

Science Department Curriculum Overview



Curriculum Overview

Our spiral curriculum ensures the trajectory of scientific learning is seamless from the beginning of KS3 into KS4 and onwards to KS5. We have designed an ambitious and holistic curriculum where we strive to equip all students with the understanding of essential scientific concepts. We aim to engage students in all three science disciplines by making links to material world applications, exploring topical updates in scientific research and discovery, engaging in educating our young people on Women in STEM who have pioneered advancements in scientific fields as well as highlighting science career links.

The aims and objectives of the science curriculum are to enable students to develop:

- essential knowledge and understanding of different aspects of science and how they relate to each other;
- demonstrate a deep appreciation of the skills, knowledge and understanding of scientific methods;
- competence and confidence in a variety of practical, mathematical and problem-solving skills;
- interest in, and enthusiasm for, the three sciences, including developing an interest in further study and careers associated with the subject;
- understanding of how decisions are made relating to scientific issues and how the three sciences contribute to the success of the economy and society.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 7	<p>Introduction to science</p> <p>Students will be introduced to the science laboratory and practical investigation skills. They will become familiar with hazard symbols and ways to work safely in a science laboratory, learn how to light and safely use a Bunsen burner, learn to identify and use</p>	<p>Cells and Movement</p> <p>Students will learn the organelles and their functions in plants and animal cells. They will also learn about specialised cells and be able to link structure and function. Students will also explore how the skeletal system</p>	<p>Interdependence</p> <p>Students will learn about organisms in a food chain and food web and how they depend on each other for nutrients. They will explain the effects of environmental changes and toxic materials on a species' population</p>	<p>Particle model and separating mixtures</p> <p>Students will learn about particle theory and use it to describe and explain changes of state. They will also use this knowledge to explain freezing and boiling points.</p>	<p>Metals, non-metals, acids and alkalis.</p> <p>Students will learn that the pH of a solution depends on the strength of the acid. They will identify the best indicator to distinguish between solutions of different pH's, using data provided, and be able to give examples of neutralisation reactions.</p>	<p>Sound and Light</p> <p>Students will learn how the ear works and that sound consists of vibrations which travel as a wave through substances. They will be able to explain observations</p>

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<p>laboratory equipment and plan and carry out investigations within a biology, a chemistry and a physics context.</p>	<p>and muscular system work together to create movement.</p> <p>Plant reproduction</p> <p>Students will learn the steps that take place when a plant reproduces successfully. They will identify parts of the flower and link structure to function. They will explain why seed dispersal is important to survival of the parent plant and its offspring.</p>		<p>Students will explain how substances dissolve using the particle model. They will learn about solutes, solvents and solutions. Students will be able to choose the most suitable technique to separate out a mixture of substances.</p> <p>Variation and human reproduction</p> <p>Students will learn about puberty, menstruation and fertilisation in humans. They will be able to explain the development of the baby. They will also be able to describe different forms of contraception.</p> <p>Students will learn that there is variation between individuals of the same species. Some variation is inherited, some is caused by the environment,</p>	<p>Students will learn about the properties of metals and non-metals and be able to identify where they are found in the periodic table. They will look at what happens when a metal reacts with oxygen and acid.</p> <p>The Earth's structure and the Universe.</p> <p>Students will learn about the structure of the Earth, the three types of rocks and how they are connected by the rock cycle. They will identify the causes of weathering and erosion and describe how they occur.</p> <p>Students will learn about our solar system and the planets. They will explain why places on the Earth experience different daylight hours and amounts of sunlight during the year.</p>	<p>where sound is reflected, transmitted, or absorbed. They will also learn that when a light ray meets a different medium, some of it is absorbed and some reflected. Students will look at reflection, refraction, dispersion, colours and use ray diagrams to describe how light passes through lenses and transparent materials.</p>

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				and some is a combination. Students will explain how characteristics of a species are adapted to environmental conditions.		
Year 8	<p>Speed, Forces and Gravity</p> <p>Students will use the speed equation to Analyse motion graphs. They will learn that when the resultant force on an object is zero, it is in equilibrium and does not move, or remains at constant speed in a straight line. Students will be able to describe factors which affect the size of frictional and drag forces. Students will explain the differences between mass and weight and explore how mass and weight differ on various celestial bodies.</p> <p>The periodic table and elements.</p> <p>Students will define an element, compound and molecule. They learn to</p>	<p>Chemical energy and types of reaction</p> <p>Students will discover that some reactions are exothermic, and some are endothermic. They will begin to write chemical equations in the context of combustion and thermal decomposition. Students will learn about the reactivity series, define what a catalyst is and describe why catalysts are useful.</p> <p>Electricity and Magnetism</p> <p>Students will be able to draw simple</p>	<p>Breathing and diet</p> <p>Students will study the structure of the lungs and breathing. They will investigate the impact of exercise on breathing and discuss the dangers of smoking and asthma.</p> <p>Students will learn about a balanced diet, the different food nutrients and their functions.</p> <p>Work, heating, and cooling</p> <p>Students will learn to identify energy stores and pathways. They will describe the efficiency of a system by using a</p>	<p>Respiration and Photosynthesis</p> <p>Students will learn to describe respiration as a chemical reaction, describe the difference between aerobic and anaerobic respiration using word equations. They will also investigate fermentation.</p> <p>Students will explore how plants and algae make their food by photosynthesis. They will use the word equation to describe photosynthesis and show how the rate of photosynthesis is affected by changing conditions.</p>	<p>Evolution and Inheritance</p> <p>Students will look at what heredity is, explore the structure of DNA and have an opportunity to extract DNA from fruit.</p> <p>They will discover what selective breeding is and study the theories behind evolution, natural selection and biodiversity.</p> <p>Waves</p> <p>Students will learn about the different types of waves: Transverse and longitudinal.</p> <p>They will expand their knowledge from sound and light to learn about absorption and transmission of light, UV damage and uses of ultrasound.</p>	<p>Climate and Earths resources</p> <p>Students will learn about the different gases in the atmosphere and their composition. Also, they will learn about the carbon cycle, climate change and human factors that can contribute to climate change.</p> <p>Students will be able to label the structure of the earth and discuss how metals can be extracted as one of the</p>

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	<p>name compounds and write equations using their chemical formulae. They will represent atoms, molecules, elements, mixtures and compounds using particle diagrams.</p> <p>Students will also learn about the history of the Periodic table and how it is arranged. They will be introduced to the principles underpinning the Mendeleev periodic table and describe the reactions of Group 1 or 7 elements.</p>	<p>circuit diagrams using circuit symbols. They will explain what current and resistance is and describe how current changes in series and parallel circuits. They will learn to model voltage as an electrical push from the battery, or the amount of energy per unit of charge transferred through the electrical pathway.</p> <p>Students will learn about static electricity. They will learn to use Ohm's law to calculate the resistance in a circuit.</p> <p>Students will learn about magnets, electromagnets and what causes a magnetic field. They will investigate ways of varying the strength of an electromagnet.</p>	<p>Sankey diagram. Students will learn about different fuels and energy resources and be able to calculate work done and power.</p>	<p>Contact Forces and Pressure Students will build on their knowledge of forces by quantifying resultant forces and looking at drag and surface area.</p> <p>Students will also investigate Hooke's law theory and learn how to calculate pressure.</p>		<p>earth's resources.</p> <p>Students will have some time for reviewing work and preparing for GCSE's.</p>

Year 9

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	<p>Chemistry Students will build on their knowledge separation techniques and begin to analyse separation techniques at a KS4 level.</p> <p>Students will also build on their knowledge of atomic structure and apply this to electronic configuration, ions and isotopes. They will also explain the development of atomic theory from Dalton to Chadwick.</p> <p><i>Required Practical - Chromatography, an introduction.</i></p>	<p>Chemistry Students will learn about the Periodic Table and its development from the pioneering work made by Newlands and Mendeleev.</p> <p>They will compliment this with how the modern day periodic is arranged (metals / non-metals) and link this to electronic configuration.</p> <p>Students should also be able to describe trends in Group 1,7,0.</p>	<p>Chemistry Students will learn about Bonding (Ionic, Covalent). Students will demonstrate their understanding through diagrams and extended writing.</p> <p>Students will be able to explain trends in reactivity of Group 1 and 7 and explain the melting point/boiling point trends of Group 7 and 0.</p>	<p>Chemistry Students will continue Bonding module by learning about Giant Covalent Structures and Metallic Bonding.</p> <p>Students will then start the next module on the Earth's Atmosphere and will evaluate the composition and the evolution of the Earth's Atmosphere.</p>	<p>Chemistry Students will learn the principles of the Greenhouse Effect and how this links to Climate Change.</p> <p>They will also learn about the Carbon Footprint and evaluate how human activities contribute to the Greenhouse Effect → Global Warming → Climate Change.</p> <p>Students will also learn about pollutants in the Earth's atmosphere: how they arise, their effects and how they can be minimised.</p>	<p>Chemistry Students will learn the principles of the Greenhouse Effect and how this links to Climate Change.</p> <p>Students will begin learning Using Resources Part 1. This includes learning about Finite resources and how to make potable water.</p> <p>End of Year Exams.</p>

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Year 9	<p>Physics Students will learn how energy stored in a system can change for example when the object is projected upwards or it hits an obstacle.</p> <p>Students will learn to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. Students will also learn how energy can be transferred from one form to another and efficiency of a system.</p>	<p>Physics The topic of energy is continued.</p> <p>Students will learn about Temperature changes in a system. Students will learn and be able to apply the equation for specific heat capacity.</p> <p><i>Core practical: Specific Heat Capacity</i></p>	<p>Physics Students will learn about energy resources, supply and demand, and the environmental impacts of supplying energy to homes and industry.</p>	<p>Physics Students will learn about Standard circuit diagram symbols representing different electrical components.</p> <p>Students will also learn about electric charge and how the current of a component depends on the resistance and potential difference.</p> <p><i>Core practical: Resistance and IV characteristics.</i></p>	<p>Physics Students will learn about how electricity gets to our homes by learning about the National Grid.</p> <p>Students will also learn about Energy transfers in everyday appliances and how Static Electricity can be formed.</p>	<p>Physics Consolidation of topics learnt this year.</p> <p>End of year assessments.</p>
Year 9	<p>Biology Students will learn how to classify cells as Eukaryotes and Prokaryotes. Explain the structure and functions of organelles found in animal and plant cells. Students will also learn that cells can specialise to perform a particular function and as organisms develop,</p>	<p>Biology Students will learn about how substances like water and minerals are transported in plants cell through different processes by studying the following concepts Diffusion, Osmosis and Active transport Biology</p>	<p>Biology Students will learn to develop an understanding of size and scale in relation to cells, tissues, organs and systems. Students should be able to relate knowledge of enzymes to metabolism and be able to describe the nature of enzyme molecules and relate</p>	<p>Biology Students will learn about the heart and lungs and the different types of blood vessels. Students will apply this knowledge to identify causes of Coronary Heart Diseases.</p>	<p>Biology Students will learn the different types of communicable diseases; viral, bacterial, fungal and protist diseases how they are spread and can be reduced.</p>	<p>Biology Students will learn about noncommunicable diseases and how drugs are developed. Students will learn how monoclonal antibodies and made and used</p>

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		<i>Required Core Practical Osmosis</i>				
Year 10	<p>Chemistry Students will continue their learning on Using Resources Part 2. Here, they will review and build on their knowledge from Year 9. They will cover the required practical, learn about the LCA, contextualising this to industry today, and build on the knowledge of Reduce, Reuse and Recycle they already have from the material world.</p> <p><i>Required Practical: Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.</i></p>	<p>Chemistry Students will learn about Energy Changes and will be able to describe both exothermic and endothermic reactions and show their differences in energy profile diagrams. Students will evaluate energy changes in reactions using bond energy calculations. Sets 1 and 2 will also learn about chemical cells and fuel cells as part of the triple pathway and evaluate their use.</p> <p><i>Required Practical: Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals.</i></p>	<p>Chemistry Students will learn about Extraction of Metals via different methods including Phytomining and Bioleaching. This will lead them into their learning on Electrolysis where they should be able to explain why this method of extraction is used and evaluate its disadvantages. Students will then learn about the extraction of both molten and aqueous electrolytes. Students will also learn about how aluminium is extracted from aluminium oxide.</p> <p><i>Required Practical - Investigate what happens when aqueous solutions are electrolysed using inert electrodes.</i></p>	<p>Chemistry Students will next develop their acids and bases knowledge from KS3, by learning about reactions of acids with: metals, bases/alkalis, metal carbonates.</p> <p>Students will apply their knowledge of the pH scale to describe and explain the principles of strong and weak acids.</p> <p><i>Required Practical: Preparation of 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.</i></p> <p>Students will learn about Quantitative Chemistry by first describing the Law of</p>	<p>Chemistry* Students will learn about Quantitative Chemistry by first describing the Law of Conservation of Mass. Students will then calculate relative formula masses. Students will calculate concentration and volume of gases (non-mole based calculations). They will then learn the mole equation and apply this to calculating masses from balanced symbol equations.</p> <p>Students will learn how to identify limiting reagents through reacting masses calculations.</p> <p>Sets 1 and 2 will apply their learning to calculating percentage yields and atom economies. They will then learn how to calculate concentrations from titration calculations.</p> <p><i>Required Practical: Determination of the reacting volumes of</i></p>	<p>Chemistry* Students will be reviewing and consolidating what they have learnt so far.</p> <p>End of Year Exams.</p>

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				<p>Conservation of Mass. Students will then calculate relative formula masses. Students will calculate concentration and volume of gases (non-mole based calculations). They will then learn the mole equation and apply this to calculating masses from balanced symbol equations.</p>	<p><i>solutions of a strong acid and a strong alkali by titration.</i></p> <p>End of Year Revision.</p>	
Year 10	<p>Physics Students will learn about the particle models and use it to explain the behaviour of solids, liquids and gases which are used in many everyday applications.</p> <p>Students will learn to apply and calculate the density of material.</p> <p><i>Core Practical: Density</i></p>	<p>Physics Students will learn about the subatomic particles in the structure of an atom, mass number and atomic number.</p> <p>Students will extend this knowledge to learn about why isotopes exist. Students will also learn about the different types radioactive decay and nuclear power plants.</p>	<p>Physics Students will learn about scalar and vector quantities, examples and how they can be represented.</p> <p>Students will expand on their knowledge of forces by learning about contact and non- contact forces, gravity and resultant forces.</p> <p><i>Core practical: Centre of mass.</i></p>	<p>Physics Students will expand their knowledge about Forces by studying motion. This will include plotting and analysing motion graphs.</p>	<p>Physics Students will expand their knowledge about Forces by studying forces in motion. This includes forces and acceleration, weight, terminal velocity, braking and momentum.</p> <p><i>Core practical: $F=ma$</i></p>	<p>Physics Students will be reviewing and consolidating what they have learnt so far.</p> <p>Students will sit year 10 exams on topics covered so far.</p> <p>Work experience.</p>

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	<p>Students will apply their knowledge about Photosynthesis to learn about the uses of glucose. Students will learn about different types of Respiration Aerobic and anaerobic respiration and where they can occur.</p> <p>Response to exercise, and metabolism.</p> <p><i>Core Practical Investigating the rate of photosynthesis</i></p>	<p>Students will learn in more about the nervous system and hormone control including Negative feedback. Students will learn how the eye works and long and short vision.</p> <p><i>Core Practical - Reaction time</i></p>	<p>Students will learn in more details about Human endocrine system; Control of blood glucose; The function of the kidney's; Hormones in human reproduction; Contraception and Infertility</p>	<p>Students will learn about Plant hormones and how they affect the way the plant grows and the uses of these hormones.</p> <p><i>Core practical – Plant growth</i></p>	<p>Students will learn about the environment including how organisms adapt and compete with each other and their role in food webs. Students will learn more about their environment by studying topical issues such as global warming, deforestation and maintaining biodiversity</p> <p><i>Core Practical - Sampling</i></p>	<p>Students will be reviewing and consolidating what they have learnt so far.</p>
Year 11	<p>Chemistry Students will learn about collision theory and the factors affecting rate of reaction.</p> <p>They will also learn about how catalysts affect the rate of reaction.</p> <p><i>Required Practicals: Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced <u>and</u> a method involving a change in colour</i></p>	<p>Chemistry Sets 1-4 will then study Le Chatelier's Principle and explain how altering reaction conditions affects the position of the equilibrium.</p> <p>Triple students will then apply their learning to the Haber Process, its economics and NKP fertilisers.</p>	<p>Chemistry All students will build on their knowledge of fossils fuels to apply this to formation, use and extraction of crude oil.</p> <p>Triple students will then extend their learning to alcohols, carboxylic acids, polymers, amino acids and DNA.</p> <p>All students will review and build on their knowledge of mixtures and pure substances by</p>	<p>Chemistry Triple students will learn about Instrumental Analysis and how this used in everyday life. They will then learn how to test for and identify positive and negative ions.</p> <p><i>Required Practical: Use of chemical tests to identify the ions in unknown single ionic compounds.</i></p>	<p>Chemistry Students will prepare for the final exams</p>	<p>Chemistry Students will sit their final chemistry exam.</p>

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	<p>Students will learn about reversible reactions and dynamic equilibrium.</p>		<p>applying this to formulations.</p> <p>Students will then build on their learning from Year 9 on chromatography, by evaluating solubilities of compounds separated using Rf value calculations.</p> <p><i>Required Practical: Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.</i></p> <p><i>Triple students: Flipped learning of remaining Using Materials topics.</i></p> <p>Students will learn about testing for gases.</p> <p>Students will then be reviewing and consolidating what they have learnt so far.</p>			

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			<i>Triple students: Flipped learning of remaining Using Materials topics.</i>			
Year 11	<p>Physics Students will learn about the different types of waves: Transverse and longitudinal waves and Properties of waves.</p> <p>Students will learn about Light. Reflection, refraction, and diffusion of light. Lenses and using lenses.</p> <p><i>Core practical: Investigating waves in solids and liquids and light</i></p>	<p>Physics Students will expand on their knowledge of waves to learn about the types of Electromagnetic wave, Properties of Electromagnetic Waves, Uses and applications of Electromagnetic waves.</p> <p><i>Core practical: IR radiation Leslie Cube</i></p>	<p>Physics Students will also learn about Magnetism and Electromagnetism: Permanent and induced magnetism, magnetic forces and fields, The motor effect.</p>	<p>Physics Students will learn about Space Physics.</p>	<p>Revision. Students will sit final exams.</p>	<p>Students will sit final exams.</p>
Year 11	<p>Biology Students will be building on their knowledge about genes students will learn about sexual and asexual reproduction; Meiosis;</p>	<p>Biology Students will be building on their knowledge about genes students will learn about Variation; Selective breeding;</p>	<p>Biology Students will be building on their knowledge about genes students will learn about Evolution; Genetic engineering; cloning and the ethics behind this.</p>	<p>Biology Students will learn at how important it is to understand Fossils in understanding evolution and extinction and also how to classify organisms</p>	<p>Biology Students will prepare for the final exams</p>	<p>Biology Students will prepare for the final exams</p>

* As of 2023, there will be a revision to the Summer Modules in Year 10 – students will be taught Rates in during the Year 10 summer term and Quantitative Chemistry at the start of the Year 11 Autumn Term.