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	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 7 *Students will build on KS2 learning to further develop their understanding of...*	**Cells** *Students will study the key features and functions of plants and animal cells. They will develop understanding of how cells are adapted for their function. They will understand structural differences between unicellular and multicellular organisms and how substances can be transported by diffusion.* **Particles** *Students further their understanding of the properties of materials, focusing on the different states of matter in terms of the particle model. Students learn about changes in state of matter and will explore how to represent this with diagrams. Students*	**Interdependence** *Students will be able to classify animals based on their physical characteristics and understand how changes in the environment can impact food chains / webs and the abundance of organisms.* **Forces** *Students explore how forces interact with objects to change their speed, shape or direction and represent these as force diagrams. They will investigate friction and measure forces in stretching and squashing.* **Atoms, Elements, Compounds** *Students further their understanding of matter and materials by learning about*	**Movement** *Students will explore the key features and functions of the skeleton, identify key parts of joints, and understand how muscles and joints work together to allow movement of the body.* **Gravity** *Students develop their understanding of gravity as a force including the difference between mass and weight, how gravity varies across the solar system, and how to draw a force diagram.*	**Science Week** *Students spend time exploring the specific theme set for British Science Week. Activities during these lessons can include research using digital technology, exploration using virtual reality headsets, bespoke investigations and more.* **Energy transfers** *Students will be introduced to the law of conservation of energy using an energy model where energy is transferred from one store at the start to another at the end.*	**Reproduction** *Students will build on learning from KS2 of the different ways in which plants can disperse their seeds, the key structures of the plant reproductive system and the process of pollination. Students will build on their knowledge of human reproduction. They will learn the differences between sexual and asexual reproduction, identify the key structures and processes of the male and female reproductive system, (including menstruation), before exploring the process of fertilisation. Here, students will be encouraged to make links with the PSHE curriculum on contraception and fertility.*	**Movement (speed)** *Students develop their understanding of forces and apply this to motion. Students will use maths skills to calculate speed and represent journeys on a distance-time graph.* **Electric circuits: current and PD** *Students explore how energy is transferred electrically in a circuit. Students will have the opportunity to build their own series and parallel circuits and draw scientific diagrams of these. Students will use their maths skills to calculate current and potential difference, using readings from practical investigations.* **Invention Convention** *Students explore the world of STEM beyond the National*

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	will have the opportunity to investigate changes of state, which may introduce them to variables and investigative techniques for the first time.	*atoms, elements and compounds. Students are introduced to chemical symbols and formulae.*			**Mixtures** *Students build on their knowledge of the states of matter to describe materials as pure and impure. In this topic, they will learn what makes a substance pure, what makes a mixture and simple methods that can be used to separate mixtures.*	*Curriculum. In these lessons, students are encouraged to be creative, and propose an invention that falls into one of three categories: 'helping the planet', 'helping humans', 'helping animals'. Students produce a prototype of the invention in small groups and a pitch to sell it. The best inventions for each class, as voted by the pupils themselves, go on to compete in the grand finale for exciting STEM prizes.*
Year 8	**Breathing and Respiration** *Students will understand the parts of the breathing system and how they play a role during the processes of inhaling and exhaling. Students will describe how gas is exchanged in the lungs, the effect of exercise on*	**Photosynthesis** *Students will further develop knowledge of how plants survive and the key concepts of photosynthesis. They will be able to name, label and describe the functions of tissues within a leaf and their role in photosynthesis, developing practical skills while learning*	**Earth Resources** *Students will relate their understanding of recycling to the limited nature of resources on Earth. They will learn about the different ways metals are found and the best methods to extract them. Students will be*	**Science Week** *Students spend time exploring the specific theme set for British Science Week. Activities during these lessons can include research using digital technology, exploration using virtual reality headsets, bespoke investigations and more.*	**Drugs** *Students will be able to understand the term "drug" and classify drugs in different ways, including their legal status and their effects on the body. With strong links to PSHE, students will learn why people choose to take recreational drugs and the effects these can*	**Waves: Light and Sound** *Students will learn about wave properties and relate them to sound and light. Students will have some knowledge of sound and light from KS2, therefore the introduction of scientific vocabulary*

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	breathing and how smoking can impact gas exchange. Students will develop understanding of the importance of respiration in living organisms. Students will be able to describe the differences between aerobic and anaerobic respiration and how respiration links to fermentation and its uses in the food and drinks industry. **Periodic Table and Metals/Non-Metals** *Students will further their knowledge of matter by sorting elements using chemical data and linking this to their position in the periodic table. Students learn about patterns in reactivity and the properties and uses of metals*	*how to test a leaf for the presence of starch.* **Acids and Alkali** *Students will further their understanding of acids and alkalis to investigate neutralisation reactions when an acid reacts with an alkali. They will be able to describe properties of acids and alkalis including their pH, give examples of each and safety precautions when handling them.* **Electrical Circuits: Resistance** *Students will build upon knowledge of electrical circuits, current and potential difference. They will link this knowledge to a new concept: resistance. Students will learn about the relationships between each concept and apply their knowledge using*	*introduced to reactivity and electrolysis.* **Digestion** *Students will also be able to describe the function of key structures of the digestive system and how they facilitate the digestion of food. Students will understand the importance of a healthy diet, the uses of nutrients found in food and consequences of poor diet. They will also understand how enzymes play a role in digestion.* **Pressure** *Students build upon their mathematical knowledge to calculate and explore the relationships between volume, area and pressure. They will look at how pressure changes with depth in*	**Variation and Inheritance** *Students will discuss variation within and between species, as well as linking their ideas of inheritance to the reproduction topic. Students will understand structures within the genome and the role of genes during inheritance. Students will be able to describe how variation occurs in a population and how this leads to differences in characteristics. They will also develop their skills of presenting scientific data.* **Earth Structure** *Students will extend their knowledge of rocks and rock formation to explain how the rock layers inside the Earth have formed. Students will develop their scientific communication skills to*	*have on their physical and mental wellbeing.*	*will be used to help them make more detailed links between the transfers of energy, waves and how we hear/see things. Students will be able to state the similarities and differences between light and sound waves. They will study and draw ray diagrams to explain what happens when light hits different surfaces and learn how lenses work, such as in the eye.* **Science Skills** *Students round off their learning in Year 8 science by consolidating key disciplinary knowledge from Year 7 and Year 8. Activities in this unit are carefully mapped out to encourage mastery of the skills required to access Year 9 and GCSE science.*

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	and non-metals. Students will learn how reactions with oxygen and acids can help determine the reactivity of a metal, applying this to explain displacement reactions.	*equations to calculate values for each. Students will have the opportunity to explore each concept with practical investigations.*	*a liquid and with height in air.*	*represent the information in a comprehensive diagram.*		
Year 9	**Evolution** *Students will further develop understanding of variation and how this can give an organism a survival advantage to drive natural selection. They will understand the importance of biodiversity and factors that may affect it.* **Work** *Students will be able to explain that work is done and energy is transferred when a force moves an object. They will*	**Chemical Energy** *Students will build on their understanding of chemical reactions to determine whether energy is required or released when a reaction takes place. They will be able link this to whether bonds are broken or being formed and will be able to use the keywords exothermic, endothermic and catalysts.* **Magnetism** *Students will build upon their understanding of magnetism. They will*	**Space and Universe** *Students will further their understanding of gravity and how it connects all things within the universe as well as the structure of the solar system, why we are held in orbit and have seasons and night and day.* **Chemical Changes** *Students will look at combustion and thermal decomposition reactions to deepen their understanding of chemical and physical changes. Students will be introduced to conservation of mass*	**Cell Structure and Transport** *Students revisit cells and build upon their fundamental KS3 knowledge as they enter their GCSE biology studies. Here, GCSE-level vocabulary will be explored and students will classify cells in more scientific ways, for example, eukaryotic and prokaryotic. Students will develop microscope techniques and apply mathematical skills to calculate magnification. Students will also*	**Cell Division** *Students continue to explore how cells are the building blocks of life. Students will understand why cells divide and use their knowledge of the cell cycle to solve related problems, such as how a tumour forms or how long it may take a wound to heal. Students will be able to fully explain the functions of specialised cells and the functions and uses of stem cells in real-life. Students will evaluate the use of stem cells in medicine.*	**Organisation and the Digestive System** *Students will relate their knowledge of organisation to the digestive system. Students will apply their KS3 knowledge of balanced diets and the structures and functions of the digestive system enhance their understanding of digestion. Students be able to describe and carry out food tests using chemical reagents and interpret the results to determine the composition of foods.*

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	investigate how simple machines such as levers and pulleys make work easier. The skills developed here will form the fundamental knowledge required to understand work done at GCSE level. **Climate** *Students will be introduced to the composition of Earth's atmosphere, the carbon cycle and the effect of human activity on both the carbon cycle and the climate. This feeds into the biology topic Human Interaction, which is taught in Spring 1.* **Heating and cooling** *Students will further their understanding of energy and be able to explain that the thermal energy depends on the*	*learn to draw magnetic field lines including when magnets attract or repel each other. They will also integrate knowledge from the current and potential difference topics to design and test electromagnets.* **Human Interaction** *Students will use their knowledge of variation, interdependence, respiration and photosynthesis in this unit. They will develop an understanding of the importance of sustainability to help pupils make responsible lifestyle choices. Pupils will go on to learn more about conservation and relationships in ecosystems, which will be further developed at GCSE level.*	*during a reaction, which will form the foundational knowledge required for GCSE quantitative chemistry, e.g., atom economy.*	*explore the different ways in which substances are transported into/out of cells and investigate diffusion and osmosis using practical techniques.* **Molecules and Matter** *Following on from energy transfers by heating, students explore the particle model in further detail to develop their understanding of changing states. This links closely with internal energy from the previous topic. In this topic, pupils will complete another required practical, this time on density.*	**Atomic Structure** *Students revisit atomic structure and are reminded that atoms are the building blocks of our world. Students will build upon their fundamental KS3 knowledge as they enter their GCSE chemistry studies. Students explore the history of the atom and consider different scientific theories, which will lead them to be able to explain why theories can change over time. Students will use their knowledge of compounds and mixtures to fully explain separating techniques.*	*Students will recap prior learning on enzymes and learn the mechanics of enzyme action and the effect that changes in temperature and pH can have on it.* **Periodic Table** *Students will expand their understanding of the periodic table, its historical development and arrangement. They will be able to explain the differences between metals and non-metals as well as identifying the properties of group 0, group 1, group 7 elements as well as transition metals and be able to compare them to group 1 elements.*

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	material, mass and temperature of an object. They will learn about different methods of heating and that energy transfers from hotter objects to cooler ones. This topic has ample cross-curricular links with maths and will have opportunities to apply their mathematical skills during data analysis.					

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KS4 (AQA GCSE Combined Science: Trilogy and Separate Science Pathways)						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Year 10	**Periodic Table** *Students will expand their understanding of the periodic table, its historical development and arrangement. They will be able to explain the differences between metals and non-metals as well as identifying the properties of group 0, group 1, group 7 elements as well as transition metals and be able to compare them to group 1 elements.* **Conservation and Dissipation of Energy** *Students revisit energy concepts from KS3 and build upon their fundamental knowledge. Students will make connections between energy stores,*	**Electricity in the Home** *Students will build on their understanding of energy and electricity by learning about electricity supply in the UK to understand the differences between direct and alternating currents. They will understand energy transfers and wiring in everyday appliances as well as the significance of power ratings and how they can be used to determine the appropriate fuse.* **Organising Plants and Animals** *Students will continue to learn about the way organisms work. Leading on from the digestive system, students will deepen their understanding of how the structures in the breathing and circulatory systems are adapted and their role*	**Chemical Changes** *Students will study reactions of metals with acid to further their understanding of how salts are formed and named including a required practical investigation. In addition, pupils will also be made aware of how we can use titration as a practical method but will not be required to conduct this practical themselves.* **Chemical Calculations** *Students will apply their understanding of conservation to the mass in reactions to balance equations and determine the relative formula mass of products and reactants in an equation. Students should be able to explain why reactions producing gases appear to lose mass and make estimations of*	**Photosynthesis** *Students review and extend their understanding of photosynthesis, leaf structure and the transport of glucose and water through the plant between the soil, air, roots, and leaves. They will explore how factors can affect the rate of photosynthesis, focusing on the effect of light intensity on the rate of photosynthesis for a practical investigation. Lastly, they will be able to explain how glucose is used by the plant. Some pupils will be able to link photosynthesis to cost-effective crop growth.* **Respiration** *Students will build on prior learning to understand the fundamentals of both aerobic and anaerobic respiration. They will explore graphical data to*	**Molecules and Matter (for Y10 2024-25 only)** *Following on from energy transfers by heating, students explore the particle model in further detail to develop their understanding of changing states. This links closely with internal energy from the previous topic. In this topic, pupils will complete another required practical, this time on density.* **Radioactivity** *Students will learn about the development of scientific models and theories with the development of our understanding of the atom, the subatomic particles and how changes in the nucleus of an atom causes radioactivity. Students will learn about the different types of radioactivity through alpha, beta and gamma*	**Preventing and Treating Disease** *Pupils explore how vaccination works and how vaccines are used to control the spread of a specific pathogen. Pupils gain an appreciation of the processes involved in drug discovery and development and will be able to explain the stages in this process. Finally, students will be able to explain how plants are useful in medicine, and the treatments available for plant diseases. Students will be able to extrapolate information from data surrounding vaccination.* **Monoclonal Antibodies (biology separate science pathway only)** *Students will explore the production and uses of monoclonal antibodies in medicine. Students deepen their*

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	energy transfers and efficiency. Students will apply mathematical skills to real-life examples of energy transfers and understand how everyday products work in terms of energy. **Energy Transfer by Heating** *Students link their prior learning of energy transfers to thermal conductivity. In this topic, pupils will complete the specific heat capacity required practical, as well as developing their maths skills in rearranging equations and drawing heating/cooling curves. This topic also makes more obvious links with "real life", as it explores ways that homeowners can save*	*in the transport of materials around the body. Students will also study plant transport system, which forms the underlying principles of understanding for photosynthesis.* **Structure and Bonding** *Students will be introduced to the fundamental concepts of how atoms join to form different compounds by covalent, ionic and metallic bonding. They will be able to identify, describe and draw diagrams to represent each type of bond. They will extend their knowledge linking bonding and structure to properties such as melting and boiling points of substances including ionic compounds, small molecules, polymers, giant covalent structures, metals and alloys.* **Space (physics separate**	*uncertainty with chemical measurements.* **Titrations (chemistry separate science pathway only)** *Students will also be made aware of how we can use titration as a practical method but will not be required to conduct this practical themselves.*	*learn how the body's response to exercise facilitates an increase in the rate of respiration and the uses of the energy released from respiration in both animals and plants. Students are introduced to metabolic reactions and will be able to describe what "metabolism" means* **Electrolysis** *Students will develop their understanding of what electrolysis is and its uses including investigating the electrolysis of aqueous solutions. Students will be able to use their practical knowledge and mathematical skills to predict observations at electrodes and, in some cases, produce half equations to represent the reactions happening at electrodes.* **Energy Changes** *Students will further develop their understanding of*	*radiation, and explore their uses and the dangers. Students will be able to represent radioactive decay using half equations. Students will be able to compare irradiation and contamination and give examples of each.* **Communicable Disease** *Students will learn about viral, fungal, bacterial and a protist disease considering the methods of transfer, symptoms and treatments across a range of human examples. Students will explore why pathogens make us ill, the immune system's response to infection and how we can prevent infection.* **Cells, batteries and fuel cells (chemistry separate science pathway only)** *Students will delve further into the topic of Energy Changes and apply their knowledge to explain*	*understanding of plant disease, mineral deficiencies and how to detect and treat plant disease.* **Non-Communicable Disease** *Students will develop understanding of correlation and cause by building on their KS3 knowledge of drugs. Students will discuss how drugs and other lifestyle factors like diet and exposure to radiation can impact on health and increase the risk of non-communicable diseases. They will understand the development of cancer and the differences between malignant and benign tumours.* **Organising an Ecosystem** *Pupils revisit learning from KS2 and KS3 surrounding interactions in ecosystems, however,*

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	money on their energy bills by investing in different types of insulation. **Electrical Circuits** *Students will build upon knowledge of electrical circuits, current, resistance and potential difference, learning about the relationships between them, equations to calculate them, and extending to static charges and electric fields. Students will investigate how different components and arrangements of circuits affect the resistance.* **Static electricity (physics separate science pathway only)** *Students will delve further into the topic of electrical circuits to*	**science pathway only)** *Students will extend their knowledge of space, starting with understanding our place in the universe, before looking at the lifecycle of a star and the effect of gravity on the orbits of planets and satellites. Students will integrate knowledge of the electromagnetic spectrum. into space physics to explain red-shift.*		*exothermic and endothermic reactions including representing them graphically, explaining them in terms of particle collisions and giving examples of each.* ***Higher tier*** *students will be able to calculate the energy changes of reactions as bonds are broken and formed.* **Communicable Disease (biology separate science pathway only)** *Students will learn about viral, fungal, bacterial and a protist disease considering transfer, symptoms and treatments across a range of human and plant examples with greater emphasis on identification and methods of protect in plants. Students will also learn about culturing microorganisms and learn how to safely do so in a laboratory.*	*how chemical and fuel cells work.*	*they develop their understanding of this by looking at the levels of feeding relationships in more detail. More advanced vocabulary is introduced and pupils explore how abiotic factors affect ecosystems, such as water and carbon in the cycling of materials.* **Decay RP (biology separate science pathway only)** *Students will apply their understanding of decay by investigating the rate of decay of milk in different environments.*

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	understand how static electricity is formed.					
Year 11 (Combined Science: Trilogy)	**Adaptations, Interdependence and Competition** *Students look at the factors that can affect the distribution of organisms and adaptations to help them survive in an ecosystem. They will describe methods to measure the distribution of organisms and link their findings to adaptations of plants and animals.* **Biodiversity and Ecosystems** *Students will build on prior learning of ecosystems and feeding relationships. They will consider ways that humans have an impact on the distribution of organisms and ecosystems, which forms cross-curricular*	**Force and Motion** *Students will apply their knowledge of forces to represent motion. Students will draw and interpret graphs to calculate displacement, velocity and time using related and sometimes multi-step equations.* **Crude Oil and Fuels** *Students will be introduced to the composition of crude oils, methods of separating into fractions and properties of hydrocarbons. Students will learn about the different structures and applications of alkanes and alkenes including methods of cracking to produce alkenes.* **Earth's Atmosphere** *Students will learn how the Earth's atmosphere was formed, what it is made of, and how it has*	**Reproduction** *Students will apply their knowledge of the cell cycle and mitosis to a new type of cell division: meiosis. They will Students will explore cellular reproduction in the formation of gametes and understand why the two processes differ. Students will be expected to use diagrams to support their explanations of meiosis and mitosis. Students will revisit fundamental key words from their KS3 genetics learning and link these to cellular reproduction.* **Variation and Evolution** *Students will develop their understanding of variation from KS3 and make scientific links between variation and evolution. Students will explore Darwin's theory of evolution by natural*	**Electromagnetic Waves** *Students will develop their understanding from KS3 light to look at the electromagnetic spectrum, the properties and uses of its component parts. Students will be able to describe the uses of the EM spectrum in real life and the dangers of certain parts of it. Students will apply their maths skills through use of standard form to represent very large and very small numbers.* **Electromagnetism** *Students will revisit their KS3 knowledge of magnets and their KS4 knowledge of forces to extend their understanding. Students will explain how a magnetic field is produced when a current passes through a wire. Some students will learn about the motor effect and how*	*Students begin tailored revision plans, produced and delivered by their class teachers, for their final GCSE exams.*	*GCSE's.*

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	links with chemistry, physics and geography. **Rates and Equilibrium** *Students be introduced to the collision theory and will use this to explain rate of reaction. Students will investigate the factors that affect rate of reaction through various experimental techniques, and will apply their graph drawing skills to represent data collected. Students will also explore the term "reversible reaction" and, in some cases, factors affecting equilibrium.* **Forces in Balance** *Students will further develop their understanding of forces as scalars and vectors, looking at how forces affect a range of objects including more complex calculations of*	*changed since the formation of the Earth. Students will broaden their understanding of carbon dioxide and methane as greenhouse gases, including human impacts, global climate change and methods of reducing carbon footprints. They will make cross-curricular links between physics and biology, as well as geography.* **Human Nervous System** *Students will gain an understanding of why homeostasis and reflex arcs are so important. Students will recall the structures involved in a reflex arc and how nerves communicate at a synapse.* *Students will further develop practical skills while investigating reaction time.* **Hormonal Coordination** *Students will understand what hormones are and*	*selection and explain the evidence to support this theory. Students will also learn about selective breeding techniques and use their knowledge to evaluate the use of GM crops in industry.* **Genetics and Evolution** *Having developed a deeper understanding of genetic inheritance and evolution from previous topics, students will explore further evidence to support the theory of evolution. Students will make links between evolution and the uprise of antibiotic resistant bacteria, as well as relating this to real-life complications. Students will learn how organisms are classified and be able to explain the importance of classification.* **Chemical Analysis** *Students will develop their understanding of pure substances,*	*to use Fleming's left hand rule in relation to this.* **Earth's Resources** *Students will develop their foundational knowledge and understanding of the limited resources available on Earth from KS3. They will be introduced to life cycle assessments to determine the environmental impact of products as well as methods of reducing waste. Some students will also evaluate the methods of extracting metals.*		

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	work done and applying Newton's Laws to explain what we observe when forces are at work. Students will apply their mathematical skills to calculate resultant forces and, in some cases, resolve vectors. **Motion** *Students will integrate Newton's Laws of motion into their existing knowledge to explain why objects act in specific and predictable ways when forces are exerted on them. Students will also will learn real world applications of force and motion by determining braking and stopping distances of vehicles.*	*how bodily responses are controlled by feedback mechanisms. Specifically deepening their understanding of changes at puberty and how hormones control the menstrual cycle. They explore the role of the pancreas in controlling blood glucose, applying this to understand causes/ treatments of diabetes. Students may also learn how glucagon and insulin interact to control blood glucose levels.*	*mixtures and chromatography through a mixture of theory and a chromatography investigation to separate and differentiate between coloured substances. They will be able to describe how to test for hydrogen, oxygen, carbon dioxide and chlorine.* **Waves** *Students will explore the properties of longitudinal and transverse waves. They will apply equations to calculate the period, speed, frequency, and length of a wave as well as how to measure the speed of waves in air, water and a solid. Students will investigate wave measurements using a ripple tank and be able*			

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			to write a method for this.			
Year 11 (Separate Sciences) 24-25 cohort only	**Hormonal Coordination** *Students will be able to link hormones and homeostasis. Students specifically deepen their understanding of changes at puberty and explain how hormones control the menstrual cycle. Students will learn the role of the pancreas in controlling blood glucose concentrations, applying this to understand causes/ treatments of diabetes. Students explore plant responses to light and gravity and how these are controlled by chemicals called auxins. Students will be able to describe and explain practical techniques to investigate the effects of auxins.*	**Reproduction** *Students will apply their knowledge of the cell cycle and mitosis to a new type of cell division: meiosis. They will Students will explore cellular reproduction in the formation of gametes and understand why the two processes differ. Students will be expected to use diagrams to support their explanations of meiosis and mitosis. Students will revisit fundamental key words from their KS3 genetics learning and link these to cellular reproduction.* **Organic Reactions** *Students will study alkenes to a greater depth than in the crude oil topic. They will learn to identify alkenes, describe their reactions, and describe the reactions of alcohols and carboxylic acids.*	**Variation and Evolution** *Students will develop their understanding of variation from KS3 and make scientific links between variation and evolution. Students will explore Darwin's theory of evolution by natural selection and explain the evidence to support this theory. Students will also learn about selective breeding techniques and use their knowledge to evaluate the use of GM crops in industry.* **Genetics and Evolution** *Having developed a deeper understanding of genetic inheritance and evolution from previous topics, students will explore further evidence to support the theory of evolution. Students will make links between evolution and the uprise of antibiotic resistant bacteria, as well as*	**Earth's Resources** *Students will develop their understanding of the limited resources available on Earth and the role chemistry plays in improving agricultural and industrial contributions to the resources we consume. They will be introduced to life cycle assessments to determine the environmental impact of products as well as methods of reducing waste. Some students will also learn about alternative methods of extracting metals and be able to evaluate these methods.* **Using Our Resources** *Students will learn about methods of improving or synthesising materials to better suit their uses and improve their longevity including preventing corrosion, metal alloys,*	*Revision/GCSE's.*	*GCSE's.*

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	Homeostasis in Action *Students will link their learning of hormones to real life. Students will explain how hormones interact to control blood glucose levels and water balance in the body, including an in depth knowledge of the structure of the kidney, which is essential learning for those continuing on to A level biology.* **Rates and Equilibrium** *Students be introduced to the collision theory and will use this to explain rate of reaction. Students will investigate the factors that affect rate of reaction through various experimental techniques, and will apply their graph drawing skills to represent data collected. Students will also explore the term "reversible reaction"*	**Waves** *Students will explore the properties of longitudinal and transverse waves. They will apply equations to calculate the period, speed, frequency, and length of a wave as well as how to measure the speed of waves in air, water and a solid. Students will investigate wave measurements using a ripple tank and be able to write a method for this. Students will also investigate the reflection of waves, looking at sound waves in greater depth and using waves for detection and exploration.*	*relating this to real-life complications. Students will learn how organisms are classified and be able to explain the importance of classification.* **Biodiversity and Ecosystems** *Students will build on prior learning of ecosystems and feeding relationships. Looking at the factors that can affect the distribution of organisms and adaptations to help them survive in an ecosystem. Students are required to describe two separate methods of practical techniques. They will describe methods to measure the distribution of organisms before learning how materials like carbon and water are recycled.* **Polymers** *Students will be introduced to addition polymerisation, synthetic*	*ceramics, polymers and composite materials. They will use their knowledge of equilibria to develop an understanding of ammonia and fertiliser production. In this topic, students are expected to draw on knowledge from their prior chemistry learning to make educated links and explanations.* **Light** *Students will be able to explain visible light in more detail and understand how we see colour. This is essential learning before students are introduced to the concept of black body radiation.* **Space (physics separate science pathway only)** *Students will extend their knowledge of space, starting with understanding our place in the universe, before looking at the lifecycle of a star and the effect of*		

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	and, in some cases, factors affecting equilibrium. **Crude Oil and Fuels** *Students will be introduced to the composition of crude oils, methods of separating into fractions and properties of hydrocarbons. Students will learn about the different structures and applications of alkanes and alkenes including methods of cracking to produce alkenes.* **Force and Motion** *Students will apply their knowledge of forces to represent motion. Students will draw and interpret graphs to calculate displacement, velocity and time using related and sometimes multi-step equations. Students will also will learn real world applications*		*polymers such as polythene and extend their understanding of DNA as a natural polymer. Some students will go further to study condensation polymerisation as well as explaining amino acids as natural polymers.* **Chemical Analysis** *Students will develop their understanding of pure substances, mixtures and chromatography including an investigation to separate and differentiate between coloured substances. They will be able to describe how to test for hydrogen, oxygen, carbon dioxide and chlorine. In addition, students will learn to identify ions present using a range of chemical methods including flame tests or through instrumental methods using spectroscopy.*	*gravity on the orbits of planets and satellites. Students will integrate knowledge of the electromagnetic spectrum.* *Students begin tailored revision plans, produced and delivered by their class teachers, for their final GCSE exams.*		

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	of force and motion by determining braking and stopping distances of vehicles. **Force and Pressure** *Students will study pressure in fluids and atmospheric pressure to understand that both liquids and gases are fluids and pressure increases with depth. Students will learn to calculate pressure at the surface of a fluid and the pressure due to a column of liquid.*		**Electromagnetic Waves** *Students will develop their understanding from units about light to understand the electromagnetic spectrum, the properties and uses of its component parts. Some students will learn how different wavelengths refract, how to draw wave front diagrams and how radio waves and alternating currents are linked. Students will further their understanding of light refraction to explain how lenses work and the type of image they produce.* **Electromagnetism** *Students will refresh and extend their knowledge of magnets and electromagnetism to understand how a magnetic field is produced when a current passes through a wire. Students will learn about the motor effect, Fleming's left-hand rule*			

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			and loudspeakers and will be able to explain each. Students will also develop an understanding of the generator effect and its uses including microphones. They will integrate this knowledge into their previous study of the national grid to understand how transformers work.			

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KS5 SCIENCE						
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Year 12 BIOLOGY	**Biological molecules** *Students will deepen their understanding of the macromolecules of life, their biochemistry and actions focusing on Water, carbohydrates and lipids.* **Cells** *Students delve deeper into cell ultrastructure and methods of studying cells. They explore prokaryotes and viruses as well as cell specialisation.*	**Biological molecules** *The biochemistry of proteins, DNA and ATP is essential fundamental knowledge to unlock understanding of a host of biological processes, including enzyme action and protein synthesis.* **Cells** *Students link their learning of DNA to describe mitosis and the cell cycle in detail, comparing this to prokaryotic division. They apply practical techniques to investigate mitosis using microscopy.* **Cellular Exchange** *Students build on knowledge from GCSE but go further to explain osmosis, diffusion and active transport with reference to the specific structures of the cell membrane using the fluid mosaic model*	**Biological Molecules** *The interplay between DNA and proteins in crucial in cell function, understanding protein synthesis is key to this.* **Cells and Exchange** *Students continue to develop their understanding of cellular exchange through practical investigations and statistical analysis.* **Immunity** *Pupils gain a greater depth of understanding of the immune response in both plants and humans, applying their knowledge of cell specialisation, proteins and cell membranes to new contexts within immunity. They explore how our understanding has led to practical and medical applications through viral research and HIV as well as*	**Genes and Variation** *This topic enables learners to interleave and apply their understanding of DNA in contexts of mutation, reproduction and meiosis which leads to genetic diversity, adaptation and selection. Pupils further explore how this has helped models develop over time in how we classify organisms.* **Exchange** *Students focus on physiology and organ systems in plant and animal gas exchange.*	**Genes and Variation** *Going further, pupils explore how we measure diversity through ecological sampling and quantitative measure of variation. This is then linked to the interdependence of populations and ecosystems and how species are linked to lead to succession, natural selection and speciation.* **Exchange** *Students focus on physiology and organ systems in digestion in humans, as well as mass transport in animals and plants through exploration of blood and circulation as well as transpiration and translocation.*	**Responses in plants and animals** *Students explore responses to stimuli in plants and animals. They are introduced to taxis and kinesis in animals and the role of auxins and other hormones in plants. They revisit the reflex arc from GCSE at greater depth, drawing on A-level understanding of cells, and movement of ions to explain how electrical impulses are formed in receptors in response to light, touch and other stimuli. Further application to explain the electrical control of the heartbeat and the role of synapses.* **Populations and ecosystems** *Ecosystems are dynamic with competition, predation and succession being key*

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		and specialist terminology to explain each process in a variety of contexts.	*monoclonal antibody testing and treatments. Pupils conduct their own investigations into microbiology using aseptic techniques.*			*processes in interdependence. Students apply their understanding to explain variation in populations and how to investigate this through fieldwork and conservation.*
Year 13 BIOLOGY	**Nerves and Muscles** *Students go further to examine and explain how action potentials are created and propagated along an axon. They will explain the processes at a synapse and how nervous action is coordinated. They will also learn the gross structure of muscles and how stimulation at a neuromuscular junction and movement of ions and the proteins actin and myosin result in muscle contraction via a power stroke.* **Photosynthesis** *Students delve deeper into the structure of chloroplasts and the biochemistry of photosynthesis exploring (1) the light-dependent reactions and (2) the light-independent*	**Homeostasis** *Students reflect and build on understanding of negative feedback and the role of endocrine glands in osmo- and gluco-regulation. They explore in more detail the structures of the pancreas, liver and kidneys to explain their functions and consequences and treatments if these organs fail (e.g. diabetes or dialysis).* **Respiration** *Students delve deeper into the sub-structure of mitochondria and the biochemistry of respiration as a four stage process, consisting of glycolysis, pyruvate*	**Inheritance** *Building on genetics from GCSE, students go further to understand monohybrid and dihybrid inheritance as well as codominance, linkage and the effects of epistasis. Students also look more closely at the Chi squared test.* **Control of gene expression** *Building on understanding of stem cells and genetic engineering, students look more closely at regulation of transcription and translation, exploring epigenetics and cancer.*	**Energy and Ecosystems** *Pupils recap their understanding of ecosystems and transfer of energy and biomass. They explore nutrient cycles more closely and the environmental impacts of different agriculture practices on ecosystems and biodiversity.* **Control of gene expression** *Students look in detail at the processes involved with amplifying and manipulating DNA in in vivo cloning and in vitro cloning (PCR), as well as genetic fingerprinting and processes such as gel electrophoresis and its application to genome sequencing.*	**Revision**	

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	reactions (also called the Calvin cycle). Students further develop their understanding of experimental techniques through investigation of photosynthetic pigments and of the photosynthesis reactions.	*oxidation, the Kreb's cycle and the electron transport chain using oxidation and reduction to explain chemical events that result in the production of ATP in aerobic and anaerobic respiration.*				

Year 12 CHEMISTRY	Physical – Atomic Structure	Physical – Atomic Structure (Inc. RP1)	Physical – Amount of Substance	Physical – Energetics (Inc. RP2)	Physical – Kinetics (Inc. RP3)	Physical – Equilibria
	Students learn that the chemical properties of elements depend on their atomic structure and on the arrangement of electrons around the nucleus in orbitals. Students learn how Chemists can measure the mass of atoms and molecules to a high degree of accuracy in a mass spectrometer.	**Physical – Amount of Substance** *Students will build on their knowledge from KS4 quantitative chemistry learning about the mole as a measure of the amount of a substance. An amount in moles can be measured out by mass in grams, by volume in dm^3 of a solution of known concentration and by volume in dm^3 of a gas.*	*Students will build on their knowledge from KS4 quantitative chemistry learning about the mole as a measure of the amount of a substance. An amount in moles can be measured out by mass in grams, by volume in dm^3 of a solution of known concentration and by volume in dm^3 of a gas.*	*The enthalpy change for a chemical reaction can be measured accurately. It is important to know this value for chemical reactions that are used as a source of heat energy in applications such as domestic boilers and internal combustion engines.*	*The study of kinetics enables chemists to determine how a change in conditions affects the speed of a chemical reaction. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are variables that can be manipulated in order to speed them up or slow them down*	*A study of equilibria indicates how far reactions will go. Le Chatelier's principle can be used to predict the effects of changes in temperature, pressure and concentration on the yield of a reversible reaction. This has important consequences for many industrial processes. The further study of the equilibrium constant, K_c, considers how the mathematical expression for the equilibrium constant enables us to calculate how an equilibrium yield will be influenced by the concentration of reactants and products.*
	Organic – Intro to organic *Organic chemistry is the study of the millions of covalent compounds of the element carbon. These structurally diverse compounds vary from naturally occurring petroleum fuels to DNA and the molecules in living systems. Organic compounds also demonstrate human*	**Organic – Alkanes** *Alkanes are the main constituent of crude oil, which is an important raw material for the chemical industry. Alkanes are also used as fuels and the environmental consequences of this use are considered in this section.*	**Organic – Haloalkanes** *Halogenoalkanes are much more reactive than alkanes. They have many uses, including as refrigerants, as solvents and in pharmaceuticals. The use of some halogenoalkanes has been restricted due to the effect of*	**Organic – Alkenes** *In alkenes, the high electron density of the carbon–carbon double bond leads to attack on these molecules by electrophiles. This section also covers the mechanism of addition to the double bond and introduces addition polymers, which are*	**Organic – Alcohols (Inc. RP5)** *Alcohols have many scientific, medicinal and industrial uses. Ethanol is one such alcohol and it is produced using different methods, which are considered in this section. Ethanol can be used as a biofuel.*	**Organic – Organic Analysis (Inc. RP6)** *Our understanding of organic molecules, their structure and the way they react, has been enhanced by organic analysis. This section considers some of the analytical techniques used by chemists, including*

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	ingenuity in the vast range of synthetic materials created by chemists. Many of these compounds are used as drugs, medicines and plastics. Organic compounds are named using the International Union of Pure and Applied Chemistry (IUPAC) system and the structure or formula of molecules can be represented in various different ways. Organic mechanisms are studied, which enable reactions to be explained. In the search for sustainable chemistry, for safer agrochemicals and for new materials to match the desire for new technology, Chemistry plays the dominant role.		*chlorofluorocarbons (CFCs) on the atmosphere.*	*commercially important and have many uses in modern society.*		*test-tube reactions and spectroscopic techniques.*
	Physical – Bonding *The physical and chemical properties of compounds depend on the ways in which the compounds are held together by chemical bonds and by intermolecular forces. Theories of bonding*	**Physical – Redox** *Redox reactions involve a transfer of electrons from the reducing agent to the oxidising agent. The change in the oxidation state of an element in a*	**Inorganic – Periodicity Group 2** *The elements in Group 2 are called the alkaline earth metals. The trends in the solubilities of the hydroxides and the sulfates of these elements are linked to*	**Inorganic – Group 7 (Inc. RP4)** *The halogens in Group 7 are very reactive non-metals. Trends in their physical properties are examined and explained. Fluorine is*	**Inorganic – Properties of period 3 Oxides (A2 Content)** *The reactions of the Period 3 elements with oxygen are considered. The pH of the solutions formed*	

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	explain how atoms or ions are held together in these structures. Materials scientists use knowledge of structure and bonding to engineer new materials with desirable properties. These new materials may offer new applications in a range of different modern technologies	*compound or ion is used to identify the element that has been oxidised or reduced in a given reaction. Separate half-equations are written for the oxidation or reduction processes. These half-equations can then be combined to give an overall equation for any redox reaction.*	*their use. Barium sulfate, magnesium hydroxide and magnesium sulfate have applications in medicines whilst calcium hydroxide is used in agriculture to change soil pH, which is essential for good crop production and maintaining the food supply.*	*too dangerous to be used in a school laboratory but the reactions of chlorine are studied. Challenges in studying the properties of elements in this group include explaining the trends in ability of the halogens to behave as oxidising agents and the halide ions to behave as reducing agents*	*when the oxides react with water illustrates further trends in properties across this period. Explanations of these reactions offer opportunities to develop an in-depth understanding of how and why these reactions occur.*	
Year 13 CHEM	**Physical – Thermodynamics (Inc. RP7)** The further study of thermodynamics builds on the Energetics section and is important in understanding the stability of compounds and why chemical reactions occur. Enthalpy change is linked with entropy change enabling the free-energy change to be calculated.	**Physical – Rates** In rate equations, the mathematical relationship between rate of reaction and concentration gives information about the mechanism of a reaction that may occur in several steps **Physical – Equilibrium** The further study of equilibria considers how the mathematical expression for the equilibrium constant K_p enables us to calculate how an equilibrium yield will be influenced by the	**Physical – Electrode Potentials (Inc. RP 8)** Redox reactions take place in electrochemical cells where electrons are transferred from the reducing agent to the oxidising agent indirectly via an external circuit. A potential difference is created that can drive an electric current to do work. Electrochemical cells have very important commercial applications as a portable supply of electricity to power electronic devices such as mobile phones, tablets and laptops. On a	**Physical – Acids and Bases (Inc. RP 9)** Acids and bases are important in domestic, environmental and industrial contexts. Acidity in aqueous solutions is caused by hydrogen ions and a logarithmic scale, pH, has been devised to measure acidity. Buffer solutions, which can be made from partially neutralised weak acids, resist changes in pH and find many important industrial and biological applications. **Inorganic**	**Revision**	**Revision**

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		partial pressures of reactants and products. This has important consequences for many industrial processes	larger scale, they can provide energy to power a vehicle. **Physical – Acids and Bases (Inc. RP 9)** Acids and bases are important in domestic, environmental and industrial contexts. Acidity in aqueous solutions is caused by hydrogen ions and a logarithmic scale, pH, has been devised to measure acidity. Buffer solutions, which can be made from partially neutralised weak acids, resist changes in pH and find many important industrial and biological applications.	**Transition metals** The 3d block contains 10 elements, all of which are metals. Unlike the metals in Groups 1 and 2, the transition metals Ti to Cu form coloured compounds and compounds where the transition metal exists in different oxidation states. Some of these metals are familiar as catalysts. The properties of these elements are studied in this section with opportunities for a wide range of practical investigations **Reactions of ions (Inc. RP 11)** The reactions of transition metal ions in aqueous solution provide a practical opportunity for students to show and to understand how transition metal ions can be identified by test-tube reactions in the laboratory.		
	Organic - Amino acids, proteins and DNA *Amino acids, proteins and DNA are the molecules of life. In this section, the structure and bonding in*	**Organic – Aldehydes and ketones** *Aldehydes, ketones, carboxylic acids and their derivatives all contain the carbonyl*	**Organic – Amines** *Amines are compounds based on ammonia where hydrogen atoms have been replaced by alkyl or aryl groups.*	**Organic – Synthesis** *The formation of new organic compounds by multi-step syntheses using reactions included in the*	**Revision**	**Revision**

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	these molecules and the way they interact is studied. Drug action is also considered. **Optical Isomerism** *Compounds that contain an asymmetric carbon atom form stereoisomers that differ in their effect on plane polarised light. This type of isomerism is called optical isomerism.*	*group which is attacked by nucleophiles. This section includes the addition reactions of aldehydes and ketones.* **Carboxylic acids (Inc. RP 10)** *Carboxylic acids are weak acids but strong enough to liberate carbon dioxide from carbonates. Esters occur naturally in vegetable oils and animal fats. Important products obtained from esters include biodiesel, soap and glycerol* **Aromatic chemistry** *Aromatic chemistry takes benzene as an example of this type of molecule and looks at the structure of the benzene ring and its substitution reactions*	*This section includes their reactions as nucleophiles.* **Polymers** *The study of polymers is extended to include condensation polymers. The ways in which condensation polymers are formed are studied, together with their properties and typical uses. Problems associated with the reuse or disposal of both addition and condensation polymers are considered.*	*specification is covered in this section.* **NMR** *Chemists use a variety of techniques to deduce the structure of compounds. In this section, nuclear magnetic resonance spectroscopy is added to mass spectrometry and infrared spectroscopy as an analytical technique. The emphasis is on the use of analytical data to solve problems rather than on spectroscopic theory.* **Chromatography (Inc. RP 12)** *Chromatography provides an important method of separating and identifying components in a mixture. Different types of chromatography are used depending on the composition of mixture to be separated*		

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Year 12 PHYSICS	**Particles and Radiation** This section introduces students both to the fundamental properties of matter, and to electromagnetic radiation and quantum phenomena. Through a study of these topics, students become aware of the way ideas develop and evolve in physics. They will appreciate the importance of international collaboration in the development of new experiments and theories in this area of fundamental research.	**Photoelectric effect** Students should know that electron diffraction suggests that particles possess wave properties, and the photoelectric effect suggests that electromagnetic waves have a particulate nature. The ultraviolet catastrophe and black-body radiation. Planck's interpretation in terms of quanta. The failure of classical wave theory to explain observations on photoelectricity. Einstein's explanation of photoelectricity and its significance in terms of the nature of electromagnetic radiation	**Electricity** This section builds on and develops earlier study of these phenomena from GCSE. It provides opportunities for the development of practical skills at an early stage in the course and lays the groundwork for later study of the many electrical applications that are important to society. Description of the qualitative effect of temperature on the resistance of metal conductors and thermistors. Applications of thermistors to include temperature sensors and resistance–temperature graphs. Superconductivity as a property of certain materials which have zero resistivity at and below a critical	**Electricity RP5, RP6** Students learn about potential dividers and they learn to construct and include potential dividers in electric circuits. Students will be expected to understand and perform calculations for circuits in which the internal resistance of the supply is not negligible Applications of superconductors to include the production of strong magnetic fields and the reduction of energy loss in transmission of electric power Terminal pd; emf Students will be expected to understand and perform calculations for circuits in which the internal resistance of the supply is not negligible.	**Nuclear Physics RP12** This section builds on the work of Particles and radiation to link the properties of the nucleus to the production of nuclear power through the characteristics of the nucleus, the properties of unstable nuclei, and the link between energy and mass. Students should become aware of the physics that underpins nuclear energy production and also of the impact that it can have on society. Investigate the decay equation using a variety of approaches (including the use of experimental data, dice simulations etc)	**Nuclear Physics** Estimate of radius from closest approach of alpha particles and determination of radius from electron diffraction. Knowledge of typical values for nuclear radius. Students will need to be familiar with the Coulomb equation for the closest approach estimate. Appreciation that E = mc 2 applies to all energy changes, Simple calculations involving mass difference and binding energy. Atomic mass unit, u. Conversion of units; 1 u = 931.5 MeV. Fission and fusion processes. Simple calculations from nuclear masses of energy released in fission and fusion reactions. Graph of average binding energy per nucleon

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			temperature which depends on the material.		and a variety of analytical methods.	against nucleon number.
	Waves RP1 GCSE studies of wave phenomena are extended through a development of knowledge of the characteristics, properties, and applications of travelling waves and stationary waves. Topics treated include refraction, diffraction, superposition and interference.	**Waves RP2** Investigation of two-source interference with sound, light and microwave radiation. Students will be expected to describe and explain interference produced with sound and electromagnetic waves. Appreciation of how knowledge and understanding of nature of electromagnetic radiation has changed over time.	**Materials RP4** This unit is an extension of GCSE, students learn about Hooke's law, tensile strain and tensile stress. Description of plastic behaviour, fracture and brittle behaviour linked to force–extension graphs. Quantitative and qualitative application of energy conservation to examples involving elastic strain energy and energy to deform. Spring energy transformed to kinetic and gravitational potential energy. Interpretation of simple stress–strain curves	**Mechanics RP3** Vectors and their treatment are introduced followed by development of the student's knowledge and understanding of forces, energy and momentum. The section continues with a study of materials considered in terms of their bulk properties and tensile strength. As with earlier topics, this section and also the following section Electricity would provide a good starting point for students who prefer to begin by consolidating work.		
Year 13	**Fields – Gravitational fields, Electric fields RP10, Rp11**	**Fields – Capacitor charge and discharge RP9**	**Fields – Magnetic fields**	**Measurement and errors** Students learn about random and systematic		

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PHYSICS	Students learn about gravity as a universal attractive force acting between all matter. Magnitude of force between point masses: F = Gm1m2 r 2 where G is the gravitational constant. Students learn to estimate various parameters of planetary orbits, eg kinetic energy of a planet in orbit.	Students learn about the definition of capacitance: C = Q/ V. Students learn about the action of a simple polar molecule that rotates in the presence of an electric field. Determine the relative permittivity of a dielectric using a parallel-plate capacitor. Investigate the relationship between C and the dimensions of a parallel-plate capacitor.	Students learn about force on a current-carrying wire in a magnetic field: F = BIl when field is perpendicular to current. Fleming's left hand rule. Magnetic flux density B and definition of the tesla. Investigate how the force on a wire varies with flux density, current and length of wire using a top pan balance	errors. Precision, repeatability, reproducibility, resolution and accuracy. Uncertainty: Absolute, fractional and percentage uncertainties represent uncertainty in the final answer for a quantity. Combination of absolute and percentage uncertainties. Represent uncertainty in a data point on a graph using error bars. Determine the uncertainties in the gradient and intercept of a straight-line graph. Individual points on the graph may or may not have associated error bars.		
	Further Mechanics RP8 The earlier study of mechanics is further advanced through a consideration of circular motion and simple	**Further Mechanics** Students should recognise the use of the small-angle approximation in the derivation of the	**Thermal Physics** Students should be able to investigate the factors that affect the change in temperature of a substance using an	**Astrophysics** Fundamental physical principles are applied to the study and interpretation of the Universe. Students	**Revision**	

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	harmonic motion (the harmonic oscillator). A further section allows the thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth.	time period for examples of approximate SHM. Investigation of the factors that determine the resonant frequency of a driven system.	electrical method or the method of mixtures. Students should be able to identify random and systematic errors in the experiment and suggest ways to remove them.	gain deeper insight into the behaviour of objects at great distances from Earth and discover the ways in which information from these objects can be gathered. The underlying physical principles of the devices used are covered and some indication is given of the new information gained by the use of radio astronomy. The discovery of exoplanets is an example of the way in which new information is gained by astronomers		