OCR GCSE (9-1) Chemistry A (Gateway Science)

# Overview of Chemistry GCSE Scheme of work

|  |  |  |  |
| --- | --- | --- | --- |
| Week | Statements | Teaching activities | Notes |
| 1 | CM1.1i represent three-dimensional shapes in two dimensions and vice versa when looking at chemical structures, e.g. allotropes of carbon M5b |  |  |
|  | C1.1a describe the main features of the particle model in terms of states of matter and change of state WS1.1a, WS1.1b |  |  |
|  | C1.1b explain in terms of the particle model the distinction between physical changes and chemical changes |  |  |
|  | **C1.1c explain the limitations of the particle model in relation to changes of state when particles are represented by inelastic spheres (e.g. like bowling balls) to include that it does not take into account the forces of attraction between particles, the size of particles and the space between them** WS1.1c |  |  |
|  | CM1.2i relate size and scale of atoms to objects in the physical world M4a |  |  |
|  | CM1.2ii estimate size and scale of atoms and nanoparticles (separate science only) M1c |  |  |
|  | C1.2a describe how and why the atomic model has changed over time to include the models of Dalton, Thomson, Rutherford, Bohr, Geiger and Marsden WS1.1a, WS1.1i, WS1.2b |  |  |
|  | C1.2b describe the atom as a positively charged nucleus surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with most of the mass in the nucleus WS1.4a |  |  |
|  | C1.2c recall the typical size (order of magnitude) of atoms and small molecules to include the concept that typical atomic radii and bond length are in the order of 10-10m WS1.1c, WS1.4b, WS1.4c, WS1.4d, WS1.4e, WS1.4f |  |  |
|  | C1.2d recall relative charges and approximate relative masses of protons, neutrons and electrons WS1.4a, WS1.4b, WS1.4c |  |  |
|  | C1.2e calculate numbers of protons, neutrons and electrons in atoms and ions, given atomic number and mass number of isotopes to include definitions of an ion, atomic number, mass number and an isotope, also the standard notation to represent these WS1.3c, WS1.4b |  |  |
|  | CM2.1i arithmetic computation, ratio, percentage and multistep calculations permeates quantitative chemistry M1a, M1c, M1d |  |  |
|  | CM2.1ii provide answers to an appropriate number of significant figures M2a |  |  |
|  | CM2.1iii change the subject of a mathematical equation M3b, M3c |  |  |
|  | CM2.1iv arithmetic computation and ratio when determining empirical formulae, balancing equations M3b, M3c |  |  |
|  | C2.1a explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term ‘pure’ (PAG C3, PAG C4, PAG C7) WS1.4a |  |  |
|  | C2.1b use melting point data to distinguish pure from impure substances |  |  |
|  | C2.1c calculate relative formula masses of species separately and in a balanced chemical equation to include the definition of relative atomic mass, relative molecular mass and relative formula mass WS1.3c, WS1.4c |  |  |
|  | C2.1d deduce the empirical formula of a compound from the relative numbers of atoms present or from a model or diagram and vice versa WS1.1b, WS1.4a |  |  |
|  | C2.1e explain that many useful materials are formulations of mixtures to include alloys |  |  |
|  | C2.1f describe, explain and exemplify the processes of filtration, crystallisation, simple distillation, and fractional distillation to include knowledge of the techniques of filtration, crystallisation, simple distillation and fractional distillation (PAG C3, PAG C4, PAG C7) WS1.2b, WS1.2c, WS2a, WS2b |  |  |
|  | C2.1g describe the techniques of paper and thin layer chromatography (PAG C3) WS1.2b, WS1.2c, WS1.4a, WS2a, WS2b |  |  |
|  | C2.1h recall that chromatography involves a stationary and a mobile phase and that separation depends on the distribution between the phases to include identification of the mobile and stationary phases WS1.4a |  |  |
|  | C2.1i interpret chromatograms, including measuring Rf values to include the recall and the use of the formula WS1.3c, WS1.4a |  |  |
|  | C2.1j suggest suitable purification techniques given information about the substances involved |  |  |
|  | C2.1k suggest chromatographic methods for distinguishing pure from impure substances to include paper, thin layer (TLC) and gas chromatography (PAG C3) WS1.4a |  |  |
|  | CM2.2ii represent three-dimensional shapes in two dimensions and vice versa when looking at chemical structures, e.g. allotropes of carbon M5b |  |  |
|  | CM2.2i estimate size and scale of atoms and nanoparticles (separate science only) M1c |  |  |
|  | CM2.2iii translate information between diagrammatic and numerical forms M4a |  |  |
|  | C2.2a describe metals and non-metals and explain the differences between them on the basis of their characteristic physical and chemical properties to include physical properties, formation of ions and common reactions, e.g. with oxygen to form oxides WS1.3f, WS1.4a |  |  |
|  | C2.2b explain how the atomic structure of metals and non-metals relates to their position in the Periodic Table |  |  |
|  | C2.2c explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atoms and hence to its atomic number to include group number and period number WS1.4a |  |  |
|  | C2.2d describe and compare the nature and arrangement of chemical bonds in:  i. ionic compounds  ii. simple molecules  iii. giant covalent structures  iv. polymers  v. metals  WS1.4a |  |  |
|  | C2.2e explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons WS1.4a |  |  |
|  | C2.2f construct dot and cross diagrams for simple covalent and binary ionic substances WS1.4a |  |  |
|  | C2.2g describe the limitations of particular representations and models to include dot and cross diagrams, ball and stick models and two and three dimensional representations WS1.1c |  |  |
|  | C2.2h explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number WS1.1b, WS1.3f, WS1.4a |  |  |
|  | C2.2i explain in terms of atomic number how Mendeleev’s arrangement was refined into the modern Periodic Table WS1.1a, WS1.4a |  |  |
|  | CM2.3i represent three-dimensional shapes in two dimensions and vice versa when looking at chemical structures, e.g. allotropes of carbon M5b |  |  |
|  | CM2.3ii relate size and scale of atoms to objects in the physical world (separate science only) M4a |  |  |
|  | CM2.3iii estimate size and scale of atoms and nanoparticles (separate science only) M1d |  |  |
|  | CM2.3v use ratios when considering relative sizes and surface area to volume comparisons (separate science only) M1c |  |  |
|  | CM2.3iv interpret, order and calculate with numbers written in standard form when dealing with nanoparticles (separate science only) M1b |  |  |
|  | CM2.3vi calculate surface areas and volumes of cubes (separate science only) M5c |  |  |
|  | C2.3a recall that carbon can form four covalent bonds WS1.4a |  |  |
|  | C2.3b explain that the vast array of natural and synthetic organic compounds occur due to the ability of carbon to form families of similar compounds, chains and rings |  |  |
|  | C2.3c explain the properties of diamond, graphite, fullerenes and graphene in terms of their structures and bonding WS1.4a |  |  |
|  | C2.3d use ideas about energy transfers and the relative strength of chemical bonds and intermolecular forces to explain the different temperatures at which changes of state occur WS1.2a, WS1.3f, WS1.4a, WS1.4c |  |  |
|  | C2.3e use data to predict states of substances under given conditions to include data such as temperature and how this may be linked to changes of state |  |  |
|  | C2.3f explain how the bulk properties of materials (ionic compounds; simple molecules; giant covalent structures; polymers and metals) are related to the different types of bonds they contain, their bond strengths in relation to intermolecular forces and the ways in which their bonds are arranged to include recognition that the atoms themselves do not have the bulk properties of these materials WS1.4a |  |  |
|  | C2.3g compare ‘nano’ dimensions to typical dimensions of atoms and molecules (separate science only) WS1.4c, WS1.4d |  |  |
|  | C2.3h describe the surface area to volume relationship for different-sized particles and describe how this affects properties (separate science only) WS1.4c |  |  |
|  | C2.3i describe how the properties of nanoparticulate materials are related to their uses (separate science only) WS1.1c, WS1.1e, WS1.3c, WS1.4a |  |  |
|  | C2.3j explain the possible risks associated with some nanoparticulate materials (separate science only) WS1.1d, WS1.1f, WS1.1h, WS1.1i WS1.4a |  |  |
|  | CM3.1i arithmetic computation and ratio when determining empirical formulae, balancing equations M1a, M1c |  |  |
|  | **CM3.1ii calculations with numbers written in standard form when using the Avogadro constant** M1b |  |  |
|  | CM3.1iii provide answers to an appropriate number of significant figures M2a |  |  |
|  | CM3.1iv convert units where appropriate **particularly from mass to moles** M1c |  |  |
|  | C3.1a use chemical symbols to write the formulae of elements and simple covalent and ionic compounds WS1.4a |  |  |
|  | C3.1b use the names and symbols of common elements and compounds and the principle of conservation of mass to write formulae and balanced chemical equations **and half equations** WS1.4a |  |  |
|  | C3.1c use the names and symbols of common elements from a supplied Periodic Table to write formulae and balanced chemical equations where appropriate to include the first 20 elements, Groups 1, 7, and 0 and other common elements included within the specification |  |  |
|  | C3.1d use the formula of common ions to deduce the formula of a compound |  |  |
|  | **C3.1e construct balanced ionic equations** |  |  |
|  | C3.1f describe the physical states of products and reactants using state symbols (s, l, g and aq) |  |  |
|  | **C3.1g recall and use the definitions of the Avogadro constant (in standard form) and of the mole to include the calculation of the mass of one atom/molecule** WS1.4b, WS1.4c, WS1.4d, WS1.4f |  |  |
|  | **C3.1h explain how the mass of a given substance is related to the amount of that substance in moles and vice versa** WS1.4b, WS1.4c |  |  |
|  | C3.1i recall and use the law of conservation of mass WS1.4c |  |  |
|  | C3.1j explain any observed changes in mass in non-enclosed systems during a chemical reaction and explain them using the particle model WS1.1b, WS1.4c |  |  |
|  | **C3.1k deduce the stoichiometry of an equation from the masses of reactants and products and explain the effect of a limiting quantity of a reactant** WS1.3c, WS1.4c, WS1.4d, WS1.4f |  |  |
|  | **C3.1l use a balanced equation to calculate masses of reactants or products** WS1.3c, WS1.4c |  |  |
|  | CM3.2i interpretation of charts and graphs when dealing with reaction profiles M4a |  |  |
|  | CM3.2ii arithmetic computation when calculating energy changes M1a |  |  |
|  | C3.2a distinguish between endothermic and exothermic reactions on the basis of the temperature change of the surroundings (PAG C8) WS1.4c |  |  |
|  | C3.2b draw and label a reaction profile for an exothermic and an endothermic reaction to include activation energy, energy change, reactants and products WS1.3b, WS1.3c, WS1.3d, WS1.3e, WS1.3g, WS1.3h, WS1.4c |  |  |
|  | C3.2c explain activation energy as the energy needed for a reaction to occur WS1.4c |  |  |
|  | **C3.2d calculate energy changes in a chemical reaction by considering bond making and bond breaking energies** WS1.3c, WS1.4c |  |  |
|  | CM3.3.i arithmetic computation, ratio, percentage and multistep calculations permeates quantitative chemistry M1a, M1c, M1d |  |  |
|  | C3.3a explain reduction and oxidation in terms of loss or gain of oxygen, identifying which species are oxidised and which are reduced to include the concept of oxidising agent and reducing agent WS1.4a |  |  |
|  | **C3.3b explain reduction and oxidation in terms of gain or loss of electrons, identifying which species are oxidised and which are reduced** WS1.4a |  |  |
|  | C3.3c recall that acids form hydrogen ions when they dissolve in water and solutions of alkalis contain hydroxide ions WS1.4a |  |  |
|  | C3.3d describe neutralisation as acid reacting with alkali or a base to form a salt plus water (PAG C7) WS1.4a |  |  |
|  | C3.3e recognise that aqueous neutralisation reactions can be generalised to hydrogen ions reacting with hydroxide ions to form water WS1.4a |  |  |
|  | C3.3f recall that carbonates and some metals react with acids and write balanced equations predicting products from given reactants WS1.4a |  |  |
|  | **C3.3g use and explain the terms dilute and concentrated (amount of substance) and weak and strong (degree of ionisation) in relation to acids include ratio of amount of acid to volume of solution** WS1.4a |  |  |
|  | C3.3h recall that relative acidity and alkalinity are measured by pH WS1.4a |  |  |
|  | **C3.3i describe neutrality and relative acidity and alkalinity in terms of the effect of the concentration of hydrogen ions on the numerical value of pH (whole numbers only) to include pH of titration curves (PAG C6)** WS1.4a |  |  |
|  | **C3.3j recall that as hydrogen ion concentration increases by a factor of ten the pH value of a solution decreases by a factor of one** WS1.4a |  |  |
|  | C3.3k describe techniques and apparatus used to measure pH (PAG C6) |  |  |
|  | CM3.4i arithmetic computation and ratio when determining empirical formulae, balancing equations M1a, M1c |  |  |
|  | C3.4a recall that metals (or hydrogen) are formed at the cathode and non-metals are formed at the anode in electrolysis using inert electrodes to include the terms cations and anions WS1.4a |  |  |
|  | C3.4b predict the products of electrolysis of binary ionic compounds in the molten state to include compounds such as NaC*l* WS1.2a, WS1.2b, WS1.2c, WS1.4a, WS2a, WS2b |  |  |
|  | C3.4c describe competing reactions in the electrolysis of aqueous solutions of ionic compounds in terms of the different species present to include the electrolysis of aqueous NaC*l* and CuSO4 using inert electrodes (PAG C2) WS1.4a |  |  |
|  | C3.4d describe electrolysis in terms of the ions present and reactions at the electrodes |  |  |
|  | C3.4e describe the technique of electrolysis using inert and non-inert electrodes |  |  |
|  | CM4.1i arithmetic computation and ratio when determining empirical formulae, balancing equations M1a, M1c |  |  |
|  | C4.1a recall the simple properties of Groups 1, 7 and 0 to include physical and chemical properties (PAG C1) WS1.2a, WS1.4a WS1.4c |  |  |
|  | C4.1b explain how observed simple properties of Groups 1, 7 and 0 depend on the outer shell of electrons of the atoms and predict properties from given trends down the groups to include ease of electron gain or loss; physical and chemical properties |  |  |
|  | C4.1c recall the general properties of transition metals and their compounds and exemplify these by reference to a small number of transition metals to include melting point, density, reactivity, formation of coloured ions with different charges and uses as catalysts (PAG C1, PAG C5, PAG C8) (separate science only) WS1.4a |  |  |
|  | C4.1d predict possible reactions and probable reactivity of elements from their positions in the periodic table WS1.1b, WS1.2a, WS1.4a |  |  |
|  | C4.1e explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion (PAG C1, PAG C7, PAG C8) WS1.4a |  |  |
|  | C4.1f deduce an order of reactivity of metals based on experimental results (PAG C1, PAG C7, PAG C8) WS1.3e, WS2a |  |  |
|  | CM4.2i interpret charts, particularly in spectroscopy (separate science only) M4a |  |  |
|  | C4.2b describe tests to identify aqueous cations and aqueous anions to include calcium, copper, iron (II), iron (III) and zinc using sodium hydroxide; carbonates and sulfates using aqueous barium chloride followed by hydrochloric acid; chloride, bromide and iodide using silver nitrate (PAG C5) (separate science only) WS1.4a |  |  |
|  | C4.2c describe how to perform a flame test (PAG C5) (separate science only) WS1.2b, WS1.2c, WS2a, WS2b |  |  |
|  | C4.2d identify species from test results (PAG C5) |  |  |
|  | C4.2e interpret flame tests to identify metal ions to include the ions of lithium, sodium, potassium, calcium and copper (separate science only) WS1.4a |  |  |
|  | C4.2f describe the advantages of instrumental methods of analysis to include sensitivity, accuracy and speed (separate science only) WS1.1e, WS1.2c, WS1.2d, WS1.2e |  |  |
|  | C4.2g interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set of data in the same form (separate science only) WS1.3e |  |  |
|  | **CM5.1i calculations with numbers written in standard form when using the Avogadro constant** (separate science only) M1b |  |  |
|  | CM5.1ii provide answers to an appropriate number of significant figures (separate science only) M2a |  |  |
|  | CM5.1iii convert units where appropriate **particularly from mass to moles** (separate science only) M1c |  |  |
|  | CM5.1iv arithmetic computation, ratio, percentage and multistep calculations permeates quantitative chemistry (separate science only) M1a, M1c, M1d |  |  |
|  | CM5.1v arithmetic computation when calculating yields and atom economy (separate science only) M1a, M1c |  |  |
|  | CM5.1vi change the subject of a mathematical equation (separate science only) M3b, M3c |  |  |
|  | **C5.1a explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution** (separate science only) WS1.3c, WS1.4a, WS1.4c |  |  |
|  | C5.1b describe the technique of titration (separate science only) |  |  |
|  | **C5.1c explain the relationship between the volume of a solution of known concentration of a substance and the volume or concentration of another substance that react completely together** (separate science only) WS1.3c, WS1.4a, WS1.4b, WS1.4c |  |  |
|  | **C5.1d describe the relationship between molar amounts of gases and their volumes and vice versa (PAG C8)** (separate science only) WS1.3c, WS1.4a, WS1.4c, WS1.4d, WS1.4f |  |  |
|  | **C5.1e calculate the volumes of gases involved in reactions using the molar gas volume at room temperature and pressure (assumed to be 24dm3)** (separate science only) |  |  |
|  | **C5.1f explain how the mass of a solute and the volume of the solution is related to the concentration of the solution** WS1.3c, WS1.4a, WS1.4c |  |  |
|  | C5.1g calculate the theoretical amount of a product from a given amount of reactant (separate science only) WS1.3c |  |  |
|  | C5.1h calculate the percentage yield of a reaction product from the actual yield of a reaction (separate science only) WS1.2a, WS1.2b, WS1.2c, WS1.2d, WS1.3c, WS2a, WS2b |  |  |
|  | C5.1i define the atom economy of a reaction (separate science only) |  |  |
|  | C5.1j calculate the atom economy of a reaction to form a desired product from the balanced equation (separate science only) WS1.3c |  |  |
|  | **C5.1k explain why a particular reaction pathway is chosen to produce a specified product given appropriate data to include data such as atom economy (if not calculated), yield, rate, equilibrium position and usefulness of by- products** (separate science only) WS1.3c, WS1.3f |  |  |
|  | M5.2i arithmetic computation, ratio when measuring rates of reaction M1a, M1c |  |  |
|  | M5.2ii drawing and interpreting appropriate graphs from data to determine rate of reaction M4b, M4c |  |  |
|  | M5.2iii determining gradients of graphs as a measure of rate of change to determine rate M4d, M4e |  |  |
|  | M5.2iv proportionality when comparing factors affecting rate of reaction M1c |  |  |
|  | C5.2a suggest practical methods for determining the rate of a given reaction (PAG C1, PAG C8) WS1.2b, WS1.2c, WS1.2d, WS2a, WS2b |  |  |
|  | C5.2b interpret rate of reaction graphs to include 1/t is proportional to rate and gradients of graphs (not order of reaction) (PAG C1, PAG C7, PAG C8) WS1.3a, WS1.3b, WS1.3c, WS1.3d, WS1.3e, WS1.3f, WS1.3g, WS1.3h, WS1.3i, WS2b |  |  |
|  | C5.2c describe the effect of changes in temperature, concentration, pressure, and surface area on rate of reaction (PAG C1, PAG C8) WS1.4c |  |  |
|  | C5.2d explain the effects on rates of reaction of changes in temperature, concentration and pressure in terms of frequency and energy of collision between particles (PAG C1, PAG C8) WS1.4c |  |  |
|  | C5.2e explain the effects on rates of reaction of changes in the size of the pieces of a reacting solid in terms of surface area to volume ratio |  |  |
|  | C5.2f describe the characteristics of catalysts and their effect on rates of reaction |  |  |
|  | C5.2g identify catalysts in reactions WS1.4c |  |  |
|  | C5.2h explain catalytic action in terms of activation energy to include reaction profiles |  |  |
|  | C5.2i recall that enzymes act as catalysts in biological systems |  |  |
|  | CM5.3i arithmetic computation, ratio when measuring rates of reaction M1a, M1c |  |  |
|  | CM5.3ii drawing and interpreting appropriate graphs from data to determine rate of reaction M4b, M4c |  |  |
|  | CM5.3iii determining gradients of graphs as a measure of rate of change to determine rate M4d, M4e |  |  |
|  | CM5.3iv proportionality when comparing factors affecting rate of reaction M1c |  |  |
|  | C5.3a recall that some reactions may be reversed by altering the reaction conditions |  |  |
|  | C5.3b recall that dynamic equilibrium occurs in a closed system when the rates of forward and reverse reactions are equal |  |  |
|  | **C5.3c predict the effect of changing reaction conditions on equilibrium position and suggest appropriate conditions to produce as much of a particular product as possible to include Le Chatelier's principle concerning concentration, temperature and pressure** WS1.2a, WS1.2b, WS1.2c, WS1.4c, WS2a, WS2b |  |  |
|  | CM6.1i arithmetic computation, ratio when measuring rates of reaction M1a, M1c |  |  |
|  | CM6.1ii drawing and interpreting appropriate graphs from data to determine rate of reaction M4b, M4c |  |  |
|  | CM6.1iii determining gradients of graphs as a measure of rate of change to determine rate (separate science only) M4d, M4e |  |  |
|  | CM6.1iv proportionality when comparing factors affecting rate of reaction (separate science only) M1c |  |  |
|  | C6.1a explain, using the position of carbon in the reactivity series, the principles of industrial processes used to extract metals, including extraction of a non-ferrous metal (PAG C1) WS1.4a |  |  |
|  | C6.1b explain why and how electrolysis is used to extract some metals from their ores (PAG C2) WS1.3a, WS1.3b, WS1.3c, WS1.3d, WS1.3e, WS1.3g, WS1.3h, WS1.3i, WS1.4, WS2b |  |  |
|  | **C6.1c evaluate alternative biological methods of metal extraction to include bacterial and phytoextraction** WS1.1a, WS1.1e |  |  |
|  | **C6.1d explain the trade-off between rate of production of a desired product and position of equilibrium in some industrially important processes to include the Haber process and Contact process** (separate science only) WS1.3f |  |  |
|  | **C6.1e interpret graphs of reaction conditions versus rate** (separate science only) WS1.3e |  |  |
|  | **C6.1f explain how the commercially used conditions for an industrial process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate** (separate science only) WS1.1d |  |  |
|  | C6.1g explain the importance of the Haber process in agricultural production (separate science only) WS1.4a |  |  |
|  | C6.1h compare the industrial production of fertilisers with laboratory syntheses of the same products (PAG C6) (separate science only) WS1.2a, WS1.2b, WS1.2c, WS1.2d, WS1.2e, WS2a, WS2b |  |  |
|  | C6.1i recall the importance of nitrogen, phosphorus and potassium compounds in agricultural production (separate science only) WS1.4a |  |  |
|  | C6.1j describe the industrial production of fertilisers as several integrated processes using a variety of raw materials to include ammonium nitrate and ammonium sulfate (separate science only) WS1.2a, WS1.2b, WS1.2c, WS1.2e, WS2a, WS2b |  |  |
|  | C6.1k describe the basic principles in carrying out a life-cycle assessment of a material or product |  |  |
|  | C6.1l interpret data from a life-cycle assessment of a material or product |  |  |
|  | C6.1m describe a process where a material or product is recycled for a different use, and explain why this is viable WS1.1f, WS1.1g |  |  |
|  | C6.1n evaluate factors that affect decisions on recycling WS1.1f, WS1.1g |  |  |
|  | C6.1o describe the composition of some important alloys in relation to their properties and uses to include steel, brass, bronze, solder, duralumin (separate science only) |  |  |
|  | C6.1p describe the process of corrosion and the conditions which cause corrosion to include iron and other metals (separate science only) |  |  |
|  | C6.1q explain how mitigation of corrosion is achieved by creating a physical barrier to oxygen and water and by sacrificial protection (separate science only) |  |  |
|  | C6.1r compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals (separate science only) |  |  |
|  | C6.1s explain how the properties of materials are related to their uses and select appropriate materials given details of the usage required (separate science only) WS1.1e, WS1.3f |  |  |
|  | CM6.2i represent three-dimensional shapes in two dimensions and vice versa when looking at chemical structures, e.g. allotropes of carbon (separate science only) M5b |  |  |
|  | C6.2a recognise functional groups and identify members of the same homologous series to include homologous series, of alkanes, alkenes, alcohols and carboxylic acids (separate science only) |  |  |
|  | C6.2b name and draw the structural formulae, using fully displayed formulae, of the first four members of the straight chain alkanes, alkenes, alcohols and carboxylic acids (separate science only) WS1.4a |  |  |
|  | C6.2c predict the formulae and structures of products of reactions of the first four and other given members of the homologous series of alkanes, alkenes and alcohols to include combustion; addition of bromine and hydrogen across a double bond; oxidation of alcohols to carboxylic acids using potassium manganate(VII) (separate science only) |  |  |
|  | C6.2d recall the basic principles of addition polymerisation by reference to the functional group in the monomer and the repeating units in the polymer (separate science only) |  |  |
|  | **C6.2e explain the basic principles of condensation polymerisation to include reference to the functional groups of the monomers, the minimum number of functional groups within a monomer, the number of repeating units in the polymer, and simultaneous formation of a small molecule, e.g. a polyester or polyamide, using block diagrams to represent polymers** (separate science only) WS1.4a |  |  |
|  | **C6.2f describe practical techniques to make a polymer by condensation** (separate science only) WS1.2a, WS1.2b, WS1.2c, WS1.4a, WS2a, WS2b |  |  |
|  | C6.2g deduce the structure of an addition polymer from a simple alkene monomer and vice versa to include the following representation of a polymer [repeat unit]n (separate science only) WS1.4a |  |  |
|  | C6.2h recall that DNA is a polymer made from four different monomers called nucleotides and that other important naturally-occurring polymers are based on sugars and amino-acids to include the names of the nucleotides (separate science only) WS1.4a |  |  |
|  | C6.2i recall that it is the generality of reactions of functional groups that determine the reactions of organic compounds (separate science only) WS1.4a |  |  |
|  | C6.2j describe the separation of crude oil by fractional distillation to include the names of the fractions WS1.3f, WS1.4a |  |  |
|  | C6.2k explain the separation of crude oil by fractional distillation to include molecular size and intermolecular forces |  |  |
|  | C6.2l describe the fractions as largely a mixture of compounds of formula CnH2n+2 which are members of the alkane homologous series WS1.4a |  |  |
|  | C6.2m recall that crude oil is a main source of hydrocarbons and is a feedstock for the petrochemical industry WS1.4a |  |  |
|  | C6.2n explain how modern life is crucially dependent upon hydrocarbons and recognise that crude oil is a finite resource WS1.1c, WS1.1f, WS1.1e, WS1.4a |  |  |
|  | C6.2o describe the production of materials that are more useful by cracking to include conditions and reasons for cracking and some of the useful materials produced |  |  |
|  | C6.2p recall that a chemical cell produces a potential difference until the reactants are used up (separate science only) |  |  |
|  | C6.2q evaluate the advantages and disadvantages of hydrogen/oxygen and other fuel cells for given uses to include the chemistry of the hydrogen/oxygen fuel cell (separate science only) WS1.1g, WS1.1i |  |  |
|  | CM6.3i extract and interpret information from charts, graphs and tables M2c, M4a |  |  |
|  | CM6.3ii use orders of magnitude to evaluate the significance of data M2h |  |  |
|  | C6.3a interpret evidence for how it is thought the atmosphere was originally formed to include knowledge of how the composition of the atmosphere has changed over time WS1.3e |  |  |
|  | C6.3b describe how it is thought an oxygen-rich atmosphere developed over time WS1.1a |  |  |
|  | C6.3c describe the greenhouse effect in terms of the interaction of radiation with matter within the atmosphere |  |  |
|  | C6.3d evaluate the evidence for additional anthropogenic (human activity) causes of climate change and describe the uncertainties in the evidence base to include the correlation between change in atmospheric carbon dioxide concentration and the consumption of fossil fuels |  |  |
|  | C6.3e describe the potential effects of increased levels of carbon dioxide and methane on the Earth’s climate and how these effects may be mitigated to include consideration of scale, risk and environmental implications WS1.1f, WS1.1h |  |  |
|  | C6.3f describe the major sources of carbon monoxide, sulfur dioxide, oxides of nitrogen and particulates in the atmosphere and explain the problems caused by increased amounts of these substances WS1.4a |  |  |
|  | C6.3g describe the principal methods for increasing the availability of potable water in terms of the separation techniques used to include ease of treatment of waste, ground and salt water |  |  |