(Triple Science) Chemistry Paper 1	Confidence Level		
	Red	Amber	Green
Topic 1a – Key concepts in chemistry (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			
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			
Higher Tier Only			
Calculate the relative atomic mass of an element from the relative masses and abundances of its isotopes			
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, H_20, CH_4, O_2, CO_2			
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 C_{60} 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}			
<u>Higher Tier Only</u>			
Recall what one mole of particles of a substance is defined as			
Calculate the number of: moles of particles of a substance in a given mass of that substance and vice versa			
Calculate the number of: particles of a substance in a given number of moles of that substance and vice versa			
Calculate the number of: particles of a substance in a given mass of that substance and vice versa			
Explain why, in a reaction, the mass of product formed is controlled by the mass of the reactant which is not in excess			
Deduce the stoichiometry of a reaction from the masses of the reactants and products			
<u>Topic 2 – States of matter and mixtures of states of matter</u>			

Describe the arrangement, movement and the relative energy of particles in each of the three states of matter			
Recall the names used for the interconversions between the three states of matter			
Compare physical changes with chemical reactions			
Explain the changes in arrangement, movement and energy of particles during these interconversions			
Predict the physical state of a substance under specified conditions, given suitable data			
Explain the difference between the use of 'pure' in chemistry compared with its everyday use and the differences between a pure substance and a mixture			
Interpret melting point data to distinguish between pure substances and mixtures			
Explain the experimental techniques for separation of mixtures by: simple & fractional distillation, filtration, crystallisation and paper chromatography			
Describe an appropriate experimental technique to separate a mixture when knowing the properties			
Describe what paper chromatography is and explain how it can be used to separate a mixture			
Interpret a paper chromatogram: to distinguish between pure and impure substances			
Interpret a paper chromatogram: to identify substances by comparison with known substances			
Interpret a paper chromatogram: to identify substances by calculation and use of Rf values			
Core Practical: Investigate the composition of inks using simple distillation and paper chromatography			
Describe how: waste and ground water can be made potable, including the need for sedimentation, filtration and chlorination			
Describe how: sea water can be made potable by using distillation			
Describe how: water used in analysis must not contain any dissolved salts			
Topic 3 – Chemical changes			
Recall that acids in solution are sources of hydrogen ions and alkalis in solution are sources of hydroxide ions			
Recall that the pH values of acids, alkalis and neutral			
Recall the effect of acids and alkalis on indicators, including litmus, methyl orange and phenolphthalein			
Core Practical: Investigate the change in pH on adding powdered calcium hydroxide or calcium oxide to a dilute hydrochloric acid			
Recall what is formed when a base of any substance reacts with an acid			
Recall what alkalis and bases are			
Explain the general reactions of aqueous solutions of acids with: metals, metal oxides, metal hydroxides and metal carbonates			
Describe the chemical test for: hydrogen and carbon dioxide (using limewater)			
Describe a neutralisation reaction as a reaction between an acid and a base			
Explain an acid-alkali neutralisation as a reaction in which in terms of the reaction between hydrogen and hydroxide ions			
Explain why, when soluble salts are prepared from an acid and an insoluble reactant: excess reactant is added and excess insoluble reactant is removed			
Explain why, if soluble salts are prepared from an acid and a soluble reactant: titration must be used and what is left after the reaction is only salt and water			
Core Practical: Investigate the preparation of pure, dry hydrated copper sulphate crystals starting from copper oxide including the use of a water bath			
Describe how to carry out an acid-alkali titration, using burette, pipette and a suitable indicator, to prepare a pure, dry salt			

Recall the general rules which describe the solubility of all common sodium, potassium and ammonium salts			
Recall the general rules which describe the solubility of all nitrates			
Recall the general rules which describe the solubility of common chlorides (except those of silver and lead)			
Recall the general rules which describe the solubility of common sulphates (except those of lead, barium and calcium)			
Recall the general rules which describe the solubility of common carbonates and hydroxides (except those of sodium, potassium and ammonium)			
Predict, using solubility rules, whether or not a precipitate will be formed when named solutions are mixed together, naming the precipitate if any is formed			
Describe the method used to prepare a pure, dry sample of an insoluble salt			
Recall that electrolytes are ionic compounds in the molten state or dissolved in water			
Describe electrolysis as a process in which electrical energy, from a direct current supply, decomposes electrolytes			
Explain the movement of ions during electrolysis			
Explain the formation of the products in the electrolysis, using inert electrodes, for copper & sodium chloride solution, sodium sulphate, acidified water & molten lead bromide			
Predict the products of electrolysis of other binary, ionic compounds in the molten state			
Explain the formation of the products in the electrolysis of copper sulfate solution, using copper electrodes, and how this can be used to purify copper			
Core Practical: Investigate the electrolysis of copper sulfate solution with inert electrodes and copper electrodes			
Higher Tier Only			
Recall what the higher the concentration of hydrogen ions and hydroxide ions in a solution does to the pH of a solution			
Recall that as hydrogen ion concentration in a solution increases by a factor of 10, the pH of the solution decreases by 1			
Explain the terms dilute and concentrated, with respect to amount of substances in solution			
Explain the terms weak and strong acids, with respect to the degree of dissociation into ions			
Write half equations for reactions occurring at the anode and cathode in electrolysis			
Explain oxidation and reduction in terms of loss or gain of electrons			
Recall that reduction occurs at the cathode and that oxidation occurs at the anode in electrolysis reactions			
Topic 4 – Extracting metals and equilibria			
Deduce the relative reactivity of some metals, by their reactions with water, acids and salt solutions			
Explain the reactivity series of metals in terms of the reactivity of the metals with water and dilute acids (relative to carbon)			
Recall what ores and native metals are			
Describe what oxidation and reduction are			
Explain why the method used to extract a metal from its ore is related to its position in the reactivity series and the cost of the extraction process (electrolysis and smelting)			
Explain how a metal's relative resistance to oxidation is related to its position in the reactivity series			
Evaluate the advantages of recycling metals			

Describe what a life time assessment for a product involves and what it needs to consider			
Evaluate data from a life cycle assessment of a product			
Recall that chemical reactions are reversible, the use of the symbol $\rightleftharpoons$ in equations and how the direction of some reversible reactions can be altered			
Explain what is meant by dynamic equilibrium			
Describe the formation of ammonia as a reversible reaction in the Haber process			
Recall the conditions for the Haber process			
Higher Tier Only			
Explain displacement reactions as redox reactions, in terms of gain or loss of electrons			
Evaluate alternative biological methods of metal extraction (bacterial and phytoextraction)			
Predict how the position of a dynamic equilibrium is affected by changes in temperature, pressure and concentration			
Topic 5 – Separate chemistry 1			
Chem ONLY: Recall that most metals are transition metals and describe their typical properties			
Chem ONLY: Recall that the oxidation of metals results in corrosion			
Chem ONLY: Explain how rusting of iron can be prevented			
Chem ONLY: Explain how electroplating can be used to improve the appearance and/or the resistance to corrosion of metal objects			
Chem ONLY: Explain, using models, why converting pure metals into alloys often increases the strength of the product			
Chem ONLY: Explain why iron is alloyed with other metals to produce alloy steels			
Chem ONLY: Explain how the uses of metals are related to their properties (and vice versa) for AL, CU, Ag and alloys inc: magnalium and brass			
Chem ONLY: Core Practical: Carry out an accurate acid-alkali titration, using burette, pipette and a suitable indicator			
Chem ONLY: Calculate the percentage yield of a reaction from the actual yield and the theoretical yield			
Chem ONLY: Describe that the actual yield of a reaction is usually less than the theoretical yield and that the causes of this			
Chem ONLY: Recall the atom economy of a reaction forming a desired product			
Chem ONLY: Calculate the atom economy of a reaction forming a desired product			
Chem ONLY: Describe what the Haber process is			
Chem ONLY: Name the elements (in compound form) fertilisers may contain to promote plant growth			
Chem ONLY: Describe how ammonia reacts with nitric acid to produce a salt that is used as a fertiliser			
Chem ONLY: Describe and compare the laboratory and industrial production of ammonium sulfate			
Chem ONLY: Recall that a chemical cell produces a voltage until what happens			
Chem ONLY: Recall that in a hydrogen–oxygen fuel cell hydrogen and oxygen are used to produce a voltage and name the only product			
Chem ONLY: Evaluate the strengths and weaknesses of fuel cells for given uses			
Higher Tier Only			
Calculate the concentration of solutions in mol dm^{-3} and convert concentration in g dm^{-3} into mol dm^{-3} and vice versa			
Carry out simple calculations using the results of titrations to calculate an unknown concentration/volume of a solution			
Explain why a particular reaction pathway is chosen to produce a specified product			
Describe what the molar volume, of any gas at room temperature and pressure is			

Use the molar volume and balanced equations in calculations involving the masses of solids and volumes of gases			
Use Avogadro's law to calculate volumes of gases involved in a gaseous reaction, given the relevant equation			
Predict how the rate of attainment of equilibrium is affected by: changes in temperature, pressure, concentration and use of a catalyst			
Explain how, in industrial reactions, including the Haber process, conditions used are related to cost, energy and acceptable yield			