

Module/Unit of Learning	Term Taught	What will students learn?	How will this build a broad and strong foundation?	Links to other subjects
Bioenergetics	Autumn 1	<i>In this section students will explore how plants harness the Sun's energy in photosynthesis to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.</i>	Students discover the fundamental chemical reactions which make life possible	PE
Quantitative Chemistry	Autumn 1	<i>Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.</i>	Students will apply their Maths skills to the chemical concepts they learnt during KS3.	Maths

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Homeostasis and Response	Autumn 1 & 2	<p>Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes.</p> <p>In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.</p>	<p>This unit starts to bring together the concepts they've learnt during Year 9 to build a bigger picture of the internal and external conditions which are required for life to thrive.</p>	PE
Chemical Changes	Autumn 1 & 2	<p>Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.</p>	<p>Students build on the concepts they've encountered during KS3 to predict the products formed during different chemical reactions.</p>	



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Ecology	Spring 1	<p><i>The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. To continue to benefit from these services humans need to engage with the environment in a sustainable way</i></p>	<p>Students will be able to explain how all life on Earth is interconnected ,and how organisms are dependent upon each other for their survival.</p>	Geography
Energy Changes	Spring 1	<p><i>Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.</i></p>	<p>This explains why some reactions are able to occur spontaneously, whilst others require an input of energy in order for them to start.</p>	

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Rate and Extent of Chemical Change	Spring 1 & 2	<p><i>Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.</i></p>	<p>It provides students with the knowledge to help them understand how Chemistry can be carried out on an industrial scale and remain profitable.</p>	
Energy	Spring 2	<p><i>The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage.</i></p>	<p>This is a core concept in Physics and provides the foundation for students to be able to understand a large amount of the Physical concepts which follow.</p>	Maths

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Organic Chemistry	Spring 2 & Summer 1	<i>The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.</i>	Students will be able to understand our dependence as a species on the products of the petrochemical industry.	Geography
Electricity	Summer 1	<i>Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. If we all continue to demand more electricity this means building new power stations in every generation – but what mix of power stations can promise a sustainable future?</i>	Students will begin to understand how power is supplied to and distributed within their homes. They will also be able to understand the importance of electrical safety and how all electrical appliances have features to keep them safe.	



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Chemical Analysis	Summer 2	<i>Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work.</i>	Students will understand the need for the strict controls needed for the production of chemical compounds which have pharmaceutical applications.	
Using Resources	Summer 2	<i>Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised.</i>	This unit explores the science behind why, as a species, we need to change our consuming habits. Students will also be able to explain the science behind the production of drinking water and the treatment of sewage.	Geography