St Thomas More Catholic Academy
FAITH | EXCELLENCE | RESPECT

Chemistry Curriculum Sequence – Key Stage 4

	KS3 National Curriculum prior learning	By the end of the term, students can:	Year 10 Term 1 - C1 Atomic Structure	Year 10 Term 2 - C3 Conservation of mass and the quantitative interpretation of chemical equations	Year 10 Term 3 - C5 Exothermic and Endothermic Reactions	Year 11 Term 1 - C3 Use of amount of substance in relation to masses of pure substances	Year 11 Term 2 - C5 Energy Change in Reactions	Year 11 Term 3 Preparation for Exams
What we want our students to know and remember	The focus in KS4 continues with the process of building upon and deepening scientific knowledge and the understanding of ideas developed in earlier key stages in the subject discipline of Chemistry. Chemistry should be taught in ways that ensure students have the knowledge to enable them to develop curiosity about the natural world, insight into working scientifically, and appreciation of the relevance of science to their everyday lives, so that students: develop scientific knowledge and conceptual understanding, develop understanding of the nature, processes and methods of science, through different types of scientific enquiry that help them to answer scientific questions about the world around them; develop and learn to apply observational, practical, modelling, enquiry, problem-solving skills and mathematical skills, both in the laboratory, in the field and in other environments; develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both	Define the key tier 3 **vocabulary**:	aqueous solution - the mixture made by adding a soluble substance to water atom - the smallest part of an element that can still be recognised as that element atomic number -the number of protons (which equals the number of electrons) in an atom. It is sometimes called the proton number balanced symbol equation - a symbol equation in which there are equal numbers of each type of atom on either side of the equation chromatography - the process whereby small amounts of dissolved substances are separated by running a solvent along a material such as absorbent paper compound - a substance made when two or more elements are chemically bonded together electron - a tiny particle with a negative charge. Electrons orbit the nucleus of atoms or ions in shells electronic structure - a set of numbers to show the arrangement of electrons in their shells (or energy levels) element - a substance made up of only one type of atom. An element cannot be broken down chemically into any	relative atomic mass Ar - the average mass of the atoms of an element compared with carbon-12 (which is given a mass of exactly 12). The average mass must take into account the proportions of the naturally occurring isotopes of the element relative formula mass Mr - the total of the relative atomic masses, added up in the ratio shown in the chemical formula, of a substance	activation energy - the minimum energy needed for a reaction to take place bond energy - the energy required to break a specific chemical bond endothermic - a reaction that takes in energy from the surroundings exothermic - a reaction that transfers energy to the surroundings reaction profile - the relative difference in the energy of reactants and products	Avogadro constant -the number of atoms, molecules, or ions in a mole of any substance (i.e., 6.02 × 10-23 per mol) concentration - the amount of a substance dissolved in a given volume of liquid limiting reactant - the reactant in a chemical reaction that when used up causes the reaction to stop mole - the amount of substance in the relative atomic or formula mass of a substance in grams	activation energy - the minimum energy needed for a reaction to take place bond energy - the energy required to break a specific chemical bond endothermic - a reaction that takes in energy from the surroundings exothermic - a reaction that transfers energy to the surroundings reaction profile - the relative difference in the energy of reactants and products	All Chemistry related key terms highlighted across years 7-11.

	qualitatively and quantitatively.		simpler substance ion - a charged particle produced by the loss or gain of electrons isotope - atoms that have the same number of protons but different number of neutrons, i.e., they have the same atomic number but different mass numbers mass number - the number of protons plus neutrons in the nucleus of an atom neutron - a dense particle found in the nucleus of an atom. It is electrically neutral, carrying no charge nucleus (of an atom) - the very small and dense central part of an atom that contains protons and neutrons product - a substance made as a result of a chemical reaction proton - a tiny positive particle found inside the nucleus of an atom reactant - a substance we start with before a chemical reaction takes place shell - an area in an atom, around its nucleus, where electrons are found state symbol - the abbreviations used in balanced symbol equations to show if reactants and products are solid (s), liquid (l), gas (g) or dissolved in water (aq) symbol equation - an equation that helps you see how much of each substance is involved in a chemical reaction by showing the chemical symbols and formulae of all the reactants and products involved word equation - a way of describing what happens in a chemical reaction by					

			showing the names of all reactants and the products they form					
			Year 10 Term 1 - C1 The Periodic Table	Year 10 Term 2 - C3 Use of amount of substance in relation to masses of pure substances		Year 11 Term 1 - C4 Redox and Electrolysis	Year 11 Term 2 - C6 Equilibrium	
			alkali metal - elements in Group 1 of the periodic table atomic number - the number of protons (which equals the number of electrons) in an atom. It is sometimes called the proton number group - all the elements in the columns (labelled 1 to 7 and 0) in the periodic table halogens - the elements found in Group 7 of the periodic table mass number - the number of protons plus neutrons in the nucleus of an atom noble gases - the very unreactive gases found in Group 0 of the periodic table. Their atoms have very stable electronic structures periodic table - an arrangement of elements in the order of their atomic numbers, forming groups and periods universal indicator - a mixture of indicators that can change through a range of colours to show how strongly acidic or alkaline liquids and solutions are	Avogadro constant -the number of atoms, molecules, or ions in a mole of any substance (i.e., 6.02 × 10-23 per mol) concentration - the amount of a substance dissolved in a given volume of liquid limiting reactant - the reactant in a chemical reaction that when used up causes the reaction to stop mole - the amount of substance in the relative atomic or formula mass of a substance in grams		anode - the positive electrode in electrolysis brine - concentrated sodium chloride solution the can undergo electrolysis to produce chlorine gas, hydrogen gas and sodium hydroxide solution cathode - the negative electrode in electrolysis electrolysis -the breakdown of a substance containing ions by electricity electrolyte - a liquid, containing free-moving ions, which is broken down by electricity in the process of electrolysis half equation - an equation that describes reduction (gain of electrons) or oxidation (loss of electrons) inert - unreactive ionic equation - an equation that shows only those ions or atoms that change in a chemical reaction oxidation/oxidised - a reaction where oxygen is added to a substance / or when electrons are lost from a substance reduction / reduced - a reaction in which oxygen is removed or electrons are gained	catalyst - a substance that speeds up a chemical reaction by providing a different pathway for the reaction that has a lower activation energy. The catalyst is chemically unchanged at the end of the reaction closed system -a system in which no matter enters or leaves equilibrium - the point in a reversible reaction at which the forward and backward rates of reaction are the same. Therefore, the amounts of substances present in the reacting mixture remain constant hydrated - Describes a substance that contains water in its crystals Le Châtelier's Principle - when a change in conditions is introduced to a system at equilibrium, the position of equilibrium shifts so as to cancel out the change reversible reaction - a reaction in which the products can re-form the reactants	

			Year 10 Term 1 - C2 Chemical Bonds	Year 10 Term 2 - C4 Reactivity of Metals and Acids			Year 11 Term 2 - C10 Using Resources	
			alloy - a mixture of two or more elements, at least one of which is a metal covalent bond - the bond between two atoms that share one or more pairs of electrons covalent bonding - the attraction between two atoms that share one or more pairs of electrons delocalised electron - bonding electron that is no longer associated with any one particular atom dot and cross diagram - a drawing to show only the arrangement of outer shell electrons of the atoms or ions in a substance fullerene - form of the element carbon that can exist as large cage-like structures, based on hexagonal rings of carbon atoms giant covalent structure - a huge 3D network of covalently bonded atoms giant lattice/giant structure - a huge 3D network of atoms or ions intermolecular forces - the attraction between the individual molecules in a covalently bonded substance ionic bond - the electrostatic force of attraction between positively and negatively charged ions polymer - a substance made from very large molecules made up of many repeating units	acid - when dissolved in water, its solution has a pH value less than 7. Acids are proton (H+ ion) donors alkali - solution that has a pH value more than 7 base - the oxide, hydroxide, or carbonate of a metal that will react with an acid, forming a salt as one of the products. (If a base dissolves in water it is called an alkali). Bases are proton (H+ ion) acceptors displacement reaction - a reaction in which a more reactive element takes the place of a less reactive element in one of its compounds or in solution ionic equation - an equation that shows only those ions or atoms that change in a chemical reaction metal ore - a rock that contains enough of a metal or metal compound that it is worth extracting the metal neutral - a solution with a pH value of 7 which is neither acidic nor alkaline. Alternatively, something that carries no overall electrical charge neutralisation - the chemical reaction of an acid with a base in which a salt and water are formed. If the base is a carbonate or hydrogen carbonate, carbon dioxide is also produced in the reaction ore - rock which contains enough metal to make it			bioleaching - a new technique that involves using bacteria to extract metals, such as copper, from low-grade ores	

				economically worthwhile to extract the metal oxidation/oxidised - a reaction where oxygen is added to a substance / or when electrons are lost from a substance pH / pH scale - a number which shows how strongly acidic or alkaline a solution is reactivity series - a list of elements in order of their reactivity reduction / reduced - a reaction in which oxygen is removed or electrons are gained salt - a compound formed when some or all of the hydrogen in an acid is replaced by a metal strong acids - these acids completely ionise in aqueous solutions weak acids - acids that do not ionise completely in aqueous solutions				
			Year 10 Term 1 - C2 Properties of Matter					
			alloy - a mixture of two or more elements, at least one of which is a metal delocalised electron - bonding electron that is no longer associated with any one particular atom fullerene - form of the element carbon that can exist as large cage-like structures, based on hexagonal rings of carbon atoms gases - substances that have no fixed shape or volume and can be compressed easily giant covalent structure - a huge 3D network of covalently bonded atoms giant lattice/giant structure - a huge 3D					

			network of atoms or ions intermolecular forces - the attraction between the individual molecules in a covalently bonded substance ionic bond - the electrostatic force of attraction between positively and negatively charged ions liquids - substances that have a fixed volume, but they can flow and change their shape particle theory - a theory that explains the properties of solids, liquids and gases based on the fact that all matter is made from tiny particles. It describes the movement of particles and the distance between them polymer - a substance made from very large molecules made up of many repeating units solids - substances that have a fixed shape and volume that cannot be compressed states of matter - the forms in which matter can exist. A substance can be solid, liquid or gas					
	For some students, studying Chemistry in KS4 provides the platform for more advanced studies, establishing the basis for a wide range of careers. For others, it will be their last formal study of subjects that provide the foundations for understanding the natural world and will enhance their lives in an increasingly technological society.	Recall the **knowledge**:	Year 10 Term 1 - C1 Atomic Structure	Year 10 Term 2 - C3 Conservation of mass and the quantitative interpretation of chemical equations	Year 10 Term 3 - C5 Exothermic and Endothermic Reactions	Year 11 Term 1 - C3 Use of amount of substance in relation to masses of pure substances	Year 11 Term 2 - C5 Energy Change in Reactions	Year 11 Term 3 Preparation for Exams
			All substances are made of atoms. An atom is the smallest part of an element that can exist. Atoms of each element are represented by a chemical symbol, e.g. O represents an atom of oxygen, Na represents an atom of sodium. There are about 100 different elements. Elements are shown in the periodic table. Compounds are formed	The law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants. This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the	Energy is conserved in chemical reactions. The amount of energy in the universe at the end of a chemical reaction is the same as before the reaction takes place. If a reaction transfers energy to the surroundings the product molecules must have less energy than the reactants, by the amount transferred. An exothermic reaction is one that transfers energy	Moles = mass/Mr The masses of reactants and products can be calculated from balanced symbol equations. Chemical equations can be interpreted in terms of moles. The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and	An exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases. An endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases. The energy needed to break bonds and the energy released when bonds are formed can be	Recall key concepts from topics C1-C10 bespoke revision lessons to meet the students' needs.

			from elements by chemical reactions. Chemical reactions always involve the formation of one or more new substances, and often involve a detectable energy change. Compounds contain two or more elements chemically combined in fixed proportions and can be represented by formulae using the symbols of the atoms from which they were formed. Compounds can only be separated into elements by chemical reactions. Chemical reactions can be represented by word equations or equations using symbols and formulae. A mixture consists of two or more elements or compounds not chemically combined together. The chemical properties of each substance in the mixture are unchanged. Mixtures can be separated by physical processes such as filtration, crystallisation, simple distillation, fractional distillation and chromatography. These physical processes do not involve chemical reactions and no new substances are made. New experimental evidence may lead to a scientific model being changed or replaced. Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided. The discovery of the electron led to the plum pudding model of the atom. The plum pudding model suggested that the	equation. The relative formula mass (Mr) of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula. In a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown. Some reactions may appear to involve a change in mass but this can usually be explained because a reactant or product is a gas and its mass has not been taken into account. For example: when a metal reacts with oxygen the mass of the oxide produced is greater than the mass of the metal or in thermal decompositions of metal carbonates carbon dioxide is produced and escapes into the atmosphere leaving the metal oxide as the only solid product	to the surroundings so the temperature of the surroundings increases. Exothermic reactions include combustion, many oxidation reactions and neutralisation. Everyday uses of exothermic reactions include self-heating cans and hand warmers. An endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases. Endothermic reactions include thermal decompositions and the reaction of citric acid and sodium hydrogen carbonate. Some sports injury packs are based on endothermic reactions. Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the activation energy. Reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction. During a chemical reaction energy must be supplied to break bonds in the reactants and energy is released when bonds in the products are formed. The energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies. The difference between the sum of the energy needed to break bonds in the reactants and the	converting the numbers of moles to simple whole number ratios. In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used. The reactant that is completely used up is called the limiting reactant because it limits the amount of products.	calculated from bond energies. The difference between the sum of the energy needed to break bonds in the reactants and the sum of the energy released when bonds in the products are formed is the overall energy change of the reaction. In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds. In an endothermic reaction, the energy needed to break existing bonds is greater than the energy released from forming new bonds.	

			atom is a ball of positive charge with negative electrons embedded in it. The results from the alpha particle scattering experiment led to the conclusion that the mass of an atom was concentrated at the centre (nucleus) and that the nucleus was charged. This nuclear model replaced the plum pudding model. Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances. The theoretical calculations of Bohr agreed with experimental observations. Later experiments led to the idea that the positive charge of any nucleus could be subdivided into a whole number of smaller particles, each particle having the same amount of positive charge. The name proton was given to these particles. The experimental work of James Chadwick provided the evidence to show the existence of neutrons within the nucleus. This was about 20 years after the nucleus became an accepted scientific idea. Protons have a relative electrical charge of +1. Electrons have a relative electrical charge of -1. Neutrons have a relative electrical charge of 0. In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge. The number of protons in an atom of an element is its atomic number. All atoms of a particular		sum of the energy released when bonds in the products are formed is the overall energy change of the reaction. In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds. In an endothermic reaction, the energy needed to break existing bonds is greater than the energy released from forming new bonds.			

			element have the same number of protons. Atoms of different elements have different numbers of protons. Atoms are very small, having a radius of about 0.1 nm (1 x 10-10 m). The radius of a nucleus is less than 1/10 000 of that of the atom (about 1 x 10-14 m). Almost all of the mass of an atom is in the nucleus. Protons have a relative mass of 1. Neutrons have a relative mass of 1. Electrons have a relative mass of very small. The sum of the protons and neutrons in an atom is its mass number. Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element. The number of neutrons = mass number - atomic (proton) number. The relative atomic mass of an element is an average value that takes account of the abundance of the isotopes of the element. The electrons in an atom occupy the lowest available energy levels (innermost available shells). The electronic structure of an atom can be represented by numbers or by a diagram. For example, the electronic structure of sodium is 2,8,1. The lowest energy level (innermost) can contain a maximum of 2 electrons. The second and third energy levels can contain a maximum of 8 electrons.					

			Year 10 Term 1 - C1 The Periodic Table	Year 10 Term 2 - C3 Use of amount of substance in relation to masses of pure substances		Year 11 Term 1 - C4 Redox and Electrolysis	Year 11 Term 2 - C6 Equilibrium	
			The elements in the periodic table are arranged in order of atomic(proton) number and so that elements with similar properties are in columns, known as groups. The table is called a periodic table because similar properties occur at regular intervals. Elements in the same group in the periodic table have the same number of electrons in their outer shell (outer electrons) and this gives them similar chemical properties. Elements in the same period have the same number of occupied energy levels (shells). Before the discovery of protons, neutrons and electrons, scientists attempted to classify the elements by arranging them in order of their atomic weights. The early periodic tables were incomplete and some elements were placed in inappropriate groups if the strict order of atomic weights was followed. Mendeleev overcame some of the problems by leaving gaps for elements that he thought had not been discovered and in some places changed the order based on atomic weights. Elements with properties predicted by Mendeleev were discovered and filled the gaps. Knowledge of isotopes	Chemical amounts are measured in moles. The symbol for the unit mole is mol. The mass of one mole of a substance in grams is numerically equal to its relative formula mass. One mole of a substance contains the same number of the stated particles, atoms, molecules or ions as one mole of any other substance. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02×10^{23} per mole. The measurement of amounts in moles can apply to atoms, molecules, ions, electrons, formulae and equations, for example that in one mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO_2). Moles = mass/Mr The masses of reactants and products can be calculated from balanced symbol equations. Chemical equations can be interpreted in terms of moles. The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers		When an ionic compound is melted or dissolved in water, the ions are free to move about within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes. Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode). Ions are discharged at the electrodes producing elements. This process is called electrolysis The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved. At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen. At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged During electrolysis, at the cathode (negative electrode), positively	When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur at exactly the same rate The relative amounts of all the reactants and products at equilibrium depend on the conditions of the reaction. If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change. The effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again. If the concentration of a reactant is increased, more products will be formed until equilibrium is reached again. If the concentration of a product is decreased, more reactants will react until equilibrium is reached again If the temperature of a system at equilibrium is increased the relative amount of products at equilibrium increases for an endothermic reaction; the relative amount of	

			made it possible to explain why the order based on atomic weights was not always correct. Elements that react to form positive ions are metals. Elements that do not form positive ions are non-metals. The majority of elements are metals. Metals are found to the left and towards the bottom of the periodic table. Non-metals are found towards the right and top of the periodic table. The elements in Group 0 of the periodic table are called the noble gases. They are unreactive and do not easily form molecules because their atoms have stable arrangements of electrons. The noble gases have eight electrons in their outer shell, except for helium, which has only two electrons. The boiling points of the noble gases increase with increasing relative atomic mass (going down the group). The elements in Group 1 of the periodic table are known as the alkali metals and have characteristic properties because of the single electron in their outer shell. The first three alkali metals react with water in a similar way - fizzing, floating, moving on the surface, producing the metal hydroxide (alkali) and hydrogen gas. Alkali metals react with oxygen to produce the metal oxide. Alkali metals react with chlorine to produce the metal chloride. In Group 1, the reactivity	of moles to simple whole number ratios. In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used. The reactant that is completely used up is called the limiting reactant because it limits the amount of products. Many chemical reactions take place in solutions. The concentration of a solution can be measured in mass per given volume of solution, e.g. grams per dm3 (g/dm3). Concentration = mass/volume		charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. Reactions at electrodes can be represented by half equations	products at equilibrium decreases for an exothermic reaction. If the temperature of a system at equilibrium is decreased the relative amount of products at equilibrium decreases for an endothermic reaction; the relative amount of products at equilibrium increases for an exothermic reaction For gaseous reactions at equilibrium an increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules as shown by the symbol equation for that reaction; a decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules as shown by the symbol equation for that reaction	

			of the elements increases going down the group. The elements in Group 7 of the periodic table are known as the halogens and have similar reactions because they all have seven electrons in their outer shell. The halogens are non-metals and consist of molecules made of pairs of atoms. In Group 7, the further down the group an element is the higher its relative molecular mass, melting point and boiling point. In Group 7, the reactivity of the elements decreases going down the group. A more reactive halogen can displace a less reactive halogen from an aqueous solution of its salt					
			Year 10 Term 1 - C2 Chemical Bonds	Year 10 Term 2 - C4 Reactivity of Metals and Acids			Year 11 Term 2 - C10 Using Resources	
			There are three types of strong chemical bonds: ionic, covalent and metallic. For ionic bonding the particles are oppositely charged ions. For covalent bonding the particles are atoms which share pairs of electrons. For metallic bonding the particles are atoms which share delocalised electrons. Ionic bonding occurs in compounds formed from metals combined with non-metals. Covalent bonding occurs in most non-metallic elements and in compounds of non-metals. Metallic bonding occurs in metallic elements and	Metals react with oxygen to produce metal oxides. The reactions are oxidation reactions because the metals gain oxygen. When metals react with other substances the metal atoms form positive ions. The reactivity of a metal is related to its tendency to form positive ions. Metals can be arranged in order of their reactivity in a reactivity series. The metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper can be put in order of their reactivity from their reactions with water and dilute acids. The non-metals			The Earth's resources of metal ores are limited. Copper ores are becoming scarce and new ways of extracting copper from low-grade ores include phytomining, and bioleaching. These methods avoid traditional mining methods of digging, moving and disposing of large amounts of rock. Phytomining uses plants to absorb metal compounds. The plants are harvested and then burned to produce ash that contains metal compounds. Bioleaching uses bacteria to produce leachate solutions that contain	

			alloys. When a metal atom reacts with a non-metal atom electrons in the outer shell of the metal atom are transferred. Metal atoms lose electrons to become positively charged ions. Non-metal atoms gain electrons to become negatively charged ions. The ions produced by metals in Groups 1 and 2 and by non-metals in Groups 6 and 7 have the electronic structure of a noble gas (Group 0). The electron transfer during the formation of an ionic compound can be represented by a dot and cross diagram. An ionic compound is a giant structure of ions. Ionic compounds are held together by strong electrostatic forces of attraction between oppositely charged ions. These forces act in all directions in the lattice and this is called ionic bonding. When atoms share pairs of electrons, they form covalent bonds. These bonds between atoms are strong. Covalently bonded substances may consist of small molecules. Some covalently bonded substances have very large molecules, such as polymers. Some covalently bonded substances have giant covalent structures, such as diamond and silicon dioxide. Metals consist of giant structures of atoms arranged in a regular pattern. The electrons in the outer shell of metal atoms are delocalised and so are free to move	hydrogen and carbon are often included in the reactivity series. A more reactive metal can displace a less reactive metal from a compound. Unreactive metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal. Metals less reactive than carbon can be extracted from their oxides by reduction with carbon. Reduction involves the loss of oxygen. Oxidation is the loss of electrons and reduction is the gain of electrons. Acids react with some metals to produce salts and hydrogen. Acids are neutralised by alkalis (e.g. soluble metal hydroxides) and bases (e.g. insoluble metal hydroxides and metal oxides) to produce salts and water, and by metal carbonates to produce salts, water and carbon dioxide. The particular salt produced in any reaction between an acid and a base or alkali depends on the acid used (hydrochloric acid produces chlorides, nitric acid produces nitrates, sulfuric acid produces sulfates) and the positive ions in the base, alkali or carbonate. Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides or carbonates. The solid is added to the acid until no more reacts and the excess solid is filtered off			metal compounds. The metal compounds can be processed to obtain the metal. For example, copper can be obtained from solutions of copper compounds by displacement using scrap iron or by electrolysis.	

			through the whole structure. The sharing of delocalised electrons gives rise to strong metallic bonds	to produce a solution of the salt. Salt solutions can be crystallised to produce solid salts. Acids produce hydrogen ions (H^+) in aqueous solutions. Aqueous solutions of alkalis contain hydroxide ions (OH^-). The pH scale, from 0 to 14, is a measure of the acidity or alkalinity of a solution, and can be measured using universal indicator or a pH probe. A solution with pH 7 is neutral. Aqueous solutions of acids have pH values of less than 7 and aqueous solutions of alkalis have pH values greater than 7. In neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water. A strong acid is completely ionised in aqueous solution. Examples of strong acids are hydrochloric, nitric and sulfuric acids. A weak acid is only partially ionised in aqueous solution. Examples of weak acids are ethanoic, citric and carbonic acids. For a given concentration of aqueous solutions, the stronger an acid, the lower the pH. As the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10				
			Year 10 Term 1 - C2 Properties of Matter	Year 10 Term 2 - C4 Electrolysis				

			The three states of matter are solid, liquid and gas. Melting and freezing take place at the melting point, boiling and condensing take place at the boiling point. The three states of matter can be represented by a simple model. In this model, particles are represented by small solid spheres. Particle theory can help to explain melting, boiling, freezing and condensing. The amount of energy needed to change state from solid to liquid and from liquid to gas depends on the strength of the forces between the particles of the substance. The nature of the particles involved depends on the type of bonding and the structure of the substance. The stronger the forces between the particles the higher the melting point and boiling point of the substance. Limitations of the simple model include that in the model there are no forces, that all particles are represented as spheres and that the spheres are solid (HT) In chemical equations, the three states of matter are shown as (s), (l) and (g), with (aq) for aqueous solutions. Ionic compounds have regular structures (giant ionic lattices) in which there are strong electrostatic forces of attraction in all directions between oppositely charged ions. These compounds have high melting points and high boiling points because of the large amounts of energy needed to break	When an ionic compound is melted or dissolved in water, the ions are free to move about within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes. Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode). Ions are discharged at the electrodes producing elements. This process is called electrolysis When a simple ionic compound (e.g. lead bromide) is electrolysed in the molten state using inert electrodes, the metal (lead) is produced at the cathode and the non-metal (bromine) is produced at the anode Metals can be extracted from molten compounds using electrolysis. Electrolysis is used if the metal is too reactive to be extracted by reduction with carbon or if the metal reacts with carbon. Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current. Aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite using carbon as the positive electrode (anode). The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative				

			the many strong bonds. When melted or dissolved in water, ionic compounds conduct electricity because the ions are free to move and so charge can flow. Substances that consist of small molecules are usually gases or liquids that have relatively low melting points and boiling points. These substances have only weak forces between the molecules (intermolecular forces). It is these intermolecular forces that are overcome, not the covalent bonds, when the substance melts or boils. The intermolecular forces increase with the size of the molecules, so larger molecules have higher melting and boiling points. These substances do not conduct electricity because the molecules do not have an overall electric charge. Polymers have very large molecules. The atoms in the polymer molecules are linked to other atoms by strong covalent bonds. The intermolecular forces between polymer molecules are relatively strong and so these substances are solids at room temperature. Substances that consist of giant covalent structures are solids with very high melting points. All of the atoms in these structures are linked to other atoms by strong covalent bonds. These bonds must be overcome to melt or boil these substances. Diamond and graphite (forms of carbon) and silicon dioxide (silica) are	reactivity of the elements involved. At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen. At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged During electrolysis, at the cathode (negative electrode), positively charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. Reactions at electrodes can be represented by half equations				

			examples of giant covalent structures. Metals have giant structures of atoms with strong metallic bonding. This means that most metals have high melting and boiling points. In pure metals, atoms are arranged in layers, which allows metals to be bent and shaped. Pure metals are too soft for many uses and so are mixed with other metals to make alloys which are harder. Metals are good conductors of electricity because the delocalised electrons in the metal carry electrical charge through the metal. Metals are good conductors of thermal energy because energy is transferred by the delocalised electrons. In diamond, each carbon atom forms four covalent bonds with other carbon atoms in a giant covalent structure, so diamond is very hard, has a very high melting point and does not conduct electricity. In graphite, each carbon atom forms three covalent bonds with three other carbon atoms, forming layers of hexagonal rings which have no covalent bonds between the layers. In graphite, one electron from each carbon atom is delocalised. Graphene is a single layer of graphite and has properties that make it useful in electronics and composites. Fullerenes are molecules of carbon atoms with hollow shapes. The structure of fullerenes is based on hexagonal rings					

			of carbon atoms but they may also contain rings with five or seven carbon atoms. The first fullerene to be discovered was Buckminsterfullerene (C60) which has a spherical shape. Carbon nanotubes are cylindrical fullerenes with very high length to diameter ratios. Their properties make them useful for nanotechnology, electronics and materials.					
What we want our students to do	Science is changing our lives and is vital to the world's future prosperity, and all students should be taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate the achievements of science in showing how the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas relating to the sciences which are inter-linked, and which are of universal application. These key ideas include: the use of conceptual models and theories to make sense of the observed diversity of natural phenomena; the assumption that every effect has one or more cause that change is driven by interactions between different objects and systems; that many such interactions occur over a distance and over time; that science progresses through a cycle of hypothesis, practical experimentation, observation, theory	Demonstrate excellence in these **skills**:	Year 10 Term 1 - C1 Atomic Structure	Year 10 Term 2 - C3 Conservation of mass and the quantitative interpretation of chemical equations	Year 10 Term 3 - C5 Exothermic and Endothermic Reactions	Year 11 Term 1 - C3 Use of amount of substance in relation to masses of pure substances	Year 11 Term 2 - C5 Energy Change in Reactions	Year 11 Term 3 Preparation for Exams
			Use the names and symbols of the first 20 elements in the periodic table, the elements in Groups 1 and 7. Name compounds of these elements from given formulae or symbol equations. Write word equations for given reactions. Write formulae and balanced chemical equations for the given reactions. Write balanced half equations and ionic equations where appropriate (HT). Describe, explain and give examples of filtration, crystallisation, simple distillation, fractional distillation and chromatography. Suggest suitable separation and purification techniques for mixtures. Describe how and why the atomic model has changed over time. Describe the difference between the plum-	State the law of conservation of mass Explain the meaning of the law of conservation of mass Construct simple word equations Construct simple symbol equations. Balance symbol equations. Describe equations in terms of reactants and products. Define relative atomic mass (Ar) Define relative formula mass (Mr) Calculate the relative formula mass (Mr) of a compound from its formula, given the relative atomic masses Explain changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model. Calculate mean, range and uncertainty	Define exothermic and endothermic State examples of exothermic and endothermic reactions Distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings. Evaluate uses and applications of exothermic and endothermic reactions given appropriate information Draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved arrow to show the energy as the reaction proceeds. Use reaction profiles to identify reactions as exothermic or endothermic.	Calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product. Use the masses of substances present in a reaction to write a balanced equation. Define limiting reagent Explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams.	Define exothermic and endothermic. Work Scientifically to determine the temperature change in a reaction Calculate the energy transferred in chemical reactions using bond energies supplied	Apply knowledge and understanding to exam questions. Develop good exam technique by practising past exam questions.

	development and review; that quantitative analysis is a central element both of many theories and of scientific methods of inquiry.		pudding model of the atom and the nuclear model of the atom. Describe why the new evidence from the scattering experiment led to a change in the atomic model. Recall the different charges of the particles that make up an atom. Describe why atoms have no overall charge. Recall what atomic number represents. Use the periodic table to identify number of protons in different elements. Describe the structure of the atom. Calculate the numbers of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number. Relate size and scale of atoms to objects in the physical world. Calculate the relative atomic mass of an element given the percentage abundance of its isotopes. Represent the electronic structures of the first twenty elements of the periodic table in both forms.		Explain what is meant by activation energy. Calculate the energy transferred in chemical reactions using bond energies supplied			
			Year 10 Term 1 - C1 The Periodic Table	Year 10 Term 2 - C3 Use of amount of substance in relation to masses of pure substances		Year 11 Term 1 - C4 Redox and Electrolysis	Year 11 Term 2 - C6 Equilibrium	
			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. Predict possible reactions and probable reactivity of elements from their positions in the periodic table.	Define one mole in terms of Mr and Ar Calculate the number of moles in a substance using the relative formula mass Calculate the masses of substances shown in a balanced symbol equation. Calculate the masses of reactants and products		Explain why solid ionic compounds cannot conduct electricity but ionic compounds can conduct electricity when melted or dissolved in water. Define the term electrolyte. Describe how an electric current can pass through an ionic compound.	Define equilibrium Describe Le Chatelier's principle. Explain the effects on equilibrium of changing temperature/concentration/pressure Predict the effect of a change in temperature/concentration/pressure on given reactions at equilibrium	

			Describe the steps in the development of the periodic table. Describe and explain how testing a prediction can support or refute a new scientific idea. Explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties. Explain how the atomic structure of metals and non-metals relates to their position in the periodic table. Explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number. Describe the reactions of the first three alkali metals with oxygen, chlorine and water. Explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms. Predict properties from given trends down the group Describe the nature of the compounds formed when chlorine, bromine and iodine react with metals and non-metals. Explain how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms. Predict properties from given trends down the group	from the balanced symbol equation and the mass of a given reactant or product. Use the masses of substances present in a reaction to write a balanced equation. Define limiting reagent Explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams. Define concentration Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution. Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution Calculate the concentration of a solution in g/cm3		Explain what happens to positive and negative ions during electrolysis and how elements form from their ions. Predict the products of the electrolysis of aqueous solutions containing a single ionic compound. Represent reactions at electrodes by half equations		
			Year 10 Term 1 - C2 Chemical Bonds	Year 10 Term 2 - C4 Reactivity of Metals and Acids			Year 11 Term 2 - C10 Using Resources	

			Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. Draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7 Work out the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7. Deduce that a compound is ionic from a diagram of its structure in one of the specified forms describe the limitations of using dot and cross, ball and stick, two and three dimensional diagrams to represent a giant ionic structure Derive the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure. Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects. Identify substances as small molecules, polymers or giant structures from diagrams showing their bonding Identify common substances that consist of small molecules from their chemical formula. Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane Represent the covalent bonds in small molecules, in the repeating units of	Explain reduction and oxidation in terms of loss or gain of oxygen Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids, where appropriate, to place these metals in order of reactivity. Explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion. Deduce an order of reactivity of metals based on experimental results. State two methods of metal extraction and explain when each one is used. Describe how carbon is used to reduce metal oxides. Evaluate specific metal extraction processes when given appropriate information. Identify the substances which are oxidised or reduced in terms of gain or loss of oxygen. Write ionic equations for displacement reactions. Identify in a given reaction, symbol equation or half equation which species are oxidised and which are reduced. Explain in terms of gain or loss of electrons, that these are redox reactions. Identify which species are oxidised and which are reduced in given chemical equations. Define neutralisation. Predict products from given reactants in neutralisation reactions. Use the formulae of common ions to deduce			Describe the processes of phytomining and bioleaching. Evaluate the impacts and benefits of biological methods of extracting metal.	

			polymers and in part of giant covalent structures, using a line to represent a single bond Describe the limitations of using dot and cross, ball and stick, two and three dimensional diagrams to represent molecules or giant structures Deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule. Identify substances as giant metallic structures from diagrams showing their bonding	the formulae of salts. Describe how to make pure, dry samples of named soluble salts Describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution. Identify acidic or alkaline solutions using the pH scale. Explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids Describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH				
			Year 10 Term 1 - C2 Properties of Matter	Year 10 Term 2 - C4 Electrolysis				
			Predict the states of substances at different temperatures given appropriate data Explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding State that atoms themselves do not have the bulk properties of materials Explain the limitations of the particle theory in relation to changes of state when particles are represented by solid spheres which have no forces between them Apply appropriate state symbols to chemical equations Explain why ionic compounds have high melting points Describe the and explain electrical conductivity of	Explain why solid ionic compounds cannot conduct electricity but ionic compounds can conduct electricity when melted or dissolved in water. Define the term electrolyte. Describe how an electric current can pass through an ionic compound. Explain what happens to positive and negative ions during electrolysis and how elements form from their ions. Predict the products of the electrolysis of ionic compounds in the molten state. Describe how aluminium is extracted from its ore. Write balanced half equations for the reactions that occur at both electrodes. Explain why a mixture is				

			ionic substances. Explain why solid ionic substances do not conduct electricity but dissolved or molten ionic substances do conduct electricity. Explain how ionic substances dissolve in water. Explain the bulk properties of molecular substances using the idea that intermolecular forces are weak compared with covalent bonds Describe melting points and boiling points of covalent substances. Explain why the melting point and boiling point increases as the size of the molecule does. Explain why covalent substances do not conduct electricity. Explain why pure water does not conduct electricity but tap water does conduct electricity. Explain the properties of polymers Identify giant covalent structures from diagrams showing their bonding and structure. Describe the structure of diamond, silicon dioxide and graphite an explain how these structures lead to the properties of these substances. Explain why alloys are harder than pure metals. describe melting points and boiling points of metallic substances. Explain why the melting point and boiling point of metallic substances are high. Explain why metallic substances conduct electricity. Describe the structure of metal alloys. Explain the properties of diamond and graphite in	used as the electrolyte. Explain why the positive electrode must be continually replaced. Predict the products of the electrolysis of aqueous solutions containing a single ionic compound. Represent reactions at electrodes by half equations				

			terms of its structure and bonding. Identify graphene and fullerenes from diagrams and descriptions of their bonding and structure. State examples of the uses of fullerenes, including carbon nanotubes.					
Key assessment questions:			Year 10 Term 1 - C1 Atomic Structure	Year 10 Term 2 - C3 Conservation of mass and the quantitative interpretation of chemical equations	Year 10 Term 3 - C5 Exothermic and Endothermic Reactions	Year 11 Term 1 - C3 Use of amount of substance in relation to masses of pure substances	Year 11 Term 2 - C5 Energy Change in Reactions	Year 11 Term 3 Preparation for Exams
			What is a compound? What is a mixture? Give three ways of separating out mixtures Describe the plum pudding model Describe the alpha scattering experiment What did Rutherford discover? What charge and mass do protons have? What charge and mass do neutrons have? What charge and mass do electrons have? What does the atomic number tell us? What does the mass number tell us? How do you find the number of protons in an atom? How do you find the number of electrons in an atom? How do you find the number of neutrons in an atom? How do you find the number of protons in an ion? How do you find the number of electrons in an ion? How do you find the number of neutrons in an ion? How many electrons fit on each of the first three shells?	State the law of conservation of mass Define relative formula mass (Mr) If mass appears to be loss or gained in a reaction, what is the most likely cause? How do you calculate the uncertainty of a group of repeat readings?	What is an exothermic reaction? State examples and uses of exothermic reactions What is an endothermic reaction? State examples and uses of endothermic reactions Define activation energy Draw and label the reaction profile for an exothermic reaction Draw and label the reaction profile for an endothermic reaction Describe an exothermic reaction in terms of bond energies Describe an endothermic reaction in terms of bond energies	What is a mole? What is the Avogadro constant? How is the mass number linked to the number of moles?	Describe the temperature change in a neutralisation reaction Describe an exothermic reaction in terms of bond energies Describe an endothermic reaction in terms of bond energies	Use of past exam questions.

			Year 10 Term 1 - C1 The Periodic Table	Year 10 Term 2 - C3 Use of amount of substance in relation to masses of pure substances		Year 11 Term 1 - C4 Redox and Electrolysis	Year 11 Term 2 - C6 Equilibrium	
			How are elements arranged in the periodic table? What does the group number tell you about the atoms in that group? How was the periodic table originally organised? How did Mendeleev improve the periodic table? How did the discovery of isotopes affect the periodic table? What is the difference between a metal and a non-metal? State the name of group 0, group 1 and group 7 Describe the properties of the elements in group 0 Explain why group 0 elements have the properties they do. How does the reactivity change in group 1? Describe how the properties of group 7 elements changes as you go down the group	What is a mole? What is the Avogadro constant? How is the mass number linked to the number of moles? How is the concentration of a solution usually expressed?		What are oxidation and reduction reactions? Describe electrolysis Which ion moves to which electrode in electrolysis? Draw an labelled diagram of the set up needed for simple electrolysis	What is a reversible reaction? What is equilibrium in terms of a reversible reaction? How does a change in temperature/concentration/pressure affect the position of equilibrium? How does a change in temperature/concentration/pressure affect the yield of an equilibrium reaction?	
			Year 10 Term 1 - C2 Chemical Bonds	Year 10 Term 2 - C4 Reactivity of Metals and Acids			Year 11 Term 2 - C10 Using Resources	
			What is ionic bonding? How are ions formed? What type of ions with a metal form? What type of ions will a non-metal form? What is an ionic bond? Draw a dot and cross diagram to show the bonding in sodium chloride. Draw a dot and cross diagram to show the bonding in magnesium chloride. Draw a dot and cross	What is produced when metals react with oxygen? Give an example What happens to a metal when it reacts with different substances? How are unreactive metals found? How are metals less reactive than carbon extracted? How are metals more reactive than carbon extracted? What is produced when a metal reacts with an			Describe phytomining Describe bioleaching Compare bioleaching and phytomining to extraction of metals from high grade ores using reduction and electrolysis	

			diagram to show the bonding in magnesium oxide. What is covalent bonding? List six simple covalent compounds. Give the formula of oxygen gas. Draw the bonding in water. Draw the bonding in carbon dioxide. Draw the bonding in chlorine gas. In a covalent bonding diagram what does each line represent? How does metallic bonding arise? What is a monomer? What is a polymer?	acid? What is produced when a metal carbonate reacts with an acid? What is produced when an acid is neutralised by an alkali or base? What makes a chemical an acid? What makes a chemical an alkali? How can the pH of a chemical be measured? Where are acids and alkalis on the pH scale? State the general equation for the reaction between an acid and an alkali What is the difference between a strong and a weak acid? Why are solid bases often added 'in excess' when making a salt? Describe the steps to make a soluble salt.				
			Year 10 Term 1 - C2 Properties of Matter	Year 10 Term 2 - C4 Electrolysis				
			Why do metals have high boiling and melting points? How are atoms in an alloy arranged? Why do people use alloys and not pure metals? How do metals conduct electricity? Describe the structure of an ionic compound. Describe the properties of an ionic compound. Describe the structure of a simple covalent compound. Describe the properties (boiling point, conductivity) of a simple covalent compound. Describe the structure of giant covalent compound. Describe the properties of a giant covalent compound.	What are oxidation and reduction reactions? Describe electrolysis Which ion moves to which electrode in electrolysis? Draw a labelled diagram of the set up needed for simple electrolysis				

			Describe the structure of a polymer. Which element is both diamond and graphite made from? Describe the bonding in diamond. Describe the difference between the bonding in diamonds and the bonding in graphite? What are the properties (melting point, softness, conductivity) of graphite? What are the uses of graphene? What are the uses of fullerenes? Describe the structure of fullerenes. Describe the structure of carbon nanotubes. Describe and draw the arrangement of particles in a solid; liquid; gas Name and define all changes of state What is the boiling point? What is the condensing point? What are the 4 state symbols?					
Disciplinary Rigour		What makes your subject different to other subjects? What are the expectations for students in your subject area in	Year 10 Term 1 - C1 Atomic Structure	Year 10 Term 2 - C3 Conservation of mass and the quantitative interpretation of chemical equations	Year 10 Term 3 - C5 Exothermic and Endothermic Reactions	Year 11 Term 1 - C3 Use of amount of substance in relation to masses of pure substances	Year 11 Term 2 - C5 Energy Change in Reactions	Year 11 Term 3 Preparation for Exams

		the KS4 National Curriculum if applicable / KS4 qualification specification?	Model atoms (using physical models or computer simulations). Research the history of the element names and their symbols. Carry out chromatography techniques using sweets or felt tip pens. Model the plum-pudding model, nuclear model and atomic model. Observe distillation of salt water or copper sulfate solution Carry out filtration and evaporation to separate rock salt. Draw an appropriate table to display data on atomic numbers and number of atomic particles in different elements.	Observe the reaction of magnesium ribbon to produce magnesium oxide. Measure the mass of the ribbon at the start of the experiment, burn the ribbon in a strong Bunsen flame and measure the mass of the ribbon at the end of the experiment and explain the changes. Use HCl acid in a conical flask with CaCO3. Measure the mass of the reaction on a top pan balance as the reaction proceeds.	Observe exothermic and endothermic reactions, such as thermal decomposition of marble or copper sulfate, barium hydroxide + ammonium chloride, thermite reaction. Investigate the variables that affect temperature changes in reacting solutions such as neutralisations	Calculate the masses of products	Investigate the variables that affect temperature changes in reacting solutions such as neutralisations	The complex and diverse phenomena of both the natural and man-made worlds can be described in terms of a number of key ideas in Chemistry. These key ideas are of universal application, and we have embedded them throughout the subject content. They underpin many aspects of the science assessment. • matter is composed of tiny particles called atoms and there are about 100 different naturally-occurring types of atoms called elements • elements show periodic relationships in their chemical and physical properties • these periodic properties can be explained in terms of the atomic structure of the elements • atoms bond either by transferring electrons from one atom to another or by sharing electrons • the shapes of molecules (groups of atoms bonded together) and the way giant structures are arranged is of great importance in terms of the way they behave • reactions can occur when molecules collide and do so at different rates due to differences in molecular collisions • chemical reactions take place in only three different ways: • proton transfer • electron transfer • electron sharing • energy is conserved in chemical reactions so can therefore be neither

								created nor destroyed
			Year 10 Term 1 - C1 The Periodic Table	Year 10 Term 2 - C3 Use of amount of substance in relation to masses of pure substances		Year 11 Term 1 - C4 Redox and Electrolysis	Year 11 Term 2 - C6 Equilibrium	

			Create a timeline for the history of the periodic table Observe the reactivity of Na, Li and K in water with universal indicator. Predict reactions for Rb, Cs and Fr. Observe displacement reactions using KCl, KBr, KI with waters of the corresponding halogens. Write word and balanced symbol equations for all reactions in the displacement practical.	Measure out and compare 1 mole of elements like iron, sulfur, magnesium, copper, aluminium and so on. Measure out and compare one mole of common compounds, water, sodium chloride, calcium carbonate and so on. Observe the making of different concentrations of tea, coffee or a dark squash and explain the differences in terms of particles Convert cm3 into dm3 . Use the equation: C = m/v to calculate the concentration of a solution. Rearrange the equation C = m/v to make mass or volume the subject		Investigate what happens when aqueous solutions are electrolysed using inert electrodes - including the development of a hypothesis	Research and explain conditions uses in industrial equilibrium processes	
			Year 10 Term 1 - C2 Chemical Bonds	Year 10 Term 2 - C4 Reactivity of Metals and Acids			Year 11 Term 2 - C10 Using Resources	

			Observe the reaction of magnesium ribbon to produce magnesium oxide and draw the dot and cross diagram for this reaction. Model the sodium chloride lattice using molecular model kits or spaghetti/marshmallows. Model simple covalent substance using molecular model kits. Observe models of giant covalent structures using molecular model kits.	Observe the reactivity of some of the metals with water and acid and use findings to construct a reactivity series. Compare this to the actual reactivity series. Reduce iron oxide using carbon. Compare and contrast the methods, evaluating the methods in terms of environmental, economic and social impacts. Carry out simple displacement reactions. Prepare a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution. Measure the pH of a variety of solutions. Observe and compare the rate of reaction when magnesium is dipped in hydrochloric acid and ethanoic acid of the same concentration			Compare the environmental aspects of bioleaching, phytomining and traditional metal extraction methods	
			Year 10 Term 1 - C2 Properties of Matter	Year 10 Term 2 - C4 Electrolysis				

			Test and observe the conductivity of ionic compounds, e.g. sodium chloride and potassium chloride. Research some uses of covalent substances. Make links between the uses of covalent substances, their properties and structure. Model polymers. Research some uses of metallic substances. Describe the links between the uses of metal substances, their properties and structure. Research some uses of metal alloys. Make links between the uses of metal alloys, their properties and structure. Observe models of diamond and graphite and graphene. Research uses of diamond, graphite and fullerenes	Observe the electrolysis of molten compounds Investigate what happens when aqueous solutions are electrolysed using inert electrodes - including the development of a hypothesis				