Thomas More Catholic Academy
FAITH | EXCELLENCE | RESPECT

Chemistry Curriculum Sequence – Key Stage 3

	KS2 National Curriculum prior learning	**By the end of the term, students can:**	Year 7 Term 1 - Chemical Reactions Investigation	Year 7 Term 2 - Matter - Separating Mixtures	Year 7 Term 3 - Earth - Universe	Year 8 Term 1 – Reactions – Acids and Alkalis	Year 8 Term 2 – Reactions – Metals and Non-Metals	Year 8 Term 3 - Matter - Periodic Table	Year 9 Term 1 - Atoms, Elements, Compounds and Mixtures	Year 9 Term 2 - Energy from Reactions	Year 9 Term 3 - Environmental Chemistry
What we want our students to know and remember	The principal focus in KS3 is to develop a deeper understanding of a range of scientific ideas. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding. Examples of these big ideas in Chemistry are: Matter (properties of materials, dissolving, state of matter, separating mixtures), Reactions (formation of new materials, burning) and Earth (rocks, movement of the Earth and other planets relative to the sun in the solar system, movement of the moon relative to the Earth, Earth's motion and rotation). They should be encouraged to relate scientific explanations to phenomena in the world around them and start to	Define the key tier 3 **vocabulary**:	Scientific enquiries: Different ways to investigate including observation over time, fair test and pattern seeking. Variable: A factor that can be changed, measured and controlled. Independent variable: What you change in an investigation to see how it affects the dependent variable. Dependent variable: What you measure or observe in an investigation. Correlation: A relationship between variables where one increases or decreases as the other increases. Control variable: One that remains unchanged or is held constant to stop it affecting the dependent variable. Range: The maximum and minimum values of a variable. Interval: The gap between the values of the independent variable.	Solvent: A substance, normally a liquid, that dissolves another substance. Solute: A substance that can dissolve in a liquid. Dissolve: When a solute mixes completely with a solvent. Solution: Mixture formed when a solvent dissolves a solute. Soluble (insoluble): Property of a substance that will (will not) dissolve in a liquid. Solubility: Maximum mass of solute that dissolves in a certain volume of solvent. Pure substance: Single type of material with nothing mixed in. Mixture: Two or more pure substances mixed together, whose properties are different to the individual substances. Filtration: Separating substances using a filter to produce a filtrate (solution) and residue.	Galaxy: Collection of stars held together by gravity. Our galaxy is called the Milky Way. Light year: The distance light travels in a year (over 9 million, million kilometres). Stars: Bodies which give out light, and which may have a solar system of planets. Orbit: Path taken by a satellite, planet or star moving around a larger body. Earth completes one orbit of the Sun every year. Exoplanet: Planet that orbits a star outside our solar system.	Acid: A solution with a pH value less than 7. Alkali: A soluble base. Base: A substance that neutralises an acid – those that dissolve in water are called alkalis. Concentration: A measure of the number of particles in a given volume. Corrosive: A substance that can burn your skin or eyes. Indicator: Substances used to identify whether unknown solutions are acidic or alkaline. The colour of an indicator is different in acidic and alkaline solutions. Irritant: A substance that makes your skin itch or swell up a little. Litmus: An indicator. Blue litmus paper goes red on adding acid. Red litmus paper goes blue on adding alkali. Neutralisation: In a neutralisation reaction, an acid cancels out a base or a base cancels out an acid.	Displacement Reaction: where a more reactive metal takes the place of a less reactive metal in a compound. Metal: Most metals are shiny, good conductors of electricity and heat, malleable and ductile, and solid at room temperature. Non-metal: Most non-metals are dull, poor conductors of electricity and heat, brittle, and solid or gaseous at room temperature. Oxidation: A chemical reaction in which a substance combines with oxygen. Oxide: A substance made up of a metal or non-metal element joined to oxygen. Reactive: A substance is reactive if it reacts vigorously with substances such as dilute acids and water. Reactivity: The tendency of a substance to undergo a chemical reaction.	Periodic table: Shows all the elements arranged in rows and columns. Physical properties: Features of a substance that can be observed without changing the substance itself. Chemical properties: Features of the way a substance reacts with other substances. Groups: Columns of the periodic table. Periods: Rows of the periodic table.	Atom - The smallest part of an element. Bond - Force holding atoms together. Chemical formula - A combination of symbols and numbers that shows how many atoms of different kinds are in a particular molecule. In compounds that do not form molecules, it shows the ratio of elements in the compound. Chromatography - Separating dissolved solids from one another. The solids are usually coloured. Compound - Substance that can be split up into simpler substances. Distillation - separating a liquid from a solution by evaporating the liquid and then condensing it. Element - A substance that cannot be split up into anything simpler by chemical reactions. All the atoms in an element are the same.	Catalysts: Substances that speed up chemical reactions but are unchanged at the end. Exothermic reaction: One in which energy is given out, usually as heat or light. Endothermic reaction: One in which energy is taken in, usually as heat.	Atmosphere - The atmosphere is the layer of gases surrounding a planet. Fossil fuel - A fuel which was made millions of years ago from the remains of dead plants or animals. Examples include coal, natural gas and the fuels which we get from crude oil (e.g. petrol and diesel). Global Warming - The increase in earth's average temperature, caused mainly by the build-up of greenhouse gases in the atmosphere. Greenhouse Gases - Gases such as water vapour, carbon dioxide, and methane in the Earth's atmosphere that trap heat. Photosynthesis - A chemical process used by plants to make glucose and oxygen from carbon dioxide and water, using light energy. Oxygen is produced as a by-product of photosynthesis. Algae subsumed within plants and

	use modelling and abstract ideas to develop and evaluate explanations.		Control group: Those that are not exposed to the factor being tested. Repeatable: When repeat readings are close together. Secondary data: Results that have already been collected by another person. Real difference: There is a real difference between two means if their ranges do not overlap much.	Distillation: Separating substances by boiling and condensing liquids. Evaporation: A way to separate a solid dissolved in a liquid by the liquid turning into a gas. Chromatography: Used to separate different coloured substances.		pH scale: The pH scale shows whether a substance is acidic, alkaline, or neutral. An acid has a pH between 0 and 7. An alkaline has a pH between 7 and 14. A solution of pH 7 is neutral. Salt: A compound in which the hydrogen atoms of an acid are replaced by atoms of a metal element. Universal indicator: An indicator that changes colour to show the pH of a solution. It is a mixture of dyes. Weak acid: An acid in which only some of the acid particles split up when it dissolves in water.	Reactivity Series: A list of metals in order of how vigorously they react.		Filtering - Separating solids that have not dissolved from a liquid. The liquid is passed through a filter to do this. Insoluble - A solid that will not dissolve. Metals - Elements that are shiny, conduct heat and electricity well, and often have high melting and boiling points. Mixture - Two or more different kinds of particles that are not chemically joined to each other. Molecule - Two or more atoms joined together. Non-metals - Elements that are not shiny, and do not conduct heat and electricity well. Periodic Table - Table that shows all the elements. Pure - A substance that does not have anything else in it. Product - New chemical formed in a chemical reaction. Reactants - Chemicals that join together to form a new substance. Soluble - A solid that can dissolve in a liquid. Salt is soluble in water. Symbol - The letter or letters that represent an element. Symbol Equation - A way of writing out what happens in a chemical		some bacteria are also photosynthetic.

									reaction using the symbols that represent the substances involved.		
			Year 7 Term 1 - Matter - Particle Model				Year 8 Term 2 - Earth - Earth's Structure		Year 9 Term 1 - Properties and uses of materials	Year 9 Term 2 - Separation of complex Mixtures	Year 9 Term 3 - Resources from the Earth
			Particle: A very tiny object such as an atom or molecule, too small to be seen with a microscope. Particle model: A way to think about how substances behave in terms of small, moving particles. Diffusion: The process by which particles in liquids or gases spread out through random movement from a region where there are many particles to one where there are fewer. Gas pressure: Caused by collisions of particles with the walls of a container. Density: How much matter there is in a particular volume, or how close the particles are. Evaporate: Change from liquid to gas at the surface of a liquid, at any temperature. Boil: Change from liquid to a gas of all the liquid when the temperature reaches boiling point.				Rock cycle: Sequence of processes where rocks change from one type to another. Weathering: The wearing down of rock by physical, chemical or biological processes. Erosion: Movement of rock by water, ice or wind (transportation). Minerals: Chemicals that rocks are made from. Sedimentary rocks: Formed from layers of sediment, and which can contain fossils. Examples are limestone, chalk and sandstone. Igneous rocks: Formed from cooled magma, with minerals arranged in crystals. Examples are granite, basalt and obsidian. Metamorphic rocks: Formed from existing rocks exposed to heat and pressure over a long time. Examples are marble, slate and schist.		Alloy – a metal with one or more other elements mixed with it, usually other metal elements. Boil - Change from liquid to a gas of all the liquid when the temperature reaches boiling point. Condense - Change of state from gas to liquid when the temperature drops to the boiling point. Evaporate - Change from liquid to gas at the surface of a liquid, at any temperature. Freeze - Change from liquid to a solid when the temperature drops to the melting point. Gas - Something that does not have a fixed shape or volume, and is easy to squash. Liquid - Something with a fixed volume but no fixed shape. Melt- Change from solid to liquid when the temperature rises to the melting point. Metals - Elements that are shiny,	Boiling point – The temperature at which a pure substance boils from a liquid into a gas. For example, the boiling point of pure water is 100°C. The boiling point is also the temperature at which a gas will condense into a liquid. Chromatogram - The piece of paper showing results after chromatography has occurred. Analysing the chromatogram allows conclusions to be made about the pigments in the mixture. Fractional distillation - A separation technique used to separate a mixture of liquids with different boiling points. This can be applied when there are more than two liquids or if two mixed liquids have boiling points which are too close for simple distillation. Mixture - When two or more compounds or elements are	Extracted - The action of removing something from somewhere, such as extracting iron ore from the ground Finite - A resource is finite if it will eventually run out. Natural resources: Materials from the Earth which act as raw materials for making a variety of products. Recycling: Processing a material so that it can be used again. Re-using – Using a product again for the same purpose Renewable - Something that can be replaced quickly. For example, there is a continuous supply of wind which makes it a renewable form of energy.

			Condense: Change of state from gas to liquid when the temperature drops to the boiling point. Melt: Change from solid to liquid when the temperature rises to the melting point. Freeze: Change from liquid to a solid when the temperature drops to the melting point. Sublime: Change from a solid directly into a gas.				Strata: Layers of sedimentary rock.		conduct heat and electricity well and often have high melting and boiling points. Non-metals - Elements that are not shiny, and do not conduct heat and electricity well. They often have low melting and boiling points. The solid ones are brittle. Ore – naturally occurring rock that contains enough metal to be worthwhile to extract. Oxide - A compound formed when something reacts with oxygen. Polymer - A molecule made of thousands of smaller molecules in a repeating pattern. Plastics are man-made polymers, starch is a natural polymer Property - A description of how a material behaves and what it is like. Hardness is a property of some solids. Reactivity Series - A list of metals which shows them in order of their reactivity, with the most reactive at the top. Solid - Something with a fixed shape and volume. States of matter - There are three different forms which a substance can be in; solid, liquid or gas. These are the	present without being chemically bonded together. Solution - A mixture made when a solute (usually a solid) dissolves into a solvent (a liquid). Sea water is a solution of salt dissolved into water. Soluble - A solid is soluble if it can dissolve into a specific solvent. For example, salt and sugar are both soluble in water. Solubility - A measurement of how soluble a solute is in a specific solvent. If the solubility is high, it means that the solute is very soluble in the solvent.	

									three states of matter. Sublime: Change from a solid directly into a gas.		
									Year 9 Term 1 - Reactions of metals and metal compounds		
									Metals - Elements that are shiny, conduct heat and electricity well and often have high melting and boiling points. Salts - Compounds made in some reactions involving acids. They have a metal part and a non-metal part. The non-metal part is usually chloride, sulphate or nitrate (e.g. potassium sulphate). Base - A chemical which reacts with an acid to form a salt. Neutralisation - Mixing an acid and a base together to make a solution with a pH of 7.		
		Recall the **knowledge**:	Year 7 Term 1 - Solubility Investigation	Year 7 Term 2 - Matter - Separating Mixtures	Year 7 Term 3 - Earth - Universe	Year 8 Term 1 – Reactions - Acids and Alkalis	Year 8 Term 2 – Reactions – Metals and Non-Metals	Year 8 Term 3 - Matter - Periodic Table	Year 9 Term 1 - Atoms, Elements, Compounds and Mixtures	Year 9 Term 2 - Energy from Reactions	Year 9 Term 3 - Environmental Chemistry

			Scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review. Risks must be evaluated. Once a questions have been identified, a line of enquiry is developed based on observations of the real world, alongside prior knowledge and experience. Predictions are made using scientific knowledge and understanding. Scientists select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate. Scientists use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety Scientists make and record observations and measurements using a range of methods for	A pure substance consists of only one type of element or compound and has a fixed melting and boiling point. Mixtures may be separated due to differences in their physical properties. The method chosen to separate a mixture depends on which physical properties of the individual substances are different. Use techniques to separate mixtures. Air, fruit juice, sea water and milk are mixtures. Liquids have different boiling points	The solar system can be modelled as planets rotating on tilted axes while orbiting the Sun, moons orbiting planets and sunlight spreading out and being reflected. This explains day and year length, seasons and the visibility of objects from Earth. Our solar system is a tiny part of a galaxy, one of many billions in the Universe. Light takes minutes to reach Earth from the Sun, four years from our nearest star and billions of years from other galaxies.	The pH of a solution depends on the strength of the acid: strong acids have lower pH values than weak acids. Mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water. Acids have a pH below 7, neutral solutions have a pH of 7, alkalis have a pH above 7. Acids and alkalis can be corrosive or irritant and require safe handling. Hydrochloric, sulfuric and nitric acid are strong acids. Acetic and citric acid are weak acids.	Metals and non-metals react with oxygen to form oxides which are either bases or acids. Metals can be arranged as a reactivity series in order of how readily they react with other substances. Some metals react with acids to produce salts and hydrogen. Iron, nickel and cobalt are magnetic elements. Mercury is a metal that is liquid at room temperature. Bromine is a non metal that is liquid at room temperature	The elements in a group all react in a similar way and sometimes show a pattern in reactivity. As you go down a group and across a period the elements show patterns in physical properties. Metals are generally found on the left side of the table, non-metals on the right. Group 1 contains reactive metals called alkali metals. Group 7 contains non-metals called halogens. Group 0 contains unreactive gases called noble gases.	An element is a simple substance that cannot be split into anything simpler by chemical reactions. Atoms are the smallest particles of an element that can exist. Atoms of one element are all the same, and are different from atoms of all the other elements. There are over 100 different elements. All the elements are shown in the Periodic Table. Each element has a chemical symbol, which is usually one or two letters. A symbol is written with the first letter as a capital, and the second letter is small. Some elements have their atoms joined to each other in small groups called molecules. For example, a molecule of oxygen contains two oxygen atoms joined together (O2). Elements can join together to make compounds. A compound contains two or more elements joined together. The name of the compound tells you the elements that are in it. The name of the compound tells you the elements	When a chemical reaction happens, energy is transferred to or from the surroundings. Exothermic reactions are chemical reactions which release energy from the chemicals into the surroundings. This energy is usually released as heat, so the surroundings get hotter. Handwarmers are an example of an exothermic reaction. They release heat into their surroundings. However, exothermic reactions don't always release heat, sometimes the energy is released as light. For example, glowsticks release light without increasing in temperature. Endothermic reactions absorb energy from the surroundings. This energy is usually absorbed as heat, so the surroundings get colder. Photosynthesis is an endothermic reaction because plant leaves absorb light energy. Thermal decomposition reactions are endothermic because they absorb energy when the	The Earth's atmosphere is the relatively thin layer of gases surrounding the planet. The atmosphere is held close to Earth by gravity, but the higher you go away from the Earth's surface, the thinner the air. Because of this, it's impossible to say how high the atmosphere extends above Earth accurately. However, most scientists use around 100 km when describing where the atmosphere ends and space begins. The three gases with the highest percentages in the atmosphere are all elements: 78% nitrogen, N_2; 21% oxygen, O_2; 0.9% argon, Ar These three gases make up 99.9% of the atmosphere. The remaining gases are found in much smaller proportions. These include carbon dioxide and water vapour. The Earth's atmosphere has changed over time and is still changing now. All living things on Earth, including humans, use oxygen from the atmosphere for respiration to stay alive. Respiration is the chemical process that occurs inside cells

			different investigations; and evaluate the reliability of methods and suggest possible improvements Analysis of results and evaluation requires scientists to apply mathematical concepts and calculate results; present observations and data using appropriate methods, including tables and graphs; interpret observations and data including identifying patterns and using observations, measurements and data to draw conclusions; present reasoned explanations, including explaining data in relation to predictions and hypotheses; evaluate data, showing awareness of potential sources of random and systematic error; identify further questions arising from results.						that are in it. Compounds made from two elements always have a name which ends in '-ide' e.g. carbon and oxygen form carbon dioxide; sodium and chlorine form sodium chloride. A chemical formula tells you the name and number of atoms in a compound. A compound always contains the same elements in the same ratio. The properties of a compound are different from the elements that make it up. Compounds can react chemically. We can write word equations and symbol equations to show a chemical reaction. The chemicals that you start with are called the reactants. The chemicals at the end are called the products. Elements and compounds can also be mixed together. A mixture is easier to separate than the elements in a compound. Soil, river water and sea water are examples of mixtures that occur naturally. Filtration can be used to separate insoluble solid particles from the liquid they are in	chemicals are heated. A catalyst is a substance that speeds up a chemical reaction without being used up or chemically changed. Catalysts are usually specific to a particular reaction. The best catalyst for one reaction is unlikely to have any effect at all on a different reaction. Different catalysts are needed for different reactions. Biological reactions in the cells of living things are sped up by catalysts called enzymes. Enzymes are biological catalysts. They are important for biological reactions like digestion. Catalysts don't get used up or chemically changed during the reaction. They will be present at the end of the reaction. The mass of the catalyst at the end of the reaction will be the same as the mass of the catalyst at the start.	to release energy from glucose when it reacts with oxygen: Glucose + oxygen → carbon dioxide + water Plants and some bacteria use carbon dioxide from the atmosphere for photosynthesis. Photosynthesis is the chemical process when carbon dioxide and water react together, in the presence of light and chlorophyll, to produce glucose and oxygen: Carbon dioxide + water → glucose + oxygen. Chemically speaking, these two processes are opposite. Even plants and animals that live in the oceans use gases which have dissolved into the seawater from the air above it. Extension - 4.6bn years ago Earth's atmosphere was similar to Mars and contained a large amount of carbon dioxide and no oxygen. Carbon dioxide has dissolved in oceans and been locked in fossil fuels. Oxygen was first produced by algae (photosynthesis). Some human activities are thought to affect the rate at which the atmosphere is changing.

									Evaporation can be used to separate dissolved substances from a solution. Distillation can used to separate the liquid from the dissolved solid in a solution or one liquid from a mixture of liquids. Chromatography can be used to separate the colours from a mixture of colours. Elements and compounds melt and boil at a fixed temperature. Mixtures do not have definite melting points and boiling points. Air is a mixture of gases – most of the air is nitrogen and oxygen. The gases in the air can be separated by fractional distillation. The properties of a substance are the words that we use to describe it, or measurements that we can make on it. Metals and non-metals have different properties. Metals are good conductors of heat and electricity; shiny; solids with a high melting point (except for mercury); found on the left-hand side of the Periodic Table; three metals are magnetic; metals can burn to form alkaline oxides; flexible Non-metals are		Most fuels contain carbon. When they are burned, carbon dioxide is produced. Human activities - like burning fossil fuels - over the past 200 years have increased the amount of carbon dioxide in the atmosphere, thickening the earth's layer of greenhouse gases. Greenhouse gases reduce the amount of energy lost from the Earth through radiation and therefore the temperature has been rising as the concentration of those gases has risen. Scientists have evidence that global warming caused by human activity is causing changes in climate. The air contains small amounts of carbon dioxide (produced by combustion of fuels and respiration), sulphur dioxide (formed when sulphur burns) and nitrogen oxides produced during lightening storms and in car engines). These gases dissolve in water to form acids, so rainwater is naturally acidic (pH between 5.6 and 5.9). Our rainwater has become even more acidic (pH between 3 and

									poor conductors of heat and electricity; dull; most are solids or gases; found on the right-hand side of the Periodic Table; non-magnetic; non-metals can burn to form acidic oxides; brittle.		5.5) due to air pollution from burning fossil fuels. This is what we call acid rain. The main sources of this pollution are power stations and cars. Both burn large amounts of fossil fuels and release more carbon dioxide, sulphur dioxide and nitrogen oxides. Sulphur dioxide and nitrogen oxides are the main contributors to acid rain. Acid rain causes damage to our environment.
			Year 7 Term 1 - Matter - Particle Model				Year 8 Term 2 - Earth - Earth's Structure		Year 9 Term 1 - Properties and uses of materials	Year 9 Term 2 - Separation of complex Mixtures	Year 9 Term 3 - Resources from the Earth

			Properties of solids, liquids and gases can be described in terms of particles in motion but with differences in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas). Observations where substances change temperature or state can be described in terms of particles gaining or losing energy. A substance is a solid below its melting point, a liquid above it, and a gas above its boiling point				Sedimentary, igneous and metamorphic rocks can be inter converted over millions of years through weathering and erosion, heat and pressure, and melting and cooling. The three rock layers inside Earth are the crust, the mantle and the core.		Properties of solids, liquids and gases can be described in terms of particles in motion but with differences in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas). Observations where substances change temperature or state can be described in terms of particles gaining or losing energy. A substance is a solid below its melting point, a liquid above it, and a gas above its boiling point. The properties of a substance are the words that we use to describe it, or measurements that we can make on it. Metals and non-metals have different properties. Metals are good conductors of heat and electricity; are shiny; are solids, often with high melting points (except for mercury); are sometimes magnetic (iron, cobalt and nickel); are rigid when thick and bendy when thin; can be	Fractional distillation is a technique used in the chemical industry to obtain petrol and diesel from crude oil (a fossil fuel). Crude oil is a mixture of lots of different liquids (fractions) and we can use their different boiling points to separate them into more useful substances. Crude oil contains hydrocarbons which are useful as they can be burned as fuels to release energy. Fractional distillation can be used if the boiling points of two mixed liquids are similar. In these cases, the boiling points would be too close for simple distillation. Fractional distillation still relies on different boiling points, but is able to accommodate much closer boiling points whilst maintaining the purity of the products. Simple distillation would risk both liquids evaporating, meaning the distillate would still be a mixture. Chromatography is a separation technique used to separate mixtures of soluble substances. These are often coloured substances such	Humans extract many resources from the Earth that can then be turned into useful substances or products. Resources are extracted from the air (atmosphere), water and land. Some resources are finite. However, others are renewable. Lots of the resources that humans use are finite. This means their supply is limited and they will eventually run out. For example, slate is a type of stone used in building and is often used for roof materials. Slate is extracted from quarries and will eventually run out, so it's a finite resource. Some resources are renewable which means they can be replaced. Wood is used in building. It is not a finite resource as more wood can be used by growing more trees. Wood is a renewable resource. However, it's important to still use wood sustainably. This means not using it up any faster than it can grow back How quickly a resource is depleted (used up) depends on two main factors: how much of the

									hammered into shape. Non-metals are poor conductors of heat and electricity (except for carbon in the form of graphite which conducts electricity); are dull; are mostly solids or gases; are never magnetic; are brittle; cannot be hammered into shape – the solid ones break. Metals and non-metals have different uses because of their different properties. For example, diamond (which is made from carbon) is used to make drills because of its hardness whilst graphite (which is also made from Carbon) is used in pencils and as a lubricant because it is soft and slippery. Alloys are harder than pure metals so are used for tools instead of pure metals which are too soft to be used for tools. A polymer is a molecule made of thousands of smaller molecules in a repeating pattern. Plastics are man-made polymers, starch is a natural polymer. Polymers are used for different purposes depending on their properties, for example	as food colourings, inks, dyes or plant pigments. Chromatograms can be used to match known pigments with those in a mixture. On a chromatogram, one spot means that the substance is pure. An impure substance produces two or more spots. Extension - Rf values can be calculated to confirm the identity of a substance from a chromatogram	resource there currently is and how quickly it is being used up. Some resources are at risk of rapid depletion because they are scarce or being used up quickly. Recycling is one way that we can reduce the amount of finite resources being extracted from the Earth. For example, there are two options for what could happen to an empty aluminium drink can - It could be thrown in the bin and end up in a landfill site. If this happens a new aluminium can will need to be made to replace it, so that more drinks can be sold. More aluminium will need to be extracted from the Earth's crust to meet this demand or the can could be recycled so that the aluminium metal it contains can be used to make a new can. Aluminium is extracted from minerals found in the Earth's crust. These minerals contain compounds of aluminium, in which the aluminium atoms are chemically bonded to other atoms. The extraction process

									polyester is used in place of cotton for clothing because it is more har wearing. Polymers are named by adding 'poly' in front of the name of the small molecule the polymer is made from. Metals can be arranged in a Reactivity Series. The most reactive metals are placed at the top of the table. The reactivity of metals can be linked to their uses. Metals used for construction need to have a low reactivity, otherwise they will corrode away. Some metals, such as aluminium, have a natural protective oxide layer. Others, such as iron, have to be protected from corrosion, e.g. by painting. Many low reactivity metals have been known for hundreds or thousands of years. They can be extracted by heating their compounds in a fire. More reactive metals are extracted by electrolysis. This means that they have only been discovered in the last two hundred years, since the invention of the electric battery.		involves separating the aluminium atoms from these other atoms, which requires lots of electricity. Recycling stops the need to extract more. Recycling an aluminium can into usable aluminium is much simpler and uses less energy (in the form of electricity) than extracting more aluminium. This is because the aluminium atoms have already been separated from the other atoms that were in the original compound (as this happened when the can was first made). The recycled cans are turned into a sheet of aluminium using processes such as cleaning and melting. These aluminium sheets can then be made into new products like more cans or kitchen equipment. Recycling metals like aluminium in drink cans or steel in food cans is now common. This has reduced the demand for the extraction of aluminium from the Earth's crust. 75% of the aluminium ever made is still in productive use today, as a result of recycling.

												Recycling is even more important for materials that are scarce.
									Year 9 Term 1 - Reactions of metals and metal compounds			
									Many metals react with acids. Some unreactive metals will only react very slowly with strong acids, some will not react at all. Some metals are more reactive and explode when added to acid. When a metal reacts with an acid, hydrogen gas is given off. The reaction also produces a compound called a salt. There are three main types of salt: Chlorides are made when hydrochloric acid is used; Sulphates are made when sulphuric acid is used; Nitrates are made when nitric acid is used. The general equation is: Acid + Metal -> Salt + Hydrogen For example: hydrochloric acid + zinc -> zinc chloride + hydrogen We can test for hydrogen by putting a burning splint into a test		

									tube of gas. If hydrogen is present, it will explode with a squeaky 'pop'. Bases are compounds which react with acids. All metal oxides, metal hydroxides and metal carbonates are bases. Bases which dissolve in water are called alkalis (e.g. sodium hydroxide). Metal oxides and hydroxides and acids. A metal oxide or a metal hydroxide reacts with an acid to form water and a salt. This reaction is called neutralisation. The general equation is: acid + metal oxide (or hydroxide) -> salt + water For example: hydrochloric acid + potassium hydroxide -> potassium chloride + water sulphuric acid + copper oxide -> copper sulphate + water We can check to see if neutralisation has occurred using universal indicator. The pH of the solution gets closer to neutral (pH7). A metal carbonate will also neutralise an acid. This time the products are a salt, carbon dioxide and water. The general		

									equation is: acid + metal carbonate -> salt + carbon dioxide + water For example: sulphuric acid + copper carbonate -> copper sulphate + carbon dioxide + water		
What we want our students to do	Pupils should understand that science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. Pupils should decide on the appropriate type of scientific enquiry to undertake to answer their own questions and develop a deeper understanding of factors to be taken into account when collecting, recording and processing data. They should evaluate their results and identify further questions arising from them.	Demonstrate excellence in these **skills**:	Year 7 Term 1 - Chemical Reactions Investigation	Year 7 Term 2 - Matter - Separating Mixtures	Year 7 Term 3 - Earth - Universe	Year 8 Term 1 – Reactions – Acids and Alkalis	Year 8 Term 2 – Reactions – Metals and Non-Metals	Year 8 Term 3 - Matter - Periodic Table	Year 9 Term 1 - Atoms, Elements, Compounds and Mixtures	Year 9 Term 2 - Energy from Reactions	Year 9 Term 3 - Environmental Chemistry
			Identify an observation that could be recorded or measured over time. Write a question in the format 'How does... change as…increases?' Identify a dependent variable. Identify an independent variable. Write a question linking variables in the form 'How does...affect...?' Identify two variables which may show a correlation. Write a question in the form 'Is there a correlation between… and…' Decide how to vary the independent variable between planned values. Decide how to measure the dependent variable. List all the variables that could affect the dependent	Explain how substances dissolve using the particle model. Use the solubility curve of a solute to explain observations about solutions. Use evidence from chromatography to identify unknown substances in mixtures. Choose the most suitable technique to separate out a mixture of substances.	Describe the appearance of planets or moons from diagrams showing their position in relation to the Earth and Sun. Explain why places on the Earth experience different daylight hours and amounts of sunlight during the year. Describe how space exploration and observations of stars are affected by the scale of the universe. Explain the choice of particular units for measuring distance	Identify the best indicator to distinguish between solutions of different pH, using data provided. Use data and observations to determine the pH of a solution and explain what this shows. Explain how neutralisation reactions are used in a range of situations. Describe a method for how to make a neutral solution from an acid and alkali.	Describe an oxidation, displacement, or metal-acid reaction with a word equation. Use particle diagrams to represent oxidation, displacement and metal-acid reactions. Identify an unknown element from its physical and chemical properties. Place an unfamiliar metal into the reactivity series based on information about its reactions	Use data to describe a trend in physical properties. Describe the reaction of an unfamiliar Group 1 or 7 element. Use data showing a pattern in physical properties to estimate a missing value for an element. Use observations of a pattern in chemical reactions to predict the behaviour of an element in a group.	Define 'atom' Explain the difference between an element and a compound. Compare the properties of metals and non metals Describe where to find metals and non-metals in the Periodic Table. Explain the difference between an element and a compound. Determine the numbers of different atoms in a compound from its formula. Explain the difference between an atom and a molecule. Name compounds from the names of the elements they contain. Identify elements, compounds and mixtures. Construct equations for reactions where elements join together to make	Describe how to identify an exothermic reaction Describe how to identify an endothermic reaction Describe how to speed up a reaction. Explain the benefits of using a catalyst.	Describe the composition of the atmosphere. Extension - explain how the atmosphere has changed from the early atmosphere Identify which gases are greenhouse gases. Explain how carbon dioxide is released from the burning of fossil fuels. Describe human activities that affect the level of carbon dioxide in the atmosphere. Describe the greenhouse effect. Explain factors that contribute to the greenhouse effect. Describe the effects of global warming. Explain the consequences of global warming for living things. Evaluate the arguments for human activity impacting global warming. Describe how

			variable. Select important control variables. Identify how to control each control variable. List variables you cannot control. Choose a suitable range for the independent and dependent variable. Gather sufficient data for the investigation and repeat if appropriate. Prepare a table with space to record all measurements. Apply sampling techniques if appropriate. Check that the measuring instrument can measure the complete range of the independent variable. Check you can detect differences in the dependent variable. Use the measuring instrument correctly. Carry out the method carefully and consistently. See if repeated measurements are close. Remove outliers and calculate mean of repeats. Incorporate the pattern you found into an answer to the enquiry question. Suggest a scientific reason for your findings. Comment on whether there is a real difference						compounds. Identify elements in compounds from the compound name. Describe a method to separate a dissolved solid from a liquid. Describe how to get salt from sea water. Describe how salt can be obtained from rock salt. Describe how to separate a liquid from anything dissolved in it. Explain how distillation works. State some uses of distillation. State what chromatography is. Describe how to make a chromatogram. Explain what the results of a chromatogram mean. State uses of chromatography.		activities such as burning fossil fuels release pollutants into the atmosphere. Explain how acid rain is formed. Describe the effects of acid rain

			between data. Justify whether anomalous results can be explained or ignored. Suggest other possible conclusions that could be drawn from your data. Quote any secondary data you have which led to the same conclusion.									
			Year 7 Term 1 - Matter - Particle Model				Year 8 Term 2 - Earth - Earth's Structure		Year 9 Term 1 - Properties and uses of materials	Year 9 Term 2 - Separation of complex Mixtures	Year 9 Term 3 - Resources from the Earth	
			Explain unfamiliar observations about gas pressure in terms of particles. Explain the properties of solids, liquids and gases based on the arrangement and movement of their particles. Explain changes in states in terms of changes to the energy of particles. Draw before and after diagrams of particles to explain observations about changes of state, gas pressure and diffusion.				Explain why a rock has a particular property based on how it was formed. Identify the causes of weathering and erosion and describe how they occur. Construct a labelled diagram to identify the processes of the rock cycle.		Describe the properties of solids. Describe the properties of liquids. Describe the properties of gases. Compare the properties of metals and non-metals. Describe how different metals have different uses because of their properties and give examples. Describe how alloys are different from pure metals and how this leads to alloys being used in place of pure metals for a given purpose. Describe how different non-metals have different uses because of their properties and give examples. Describe what a polymer is, using examples.	Explain why crude oil needs to be separated. Explain why hydrocarbons are useful as fuels. Extension - explain how boiling points of hydrocarbons are linked to the chain length Explain how fractional distillation works in terms of evaporation and condensation. Explain how paper chromatography works. Describe how to carry out paper chromatography. Work Scientifically to separate and mixture of inks and analyse the results. Extension - calculate Rf Values from chromatograms	Describe resources that the Earth provides. Compare renewable and finite resources. Explain why natural resources need to be conserved. Describe examples of recycling. Explain the benefits and limitations of recycling schemes. Compare the efficiency of recycling methods

									Explain how the properties of polymers relate to their function. Explain how the extraction and discovery of metals links to their reactivity.		
									Year 9 Term 1 - Reactions of metals and metal compounds		
									Describe what happens when metals and acids react. Describe how to test for hydrogen safely. Write a general word equation for the reaction between a metal and an acid. Predict the name of the product formed when a metal and an acid react. Write a word equation for the reaction between an acid and a metal carbonate. Describe how to tell if a chemical reaction has taken place between an acid and a base or an acid and a metal. State what neutralisation is. Write the general word equation for the reaction between an acid and a base. Write a word equation for the reaction between an acid and a metal oxide.		

Key assessment questions:			Year 7 Term 1 - Chemical Reactions Investigation	Year 7 Term 2 - Matter - Separating Mixtures	Year 7 Term 3 - Earth - Universe	Year 8 Term 1 – Reactions – Acids and Alkalis	Year 8 Term 2 – Reactions – Metals and Non-Metals	Year 8 Term 3 - Matter - Periodic Table	Year 9 Term 1 - Atoms, Elements, Compounds and Mixtures	Year 9 Term 2 - Energy from Reactions	Year 9 Term 3 - Environmental Chemistry
			Explain which type of enquiry is best for answering a given scientific question. Explain whether a given question can be investigated scientifically. Explain why some variables are difficult to control. Explain why having a large range or many readings leads to accurate data. Describe the factors that influence the choice of range and interval for the variables. Describe how controlling variables is important in providing evidence for a conclusion. Make a conclusion and explain it. Judge whether the conclusion is supported by the data. Explain how in an investigation in which not all variables could be controlled that a conclusion could still be drawn. Identify further questions arising from the investigation.	Analyse and interpret solubility curves. Suggest a combination of methods to separate a complex mixture and justify the choices. Evaluate the evidence for identifying a unknown substance using separating techniques.	Predict patterns in day length, the Sun's intensity or an object's shadow at different latitudes. Make deductions from observation data of planets, stars and galaxies. Compare explanations from different periods in history about the motion of objects and structure of the Universe	Given the names of an acid and an alkali, work out the name of the salt produced when they react. Deduce the hazards of different alkalis and acids using data about their concentration and pH. Estimate the pH of an acid based on information from reactions.	Deduce the physical or chemical changes a metal has undergone from its appearance. Justify the use of specific metals and non-metals for different applications, using data provided. Deduce a rule from data about which reactions will occur or not, based on the reactivity series	Predict the position of an element in the periodic table based on information about its physical and chemical properties. Choose elements for different uses from their position in the periodic table. Use data about the properties of elements to find similarities, patterns and anomalies	Give an example of a substance that is a chemical compound. Why is copper a good metal to use for making coins? Sometimes copper objects get a pale green coating. This is copper carbonate, which has the chemical formula CuCO3. How many different elements are there in copper carbonate? Copper coins can react with oxygen to form a compound which gives the coins a black coating. Write a word equation for this reaction. Write a method to separate salt from rock salt. How does paper chromatography separate different colours in an ink?	What is an exothermic reaction? Give an example of an exothermic reaction. What is an endothermic reaction? State a use of an endothermic reaction. How can you speed up a reaction? What is an enzyme?	Describe the composition of Earth's atmosphere. State three examples of processes that involve the burning of fossil fuels. Suggest why fossil fuels are so widely used. What is the natural greenhouse effect and why is it important for life on Earth? Name three greenhouse gases and identify where they come from What is the possible effect of rising world temperatures on sea levels? The rise in world temperatures has been linked to increasing levels of carbon dioxide in our atmosphere. Give one reason why levels of carbon dioxide in the air are increasing. Give one reason why scientists cannot agree that world temperatures are going to show a steep rise in the near future. Suggest how global warming might affect global food security. Rainwater is naturally acidic. It

												has a pH between 5 and 6. Three gases contribute to this. What are the names of these gases? Name two industrial sources of gases which cause acid rain
			Year 7 Term 1 - Matter - Particle Model				Year 8 Term 2 - Earth - Earth's Structure		Year 9 Term 1 - Properties and uses of materials	Year 9 Term 2 - Separation of complex Mixtures	Year 9 Term 3 - Resources from the Earth
			Argue for how to classify substances which behave unusually as solids, liquids or gases. Evaluate observations that provide evidence for the existence of particles. Make predictions about what will happen during unfamiliar physical processes, in terms of particles and their energy.				Identify circumstances that indicate fast processes of change on Earth and those that indicate slower processes. Predict planetary conditions from descriptions of rocks on other planets. Describe similarities and differences between the rock cycle and everyday physical and chemical processes. Suggest how ceramics might be similar to some types of rock.		State three properties of metals. State three properties of non metals. Diamond and graphite are both made from carbon but diamond can't be used in pencils. Why is this? Diamond and graphite are both made from carbon but graphite can't be used in to make drill bits like diamond can. Why is this? Why are alloys used for car wheels and not pure metals? Why have polymers replaced some natural resources? Why can iron be extracted from its ore by heating it in a furnace but aluminium cannot?	What are hydrocarbons used for? Name the two processes in fractional distillation What property does fractional distillation rely on to separate the different parts of crude oil? Why can't simple distillation be used to separate crude oil? What is the method used to separate the different colours in inks is called? Biro ink does not dissolve in water. How could you find out which different colours are in black biro ink? Describe one way in which chromatography is useful	Name ten materials that can be recycled. Give two advantages of recycling an aluminium can. Why is reducing the demand for natural resources an advantage of recycling? Suggest why recycling sites may be unsafe and unhygienic. Explain why it is efficient to recycle aluminium. Suggest why China imports waste paper to recycle.
									Year 9 Term 1 - Reactions of metals and metal compounds		

									A gas was thought to be hydrogen. How could you test the gas to see if it was hydrogen? Predict the name of the compound formed when a reaction takes place between zinc and dilute sulphuric acid. Predict the name of the compound formed when a reaction takes place between zinc and dilute nitric acid Predict the name of the compound formed when a reaction takes place between magnesium and dilute hydrochloric acid Some calcium carbonate powder (crushed limestone) was added to some dilute hydrochloric acid in a conical flask. A reaction took place. How could you tell? Write a word equation for the reaction between calcium carbonate and hydrochloric acid What name is given to the reaction between an acid and an alkali? Write the general word equation for the reaction between an acid and an alkali List the main steps in the preparation of a dry sample of a salt		

									Write a balanced symbol equation for the reaction that takes place when zinc metal reacts with hydrochloric acid.		
Disciplinary Rigour		What makes your subject different to other subjects? What are the expectations for students in your subject area in the KS3 National Curriculum?	Year 7 Term 1 - Chemical Reactions Investigation	Year 7 Term 2 - Matter - Separating Mixtures	Year 7 Term 3 - Earth - Universe	Year 8 Term 1 – Reactions – Acids and Alkalis	Year 8 Term 2 – Reactions – Metals and Non-Metals	Year 8 Term 3 - Matter - Periodic Table	Year 9 Term 1 - Atoms, Elements, Compounds and Mixtures	Year 9 Term 2 - Energy from Reactions	Year 9 Term 3 - Environmental Chemistry
			Devise questions, plan variables, collect data, draw conclusions	Collect data, Devise questions, Test hypothesis, Estimate Risks	Analyse patterns, Draw conclusions, Present data, Communicate ideas, Construct explanations, Justify opinions, Review Theories	Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Critique claims, Collect data, Devise questions, Plan variables, Test hypothesis, Estimate risks	Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Present data, Test hypothesis, Estimate risks, Examine consequences	Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Review Theories	Collect data, Devise questions, Test hypothesis, Estimate Risks	Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Critique claims, Justify opinions, Devise questions, Test hypothesis, Estimate risks	Communicate ideas, Construct explanations, Justify opinions, Examine consequences, Review theories
			Year 7 Term 1 - Matter - Particle Model				Year 8 Term 2 - Earth - Earth's Structure		Year 9 Term 1 - Properties and uses of materials	Year 9 Term 2 - Separation of complex Mixtures	Year 9 Term 3 - Resources from the Earth
			Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Estimate Risks, Review Theories				Analyse patterns, Discuss limitations, Draw conclusions, Communicate ideas, Construct explanations, Review theories		Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations	Collect data, Devise questions, Test hypothesis, Estimate Risks	Analyse patterns, Draw conclusions, Present data, Construct explanations, Examine consequences

										Year 9 Term 1 - Reactions of metals and metal compounds		
										Analyse patterns, Discuss limitations, Draw conclusions, Present data, Communicate ideas, Construct explanations, Critique claims, Collect data, Devise questions, Plan variables, Test hypothesis, Estimate risks		