

## Science Curriculum Map

Year 7	Topics covered	Key knowledge and skills covered	Sequencing of units
Year 7 term 1	Matter	Describing the basic structure of solids, liquids and gases, then using this knowledge to justify the properties of these substances. Explaining state changes in terms of differences in energy of the particles and therefore the arrangement of the particles. Application of these ideas is then used to explain the differences between compounds, mixtures and atoms which then leads into separation techniques and the selection of different methods based on the substances being separated. This builds technical skills and the practical use of equipment but also the ability to select and explain the choice of different techniques.	This builds upon the work covered at KS2 on solids, liquids and gases, extending that knowledge to explain the particle model and the fundamental idea of the atom and the interactions that occur with it. The arrangement of atoms and particles are explained and then used to explain how mixtures and solutions can be separated with an increasing complexity from the work initially covered in KS2.
Year 7 term 2	Earth	The structure of the Earth is examined, explaining the various layers and the continual movement of the mantle to produce the tectonic plates and their movement. This is further developed to explain the rock cycle and reinforces previous knowledge on the types of rock. This is then experimentally examined and used to explain the properties of ceramics, polymers, and composites. The position of the Earth in the Solar System is then used to explain how we get day and night but also the tilt of the axis to explain how seasons are produced and why they vary across the globe. Our natural satellite is then examined to show how the Moon phases are produced including eclipses (both solar and lunar). Finally the fundamental force of gravity is examined to explain the difference between weight and mass and how it holds the various planets in the Solar System. This is taught with reference to the different visitors we have in the Solar System such as comets, meteors and satellites.	We start this unit by introducing the structure of the Earth which builds upon pupils' knowledge from Year 3 on the types of rocks that exist. This is extended to show how the rock cycle dynamically changes the face of the Earth. We then look further at different types of materials including ceramics and the properties that they have. The Earth's position in the solar system and how it is influenced by the Sun to produce day, night and seasons is examined in greater depth than in year 5 and this is then used to explain how the Moon and its phases influence the Earth. Finally the effect of gravity is outlined and its importance in the Solar System.
Y7 term 3	Reactions	Pupils examine how to tell the difference between acids and alkalis using homemade and industrially produced indicators. This links to the pH scale and how the strength of acids varies due to the presence of Hydrogen ions which are briefly introduced here. Chemical reactions are then examined through	This leads on from the idea of acids reacting with bicarbonate of soda to examine acids in further detail. We build practical skills to examine the differences between acids and

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		<p>using neutralisation to produce new substances. The production of these salts is then explained using equations and by further developing the idea of different elements that we call metals and non-metals. Metals then come under greater scrutiny by observing their reactions with acids, oxygen, and water. The naming of formulae using word and symbol equations are examined in detail through these reactions and we finish the unit by comparing metal displacement reactions to derive the reactivity series of metals.</p>	<p>alkalis which then leads to an examination of indicators, the pH scale and acid strengths. This leads on to examine neutralisation and the chemical reactions of metals and acids. Metals are then examined in further detail, practically, by comparing their reactions with acids, oxygen, water and each other, thereby introducing the idea of displacement and the reactivity series.</p>
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Year 8	Topics covered	Key knowledge and skills covered	Sequencing of units
Year 8 term 1	Matter – Elements & The Periodic Table	<p>Here we look at what an element is and the symbols that are given to these. We then look at the differences between atoms, molecules and compounds, and link these to chemical formulae and how pupils can interpret these using both symbol and word equations. Pupils are then encouraged to look at the long chains that are made when polymers are produced both in nature and in synthetics. The periodic table is examined and pupils will experiment with the various reactions of the alkali metals, the halogens and the absence of reactions in the noble gases.</p>	<p>In this unit we explain the idea of formulae and the periodic table developing the ideas of the atom that we introduced in Year 7. We explain what polymers are and then look in greater depth at the periodic table and look specifically at the groups and their reactions linking to the work completed in Year 7 term 3.</p>

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Year 8 term 1	Reactions – Reaction types & energy	We begin by looking at chemical formulae and revising word equations. This reminds pupils of atoms and elements from term 1. Then we move into reactions including combustion and thermal decomposition where pupils continue to develop their practical skills. We then study the conservation of mass in reactions and the way that masses and importantly numbers of molecules can be predicted. Balancing of equations will be taught here alongside formulae and their use in equations. Reactions are then classified as either exothermic or endothermic and we look at the energy changes involved.	We use this unit to consolidate and deepen the pupils understanding of chemical reactions picking up from the work in Year 7 term 3 and Year 8 term 1. This includes work on the conservation of mass and the difference between endothermic and exothermic reactions.
Year 8 term 2/3	The Earth – Climate & Resources	This unit examines human’s effects on the planet and the valuable resources that we must try to look after. The carbon cycle is examined to show the natural flow of compounds in the Earth and its’ atmosphere and then we examine the dangers inherent in increasing the amount of carbon dioxide in the atmosphere. Pupils examine the effects of increased global warming and the effects of climate change on the planet. We then look at the importance of the resources within the Earth and look at how metals are extracted using electrolysis and carbon reduction. Finally we focus on the importance of recycling and look at ways to reduce our impact on the Earth.	This unit links the carbon cycle to the previous year 7 term 2 topic of the rock cycle. We build on pupil’s knowledge of the climate to look at the effect of global warming on climate change and how the idea of reduce, reuse and recycle are protecting the Earth’s resources.

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Y9 Term 1	Atomic Structure	<p>In this unit, students will develop their understanding of atoms as fundamental chemical building blocks. They will see how to interpret chemical formulae and extend their knowledge of the law of the conservation of mass, leading them to balance chemical equations. Students will also develop their understanding of the differences between compounds and mixtures, and how mixtures can be separated using techniques such as filtration, crystallisation, distillation, and chromatography.</p> <p>Students will learn about the development of the atomic model, providing ample opportunity to foster their Working scientifically skills – specifically around the development and use of models within science. Students will be able to describe the evidence that lead to each new stage in the development of the atomic model. Studying the development of the atomic model will lead into the model currently accepted, and students will be able to use this to write and draw electronic structures up to element 20.</p>	<p>This unit picks up on work from Year 7 term 1 on the separation of mixtures in a variety of ways but extends this knowledge by including chromatography. It then continues on to link with ions and isotopes which leads to the arrangement of the periodic table where we focus on the groups of the periodic table (initially looked at in Year 8 term1) and the trends found within the groups.</p>
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Y9 Term 1	The Atmosphere	<p>In this unit, students will have learnt about the Earth's atmosphere. Students should be able to interpret evidence concerning theories, and be able to evaluate them. To describe the history of the atmosphere students will be able to describe the timescales involved and how it evolved over time. This includes both how the general composition of the atmosphere has changed and how the atmosphere is currently being affected by human activity. Students should be able to describe the human activities that are thought to cause global warming, and be able to explain some of the effects this has on the climate of the Earth. Students should also be able to explain the effect of other pollutants on the Earth, including carbon monoxide, sulfur dioxide, nitrogen oxides, and particulates. Throughout this unit, students will be given many opportunities to develop their working scientifically skills, including evaluating models and interpreting and evaluating evidence for scientific theories.</p>	<p>This unit picks up from the work on the Earth (Year 7 term 2 and Year 8 term 2) where we looked at the effects of the greenhouse gases on Earth's temperature. This is then further developed by looking at the evolution of our atmosphere and how it continues to change plus focusing on the pollutants we find in the air that produce acid rain as well as climate change.</p>
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Y9 Term 2	The Periodic Table	<p>Studying the development of the atomic model will lead into the model currently accepted, and students will be able to use this to write and draw electronic structures up to element 20. Students will learn about the development of the periodic table, including the work of Dalton, Newlands, and Mendeleev. Students will understand how each stage in the development of the periodic table was facilitated by new evidence becoming available. Students should also develop their understanding of electronic structures, and apply this to the arrangement of the periodic table and the chemical properties of Group 0, Group 1, and Group 7 elements. They should also be able to identify trends in properties and reactivity, and be able to explain these in terms of the electronic structure of the elements.</p>	<p>This unit picks up on work from Year 7 term 1 on the separation of mixtures in a variety of ways but extends this knowledge by including chromatography. It then continues on to link with ions and isotopes which leads to the arrangement of the periodic table where we focus on the groups of the periodic table (initially looked at in Year 8 term1) and the trends found within the groups.</p>
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Y9 Term 2	Structure & Bonding	<p>In this unit, students will develop their understanding of the states of matter. They will have built upon their understanding of the particle model, using this to explain the energy transfers involved when substances change state. Students will have also learnt about the different types of bonding in substances. They should understand that covalent bonding is the sharing of one or more pairs of electrons between non-metal atoms; ionic bonding involves a metal and non-metal atom, with the metal atom losing one or more electrons and the non-metal atom gaining one or more electron; and metallic bonding involves a delocalised sea of electrons surrounding the positive metal ions.</p>	<p>We start this unit by reinforcing the work started in Year 9 term 2 in Atomic Structure and developing the work on ions to show pupils the three main types of bonding – ionic, covalent and metallic. The arrangement of the atoms in these are studied extensively to enable the pupils to draw diagrams of the bonding.</p>
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Y9 Term 2	Chemical changes (a): Reactions of metals	In this unit, students will develop their understanding of the reactivity series. They will study the reactions of the metals potassium, sodium, lithium, calcium, magnesium, zinc, iron, and copper with water and acids and should be able to recall and describe these reactions. They will apply their understanding of the reactivity series to displacement reactions and the extraction of metals, as well as introducing them to the concepts of oxidation and reduction as the loss and gain of electrons respectively (HT only)	The Chemical Changes (a) unit picks up where the structure and properties unit ended in year 9 term 3 and links to some content from Reactions in Year 7 term 3. From there it deals with the reactivity of metals and displacement reactions
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Y9 Term 3	Structure and properties	Students will learn how the bonding of a substance affects its bulk properties. They can describe the difference in bonding and properties of giant ionic structures, simple covalent molecules, and giant covalent structures (including different arrangements of carbon). Students should also understand that covalent, metallic, and ionic bonding is strong, but it is how the particles interact (intermolecular forces) that determines properties such as melting point, boiling point, and electrical conductivity.	This topic reviews the work from Year 9 term 2 on Structure and bonding. It builds on the knowledge of different types of bonding and explains how the properties of these substances can be inferred from the bond type and therefore structure. The allotropes of carbon are then studied to highlight how they will be used in the future. Triple science also study nanochemistry.
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Y9 Term 3	Chemical changes (b): Reactions of acids	Students will learn about salts and how they are prepared, including from metals and acids, acids and bases, and acids and carbonates. Students learn about ionic equations and half equations to describe the movement of ions during neutralisation reactions. Students learn about reactions in terms of loss and gain of electrons (redox). Students should be able to predict the products of neutralisation reactions and use common ion formulae to deduce the formulae of salts (crossover rule). Students will carry out a required practical to produce a soluble salt. Students will learn about the pH scale and be able to explain how pH relates to $H^+(aq)$ ion concentration and the difference between strong and weak acids.	This topic builds on the reactions topic in year 7 term 3, where students met acids, alkalis and reactions of metals. It also builds on ions and the properties of ionic compounds from the structure and bonding topics in yr 9 terms 2 & 3.
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Yr 10 Term 1	Electrolysis	<p>Students are introduced to the idea that an ionic compound can be broken down by the process of electrolysis. Students build upon their knowledge of properties of ionic compounds to explain why ionic compounds can undergo electrolysis when molten or in solution. They will also be able to explain the movement of particles during electrolysis, and the reactions that occur at the electrodes. Students will then apply their understanding of electrolysis to the extraction of aluminium, and learn how to investigate the electrolysis of a solution. They should be able to predict the products of electrolysis and be able to write balanced half equations (HT)</p>	<p>We introduce and deal with the use of electrolysis as an extraction technique and the importance of ions in this method. Students revisit the year 9 topic of structure and properties to understand how electricity can be used to break down compounds. They also make comparisons between the conduction of electricity in metals and salts.</p>
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Yr 10 term 1	Energy Changes	In this unit, students will learn about the energy transfers that occur during chemical reactions. They should understand that an exothermic reaction transfers energy from the system to the surroundings, and an endothermic reaction transfers energy from the surroundings to the system. Students will further develop their qualitative understanding of the energy transfers in a reaction into a quantitative understanding. They should be confident with sketching and interpreting reaction profile diagrams and some students should be able to use bond energies to calculate overall energy changes for a reaction, identifying if it is exothermic or endothermic. Students will also apply their understanding of the reactivity series and electrolysis to chemical cells and fuel cells.	This unit takes the learning from Year 8 term 2 and increases the depth and complexity. We investigate the energy changes involved in exothermic and endothermic reactions and deepen that knowledge by looking at reaction profiles and then bond energy calculations. It also revisits the work on bonding from year 9 and reviews some of the neutralisation reactions in the year 9 term 3 topic of chemical changes.
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Yr 10 Term 2	Quantitative chemistry	In this unit, students will build upon their understanding of the structure of atoms and sub-atomic particles to understand relative atomic mass and relative formula mass. Students should be able to use relative atomic masses to calculate relative formula masses of compounds. For some students, this is then related to the mole and Avogadro's constant, and the relevant calculations introduced. Students should be able to use the equation number of moles = mass (g) / $A_r$ and use moles to balance symbol equations and calculate reacting masses. Students will apply their understanding of relative atomic mass, relative formula mass, and moles to concentrations. All students should be able to carry out calculations with concentrations in $\text{g/dm}^3$ .	This unit links to the Matter unit taught in Year 8 term 1 and the Atomic structure unit taught in Year 9 term 1. We also revisit the periodic table from yr 9, term 2. The quantitative chemistry topic gives an ideal opportunity for revision of order of elements, proton number and isotopes. We deal with the way in which equations can be used to calculate reacting masses and from there link to the idea of the chemical mole. This then is used to balance equations and calculate concentrations of substances.
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Yr 10 Term 2	Rate and extent of chemical change	<p>In this unit, students will have learnt about the factors that affect the rate of a reaction, including temperature, surface area, concentration, and pressure. Students should be able to explain the effect of each factor on the rate of reaction using collision theory – understanding that each factor increases the <i>frequency</i> of effective collisions, <b>not</b> just the number of collisions. They should also be able to explain the effect of catalysts on the rate of a reaction in terms of providing an alternative reaction pathway with a lower activation energy. Students have also learnt about reversible reactions and dynamic equilibrium. Students should apply their knowledge on endothermic and exothermic reactions to equilibrium reactions to be able to predict the effect of temperature changes on the reversible reactions and the position of the equilibrium. Some students should also be able to use Le Châtelier's principle to explain the effect of temperature and pressure on the position of equilibrium.</p>	<p>This unit links to many of the other units before as it encompasses many different reactions and explains how they can be made to react quicker or slower. We look at the effect of temperature, pressure (linking to the particle theory covered in Year 9 term 1), concentration (Year 10 term 2) and catalysts (mentioned in organisation Year 10 term 1), we also revisit reaction profiles from the energy changes topic in year 10 term 1. This is made more complex by looking at reversible reactions, and how these can be altered by applying Le Châtelier's principle.</p> <p>Le Chatelier will be revisited in year 11 when pupils learn about the Haber process and fertilisers.</p>
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Year 10 term 2	Organic Chemistry (crude oil and hydrocarbons)	In this unit, students are taught about hydrocarbons and are introduced to the alkanes. They should be able to identify alkanes from their formulae, and be able to name and draw the displayed formula of the first four alkanes. Students have also learnt about some of the reactions of hydrocarbons, including combustion (both complete and incomplete) and cracking. All students should be able to write balanced symbol equations for the complete combustion of hydrocarbons and to describe the conditions of cracking. All students should be able to describe the test for alkenes (a product of cracking). Students will have also learned about crude oil as a source of hydrocarbons and the fractional distillation of crude oil. They should be able to describe how the size of the hydrocarbon molecule affects its properties, including viscosity, boiling point, and flammability.	This links to the unit on structure and bonding (Year 9 Term 2). It deals with the importance of hydrocarbons industrially, how they are separated using fractional distillation (previously taught in atomic structure Year 9 term 1) and then how they are cracked to form alkanes and alkenes. It is an ideal opportunity to revisit the properties of small molecules and intermolecular forces. They can also practise relative formula mass calculations and percent by mass (learned in year 10, term 2). They also revisit balancing equations from year 10 term 2.
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Year 10 term 3	Organic Reactions (Chemistry only)	This topic introduces pupils to the reactions of alkenes, alcohols, carboxylic acids and ester formation. Students study the uses of alcohols and different methods of production. This is a good grounding for A level organic chemistry as these basic reactions are the starting point for mechanisms at A level.	This builds on the crude oil topic taught in year 10 term 2 and reinforces covalent bonding and structure and properties of small molecules (yr 9 term 2). This topic provides a valuable opportunity to revise the use of catalysts and concentrated acids as well as the use of yeast in biotechnology from yr ecosystems. It also links to biology enzymes topic.
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Yr 10 term 3	Combined Chemical analysis	In this unit, students will be taught about various techniques for analysing substances. All students should understand the difference between a pure substance, a mixture, and a formulation, and what is meant by purity. Students should also have built upon their understanding of chromatography experiments and be able to analyse a chromatogram, both qualitatively and quantitatively using $R_f$ values. Students should also be able to describe the different experimental tests for gases, including both the procedure and positive result.	In this final unit we use laboratory tests to identify key substances such as hydrogen, oxygen and carbon dioxide gases. We also analyse chromatograms using $R_f$ values (linking to Year 9 term 2) and explain the differences between pure substances and formulations used industrially. This links to the matter topic and reactions topic both taught in yr 7.
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Yr 11 Term 1	Using Resources	<p>In this unit, students will learn about the difference between finite and renewable resources. They should understand that renewable resources are not an infinite supply, but are replaceable at a rate similar to the rate they are used up, whereas finite resources are used up faster than they can be replenished. Students understanding of finite and renewable resources should be applied to the need to reuse and recycle, and they will be able to describe and evaluate ways of reducing the use of finite resources, and carry out life cycle assessments on products. Students then look at specific resources that we use, including water and metals (in particular copper). Students should be able to describe the different ways that water is treated, both to create potable water and to remove waste products so it is safe to release into the environment. Chemistry only then extends this topic by looking at the Haber process and its importance for NPK fertiliser production, useful alloys, rusting and ceramics, glass and composites.</p>	<p>The work completed in Year 8 term 3 is now further developed by looking at the extraction of metals from their ores using carbon reduction and electrolysis. We then teach pupils how to carry out life cycle assessments and how water is treated to enable us to have potable water. Chemistry only also links the Haber process to the equilibrium topic taught in the Rates of reaction section, yr 10 term 2, and neutralisation reactions from yr 9 term 2. Polymers will be revisited in the chemistry only organic reactions topic (yr 11 term 2)</p>
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Yr 11 Term 2	Polymers (top set only)	This topic introduces students to the formation of addition and condensation polymers in science and in the natural world. Pupils are taught how polymers form and some properties. They study amino acids and proteins as well as the biochemical structure of DNA.	This topic builds on the chemistry only organic reactions topic which introduced alcohols, carboxylic acids and alkenes to students. This links to biology DNA and proteins topics. It also builds on the thermosetting and thermosoftening topic in the using resources chemistry only topic. It's a good opportunity to review covalent bonding.
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