Avonbourne Boys' & Girls' Academies
The best in everyone™
Part of United Learning

United Sixth Form
The best in everyone™
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Subject: Science

Curriculum vision

The Science curriculum at Avonbourne inspires curiosity and a deep understanding of the technologically advancing world around us. In the pursuit of excellence, over their seven-year journey, students will develop lifelong skills which will enable them to think critically and apply scientific knowledge to make informed decisions within society.

Our students receive inspirational teaching which is expertly delivered through a knowledge rich curriculum. We provide a sequenced learning journey, building a solid foundation in years 7 to 9, which prepares students for their GCSE and A level courses. Students then have the key transferrable skills to progress to higher education and to be successful in their chosen career. Powerful knowledge is delivered through experimental practice and the understanding and application of the scientific method. Our students experience a consistent research led approach to teaching and learning. This approach is based upon extensive practice delivered through detailed explanations, the use of worked examples and frequently revisiting prior knowledge.

We foster a spirit of inquiry which nurtures our students' curiosity, stimulates their awe and wonder, and brings current, relevant and real-world science into the classroom. Through our knowledge rich curriculum, we debunk embedded misconceptions and stereotypes within science. Our science curriculum helps students understand the historical, ethical, and contemporary issues linked to science and its development. Students learn that scientific developments have always required collaboration and to make new scientific discoveries, we must challenge existing theories.

The science curriculum enables our students to become more confident, resilient and informed citizens capable of critical analysis. They are equipped with the knowledge to make well-reasoned judgements and take positive actions when faced with our rapidly changing world.

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Curriculum Overview

Term 1	Autumn 1	Why this? Why now?	Autumn 2	Why this? Why now?
Year 7	Particles Cells and Organisation	In Key Stage 2, students have been taught to: • Compare and group materials together, according to whether they are solids, liquids or gases • Observe that some materials change state when they are heated or cooled • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • Use knowledge of solids, liquids and gases to decide how mixtures can be separated (filtering, sieving and evaporating) Particles begins with the particle model and the movement of particles in diffusion and changing state. Separation techniques are then taught, which forms the bases for the first GCSE Chemistry unit. Within separation, pure and impure need to be covered, as well as planning and carrying out a practical based on rock salt purification. Distillation and saturation is also covered towards the end of the unit, followed by the effect of temperature on solubility. In Key Stage 2, students have been taught to: • Investigate the way in which water is transported in plants • Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves & flowers • Explore the requirements of plants for life and growth (air, light, water, nutrients from the soil and room to grow) • Identify that some animals, including humans, have skeletons for support, movement and protection. • Identify and name the parts of the circulatory system and describe the function of the heart, blood vessels and blood.	Fundamentals of Physics	In Key Stage 2, students have been taught to: • identify common appliances that run on electricity • particle theory of solids, liquids and gases • recognize some common conductors and insulators, and associate metals with being good conductors. This unit of work begins with looking at the main energy stores and pathways, forming a foundation for KS4. This follows on to look at conservation of energy and the three methods of heat transfer, conduction, convection and radiation. There is a required practical on the effect of colour on cooling. From there, students will study the relationship between power and energy, introducing SI units, and how to calculate electricity costs. This leads to the second required practical, testing foods for energy. The unit finishes with a study of energy resources, starting with the formation and use of fossil fuels, moving to renewable sources, and a section evaluating the relative merits of both.

		• Describe the way in which water and nutrients are transported within animals, including humans. This unit of work begins with how to use a microscope to estimate size, then looks at cell structure in unicellular organisms before moving on to plants and animals as multicellular organisms, linking structures to the 7 life functions. From there, organisation of multicellular organisms in terms of cells-tissues-organs-systems and why complex organisms need these systems in order to keep cells alive. Diffusion and transport are the connecting ideas. The digestive system and breathing system are used as two example systems, but the focus really is on the adaptations of these systems in terms of diffusion – introducing ideas such as thin membranes, surface area and blood supply.		
Year 8	Digestion and Nutrition	In year 7 students have learned: • The function of the digestive system • diffusion and the adaptations of the small intestines for efficient diffusion as part of the work on tissues and organ systems • The meaning of the term 'semi permeable' or 'partially permeable' • To compare the energy values in kJ of different foods (from labels) This unit builds on the work done in year 7 on organ systems and diffusion. It begins by establishing the components of food and the use of each within the body. Students will look at what is meant by a balanced diet and the consequences when nutritional and calorie intake is not inadequate or excessive. Students will carry out practicals to test foods for the main components and then move on to look at the organs of the digestive system and the role each plays in digestion.	Periodic Table	In Key Stage 2, students have been taught about everyday materials how to: • identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets • know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic

	Light and Sound	The role of enzymes is introduced as part of this, as well as the role of gut bacteria In Key Stage 2, students have been taught to: • recognize that light appears to travel in straight lines • use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye • explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes • use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. • describe how sounds are made. • What volume and pitch are. • How sound is detected by human ears. The unit builds on concepts from KS2. Students should know that light travels in straight lines, is reflected and enters the eye in order to see. The unit begins by looking at light as a wave, that transfers energy and what happens when it meets different surfaces. The unit then moves to reflection, refraction in more detail and this offers the opportunity to look at reproducibility in data and accuracy of measurements, before moving on to vision and problems with vision, the colors of the spectrum and how color is seen and then how different colored light can be produced and affects the color of objects.		• demonstrate that dissolving, mixing and changes of state are reversible changes • explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda This unit of work begins with what an element is and how elements can combine/mix to form compounds and mixtures. Some work is then done linking elements to the periodic table and their significance. Following this, compounds are studied in more detail including naming them and how to write a formula. This links to the next area of conservation of mass showing the same numbers of atoms on each side of a balanced symbol equation and use the reaction of magnesium and oxygen to help develop an understanding of this. The periodic table is then looked at in more detail starting first with the Dalton atomic model and moving on to the nuclear model and electron configuration. Group 1 and 7 and their main properties are then looked at in further detail including their reactivity and general uses.
Year 9	Forces in action	In Key Stage 3 so far, students have been taught: • forces as pushes or pulls, arising from the interaction between two objects • how to use force arrows in diagrams, adding forces in one dimension, what are balanced and unbalanced forces	Reactivity	In Key Stage 3 so far, students have been taught: • To represent elements & compounds using diagrams and formula • Definitions for elements, compounds & mixtures • How to write and interpret chemical formulae

		• forces: associated with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water • forces are measured in newtons • forces are needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) • changes depend on the direction of force and its size. • pressure is measured by ratio of force over area –acting normal to any surface. • gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, This unit builds on forces from year 7 to look at how forces can cause turning effects, how this can be amplified, how forces can cause deformation and what elastic deformation is, how forces are linked to energy (work done) and how machines can reduce the force needed to do a particular job. There are lots of opportunities to make links with real life objects (bikes, cars, screwdrivers) engineering, tools etc. There is a lot of maths, although the relationships are simple, so challenge can be built by rearrangement and unit changes.		• How to represent reactions using word equations • Atomic structure – protons and electrons only • Electron configuration • The link between outer electron number and group number This unit is the groundwork for much of the GCSE Chemistry – particularly the work on metal extraction, but also the ideas around useful materials from the Earth, particularly metals. The unit begins by recapping the work covered in year 8 on basic atomic structure and electron configuration and then adds on neutron numbers, atomic mass, and formula mass. Writing chemical formulae and balancing equations are brought together too, and this is a good place to start students writing symbol equations if they haven't already done so. At a minimum, students should be using the formula for common acids and attempting to balance simple equations provided. More able students may be able to use ion charges to write and balance whole equations. The skills introduced in the first few lessons (writing ionic formulae, RFM and balancing equations) are consolidated throughout the unit whilst they look at a variety of chemical reactions. The latter part of the scheme introduces the reactivity series and how it can be used to predict and/or explain reaction outcomes. The required practical in this unit is displacement reactions and focusses on the application of the reactivity series. There are many opportunities within this scheme to interleave conservation of mass ideas by incorporating mass calculations that link directly to the reactions carried out.
Year 10	P1 Energy	In KS3 students will have learned to: • describe examples of energy transfers • describe how thermal energy transfers from one place to another	C2 Bonding, structure and properties	In KS3 students will have learned to: • describe the arrangement of particles in a solid, liquid and gas, and link this to their properties • explain changes of state in terms of the particle mode

	B2 Organisation	• apply the law of conservation of energy to situations involving energy transfers • distinguish between power and energy • compare values of energy and power using appropriate SI values • compare different fuels and energy resources • measure extension or compression and relate this to the force applied to a spring and to Hookes law Students will learn how energy can be transferred between different stores, that is conserved, and that different systems have different efficiencies. They will learn how to calculate kinetic, gravitational potential and elastic potential energy. They will link energy with work done and with power. They will learn about energy transfers during heating or cooling by investigating specific heat capacity, and how transfers can be reduced by using insulating materials. The final section of the units discusses renewable and non-renewable energy resources. In KS3 students will have learned to: • describe and explain the components that make up a balanced diet, describing the consequences of an imbalanced diet • evaluate how different lifestyles have different energy needs • describe the symbiotic relationship between bacteria and the human digestive system • describe how and explain why foods are broken down in the digestive system, in terms of enzymes In this section we will learn about the human digestive system which provides the body with nutrients, and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly	P2 Electricity	• represent chemical reactions as word equations and apply this to the idea of conservation of mass In this unit students will use theories of structure and bonding to explain the physical and chemical properties of materials. They will describe how analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. The theories of bonding they will cover explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. Students will appreciate that the properties of these materials may offer new applications in a range of different technologies. In KS3 students will have learned to: • describe examples of energy transfers • apply the law of conservation of energy to situations involving energy transfers • distinguish between power and energy • compare values of energy and power using appropriate SI values • define current, and describe its behaviour in series and parallel circuits • correctly use apparatus to measure current and potential difference • identify conductors and insulators and calculate resistance values using appropriate units • explain how insulators are charged by friction, and describe the forces between charged objects • draw and interpret simple magnetic field diagrams • describe how electromagnets and direct current motors work Students will learn how to construct circuits and what electrical charge and current are. They will investigate voltage, current

		around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.		and resistance in series and parallel circuits as well as individual circuit components. They will apply this knowledge to how electricity can be used safely in the home, how AC and DC currents differ, and how power links to electricity. They will also cover how energy is transferred from power stations through the National Grid.
Year 11	C6 The rate and extent of chemical change	In KS3 students will have learned to: • describe combustion, thermal decomposition and oxidation, representing them as symbol equations • describe how a catalyst affects the rate of a reaction • describe the differences between an exothermic and endothermic reaction, and link these to energy changes GCSE content covered relevant to this topic: • C3 Quantitative – what 'concentration' means, the difference between strong/weak and concentrated/dilute • C4 Chemical change – evidence for a chemical reaction, neutralization reactions, • C5 Energy changes – endothermic and exothermic reactions, energy level diagrams Students will learn that 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	B6 Inheritance and variation	In KS3 students will have learned to: • label plant and animal cells; state the function of the organelles; and compare plant and animal cells • identify variation between individuals of a species and state the differences between species, describing the difference between continuous and discontinuous variation • explain how variation allow organisms to compete, and the way this drives natural selection • describe how a species may become extinct • describe how genetic material can be inherited, and the role of Watson, Crick, Wilkins and Franklin in the discovery of DNA structure In this topic we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An

		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.		understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them into the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.
	P5 Forces	In KS3 students will have learned to: • use diagrams with correctly labelled force arrows to display a range of forces in different situations • interpret force diagrams to determine the motion of an object • calculate pressure, weight and average speed using appropriate equations • relate the description of a journey to a distance-time graph • measure extension or compression and relate this to the force applied to a spring and to Hookes law • describe energy transfers and conservation of energy for the deformation of objects • describe balanced forces in relation to mechanical systems This topic will cover how forces can affect the velocity and acceleration of objects. Students will learn how to calculate resultant forces, link force, mass and acceleration, link gravity, weight and mass, and calculate work done. They will investigate how forces can affect elasticity, or lead to terminal velocity in a falling object. They will cover Newton's laws of motion and apply these to braking and stopping distances of vehicles. They will also investigate how momentum is affected in moving or colliding objects.	C7 Organic Chemistry	In KS3 students will have learned to: • identify, with reasons, differences between atoms, elements and compounds • represent chemical reactions as word equations and apply this to the idea of conservation of mass • describe combustion, thermal decomposition and oxidation • describe how a catalyst affects the rate of a reaction • describe the differences between an exothermic and endothermic reaction, and link these to energy changes In this topic students will learn how 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
	B4 Bioenergetics	In KS3, students have learned to: • explain the respiratory system as a mechanism of breathing and gas exchange (to allow substances to diffuse)		

		• compare aerobic to anaerobic respiration, and describe the situations in which they occur • describe how roots take up minerals, nutrients and water from the soil • describe photosynthesis in a word equation representing products and reactants • describe how leaves are adapted to carry out photosynthesis In this section we will explore how plants harness the Sun's energy in photosynthesis in order 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.		useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.
Year 12	Biology Foundations in Biology	All living organisms have similarities in cellular structure, biochemistry and function. An understanding of these similarities is fundamental to the study of the subject. This module gives learners the opportunity to use microscopy to study the cell structure of a variety of organisms. Biologically important molecules such as carbohydrates, proteins, water and nucleic acids are studied with respect to their structure and function. The structure and mode of action of enzymes in catalysing biochemical reactions is studied. Membranes form barriers within, and at the surface of, cells. This module also considers the way in which the structure of membranes relates to the different methods by which molecules enter and leave cells and organelles. The division and subsequent specialisation of cells is studied, together with the potential for the therapeutic use	Biology Foundations in Biology Exchange and transport	In this module, learners study the structure and function of gas exchange and transport systems in a range of animals and in terrestrial plants. The significance of surface area to volume ratio in determining the need for ventilation, gas exchange and transport systems in multicellular organisms is emphasised. The examples of terrestrial green plants and a range of animal phyla are used to illustrate the principle. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.

		of stem cells. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.	Chemistry Developing fuels	Developing fuels builds on to knowledge from GCSE including catalysts, alkanes and alkenes as well as bond enthalpy. The topic also introduces new content which includes ideal gas laws, enthalpy changes, Hess's law, isomers and shapes of organic molecules as well as alternative sources of fuels and the environment.
	Chemistry Elements of life	Elements of life builds on to knowledge from GCSE including atomic structure, isotopes, the periodic table, reactions of masses, qualitative analysis, reacting masses as well as bonding and structure. New content introduced at this stage includes energy and matter calculations which are further explored in the Ozone topic.		
Year 13	Biology Communication, homeostasis and energy	It is important that organisms, both plants and animals are able to respond to stimuli. This is achieved by communication within the body, which may be chemical and/or electrical. Both systems are covered in detail in this module. Communication is also fundamental to homeostasis with control of temperature, blood sugar and blood water potential being studied as examples. In this module, the biochemical pathways of photosynthesis and respiration are considered, with an emphasis on the formation and use of ATP as the source of energy for biochemical processes and synthesis of biological molecules. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.	Biology Communication, homeostasis and energy	
	Chemistry Storylines – The ozone story	An initial study of the composition of the atmosphere provides the opportunity to introduce composition by volume calculations for gases. Discussion of ozone's role as a 'sunscreen' then leads to ideas of the principal types of electromagnetic radiation and their effects on molecules. This introduces a study of radical reactions, reaction kinetics and catalysis, set in the context of the ways in which ozone is made and destroyed in the atmosphere. A consideration of CFCs and HFCs then provides the introduction to the chemistry of	Chemistry Storylines – Polymers and life	The storyline begins with the uses of condensation polymers such as nylons and polyesters, introducing the chemistry of carboxylic acids, phenols, esters, amines and amides, as well as naming of other organic groups. Surgical stitches that 'disappear' in the body then form the context for discussing hydrolysis of polymers. The storyline then turns to the chemistry of proteins. Amino acid chemistry, optical isomerism and the structure of proteins are introduced in relation to the structure of insulin. The storyline then moves to testing for

		haloalkanes, including nucleophilic substitution, and intermolecular bonding. The chemical ideas in this module are: • composition by volume of gases • the electromagnetic spectrum and the interaction of radiation with mater • rates of reaction • radical reactions • intermolecular bonding • haloalkanes • nucleophilic substitution reactions • the sustainability of the ozone layer.		glucose in urine as a basis for introducing enzyme catalysis. Various examples of medicines that work as enzyme inhibitors are then used to discuss molecular recognition. The storyline continues with the development of models of the DNA and RNA structures and a description of the Human Genome project. Finally, aspirin – discussed in WM – is revisited as the context for a more detailed discussion of mass spectrometry, as well as introduction of proton and carbon-13 NMR and the use of combined techniques in structural analysis. The chemical ideas in this module are: • condensation polymers • organic functional groups • amines and amides • acid–base equilibria • amino acid and protein chemistry • optical isomerism • enzyme catalysis and molecular recognition • the structure and function of DNA and RNA • structural analysis.
	What's in a medicine	A consideration of medicines from nature focuses on aspirin. The chemistry of the –OH group is introduced through reactions of salicin and salicylic acid, beginning with alcohols and continuing with phenols. The discussion of chemical tests for alcohols and phenols leads to the introduction of IR and mass spectrometry as more powerful methods for identifying substances. The storyline concludes by examining the synthesis of aspirin to illustrate organic preparative techniques, including a look at the principles of green chemistry. The chemical ideas in this module are: • the chemistry of the –OH group, phenols and alcohols • carboxylic acids and esters • mass spectrometry and IR spectroscopy • organic synthesis, preparative techniques and thin layer chromatography • green chemistry.	The chemical industry	The storyline opens with a look at crop production and the nitrogen cycle, which leads into consolidation of redox concepts from the first year and introduces nitrogen chemistry. The industrial production of nitric acid and sulfuric acid – both used in the fertiliser industry – then form the context for developing understanding of rates, including determination of rate equations and equilibria, consolidating Kc and the introduction of how to determine units. These ideas are finally drawn together by looking at the industrial production of ethanoic acid. Overall, the three industrial processes allow for an overview of the effects of factors on the rate and equilibrium yields of reactions, leading to a consideration of the best conditions for an industrial process. The processes

				also allow learners to look at the costs of an industrial process, including hazards and the effect of these processes on society. The chemical ideas in this module are: • aspects of nitrogen chemistry • kinetics • equilibrium and equilibrium constant calculations • effects of factors on the rate and equilibrium yields of reactions; consideration of the best conditions for an industrial process • analysis of costs, benefits and risks of industrial processes.

Term 2	Spring 1	Why this? Why now?	Spring 2	Why this? Why now?
Year 7	Chemical Changes	In Key Stage 2, students have been taught to: • explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda. This unit begins by reminding students of the work completed in KS2 on physical and chemical change. This work continues into using oxidation as a common example of a reaction and simple word equations are introduced. The link between oxidation and combustion is made. Particle diagrams support the idea of the conservation of mass, which is introduced in Section 1 and simple calculations show that mass in = mass out. The unit then moves onto acids and alkalis, using simple indicators and neutralization as a further common chemical reaction. More word equation practice and then the planning of a neutralization practical completes the unit.	Organ systems	In Key Stage 2, students have been taught to: • describe how humans digest food • describe how animals break down food • describe how animals digest food • describe the role of the heart • describe how different circulatory systems work This unit begins with the recap of the major human organs and their roles in sustaining life and will include an introduction to the skeletal system and its role. The cycle moves on to introducing puberty and menstruation. The unit then moves on to look at plant sexual reproduction and seed dispersal methods. Finally, what is meant by a species and examples of variation within a species are covered, with opportunities to collect and display data to develop understanding of types of data. The final lesson uses a simple model for reproduction, which should reinforce the idea of half of the genetic information coming from each parent.
Year 8	Space	In Key Stage 2, students have been taught to: • describe the movement of the Earth, and other planets, relative to the Sun in the solar system • describe the movement of the Moon relative to the Earth • describe the Sun, Earth and Moon as approximately spherical bodies	Matter	In Key Stage 3 so far, students have been taught to: • use diagrams with correctly labelled force arrows to display a range of forces in different situations • interpret force diagrams to determine the motion of an object • calculate pressure, weight and average speed using appropriate equations • describe the arrangement of particles in a solid, liquid and gas, and link this to their properties • explain changes of state in terms of the particle model

	Materials and the Earth	• use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. The section deals with the Earth in space, the cause of seasons and the Earth's place in the universe. Connections between this and light can be explored – light years, speed of light etc. In Key Stage 2 Science, students have been taught to: • Recognize that living things have changed over time and that fossils provide information about living things that inhabited Earth millions of years ago. • Compare and group together different types of rock based on their appearance and simple physical properties (Year 3) • Describe in simple terms how fossils are formed when things that have lived are trapped within rock (Year 3) The unit begins by looking at the structure of the Earth and some basic plate tectonics to highlight the changing nature of the surface and how this can lead to earthquakes and volcanoes. The formation of the three different types of rock and their physical properties is then covered, as well as fossil formation. The unit then moves on to the atmosphere, how it has changed over the Earth's history and more recently, and the human impact on that. Finally, we learn about the properties of some of the materials made from earth's resources and recycling. The concepts resurface in GCSE Energy and Using Resources.		The matter topic builds extensively on the particles (7CP) and forces and motion (7PF) topics. In this topic students will reinforce their understanding of the particle model, kinetic theory, and resultant forces. They will learn to apply these to situations revolving around pressure and diffusion.

Year 9	Sound waves	In Key Stage 2, students have been taught to: • Identify how sounds are made, associating some of them with something vibrating • Recognize that vibrations form sounds travel through a medium to the ear • Find patterns between the pitch of a sound and features of the object that produced it • Find patterns between the volume of a sound and the strength of the vibrations that produced it • Recognize that sounds get fainter as the distance from the sound source increases This unit builds on the work in year 8 on light waves and makes several links to it. The unit begins by reviewing the work from year 8 and establishing the different types of waves. Waves in matter are introduced and water and sound waves are used as examples of this. The idea of absorption of energy leading to an increase in the thermal store of a substance is revisited here too. The unit then looks at the speed of sound in different media and is a chance to revisit accurate language around particle theory. Then, students learn about uses of ultrasound and how microphones and loudspeakers work. The last section provides a chance to revisit electromagnetism.	Biological systems and processes	In Key Stage 2, students have been taught to: • Identify that some animals, including humans, have skeletons for support, movement and protection In Year 7, students have been taught to: • describe the relationship between cells, tissues and organs; and describe the function of the main organ systems • describe the structure of the gas exchange system in humans • outline reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilization, gestation, and birth This unit of work begins with a recap of organizational hierarchy, with students recalling the function of different organ systems. Students will then focus on the skeletal and muscular systems, considering how these two interact to produce movement and locomotion. Students will be introduced to the concept of antagonistic muscle pairings and will investigate the forces exerted by different muscles involved in movement. Students will then examine the respiratory system, looking at the mechanism of breathing, lung volumes and the role of diffusion in gas exchange. The impacts of drugs and exercise on the respiratory and other systems will be explored. Finally, students will consider the basis of life by investigating the structure and function of DNA. The work of key scientists and a model for inheritance will be introduced. Through this module students will be introduced to key biological concepts such as DNA as a blueprint for life and its link to cells, tissues, organs, organ systems and organisms.
Year 10	B3 Infection and response	In KS3, students have learned to: • label plant and animal cells; state the function of the organelles; and compare plant and animal cells	P3 The particle model of matter	In KS3, students have learned: • the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure • changes of state in terms of the particle model • conservation of mass during changes of state

		• describe how roots take up minerals, nutrients and water from the soil • describe how leaves are adapted to carry out photosynthesis Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.	P4 Atomic Structure	• to describe the factors that affect pressure in fluids • to describe the motion of particles in different states of matter and link this to different behaviors • to compare and explain differences in density between solids, liquids and gases In this unit students learn to describe the particle model of matter but taking into account the energy and arrangement of the particles. They investigate how to measure the density or regular and irregularly shaped objects, and liquids. They will explain changes of state in terms of latent heat. In Key Stage 3 so far, students have been taught to: • Describe the structure of an atom and draw electron configuration diagrams for named elements (first 20 only) This topic covers how ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.
	C3 Quantitative chemistry	In KS3, students have learned: • how to represent chemical reactions as word equations and apply this to the idea of conservation of mass • Relative Formula Mass calculations Previously studied GCSE content that is relevant: • C1 – atomic structure, atomic mass • C2 – ion formation and writing/interpreting ionic formulae	B4 Bioenergetics	In KS3, students have learned to: • explain the respiratory system as a mechanism of breathing and gas exchange (to allow substances to diffuse) • compare aerobic to anaerobic respiration, and describe the situations in which they occur • describe how roots take up minerals, nutrients and water from the soil • describe photosynthesis in a word equation representing products and reactants • describe how leaves are adapted to carry out photosynthesis

		In this unit students learn how 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.		In this section we will explore how plants harness the Sun's energy in photosynthesis in order 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.
Year 11	P6 Waves	In KS3, students have learned to: • describe how light interacts with different materials • describe the effects of absorption of light in terms of energy • use ray diagrams to show how images are formed –such as mirrors, pinhole cameras and the human eye • compare light, mechanical and sound waves • describe the process of reflection, absorption and superposition (add or cancel waves) • compare human and animal auditory ranges using appropriate units • describe uses of sound and ultrasound, including industrial and medical uses Students will learn about how waves transfer energy, how to correctly describe wave properties, and the difference between electromagnetic and mechanical waves. They will investigate how to measure wave speed, and will	P7 Magnetism and Electromagnetism C9 Chemistry of the atmosphere	In KS3, students have learned: • How forces can act at a distance • That magnets can be permanent or induced In this topic students learn that Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this. Examples covered in this unit are generators and motors. In KS3, students have learned to: • describe the arrangement of particles in a solid, liquid and gas, and link this to their properties • represent chemical reactions as word equations and apply this to the idea of conservation of mass • describe the effects of absorption of light in terms of energy • explain how carbon is recycled in the Earth's atmosphere and link the impact of human activity to climate change • describe the process of reflection, absorption and superposition (add or cancel waves)

	C8 Chemical analysis	discover the uses and dangers of the waves in the electromagnetic spectrum. In KS3 students will have learned to: • classify substances as pure and impure, and describe techniques to separate mixtures • represent chemical reactions as word equations and apply this to the idea of conservation of mass In this unit students will appreciate how 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. In KS3, students have learned to: • describe feeding relationships and food webs, and explain how a changing environment may affect them • explain how variation allow organisms to compete, and the way this drives natural selection • describe how a species may become extinct • describe the importance of maintaining biodiversity and how gene banks can be used for preservation In this topic students learn how the Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by	C10 Using resources	In this topic students learn that the Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity. In KS3, students have learned to: • describe the arrangement of particles in a solid, liquid and gas, and link this to their properties • explain changes of state in terms of the particle model • classify substances as pure and impure, and describe techniques to separate mixtures • represent chemical reactions as word equations and apply this to the idea of conservation of mass In this topic students learn how industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimize 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 utilized. 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 minimized.

	B7 Ecology	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 particular conditions, both abiotic and biotic. These ecosystems provide essential services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.		
Year 12	Biology Exchange and transport Biodiversity, evolution and disease	In this module the learners study the biodiversity of organisms; how they are classified and the ways in which biodiversity can be measured. It serves as an introduction to ecology, emphasising practical techniques and an appreciation of the need to maintain biodiversity. The learners also gain an understanding of the variety of	Biology Biodiversity, evolution and disease	

		organisms that are pathogenic and the way in which plants and animals have evolved defences to deal with disease. The impact of the evolution of pathogens on the treatment of disease is also considered. The relationships between organisms are studied, considering variation, evolution and phylogeny. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems		
	Chemistry Elements from the Sea	The presence of halide salts in the sea provides the entry to the properties of the halogens and reactions between halide ions. The manufacture of bromine and chlorine then provide the context for discussion of redox chemistry, electrolysis and the nomenclature of inorganic compounds. The use of chlorine in bleach is used to introduce the concept of equilibrium and calculations of the equilibrium constant, as well as iodine–thiosulfate titrations. This leads into a discussion of the risks and benefits of using chlorine. Finally, atom economy is introduced through the manufacture of hydrogen chloride and other hydrogen halides. The Deacon process for making HCl provides an opportunity to expand on ideas relating to the position of equilibrium. The chemical ideas in this teaching module are: • halogen chemistry • redox chemistry and electrolysis • equilibrium • atom economy.	Chemistry What's in a medicine	A consideration of medicines from nature focuses on aspirin. The chemistry of the –OH group is introduced through reactions of salicin and salicylic acid, beginning with alcohols and continuing with phenols. The discussion of chemical tests for alcohols and phenols leads to the introduction of IR and mass spectrometry as more powerful methods for identifying substances. The storyline concludes by examining the synthesis of aspirin to illustrate organic preparative techniques, including a look at the principles of green chemistry. The chemical ideas in this module are: • the chemistry of the –OH group, phenols and alcohols • carboxylic acids and esters • mass spectrometry and IR spectroscopy • organic synthesis, preparative techniques and thin layer chromatography • green chemistry.

	The Ozone Story	An initial study of the composition of the atmosphere provides the opportunity to introduce composition by volume calculations for gases. Discussion of ozone's role as a 'sunscreen' then leads to ideas of the principal types of electromagnetic radiation and their effects on molecules. This introduces a study of radical reactions, reaction kinetics and catalysis, set in the context of the ways in which ozone is made and destroyed in the atmosphere. A consideration of CFCs and HFCs then provides the introduction to the chemistry of haloalkanes, including nucleophilic substitution, and intermolecular bonding. The chemical ideas in this module are: • composition by volume of gases • the electromagnetic spectrum and the interaction of radiation with mater • rates of reaction • radical reactions • intermolecular bonding • haloalkanes • nucleophilic substitution reactions • the sustainability of the ozone layer.		
Year 13	Biology Genetics, evolution and ecosystems	This module covers the role of genes in regulating and controlling cell function and development. Heredity and the mechanisms of evolution and speciation are also covered. Some of the practical techniques used to manipulate DNA such as sequencing and amplification are considered and their therapeutic medical use. The use of microorganisms in biotechnology is also covered. Both of these have associated ethical considerations and it is	Biology Genetics, evolution and ecosystems	

		important that learners develop a balanced understanding of such issues. Learners gain an appreciation of the role of microorganisms in recycling materials within the environment and maintaining balance within ecosystems. The need to conserve environmental resources in a sustainable fashion is considered, whilst appreciating the potential conflict arising from the needs of an increasing human population. Learners also consider the impacts of human actives on the natural environment and biodiversity. Learners are expected to apply knowledge, understanding and other skills developed in this module to new situations and/or to solve related problems.		
	Chemistry Oceans	The storyline begins by looking at how the oceans have been and are surveyed, and what we know about their composition. This leads into a discussion of the solution of ionic solids, focusing on the energy changes involved. A study of the role of the oceans in redistributing energy from the Sun next forms the context for introducing the greenhouse effect. The absorption of CO_2 by the oceans also provides the basis for introduction of acid–base equilibria, including Brønsted–Lowry theory, pH calculations, strong and weak acids, and buffers. The role of calcium carbonate in seashells as a carbon store then leads into understanding of solubility products. Finally, the storyline returns to the redistribution of energy by the oceans, forming the basis of an in-depth discussion of ideas relating to entropy. The chemical ideas in this module are: • dissolving and associated enthalpy changes • the greenhouse effect	Chemistry Developing metals	The storyline begins with metals in ancient times and their subsequent use in coinage and weaponry, moving on to modern uses of metals including dental alloys. Transition metals and their properties are introduced in this context. The storyline continues with redox chemistry and electrochemical cells, studied in the context of cells from Volta through modern-day usage of cells to electrochemistry in the mouth. Finally, the topic of pigments leads into discussion of transition metal chemistry and complexes. The storyline ends with a review of biologically important complexes such as haemoglobin and cis-platin and the role of metals as catalysts in car exhaust systems. The chemical ideas in this module are: • redox titrations • cells and electrode potentials • d-block chemistry • colorimetry.

		• acid–base equilibria and pH • solubility products • entropy.		

Term 3	Summer 1	Why this? Why now?	Summer 2	Why this? Why now?
Year 7	Forces and Motion	At KS2 students have been taught to: • compare how things move on different surfaces • notice that some forces need contact between two objects, but magnetic forces can act at a distance • explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • identify the effects of air resistance, water resistance and friction, that act between moving surfaces This unit begins by naming forces, drawing forces diagrams & measuring forces. This leads into looking at effect of balanced and unbalanced forces on the motion of objects, building on concepts introduced in lesson1. The required practical asks students to find the gravitational field strength on Earth, allowing them to calculate the weight of an object on Earth. With the relevant data provided about gravitational field strength of other planets, they can calculate weight on other planets. The link is made between force and pressure, allowing students to perform pressure calculations and use the idea of pressure to explain everyday situations. The remainder of the unit looks at how forces affect the speed of an object, making speed calculations and interpreting distance-time graphs.	Plants and photosynthesis	In KS2 students have been taught to describe the basic structure of plants, *eg leaf, root, stem, flower* In year 7 students should have labelled plant and animal cells, described the function of the organelles, compared plant and animal cells and explained how root hair cells are adopted for their role. They have also described the function of flower parts, explained how pollination occurs and explained different seed dispersal techniques. In year 8, students will have described feeding relationships and food webs, and explained how a changing environment may affect them. They have also explained how carbon is recycled in the Earth's atmosphere through the carbon cycle and the link between human activity and climate change. This unit provides the foundation for work in key stage 4 on limiting factors in photosynthesis, energy transfer through an ecosystem and the mineral requirements of plants. The unit starts with exploring the structure and function of roots, with emphasis on its adaptations. Pupils then progress on to the process of photosynthesis and its importance. This will include understanding that the carbon dioxide for photosynthesis comes from the air, that chlorophyll enables a plant to utilise light in photosynthesis, the role of the leaf in photosynthesis, the importance and roles of the xylem and phloem and the importance of photosynthesis to humans and other animals.
Year 8	Plants and Photosynthesis	In KS2 students have been taught to describe the basic structure of plants, *eg leaf, root, stem, flower* In year 7 students should have labelled plant and animal cells, described the function of the organelles, compared plant and animal cells and	Forces in action	In Key Stage 3 so far, students have been taught: • forces as pushes or pulls, arising from the interaction between two objects

		explained how root hair cells are adopted for their role. They have also described the function of flower parts, explained how pollination occurs and explained different seed dispersal techniques. In year 8, students will have described feeding relationships and food webs, and explained how a changing environment may affect them. They have also explained how carbon is recycled in the Earth's atmosphere through the carbon cycle and the link between human activity and climate change. This unit provides the foundation for work in key stage 4 on limiting factors in photosynthesis, energy transfer through an ecosystem and the mineral requirements of plants. The unit starts with exploring the structure and function of roots, with emphasis on its adaptations. Pupils then progress on to the process of photosynthesis and its importance. This will include understanding that the carbon dioxide for photosynthesis comes from the air, that chlorophyll enables a plant to utilise light in photosynthesis, the role of the leaf in photosynthesis, the importance and roles of the xylem and phloem and the importance of photosynthesis to humans and other animals.		• how to use force arrows in diagrams, adding forces in one dimension, what are balanced and unbalanced forces • forces: associated with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water • forces are measured in newtons • forces are needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) • changes depend on the direction of force and its size. • pressure is measured by ratio of force over area –acting normal to any surface. • gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, This unit builds on forces from year 7 to look at how forces can cause turning effects, how this can be amplified, how forces can cause deformation and what elastic deformation is, how forces are linked to energy (work done) and how machines can reduce the force needed to do a particular job. There are lots of opportunities to make links with real life objects (bikes, cars, screwdrivers) engineering, tools etc. There is a lot of maths, although the relationships are simple, so challenge can be built by rearrangement and unit changes.
Year 9	Biological Processes	In Key Stage 2, students have been taught to: • Identify that some animals, including humans, have skeletons for support, movement and protection In Year 7, students have been taught to: • describe the relationship between cells, tissues and organs; and describe the function of the main organ systems • describe the structure of the gas exchange system in humans	Start of GCSE C1 Atomic Structure	In Key Stage 3 so far, students have been taught to: • name, describe and explain changes of state in terms of particles • classify substances as pure and impure, describe techniques to separate mixtures and interpret a chromatogram

		• outline reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth This unit of work begins with a recap of organizational hierarchy, with students recalling the function of different organ systems. Students will then focus on the skeletal and muscular systems, considering how these two interact to produce movement and locomotion. Students will be introduced to the concept of antagonistic muscle pairings and will investigate the forces exerted by different muscles involved in movement. Students will then examine the respiratory system, looking at the mechanism of breathing, lung volumes and the role of diffusion in gas exchange. The impacts of drugs and exercise on the respiratory and other systems will be explored. Finally, students will consider the basis of life by investigating the structure and function of DNA. The work of key scientists and a model for inheritance will be introduced. Through this module students will be introduced to key biological concepts such as DNA as a blueprint for life and its link to cells, tissues, organs, organ systems and organisms.		• identify, with reasons, differences between atoms, elements and compounds • represent chemical reactions as word equations and apply this to the idea of conservation of mass • explain how an elements position in the periodic table links to its properties • describe the structure of an atom and draw electron configuration diagrams for named elements (first 20 only) In this topic students will learn that the periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels. In Key Stage 3 so far, students have been taught to: • use a microscope to produce an image of a cell in focus • label plant and animal cells; state the function of the organelles; and compare plant and animal cells • describe how roots take up minerals, nutrients and water from the soil • make and record observations and measurements and present data using appropriate methods including tables with repeat measurements • use basic data analysis to calculate means, plot graphs with line of best fit and use this data to draw conclusions

			B1 Cell Biology	• relate results to predictions and hypotheses, giving reasoned explanations, and identify further questions from their results • apply mathematical concepts to use and rearrange equations in order to calculate results, using appropriate SI unit In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialized, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cell.
Year 10	C4 Chemical changes	In KS3, students have learned to: • identify substances as acid, alkali or neutral based on observations with indicators and the pH scale • describe neutralisation in terms of acids and alkalis reacting • use patterns of reactivity to make predictions for chemical reactions • link the properties and uses of a metal to its position in the reactivity series In this topic students investigate redox reactions and the reactions of acids with metals, metal oxides, and metal carbonates. They learn about the reactivity series of metals, how make salts, neutralisation reactions, and the difference between strong and weak acids. They link the reactivity of metals with how they can be extracted from compounds	B7 Ecology	In KS3, students have learned to: • describe feeding relationships and food webs, and explain how a changing environment may affect them • explain how variation allow organisms to compete, and the way this drives natural selection • describe how a species may become extinct • describe the importance of maintaining biodiversity and how gene banks can be used for preservation In this topic students learn how 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

	C5 Energy changes	using techniques such as electrolysis. This also links to their previous understanding of ions and electricity. In KS3, students have learned to: • use patterns of reactivity to make predictions for chemical reactions • link the properties and uses of a metal to its position in the reactivity series • describe combustion, thermal decomposition and oxidation, representing them as symbol equations • describe the differences between an exothermic and endothermic reaction, and link these to energy changes In this topic students will learn that 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.		species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.
Year 11	Revision	Preparation for GCSE exams through targeted revision	Revision and exams	Preparation for GCSE exams through targeted revision
Year 12	Biology Biodiversity, evolution and disease Chemistry	Continue with the Term 2 topic.	Biology Biodiversity, evolution and disease Chemistry	

	What's in a medicine	A consideration of medicines from nature focuses on aspirin. The chemistry of the –OH group is introduced through reactions of salicin and salicylic acid, beginning with alcohols and continuing with phenols. The discussion of chemical tests for alcohols and phenols leads to the introduction of IR and mass spectrometry as more powerful methods for identifying substances. The storyline concludes by examining the synthesis of aspirin to illustrate organic preparative techniques, including a look at the principles of green chemistry. The chemical ideas in this module are: • the chemistry of the –OH group, phenols and alcohols • carboxylic acids and esters • mass spectrometry and IR spectroscopy • organic synthesis, preparative techniques and thin layer chromatography • green chemistry.	Polymers and life	The storyline begins with the uses of condensation polymers such as nylons and polyesters, introducing the chemistry of carboxylic acids, phenols, esters, amines and amides, as well as naming of other organic groups. Surgical stitches that 'disappear' in the body then form the context for discussing hydrolysis of polymers. The storyline then turns to the chemistry of proteins. Amino acid chemistry, optical isomerism and the structure of proteins are introduced in relation to the structure of insulin. The storyline then moves to testing for glucose in urine as a basis for introducing enzyme catalysis. Various examples of medicines that work as enzyme inhibitors are then used to discuss molecular recognition. The storyline continues with the development of models of the DNA and RNA structures and a description of the Human Genome project. Finally, aspirin – discussed in WM – is revisited as the context for a more detailed discussion of mass spectrometry, as well as introduction of proton and carbon-13 NMR and the use of combined techniques in structural analysis. The chemical ideas in this module are: • condensation polymers • organic functional groups • amines and amides • acid–base equilibria • amino acid and protein chemistry • optical isomerism • enzyme catalysis and molecular recognition • the structure and function of DNA and RNA • structural analysis.
Year 13	Biology Genetics, evolution and ecosystems	Finish the term 2 topic	Biology Exam revision Chemistry Revision	

	Chemistry Colour by design	A study of dyes and dyeing and the use of chemistry to provide colour to order. The storyline begins by looking at biological pigments, such as found in carrots, to examine the origins of colour in delocalised systems in organic molecules. This discussion moves into the structure of benzene, where the storyline touches on how scientific ideas develop. The storyline then moves on to synthetic dyes, including picric acid, chrysodin and mauveine. The concepts explored in this context includes electrophilic substitution reactions of benzene, and formation of diazonium compounds. At this point, the storyline also takes a look at the overall structure of dye molecules and how dyes attach themselves to fibres. Food dyes and food testing then form the context for studying the structure of fats and oils and the principles of gas–liquid chromatography. The storyline ends with reactions of carbonyl compounds, and case studies to illustrate the synthesis of organic molecules. The chemical ideas in this module are: • the chemical origins of colour in organic compounds • aromatic compounds and their reactions • dyes and dyeing • diazonium compounds • fats and oils • gas–liquid chromatography • carbonyl compounds and their reactions • organic synthesis and polyfunctional compounds.		

Wider reading

Extracurricular Opportunities (competitions, associations and clubs): CREST club for Years 7 and 8 allowing students the opportunity to explore their own interests and conduct their own experiments. Students research independently and expand their practical skills – a chance to do practical's that cannot/ are not done in the classroom. Nationally recognised CREST Bronze accreditation can be achieved at the end of the year.	**Revision Guides** **Oak National Academy** **BBC Bitesize** **CGP Revision books and workbooks**

Academic Reading

Websites
New Scientist – online
Wired.com/category/science
Space.com
Badscience.net
phys.org
www.sciencefocus.com
https://www.nhm.ac.uk/discover/news/science-news.html

Books
The Big Bang by Simon Singh
Bad Science by Ben Goldacre
Bad Astronomy by Philip Plait
What if? by Randall Munroe
The disappearing spoon by Sam Kean