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| **Edexcel Single Chemistry (1CI0) from 2016 Topic C1a&b** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **Topic 1a – Key concepts in chemistry Edexcel Single Chemistry (1CI0) from 2016 Topic C1a&b** | Describe how the Dalton model of an atom has changed over time because of the discovery of subatomic particles |  |  |  |
| Describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by electrons in shells |  |  |  |
| Recall the relative charge and relative mass of: a proton, a neutron and an electron |  |  |  |
| Explain why atoms contain equal numbers of protons and electrons |  |  |  |
| Describe the nucleus of an atom as very small compared to the overall size of the atom |  |  |  |
| Recall that most of the mass of an atom is concentrated in the nucleus |  |  |  |
| Recall the meaning of the term mass number of an atom |  |  |  |
| Describe atoms of a given element as having the same number of protons in the nucleus and that this number is unique |  |  |  |
| Describe what isotopes are |  |  |  |
| Calculate the numbers of protons, neutrons and electrons in atoms given the atomic number and mass number |  |  |  |
| Explain how the existence of isotopes results in relative atomic masses of some elements not being whole numbers |  |  |  |
| **HT ONLY: Calculate the relative atomic mass of an element from the relative masses and abundances of its isotopes** |  |  |  |
| Describe how Mendeleev arranged the elements known at that time, in a periodic table by using properties of these elements and their compounds |  |  |  |
| Describe how Mendeleev used his table to predict the existence and properties of some elements not discovered by then |  |  |  |
| Explain that Mendeleev thought he had arranged elements in order of increasing relative atomic mass but this was not always true |  |  |  |
| Explain the meaning of atomic number of an element in terms of position in the periodic table and number of protons in the nucleus |  |  |  |
| Describe how elements are arranged in the groups and periods of the periodic table |  |  |  |
| Identify elements as metals or non-metals according to their position in the periodic table, explaining this division in terms of atomic structure |  |  |  |
| Predict the electronic configurations of the first 20 elements in the periodic table as diagrams and in the form 2.8.1 etc |  |  |  |
| Explain how the electronic configuration of an element is related to its position in the periodic table |  |  |  |
| Explain how ionic bonds are formed to produce cations and anions, including the use of dot and cross diagrams |  |  |  |
| Recall that an ion is an atom or group of atoms with a positive or negative charge |  |  |  |
| Calculate the numbers of protons, neutrons and electrons in simple ions given the atomic number and mass number |  |  |  |
| Explain the formation of ions in ionic compounds from their atoms, limited to compounds of elements in groups 1, 2, 6 and 7 |  |  |  |
| Explain the use of the endings –ide and –ate in the names of compounds |  |  |  |
| Deduce the formulae of ionic compounds given the formulae of the constituent ions |  |  |  |
| Explain the structure of an ionic compound including a description of the lattice and electrostatic forces |  |  |  |

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| **Topic 1b – Key concepts in chemistry** | Explain how a covalent bond is formed when a pair of electrons is shared between two atoms |  |  |  |
| Recall that covalent bonding results in the formation of molecules |  |  |  |
| Recall the typical size (order of magnitude) of atoms and small molecules |  |  |  |
| Explain the formation of simple molecular, covalent substances, using dot and cross diagrams, including: H, HCl, H20, CH4, O2, CO2 |  |  |  |
| Explain why elements and compounds can be classified as: ionic, simple molecular (covalent), giant covalent and metallic |  |  |  |
| Explain how the structure and bonding of substances results in different physical properties |  |  |  |
| Explain the properties of ionic compounds limited to: melting/boiling points, forces between ions and conductivity |  |  |  |
| Explain the properties of typical covalent, simple molecular compounds limited to: melting/boiling points, forces between ions and conductivity |  |  |  |
| Recall that graphite and diamond are different forms of carbon and that they are examples of giant covalent substances |  |  |  |
| Describe the structures of graphite and diamond |  |  |  |
| Explain, in terms of structure and bonding, why graphite and diamond have different uses |  |  |  |
| Explain the properties of fullerenes including C60 and graphene in terms of their structures and bonding |  |  |  |
| Describe, using poly(ethene) as the example, that simple polymers consist of large molecules containing chains of carbon atoms |  |  |  |
| Explain the properties of metals, including malleability and the ability to conduct electricity |  |  |  |
| Describe the limitations of particular representations and models, to include dot & cross, ball & stick models & 2/3D |  |  |  |
| Describe the properties of most metals |  |  |  |
| Calculate relative formula mass given relative atomic masses |  |  |  |
| Calculate the formulae of simple compounds from reacting masses and understand that these are empirical formulae |  |  |  |
| Deduce: empirical formula of a compound from the formula of its molecule |  |  |  |
| Deduce: molecular formula of a compound from its empirical formula and its relative molecular mass |  |  |  |
| Describe an experiment to determine the empirical formula of a simple compound such as magnesium oxide |  |  |  |
| Explain the law of conservation of mass applied to: a closed system and a non-enclosed system |  |  |  |
| Calculate masses of reactants and products from balanced equations, given the mass of one substance |  |  |  |
| Calculate the concentration of solutions in g dm–3 |  |  |  |
| **HT ONLY: Recall what one mole of particles of a substance is defined as** |  |  |  |
| **HT ONLY: Calculate the number of: moles of particles of a substance in a given mass of that substance and vice versa** |  |  |  |
| **HT ONLY: Calculate the number of: particles of a substance in a given number of moles of that substance and vice versa** |  |  |  |
| **HT ONLY: Calculate the number of: particles of a substance in a given mass of that substance and vice versa** |  |  |  |
| **HT ONLY: Explain why, in a reaction, the mass of product formed is controlled by the mass of the reactant which is not in excess** |  |  |  |
| **HT ONLY: Deduce the stoichiometry of a reaction from the masses of the reactants and products** |  |  |  |

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| **Edexcel Single Chemistry (1CI0) from 2016 Topics C6&7** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **Topic 6 – Groups in the periodic table** | Explain why some elements can be classified as alkali metals, halogens or noble gases, based on their position in the periodic table |  |  |  |
| Recall the physical properties of alkali metals |  |  |  |
| Describe the reactions of lithium, sodium and potassium with water |  |  |  |
| Describe the pattern in reactivity of the alkali metals, lithium, sodium and potassium, with water; and use this pattern to predict the reactivity of other alkali metals |  |  |  |
| Explain this pattern in reactivity in terms of electronic configurations |  |  |  |
| Recall the colours and physical states of chlorine, bromine and iodine at room temperature |  |  |  |
| Describe the pattern in the physical properties of the halogens, chlorine, bromine and iodine, and use this pattern to predict the physical properties of other halogens |  |  |  |
| Describe the chemical test for chlorine |  |  |  |
| Describe the reactions of the halogens, chlorine, bromine and iodine, with metals to form metal halides, and use this pattern to predict the reactions of other halogens |  |  |  |
| Recall that the halogens, chlorine, bromine and iodine, form hydrogen halides which dissolve in water to form acidic solutions, and use this pattern to predict the reactions of other halogens |  |  |  |
| Describe the relative reactivity of the halogens chlorine, bromine and iodine, as shown by their displacement reactions with halide ions and use this to predict the reactions of astatine |  |  |  |
| **HT ONLY: Explain why these displacement reactions are redox reactions in terms of gain and loss of electrons, identifying which of these are oxidised and which are reduced** |  |  |  |
| Explain the relative reactivity of the halogens in terms of electronic configurations |  |  |  |
| Explain why the noble gases are chemically inert, compared with the other elements, in terms of their electronic configurations |  |  |  |
| Explain how the uses of noble gases depend on their inertness, low density and/or non-flammability |  |  |  |
| Describe the pattern in the physical properties of some noble gases and use this pattern to predict the physical properties of other noble gases |  |  |  |
| **Topic 7 - Rates of reaction and energy changes** | *Core Practical: Investigate the effects of changing the conditions of a reaction on the rates of chemical reactions by: measuring the production of a gas/observing a colour change* |  |  |  |
| Suggest practical methods for determining the rate of a given reaction |  |  |  |
| Explain how reactions occur by discussing the collision theory |  |  |  |
| Explain the effects on rates of reaction of changes in temperature, concentration, surface area to volume ratio and pressure in terms of frequency and energy of collisions |  |  |  |
| Interpret graphs of mass, volume or concentration of reactant or product against time |  |  |  |
| Describe what a catalyst is |  |  |  |
| Explain how the addition of a catalyst increases the rate of a reaction in terms of activation energy |  |  |  |
| Recall that enzymes are biological catalysts and that enzymes are used in the production of alcoholic drinks |  |  |  |
| Recall when chemical changes occur that they cause changes in heat energy |  |  |  |
| Describe the differences between endothermic and exothermic in terms of energy taken in or given out |  |  |  |
| Recall if bonds are broken or made for each of the following reactions: endothermic and exothermic |  |  |  |
| Describe why the overall heat energy change for a reaction is exothermic or endothermic in terms of bonds being made or broken |  |  |  |
| **HT ONLY: Calculate the energy change in a reaction given the energies of bonds (in kJ mol–1)** |  |  |  |
| Explain the term activation energy |  |  |  |
| Draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy |  |  |  |

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| **Edexcel Single Chemistry (1CI0) from 2016 Topic C8** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **Topic 8 – Fuels and Earth science** | Recall what a hydrocarbon is |  |  |  |
| Describe and explain what crude oil is and why it is important |  |  |  |
| Describe and explain the separation of crude oil into simpler, more useful mixtures by the process of fractional distillation |  |  |  |
| Recall the names and uses of the following fractions: gases, petrol, kerosene, diesel oil, fuel oil and bitumen |  |  |  |
| Explain how hydrocarbons in different fractions differ from each other in terms of boiling point, number of C & H's, flammability and viscosity |  |  |  |
| Explain what a homologous series of hydrocarbon compounds is |  |  |  |
| Describe the complete combustion of hydrocarbon fuels including energy changes and products |  |  |  |
| Explain why the incomplete combustion of hydrocarbons can produce carbon and carbon monoxide |  |  |  |
| Explain how carbon monoxide behaves as a toxic gas |  |  |  |
| Describe the problems caused by incomplete combustion in appliances that use carbon compounds as fuels |  |  |  |
| Explain how impurities in some hydrocarbon fuels result in the production of sulfur dioxide |  |  |  |
| Explain some problems associated with acid rain |  |  |  |
| Explain why, when fuels are burned in engines, oxides of nitrogen are formed and that they are pollutants |  |  |  |
| Evaluate the advantages and disadvantages of using hydrogen, rather than petrol, as a fuel in cars |  |  |  |
| Recall the names and sources of some renewable fossil fuels |  |  |  |
| Explain what cracking is and why it is necessary |  |  |  |
| Recall that the gases produced by volcanic activity formed the Earth’s early atmosphere |  |  |  |
| Describe what the Earth’s early atmosphere was thought to contain |  |  |  |
| Explain what the oceans were formed from |  |  |  |
| Explain why the amount of carbon dioxide in the atmosphere decreases when the oceans were formed |  |  |  |
| Explain how the growth of primitive plants changes the composition of gases in the atmosphere |  |  |  |
| Describe the chemical test for oxygen |  |  |  |
| Describe and explain the greenhouse effect and name the gases that contribute to it |  |  |  |
| Evaluate the evidence for human activity causing climate change |  |  |  |
| Describe the potential effects on the climate of increased levels of carbon dioxide and methane generated by human activity |  |  |  |
| Describe how effects on the climate may be mitigated: consider scale, risk and environmental implications |  |  |  |

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| **Edexcel Single Chemistry (1CI0) from 2016 Topic C9a&b (Chem only)** | | | | |
| **Topic** | **Student Checklist** | **R** | **A** | **G** |
| **Topic 9a – Separate chemistry 2 part a** | Chem ONLY: Explain why the test for any ion must be unique |  |  |  |
| Chem ONLY: Describe flame tests to identify the following ions in solids: Li+, Na+, K+, Ca2+, Cu2+ including the colours of the flames |  |  |  |
| Chem ONLY: Describe tests to identify the following ions: Al3+, Ca2+, Cu2+, Fe2+, Fe3+, NH4 using NaOH solution |  |  |  |
| Chem ONLY: Describe the chemical test for ammonia |  |  |  |
| Chem ONLY: Describe tests to identify the following ions: CO32–, SO42–, Cl-, Br-, I- |  |  |  |
| *Chem ONLY: Core Practical: Identify the ions in unknown salts, using the tests for the specified cations and anions in the specification* |  |  |  |
| Chem ONLY: Identify the ions in unknown salts, using results of the tests stated |  |  |  |
| Chem ONLY: Describe that instrumental methods of analysis are available and that these may improve sensitivity, accuracy and speed of tests |  |  |  |
| Chem ONLY: Evaluate data from a flame photometer to determine the concentration of ions in dilute solution using a calibration curve |  |  |  |
| Chem ONLY: Evaluate data from a flame photometer to identify metal ions by comparing the data with reference data |  |  |  |
| Chem ONLY: To identify metal ions by comparing the data with reference data |  |  |  |
| Chem ONLY: Recall the formulae of molecules of the alkanes, methane, ethane, propane and butane, and draw the structure of these |  |  |  |
| Chem ONLY: Explain why the alkanes are saturated hydrocarbons |  |  |  |
| Chem ONLY: Recall the formulae of molecules of the alkenes, ethene, propene, butene, and draw the structures (but-1-ene and but-2-ene only) |  |  |  |
| Chem ONLY: Explain why the alkenes are unsaturated hydrocarbons |  |  |  |
| Chem ONLY: Recall the addition reaction of ethene with bromine, showing the structures of reactants and products, and extend this to other alkenes |  |  |  |
| Chem ONLY: Explain how bromine water is used to distinguish between alkanes and alkenes |  |  |  |
| Chem ONLY: Describe how the complete combustion of alkanes and alkenes involves the oxidation of the hydrocarbons, name the products |  |  |  |

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| **Topic 9b – Separate chemistry 2 part b** | Chem ONLY: Recall that a polymer is a substance of high average relative molecular mass made up of small repeating units |  |  |  |
| Chem ONLY: Describe how ethene molecules can combine together in a polymerisation reaction |  |  |  |
| Chem ONLY: Describe that the addition polymer formed is called polyethene |  |  |  |
| Chem ONLY: Describe how other addition polymers can be made by combining together other monomer molecules containing C=C |  |  |  |
| Chem ONLY: Describe how to deduce the structure of a monomer from the structure of an addition polymer and vice versa |  |  |  |
| Chem ONLY: Explain how the uses of polymers are related to their properties and vice versa |  |  |  |
| **HT & Chem ONLY: Explain why polyesters are condensation polymers** |  |  |  |
| **HT & Chem ONLY: Explain how a polyester is formed when a monomer molecule containing two carboxylic acid groups is reacted with a monomer molecule containing two alcohol groups** |  |  |  |
| **HT & Chem ONLY: Explain how a molecule of water is formed each time an ester link is formed** |  |  |  |
| Chem ONLY: Describe some problems associated with polymers including the availability of starting materials |  |  |  |
| Chem ONLY: Describe the advantages and disadvantages of recycling polymers, including economic implications, availability of starting materials and environmental impact |  |  |  |
| Chem ONLY: Recall that DNA is a polymer made from four different monomers called nucleotides |  |  |  |
| Chem ONLY: Recall that starch is a polymer based on sugars |  |  |  |
| Chem ONLY: Recall that proteins are polymers based on amino acids |  |  |  |
| Chem ONLY: Recall the formulae of molecules of the alcohols, methanol, ethanol, propanol and butanol, and draw the structures of these molecules, showing all covalent bonds |  |  |  |
| Chem ONLY: Recall that the functional group in alcohols is –OH |  |  |  |
| *Chem ONLY: Core Practical: Investigate the temperature rise produced in a known mass of water by the combustion of the alcohols ethanol, propanol, butanol and pentanol* |  |  |  |
| Chem ONLY: Recall the formulae of molecules of the carboxylic acids, methanoic, ethanoic, propanoic and butanoic acids, and draw the structures of these molecules, showing all covalent bonds |  |  |  |
| Chem ONLY: Recall that the functional group in carboxylic acids is –COOH |  |  |  |
| Chem ONLY: Recall that ethanol can be oxidised to produce ethanoic acid and extend this to other alcohols |  |  |  |
| Chem ONLY: Recall members of a given homologous series have similar reactions because their molecules contain the same functional group and use this to predict the products of other in series |  |  |  |
| Chem ONLY: Describe the production of ethanol by fermentation of carbohydrates in aqueous solution, using yeast to provide enzymes |  |  |  |
| Chem ONLY: Explain how to obtain a concentrated solution of ethanol by fractional distillation of the fermentation mixture |  |  |  |
| Chem ONLY: Compare the size of nanoparticles with the sizes of atoms and molecules |  |  |  |
| Chem ONLY: Describe how the properties of nanoparticulate materials are related to their uses including surface area to volume ratio of the particles they contain, including sunscreens |  |  |  |
| Chem ONLY: Explain the possible risks associated with some nanoparticulate materials |  |  |  |
| Chem ONLY: Compare, using data, the physical properties of glass and clay ceramics, polymers, composites and metals |  |  |  |
| Chem ONLY: Describe how the properties of nanoparticulate materials are related to their uses including surface area to volume ratio of the particles they contain, including sunscreens |  |  |  |
| Chem ONLY: Explain the possible risks associated with some nanoparticulate materials |  |  |  |
| Chem ONLY: Compare, using data, the physical properties of glass and clay ceramics, polymers, composites and metals |  |  |  |
| Chem ONLY: Explain why the properties of a material make it suitable for a given use and use data to select materials appropriate for specific uses |  |  |  |