Curriculum Overview			
Year Group	**Term**	**Unit of Work**	**Assessment Content**
7	1/2	**Particles** This unit of work 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 Chemistry unit at GCSE. Within separation, students plan and carry out a practical based on rock salt purification. Distillation and saturation are also covered towards the end of the unit, followed by the effect of temperature on solubility. For many students in Year 7 this is their first genuine experience of working in a science laboratory! Science Club is open to all Year 7 students. Students will: • Know the arrangement of particles in a solid, liquid and gas, and link this to their properties. • Understand why some substances are classified as pure and others as impure and be able to describe techniques to separate mixtures. • Be able to explain changes of state in terms of the particle model.	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of autumn term test, and end of year chemistry test in term 4.
	1/2	**Cells** 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 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. Students will: • Know the parts of a plant cell and an animal cell, and their function. • Be able to make comparisons between plant and animal cells.	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of autumn term test and the end of year biology test in term 5.

		• Understand the relationship between cells, tissues and organs and describe the function of the main organ systems. • Be able to use a microscope to produce an image of a cell in focus.	
	3/4	**Energy** 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. From there, students will study the relationship between power and energy, introducing SI units, and how to calculate electricity costs. It finishes with a study of energy resources, starting with the formation and use of fossil fuels, moving to renewable sources, a lesson evaluating the relative merits of both. The unit provides many opportunities for developing working scientifically skills. Students will: • Know the law of conservation of energy and be able to apply it to situations involving energy transfers. • Understand the difference between power and energy. • Be able to describe examples of energy transfers. • Be able to describe how thermal energy transfers from one place to another. • Know the appropriate SI units of energy and power. • Be able to compare different fuels and energy resources.	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end year physics test in term 6.
	3/4	**Chemical Reactions** This unit begins by reminding students of the work completed in KS2 on physical and chemical change and a circus of experiments for the students to see how to spot evidence for a chemical reaction. 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, 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. Planning and observing skills are developed through a simple investigation about antacids. Students will: • Know how to use observations with indicators and the pH scale to identify substances as acids, alkalis or neutral.	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year chemistry test in term 4.

		• Understand the dangers associated with using acids and alkalis and how to use them safely. • Be able to describe neutralisation in terms of the reaction between an acid and an alkali.	
	5/6	**Reproduction** This unit begins with the structure of the male and female reproductive system and progresses to sexual reproduction, fertilization, embryo development and implantation, development of the foetus, birth and growth. The cycle is completed by coming back to 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. Students will: • Know the parts of the structure of the male and female reproductive system. • Understand the functions of the parts of the reproductive system. • Be able to describe the processes of menstruation and fertilisation and identify the stages of gestation and birth. • Know the function of each part of the flower, • Understand how pollination occurs. • Be able to evaluate different seed dispersal techniques in plants. • Know the difference between continuous and discontinuous variation.	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year biology test in term 5.
	5/6	**Forces** This unit begins by naming forces, drawing forces diagrams and measuring forces. This leads into looking at effect of balanced and unbalanced forces on the motion of objects. Students investigate how 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 unit progresses onto to how forces affect the speed of an object, making speed calculations and interpreting distance-time graphs. Students will:	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year physics test in term 6.

		• Know how to use diagrams with correctly labelled force arrows to display a range of forces in different situations. • Understand how to interpret force diagrams to determine weight of an object. • Be able to calculate pressure, weight and average speed using appropriate equations. • Be able to relate the description of a journey to a distance-time graph. During Term 6 we begin the Year 8 Ecology unit, making the most of the weather to begin fieldwork in our wildlife area.	
8	1	**Digestion and Nutrition** 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. Student will look at what is meant by a balanced diet and the consequences when nutritional and calorie intake is inadequate or excessive. Students will carry out practical 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. The role of enzymes is introduced as part of this, as well as the role of gut bacteria. Students will: • Know the components of a balanced diet and why each component is needed by the body. • Understand the consequences of a diet that is not balanced. • Be able to evaluate how different lifestyles have different energy needs. • Be able to describe how and explain why foods are broken down in the digestive system, in terms of enzymes.	In class assessment tasks made up of short and longer answer questions. The unit is assessed again in the end of autumn term test and end of year biology test in term 6.
	2	**Light** The unit builds on work done at 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. Electrical and chemical effects are studied by way of a solar cell investigation. The unit then moves to reflection and refraction in more detail. This offers the opportunity to look at reproducibility in data and accuracy of measurements. It then moves on to vision and problems with vision, the colours of the spectrum and how colour is seen and then how different coloured light can be produced and affects the colour of objects.	In class assessment tasks made up of short and longer answer questions. The unit is assessed again in the mid-year test and end of year physics test in term 4.

		The final 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, daylength, seasonal temperature changes. Students will: • Know how light interacts with different materials. • Be able to describe the effects of absorption of light in terms of energy. • Be able to use ray diagrams to show how images are formed. • Understand why we have seasons on Earth. • Be able to calculate weight of objects on different planets. • Be able to describe the properties that affect the sizes of gravitational forces between different objects in the Solar system. • Be able to compare the relative sizes of different astronomical structures within the universe using astronomical distances.	
	3	**Periodic Table** This unit of work begins with what an element is and how elements can combine or 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. Students will: • Know the patterns of reactivity of group 1 and group 7 elements. • Understand the differences between elements, compounds and mixtures. • Be able to represent chemical reactions as word equations and apply this to the law of conservation of mass.	In class assessment tasks made up of short and longer answer questions. The unit is assessed again in the autumn term and end of year chemistry test in term 5.
	3/4	**Electricity and Magnetism** This unit begins with electricity – what it is and how current behaves in series and parallel circuits. Ohm's Law is introduced in a simple way. The unit then switches to magnetism and	In class assessment tasks made up of short and longer answer questions.

		then the link between the two before investigating how to make electromagnets and some uses of them. Students will: • Know what current is and how to describe its behaviour in series and parallel circuits • Understand how insulators are charged by friction, and describe the forces between charged objects • Be able to correctly use apparatus to measure current and potential difference • Be able to identify conductors and insulators and calculate resistance values using appropriate units • Be able to draw and interpret simple magnetic field diagrams • Be able to describe how electromagnets and direct current motors work **Earth's**	The unit is assessed in the end of year physics test in term 4.
	4/5	**Earth's Materials** 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, the properties of some of the materials made from earth's resources and recycling. • Students will: • Know the structure and composition of the Earth and link this to the rock cycle. • Understand that climate change is linked to human activity. • Be able to explain how carbon is recycled in the Earth's atmosphere. •	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year chemistry test in term 5.
	6	**Ecological Relationships** The unit begins by recapping basic KS2 knowledge of food chains, and building on this to look at food webs, what organisms are dependent on each other for and bioaccumulation. Students will then look at factors that affect populations of organisms, impacts of changing populations and carry out some field work to estimate daisy population on the playing fields. They then move on to classify living organisms, focusing on the features of the main chordate group. This leads into how well adapted organisms are to their environment and how these adaptations may improve over time by mutations and natural selection. The unit finishes by focusing on	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year biology test in term 6.

		biodiversity and the importance of taking steps to maintain, and where possible improve, biodiversity. Students will: • Know how to use a food web to describe feeding relationships. • Understand how a changing environment may affect the organisms in a food web • Be able to explain how variation allow organisms to compete, and the way this drives natural selection • Be able to describe how a species may become extinct • Be able to describe the importance of maintaining biodiversity and how gene banks can be used for preservation	
9	1	**Green Plants** This unit provides the foundation for work in KS4 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. The unit then progresses 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. Students will: • Know the structure and function of the parts of a green plant • Understand how leaves are adapted to carry out photosynthesis • Be able to describe how roots take up minerals, nutrients and water from the soil • Be able to describe photosynthesis in a word equation representing products and reactants • Be able to describe how leaves are adapted to carry out photosynthesis • Be able to describe the role of plants in maintaining the levels of gases in the atmosphere • Be able to describe the importance of pollination on food security	In class assessment tasks made up of short and longer answer questions. This unit is assessed in the end of autumn term test and the end of year biology test.
	1/2	**Matter** The matter topic build on the particles and forces and motion topics we met in Year 7. In this topic students will reinforce their understanding of the particle model, kinetic theory and	In class assessment tasks made up of short and longer answer questions.

		resultant forces. They will learn to apply these to situations revolving around pressure and diffusion. Students will: • Know how particles are arranged in the three states of matter • Understand how the motion of particles in different states of matter are linked to the different behaviours • Be able to describe the factors that affect pressure in fluids • Be able to compare and explain differences in density between solids, liquids and gases	This unit is assessed in the end of autumn term test and of year physics test.
	2	**Forces in Action** 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. Lots of opportunity 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. Students will: • Know that a moment is the turning effect of a force and relate this to force multipliers. • Be able to calculate a moment • Understand that energy cannot be created or destroyed • Be able to describe energy transfers and conservation of energy for the deformation of objects • Be able to measure extension or compression and relate this to the force applied to a spring and to Hooke's law • Be able to describe balanced forces in relation to mechanical systems	In class assessment tasks made up of short and longer answer questions. This unit is assessed in the end of autumn term test and of year physics test.
	2/3	**Reactivity** This unit is the groundwork for much of the Chemistry at GCSE – 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. The second part of	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year chemistry test.

		the unit introduces the reactivity series and how it can be used to predict and explain reaction outcomes. Students will: • Know how to use the reactivity series of metals • Be able to use patterns of reactivity to make predictions for chemical reactions • Be able to 2 link the properties and uses of a metal to its position in the reactivity series	
	4	**Rates of Reaction** This topic will introduce the idea of rates and factors that affect rates for the first time. How rates are measured is covered first, focusing on the element of time that is essential. The ideas of surface area and catalysts are introduced. The unit then covers types of reaction – endothermic, exothermic, combustion as a type of oxidation reaction and thermal decomposition. • Students will: • Know the factors that affect the rate of a reaction • Be able to describe combustion, thermal decomposition and oxidation, representing them as symbol equations • Be able to describe how a catalyst affects the rate of a reaction • Be able to describe the differences between an exothermic and endothermic reaction, and link these to energy changes	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year chemistry test.
	4	**Biological Systems** 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 unit 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. Students will:	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year biology test.

		• Know the similarities and differences between aerobic and anaerobic respiration • Be able to explain the functions of the skeleton, and describe the function of antagonistic muscle pairings • Be able to explain how the use of recreational drugs and smoking can affect biological systems, such as during gas exchange and gestation • Be able to explain the respiratory system as a mechanism of breathing and gas exchange (to allow substances to diffuse) • Be able to describe how genetic material can be inherited, and the role of Watson, Crick, Wilkins and Franklin in the discovery of DNA structure	
	4	**Sound** 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 wave. 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, uses of ultrasound and how microphones and loudspeakers work. • Students will: • Know that sound is a wave • Understand that sound cannot travel through a vacuum • Be able to compare light, mechanical and sound waves • Be able to describe the process of reflection, absorption and superposition (add or cancel waves) • Be able to compare human and animal auditory ranges using appropriate units • Be able to describe uses of sound and ultrasound, including industrial and medical use	In class assessment tasks made up of short and longer answer questions. The unit is assessed in the end of year physics test.
	5	**Introduction to Biology at GCSE Cell Biology** Cells are the basic unit of all forms of life. 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. Students will: • Know the key differences between prokaryotic and eukaryotic cells • Understand the function of key organelles within the cells	Peer and self-assessment of GCSE style questions in class.

		• Be able to use a microscope to make observations, and be able to calculate order of magnitude	
	6	**Introduction to Chemistry at GCSE Separating Mixtures** A mixture consists of two or more elements or compounds not chemically combined together. The chemical properties of each substance in the mixture are unchanged. Mixtures can be separated by physical processes such as filtration, crystallisation, simple distillation, fractional distillation and chromatography. These physical processes do not involve chemical reactions and no new substances are made. Students will: • Know the difference between pure and impure. • Understand the physical process used to separate mixtures • Be able to suggest a method to separate a given mixture. **Introduction to Physics at GCSE The Particle Model of Matter** The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide variety of observations and engineers use these principles when designing vessels to withstand high temperature and pressure, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up in a mountain! Students will: • Know that the particle model is used to explain and make predictions about the behaviour of solids, liquids and gases. • Be able to draw simple diagrams to model the difference between solids, liquids and gases. • Understand that the differences in density between different states of matter is due to the arrangement of atoms or molecules.	Peer and self-assessment of GCSE style questions in class.
10	1	**Energy P1** 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. Students will:	Exam questions in class and set as homework, marked in class and linked to current topics.

		• Understand how energy is transferred along energy pathways • Know that energy cannot be created or destroyed • Be able to carry out energy calculations **Particle Model of Matter P3** We continue with the topic students first met at the end of Year 9. Here we find out why it is difficult to make that good cup of tea up a mountain! Students will: • Understand the idea of internal energy • Know that changes in internal energy can lead to a change in temperature or a change of state • Be able to apply the concept of internal energy to changes of state and gas pressure to solve problems **Cell Biology B1** 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 specialised, 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 cells. Students will: • Understand how cells and organs are adapted for their functions • Know the key stages in the cell cycle • Be able to describe how substances are transported into and out of cells by diffusion, osmosis and active transport **Organisation B2** In this unit 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 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. Students will: • Understand the role of enzymes in digestion, the heart in circulation and the importance of healthy lifestyle choices • Know the products of digestion and their importance, the functions of the different components of the blood and how substances move into and out of cells • Be able to evaluate the advantages and disadvantages of medical treatments	
	2	**Atomic Structure and the Periodic Table C1** 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. Students will: • Know the nuclear model of the atom • Understand how the position of an element on the Periodic Table relates to its structure • Be able to describe the atom of an elements using the Periodic Table **Atomic Structure P4** 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. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generators. • Students will: • Know that atoms are made of protons, neutrons and electrons and their relative charge and mass, and that elements have different isotopes • Know the types of nuclear radiation, their uses and dangers	Exam questions in class and set as homework, marked in class and linked to current topics.

		• Understand that the atomic model has changed overtime • Be able to use the properties of radiation to justify the use of radioisotopes in different scenarios • Be able to write equations to represent nuclear decay **Bonding, Structure, and Properties of Matter C2** Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies. • Infection and Response. • Students will: • Know that there are three types of strong chemical bond: ionic, covalent and metallic. • Understand how the properties of a substance can be explained by the type of chemical bonds within it • Be able to explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons	
	3	**Electricity P2** 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? Students will: • Know that electric current is a flow of electrons	Exam questions in class and set as homework, marked in class and linked to current topics.

		• Understand that the size of the current depends upon the potential difference and the resistance and know the current and potential difference characteristics of different components. • Be able to apply the equations from the unit and solve problems relating to series and parallel circuits • Know the characteristics of mains electricity and the electrical safety features in the home **Quantitative Chemistry C3** 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. Students will: • Know the law of conservation of mass • Understand how the law of conservation of mass applies to balancing chemical equations • Be able to interpret chemical formulae and use them to calculate, in a range of scenarios • At higher tier, be able to use the concept of the mole	
	4	**Chemical Change C4** 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	Exam questions in class and set as homework, marked in class and linked to current topics.

		of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'. Students will: • Know that during a chemical reaction, new products are made • Understand that there are different types of chemical reaction • Be able to describe a range of different types of chemical reaction and make predictions using the reactivity series of metals **Infection and Response B3** 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. Students will: • Be able to be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants • Be able to explain the role of the immune system in the defence against disease GCSE Biology students will also learn about monoclonal antibodies and plant defences. **Bioenergetics B4** 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. Students will: • Know the factors that affect the rate of photosynthesis and how plants use the glucose that is made, and that living things can respire aerobically and anaerobically • Understand that light intensity, temperature and carbon dioxide levels are limiting factors of photosynthesis, and how the human body responds to exercise • Be able to describe the processes of photosynthesis, and be able to compare aerobic and anaerobic respiration	
	5	**Energy Changes C5** 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. Students will: • Know the law of conservation of energy • Understand that chemical reactions can be either exothermic or endothermic • Be able to interpret and draw simple energy profile diagrams, and at higher tier, calculate the energy changes using bond energies **Rate and Extent of Chemical Change C6** 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.	Exam questions in class and set as homework, marked in class and linked to current topics.

		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. Students will: • Know the factors that affect the rate of reaction • Understand how collision theory can be used to explain why different factors affect the rate of reaction • Be able to calculate the rate of reaction **Homeostasis and Response B5** 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. 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. Students will: • Know that the human body must have control systems to function properly and that this is called homeostasis • Know that the homeostasis may involve nervous or hormonal responses • Understand the importance of maintaining conditions inside the body • Be able to describe how hormones control fertility and blood-glucose levels, and describe how information is from receptors is passed along cells in the nervous system GCSE Biology extends this unit to include the brain and eye, controlling body temperature, and the kidney and water balance.	
	6	**Ecology B7** 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	End of Year PPE Exams. Three GCSE passed papers, Biology Paper 1 (B1 to B4), Chemistry Paper 1 (C1 to C5)

		on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these 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. Students will: • Know that an ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment • Understand that photosynthetic organisms are the producers of biomass for life on Earth • Be able to extract and interpret information relating to different factors that affect populations within an ecosystem	and Physics Paper 1 (P1 to P4).
11	1	**Rate and Extent of Chemical Change** We pick up where we left this topic at the end of Year 10. **Homeostasis** We pick up where we left this topic at the end of Year 10. **Ecology (GCSE Biology only)** Students following the separate science (triple) pathway also learn about the decay cycle and explore trophic (feeding) levels in more depth and explore human impacts on the environments.	End of units test, short and long answer questions.
	2	**Organic Chemistry** 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. Students will:	GCSE PPE. Three papers, marked by class teachers, Biology paper 1 (B1 to B4), Chemistry paper 1 (C1 to C5) and Physics paper 1 (P1 to P4).

		• Know that crude oil is made from the remains of ancient biomass and that it can be separated into smaller, more useful, fractions, and cracked into shorter chain molecules • Understand that the properties of alkanes are linked to the size of the molecules, and that the need for cracking relates to supply and demand of more useful hydrocarbons • Be able to explain how fractional distillation works in terms of evaporation and condensation GCSE Chemistry extends this topic to include the reactions of alkenes, alcohols and carboxylic acids, and the production of polymers. **Forces** Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible Students will: • Know the properties of scaler and vector quantities • Understand a range of forces and their interactions and relate this to motion • Be able to apply the equations related to forces. **GCSE Physics only:** • Know how to calculate the size of forces, or its distance from a pivot. • Understand how safety features such as air bags change momentum • Be able to apply calculations relating to force, mass, velocity and acceleration to explain how the changes involved are inter-related. **Variation and Inheritance** 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 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 in to 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. Students will: • Know the structure of DNA and define a genome. • Understand that the process of meiosis leads to non-identical cells whereas mitosis produces identical cells. • Be able to discuss the importance of understanding the human genome. **Biology only:** • Know the structure of DNA in terms of bases that code for particular amino acids which make particular proteins. • Understand how protein synthesis in the ribosomes • Be able to **Space (GCSE Physics only)** Questions about where we are, and where we came from, have been asked for thousands of years. In the past century, astronomers and astrophysicists have made remarkable progress in understanding the scale and structure of the universe, its evolution and ours. New questions have emerged recently. 'Dark matter', which bends light and holds galaxies together but does not emit electromagnetic radiation, is everywhere – what is it? And what is causing the universe to expand ever faster? Students will: • Know how our solar system was created • Understand the stages that a star goes through in its lifetime • Be able to explain how red-shift provides evidence for the Big Bang model	
	3	**Waves** Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.	End of units test, short and long answer questions.

		Students will: • Know the properties of transverse and longitudinal waves. • Understand how waves travel and the properties of electromagnetic waves. • Be able to discuss the uses of each type of electromagnetic radiation and relate this to their properties. **Physics only:** • Know how convex and concave lenses refract light • Understand how the colour of an object is related to the absorption, transmission and reflection of different wavelengths of light • Be able to explain how objects appear different colours when using coloured filters. **Chemical Analysis** 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. Students will: • Know the difference between a pure substance and a formulation • Understand how to test for hydrogen, oxygen, carbon dioxide and chlorine. • Be able to explain how paper chromatography separates mixtures and interpret chromatograms and identify the R_f from chromatograms. **Chemistry only:** • Know how to identify metal ions from flame tests • Be able to identify products either through testing or observation **Chemistry of the Atmosphere** 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. Students will:	

		• Know how gases in the early atmosphere formed and how that has changed over time • Understand the human impact of the atmosphere and how this leads to climate change. • Be able to explain the environmental impacts of climate change and ways to reduce this.	
	4	**Magnetism and Electromagnetism** 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. Students will: • Know the difference between permanent and induced magnets. • Understand how the magnetic effect of a current and how this can be useful. • Be able to plot the magnetic field of a magnet, a straight wire and explain how a solenoid can increase the magnetic effect of the current. **Using Resources** 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. Students will: • Know the difference between finite and renewable resources and the impact of these resources on the environment • Understand how water is treated to make it potable • Be able to carry out simple life cycle assessments and evaluate ways of reducing the use of limited resources. **Chemistry only:** • Know that most metals in everyday use are alloys • Understand the Haber process and how ammonia is used in the production of NPK fertilisers.	GCSE paper 2 PPE exams.

		• Be able to explain how the commercially used conditions for the Haber process are related to availability and cost.	
	5	Preparation for the GCSE exams. The first three of six papers usually take place in term 5.	GCSE Double Award Science: Trilogy 3 papers each 1 hour and 15 minutes. Or/ GCSE Biology 2 papers, each 1 hour 45 minutes. GCSE Chemistry 2 papers, each 1 hour 45 minutes. GCSE Physics 2 papers, each 1 hour 45 minutes.
	6	Preparation for the GCSE exams. The second three of six papers usually take place in term 6.	GCSE Double Award Science: Trilogy 3 papers each 1 hour and 15 minutes. Or/ GCSE Biology 2 papers, each 1 hour 45 minutes. GCSE Chemistry 2 papers, each 1 hour 45 minutes. GCSE Physics 2 papers, each 1 hour 45 minutes.