to A level, it will be useful if centres establish a baseline point from which to build on. The mapping document should enable teachers to streamline the teaching and get to the A level content within the first two weeks of term. This will serve two purposes:

* 1. Students will actually feel they are learning something new and maintain their interest in the subject.
  2. Students will be able to discover very early on in the course whether Chemistry A level is really a   
     suitable subject choice for them.

The following are some suggestions for how to use this resource:

1. post International GCSE exams – if your school brings back the Year 11s after their exams
2. induction weeks at the start of 6th Form
3. setting summer homework in preparation for 6th Form
4. levelling the baseline of all students from their range of International GCSE qualifications.

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| GCE Chemistry  Topic 1 – Atomic structure and the Periodic Table | International GCSE Chemistry |
| 1. know the structure of an atom in terms of electrons, protons and neutrons | **Topic 1(c) - Atomic Structure**  1.15 know the structure of an atom in terms of the positions, relative masses and relative charges of sub-atomic particles |
| 2. know the relative mass and relative charge of protons, neutrons and electrons | **Topic 1(c) - Atomic Structure**  1.15 know the structure of an atom in terms of the positions, relative masses and relative charges of sub-atomic particles |
| 3. know what is meant by the terms ‘atomic (proton) number’ and ‘mass number’ | **Topic 1(c) - Atomic Structure**  1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A*r*) |
| 4. be able to determine the number of each type of sub-atomic particle in an atom, molecule or ion from the atomic (proton) number and mass number | **Topic 1(c) - Atomic Structure**  1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (*Ar*) |
| 5. understand the term ‘isotopes’ | **Topic 1(c) - Atomic Structure**  1.16 know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (*Ar*) |

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| **GCE Chemistry**  **Topic 1 – Atomic structure and the Periodic Table** | **International GCSE Chemistry** |
| 7. understand the terms ‘relative molecular mass’ and ‘relative formula mass’, including calculating these values from relative atomic masses.  *Definitions of these terms will not be expected*  *The term ‘relative formula mass’ should be used for compounds with giant structures.* | **Topic 1(e) - Chemical formulae, equations and calculations**  1.26 calculate relative formula masses (including relative molecular masses) (M*r*) from relative atomic masses (A*r*) |
| 8. be able to analyse and interpret data from mass spectrometry to calculate relative atomic mass from relative abundance of isotopes and vice versa | **1(c) Atomic Structure**  1.17 be able to calculate the relative atomic mass of an element (*A*r) from isotopic abundances |
| 16. know the number of electrons that can fill the first four quantum shells | **1(d) The Periodic Table**  1.19 understand how to deduce the electronic configurations of the first 20 elements from their positions in the Periodic Table 1.20 |
| 22. know that elements can be classified as *s*-, *p*- and *d*-block elements | **1(d) The Periodic Table**  1.22 understand how the electronic configuration of a main group element is related to its position in the Periodic Table |

| GCE Chemistry  Topic 2 – Bonding and structure | International GCSE Chemistry |
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| 1. know that ionic bonding is the strong electrostatic attraction between oppositely charged ions | **1(f) Ionic bonding**  1.41 understand ionic bonding in terms of electrostatic attractions |
| 3. understand the formation of ions in terms of electron loss or gain  4. be able to draw electronic configuration diagrams of cations and anions using dot-and-cross diagrams | **1(f) Ionic bonding**  1.37 understand how ions are formed by electron loss or gain  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 to be shown* |
| 7. know that a covalent bond is the strong electrostatic attraction between two nuclei and the shared pair of electrons between them | **1(g) Covalent bonding**  1.44 know that a covalent bond is formed between atoms by the sharing of a pair of electrons  1.25 understand covalent bonds in terms of electrostatic attractions |
| 8. be able to draw dot-and-cross diagrams to show electrons in simple covalent molecules, including those with multiple bonds and dative covalent (coordinate) bonds | **1(g) Covalent bonding**  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 2 carbon atoms, including methane, ethane, ethene and those containing halogen atoms |
| 22. know that metallic bonding is the strong electrostatic attraction between metal ions and the sea of delocalised electrons | **1(h) Metallic bonding**  **1.52C know how to represent a metallic lattice by a 2-D diagram**  **1.53C understand metallic bonding in terms of electrostatic attractions** |
| 23. know that giant lattices are present in:  i. ionic solids (giant ionic lattices)  ii. covalently bonded solids, such as diamond, graphite and silicon(IV) oxide (giant covalent lattices)  iii. solid metals (giant metallic lattices)  25. know the different structures formed by carbon atoms, including graphite, diamond and graphene | **1(f) Ionic bonding**  1.42 understand why compounds with giant ionic lattices have high melting and boiling points  **1(g) Covalent bonding**  1.49 explain why substances with giant covalent structures are solids with high melting and boiling points  **1(h) Metallic bonding**  **1.52C know how to represent a metallic lattice by a 2-D diagram**  **1(g) Covalent bonding**  1.50 explain how the structures of diamond, graphite and C60 fullerene influence their physical properties, including electrical conductivity and hardness |

| GCE Chemistry  Topic 3 – Redox 1 | International GCSE Chemistry |
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| 4. understand oxidation and reduction in terms of electron loss or electron gain  5. know that oxidising agents gain electrons  6. know that reducing agents lose electrons | **2(d) Reactivity series**  2.20 understand the terms oxidation, reduction, redox, oxidising agent, reducing agents in terms of gain or loss of oxygen and loss or gain of electrons |
| 11. understand that metals, in general, form positive ions by loss of electrons with an increase in oxidation number  12. understand that non-metals, in general, form negative ions by gain of electrons with a decrease in oxidation number  13. be able to write ionic half-equations and use them to construct full ionic equations | **1(f) Ionic bonding**  1.37 understand how ions are formed by electron loss or gain  1.38 know the charges on these ions   * metals in Groups 1, 2 and 3 * non-metals in Groups 5, 6 and 7 * Ag+, Cu2+, Fe2+, Fe3+, Pb2+, Zn2+   **1(i) Electrolysis**  **1.59C write ionic half-equations representing the reactions at the electrodes during electrolysis and understand why these reactions are classified as oxidation and reduction** |

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| **GCE Chemistry**  **Topic 4 – Inorganic Chemistry and the Periodic Table** | **International GCSE Chemistry** |
| 2. understand reasons for the trend in reactivity of the Group 2 elements down the group  3. know the reactions of the elements Mg to Ba in Group 2 with oxygen, chlorine and water  4. know the reactions of the oxides of Group 2 elements with water and dilute acid, and their hydroxides with dilute acid | **2(a) Group 1 (alkali metals) – lithium, sodium and potassium**  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  **2.4C explain the trend in reactivity in Group 1 in terms of electronic configurations**  **2(g) Acids, bases and salt preparations**  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 |

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| **GCE Chemistry**  **Topic 4 – Inorganic Chemistry and the Periodic Table** | **International GCSE Chemistry** |
| 7. understand the formation of characteristic flame colours by Group 1 and 2 compounds in terms of electron transitions  *Students will be expected to know the flame colours for Groups 1 and 2 compounds.*  8. understand experimental procedures to show:   1. patterns in thermal decomposition of Group 1 and 2 nitrates and carbonates 2. flame colours in compounds of Group 1 and 2 elements | **2(h) Chemical tests**  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   2.45 describe how to carry out a flame test |

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| **GCE Chemistry**  **Topic 4 – Inorganic Chemistry and the Periodic Table** | **International GCSE Chemistry** |
| 9. understand reasons for the trends in melting and boiling temperatures, physical state at room temperature, and electronegativity for Group 7 elements  10. understand reasons for the trend in reactivity of Group 7 elements down the group  11. understand the trend in reactivity of Group 7 elements in terms of the redox reactions of Cl2, Br2 and I2 with halide ions in aqueous solution, followed by the addition of an organic solvent | **2(b) Group 7 (halogens) – chlorine, bromine and iodine**  2.5 know the colours, physical states (at room temperature) and trends in physical properties of these elements  **2.8C explain the trend in reactivity in Group 7 in terms of electronic configuration**  2.7 understand how displacement reactions involving halogens and halides provide evidence for the trend in reactivity in Group 7 |

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| **GCE Chemistry Topic 4 – Inorganic Chemistry and the Periodic Table** | **International GCSE Chemistry** |
| 13. understand the following reactions:   1. solid Group 1 halides with concentrated sulfuric acid, to illustrate the trend in reducing ability of the hydrogen halides 2. precipitation reactions of the aqueous anions Cl–, Br– and I– with aqueous silver nitrate solution, followed by aqueous ammonia solution 3. hydrogen halides with ammonia and with water (to produce acids)   14. be able to make predictions about fluorine and astatine and their compounds, in terms of knowledge of trends in halogen chemistry | **2(h) Chemical tests**  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(b) Group 7 (halogens) – chlorine, bromine and iodine**  2.6 use knowledge of trends in Group 7 to predict the properties of other halogens |

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| **GCE Chemistry**  **Topic 4 – Inorganic Chemistry and the Periodic Table** | **International GCSE Chemistry** |
| 15. know reactions, including ionic equations where appropriate, for identifying:   1. carbonate ions, CO32-, and hydrogencarbonate ions, HCO3-, using an aqueousacid to form carbon dioxide 2. sulfate ions, SO42-, using acidified barium chloride solution 3. ammonium ions, NH4+, using sodium hydroxide solution and warming to form ammonia   *Tests for halide ions and for the ions of Group 1 and 2 metals are also required, but are covered elsewhere in this topic.* | **2(h) Chemical tests**  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   2.47 describe tests for these cations   * NH4+ using sodium hydroxide solution and identifying the gas evolved * Cu2+, Fe2+ and Fe3+ using sodium hydroxide solution |

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| **GCE Chemistry**  **Topic 5 – Formulae, equations and amounts of substance** | **International GCSE Chemistry** |
| 1. know that the mole (mol) is the unit for amount of a substance | **1(e) Chemical formulae, equations and calculations**  1.27 know that the mole (mol) is the unit for the amount of a substance |
| 4. know what is meant by the terms ‘empirical formula’ and ‘molecular formula’ | **1(e) Chemical formulae, equations and calculations**  1.32 know what is meant by the terms empirical formula and molecular formula  1.33 calculate empirical and molecular formulae from experimental data |
| 5. be able to calculate empirical and molecular formulae from experimental data  *Calculations of empirical formula may involve composition by mass or percentage composition by mass data.* |
| 6. be able to write balanced full and ionic equations, including state symbols, for chemical reactions | **1(e) Chemical formulae, equations and calculations**  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 |

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| **GCE Chemistry**  **Topic 5 – Formulae, equations and amounts of substance** | **International GCSE Chemistry** |
| 7. be able to calculate amounts of substances (in mol) in reactions involving mass, volume of gas, volume of solution and concentration  *These calculations may involve reactants and/or products.* | **1(e) Chemical formulae, equations and calculations**  1.28 understand how to carry out calculations involving amount of substance, relative atomic mass (*A*r) and relative formula mass (*M*r)  **1.34C understand how to carry out calculations involving amount of substance, volume and concentration (in mol/dm3) of solution**  **1.35C understand how to carry out calculations involving gas volumes and the molar volume of a gas (24 dm3 and 24000cm3 at room temperature and pressure (rtp))**  1.29 calculate reacting masses using experimental data and chemical equations |
| 8. be able to calculate reacting masses from chemical equations, and vice versa, using the concepts of amount of substance and molar mass |

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| **GCE Chemistry**  **Topic 5 – Formulae, equations and amounts of substance** | **International GCSE Chemistry** |
| 9. be able to calculate reacting volumes of gases from chemical equations, and vice versa, using the concepts of amount of substance  10. be able to calculate reacting volumes of gases from chemical equations, and vice versa, using the concepts of molar volume of gases  ***CORE PRACTICAL 1: Measure the molar volume of a gas*** | **1(e) Chemical formulae, equations and calculations**  1.35C understand how to carry out calculations involving gas volumes and the molar volume of a gas (24 dm3 and 24000cm3 at room temperature and pressure (rtp)) |

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| **GCE Chemistry**  **Topic 5 – Formulae, equations and amounts of substance** | **International GCSE Chemistry** |
| 11. be able to calculate solution concentrations, in mol dm–3 and g dm–3, for simple acid–base titrations using a range of acids, alkalis and indicators  *The use of both phenolphthalein and methyl orange as indicators will be expected*  ***CORE PRACTICAL 2: Prepare a standard solution from a solid acid and use it to find the concentration of a solution of sodium hydroxide***  ***CORE PRACTICAL 3: Find the concentration of a solution of hydrochloric acid*** | **1(e) Chemical formulae, equations and calculations**  1.34C understand how to carry out calculations involving amount of substance, volume and concentration (in mol/dm3) of solution |
| 14. be able to calculate percentage yields and percentage atom economies using chemical equations and experimental results  Atom economy of a reaction =  (molar mass of the desired product) (sum of the molar masses of all products) × 100% | **1(e) Chemical formulae, equations and calculations**  1.30 calculate percentage yield |

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| **GCE Chemistry**  **Topic 5 – Formulae, equations and amounts of substance** | **International GCSE Chemistry** |
| 15. be able to relate ionic and full equations, with state symbols, to observations from simple test tube reactions, to include:   1. displacement reactions 2. reactions of acids 3. precipitation reactions | **2(d) Reactivity series**  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(g) Acids, bases and salt preparations**  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  2.34 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 those of barium, calcium and lead(II) * common carbonates are insoluble except those of sodium, potassium and ammonium * common hydroxides are insoluble except those of sodium, potassium and ammonium (calcium hydroxide is slightly soluble) |
| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 1. know that a hydrocarbon is a compound of hydrogen and carbon only | **4(a) Introduction**  4.1 know that a hydrocarbon is a compound of hydrogen and carbon only |
| 2. be able to represent organic molecules using empirical formulae, molecular formulae, general formulae, structural formulae, displayed formulae and skeletal formulae | **4(a) Introduction**  4.2 understand how to represent organic molecules using empirical formulae, molecular formulae, general formulae, structural formulae and displayed formulae |
| 3. know what is meant by the terms ‘homologous series’ and ‘functional group’ | **4(a) Introduction**  4.3 know what is meant by the terms homologous series, functional group and isomerism |
| 4. be able 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 know prefixes for compounds up to C10* | **4(a) Introduction**  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* |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 5. be able to classify reactions as addition, elimination, substitution, oxidation, reduction, hydrolysis or polymerisation | **4(a) Introduction**  4.6 understand how to classify reactions of organic compounds as substitution, addition and combustion  *knowledge of reaction mechanisms is not required*  **4(e) Alcohols**  **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(h) Synthetic polymers**  4.44 know that an addition polymer is formed by joining up many small molecules called monomers  **4.48C know that condensation polymerisation, in which a carboxylic acid reacts with a diol, produces a polyester and water** |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 6. understand the term ‘structural isomerism’ and determine the possible structural, displayed and skeletal formulae of an organic molecule, given its molecular formula | **4(h) Synthetic polymers**  4.3 know what is meant by the terms homologous series, functional group and isomerism  4.5 understand how to write the possible structural and displayed formulae of an organic molecule given its molecular formula  **4(c) Alkanes**  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(d) Alkenes**  4.26 understand how to draw the structural and displayed formulae for alkenes with up to four carbon atoms in the molecule, and to name the unbranched-chain isomers  *knowledge of cis-trans or E/Z notation is not required* |
| 8. know the general formula for alkanes | **4(c) Alkanes**  4.19 know the general formula for alkanes |
| 9. know that alkanes and cycloalkanes are saturated hydrocarbons | **4(c) Alkanes**  4.20 explain why alkanes are classified as saturated hydrocarbons |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | International GCSE Chemistry |
| 10. understand that alkane fuels are obtained from the fractional distillation, cracking and reforming of crude oil  *Reforming is described as the processing of straight-chain hydrocarbons into branched-chain alkanes and cyclic hydrocarbons for efficient combustion.* | **4(b) Crude oil**  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  4.17 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) |
| 11. know that pollutants, including carbon monoxide, oxides of nitrogen and sulfur, carbon particulates and unburned hydrocarbons, are formed during the combustion of alkane fuels | **4(b) Crude oil**  4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air  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 I hydrocarbon fuels results in the formation of sulfur dioxide |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 12. understand the problems arising from pollutants from the combustion of fuels, limited to the toxicity of carbon monoxide and the acidity of oxides of nitrogen and sulfur | **4(b) Crude oil**  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* |
| 16. understand the reactions of alkanes with:   1. oxygen in air (combustion) 2. halogens, in terms of the mechanism of radical substitution through initiation, propagation and termination steps   *The use of curly half-arrows is not expected in this mechanism*. | **4(b) Crude oil**  4.12 know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air  **4(c) Alkanes**  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* |
| 18. know the general formula for alkenes | **4(d) Alkenes**  4.24 know the general formula for alkenes |
| 19. know that alkenes and cycloalkenes are unsaturated hydrocarbons | **4(d) Alkenes**  4.23 know that alkenes contain the functional group >C=C<  4.25 explain why alkenes are classified as unsaturated hydrocarbons |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 1. understand the addition reactions of alkenes with:    1. hydrogen, in the presence of a nickel catalyst, to form an alkane   *Knowledge of the application of this reaction to the manufacture of margarine by catalytic hydrogenation of unsaturated vegetable oils is expected*.   * 1. halogens to produce dihalogenoalkanes   2. hydrogen halides to produce halogenoalkanes   3. steam, in the presence of an acid catalyst, to produce alcohols   4. potassium manganate(VII), in acid conditions, to oxidise the double bond and produce a diol | **4(d) Alkenes**  4.27 describe the reactions of alkenes with bromine to produce dibromoalkanes  **4(e) Alcohols**  **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 300oC 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** |
| 25. know the qualitative test for a C=C double bond using bromine or bromine water | **4(d) Alkenes**  4.28 describe how bromine water can be used to distinguish between an alkane and an alkene |

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| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 26. know that alkenes form polymers through addition polymerisation  *Be able to identify the repeat unit of an addition polymer given the monomer, and vice versa.* | **4(h) Synthetic polymers**  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(tetrafluoroethene)  4.46 understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa |
| 27. know that waste polymers can be separated into specific types of polymer for:   1. recycling 2. incineration to release energy 3. use as a feedstock for cracking | **4(h) Synthetic polymers**  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 |
| 37. know that alcohols can be classified as primary, secondary or tertiary | **4(e) Alcohols**  **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* |
| **GCE Chemistry**  **Topic 6 – Organic Chemistry I** | **International GCSE Chemistry** |
| 38. understand the reactions of alcohols with:  i oxygen in air (combustion)   * 1. halogenating agents:      + PCl5 to produce chloroalkanes      + 50% concentrated sulfuric acid and potassium bromide to produce bromoalkanes      + red phosphorus and iodine to produce iodoalkanes   2. potassium dichromate(VI) in dilute sulfuric acid to oxidise primary alcohols to aldehydes (including a test for the aldehyde using Benedict’s/Fehling’s solution) and carboxylic acids, and secondary alcohols to ketones   *In equations, the oxidising agent can be represented as [O].*   * 1. concentrated phosphoric acid to form alkenes by elimination   *Descriptions of the mechanisms of these reactions are not expected* | **4(e) Alcohols**  **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** |
| **GCE Chemistry**  **Topic 8 – Energetics I** | **International GCSE Chemistry** |
| 3. be able to construct and interpret enthalpy level diagrams showing an enthalpy change, including appropriate signs for exothermic and endothermic reactions  *Activation energy is not shown in enthalpy level diagrams but it is shown in reaction profile diagrams.* | **3(a) Energetics**  **3.5C draw and explain energy level diagrams to represent exothermic and endothermic reactions** |
| 5. understand experiments to measure enthalpy changes in terms of:   1. processing results using the expression:   energy transferred = mass x specific heat capacity × temperature change (Q=mcΔT)   1. evaluating sources of error and assumptions made in the experiments   *Students will need to consider experiments where*:   * + *substances are mixed in an insulated container and the temperature change is measured*   + *enthalpy of combustion is measured, such as using a series of alcohols in a spirit burner*   + *the enthalpy change cannot be measured directly*. | **3(a) Energetics**  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 = mc*Δ*T*  3.8 *practical: investigate temperature changes accompanying some of the following types of change:*   * *salts dissolving in water* * *neutralisation reactions* * *displacement reactions* * *combustion reactions* |

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| **GCE Chemistry**  **Topic 8 – Energetics I** | **International GCSE Chemistry** |
| 6. be able to calculate enthalpy changes in kJ mol-1 from given experimental results  *Both a sign and units are expected in the final answer.* | **3(a) Energetics**  3.4 calculate the molar enthalpy change (Δ*H*) from the heat energy change, *Q* |
| 10. be able to calculate an enthalpy change of reaction  using mean bond enthalpies and explain the limitations  of this method of calculation | **3(a) Energetics**  **3.7C use bond energies to calculate the enthalpy change during a chemical reaction** |
| 11. be able to calculate mean bond enthalpies from enthalpy changes of reaction | **3(a) Energetics**  **3.7C use bond energies to calculate the enthalpy change during a chemical reaction** |

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| **GCE Chemistry**  **Topic 9 – Kinetics I** | **International GCSE Chemistry** |
| 1. understand, in terms of collision theory, the effect of a change in concentration, temperature, pressure and surface area on the rate of a chemical reaction. | **3(b) Rates of reaction**  3.9 describe experiments to investigate the effects of change 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 hydrochloric acid* |

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| **GCE Chemistry**  **Topic 9 – Kinetics I** | **International GCSE Chemistry** |
| 5. understand the role of catalysts in providing alternative reaction routes of lower activation energy | **3(b) Rates of reaction**  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  *3.16 practical: investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution* |
| 6. be able to draw the reaction profiles for uncatalysed and catalysed reactions | **3(b) Rates of reaction**  **3.14C draw and explain reaction profile diagrams showing Δ*H* and activation energy** |

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| **GCE Chemistry**  **Topic 10 – Equilibrium I** | **International GCSE Chemistry** |
| 1. know that many reactions are readily reversible and that they can reach a state of dynamic equilibrium in which:   1. the rate of the forward reaction is equal to the rate of the backward reaction 2. the concentrations of reactants and products remain constant | **3(c) Reversible reactions and equilibria**  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  **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** |

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| **GCE Chemistry**  **Topic 10 – Equilibrium I** | **International GCSE Chemistry** |
| 2. be able to predict and justify the qualitative effect of a change in temperature, concentration or pressure on a homogeneous system in equilibrium | **3.22C know the effect of changing either temperature or pressure on the position of equilibrium in a reversible reaction:**   * **an increase (or decrease) in temperature shifts the position of equilibrium in the direction of the endothermic (or exothermic) reaction** * **an increase (or decrease) in pressure shifts the position of equilibrium in the direction that produces fewer (or more) moles of gas**   ***References to Le Chatelier’s principle are not required*** |