Biology	
Cell Biology	Studying Cells first in Biology is important as it underpins the majority of further units. Students start the unit by revisiting cell structure from KS3 Organisms. They look at the functions of the sub cellular structures in animal and plant cells. Students are introduced to the terms eukaryote and prokaryote, looking at examples of each and being able to make comparisons. This leads on to explaining cell specialisation and cell differentiation. Students are then given the opportunity to view different cells under the microscope, again revisiting from KS3 Organisms the basic structure of a microscope and basic magnification calculations. They complete the required microscopy practical preparing onion cell slides using the magnification equation to work out the actual size of the cells, using the numeracy skills of converting units. They compare the light microscope with the electron microscope placing an emphasis on resolution and magnification. Students already understand the difference between unicellular and multicellular from KS3 Organisms and cells become differentiated so they can now link this with how cells replicate, in particular eukaryotes. From KS3 Genes students use this knowledge to understand the cell cycle and mitosis. This leads on to Stem cells. Students look at different types, sources of and evaluate their use. Now students have this knowledge they can look at how substances enter and leave the cell. Students have an idea of diffusion from KS3 Organisms. They can develop this further exploring the factors that affect the rate of diffusion. Emphasis is placed on the numeracy skills of surface area: volume ratios, which students have studied at KS3. This enables them to compare single and multicellular organisms. Students briefly look at exchange surfaces such as alveoli, villi and gills to appreciate the similarities in these structures for efficient exchange. Students then study Osmosis in animal and plant cells, which is a new concept and involves a required practical on Osmosis in plant cells. Finally, another new concept of active transport, which involves the understanding of the role of mitochondria covered in KS3 Organisms and Ecosystems. With these three methods of transport students can then make comparisons between all three and have a more secure understanding of transport in cells. Separate students explore culturing microorganisms.
Organisation	This unit follows on from Cell Biology and enables students to learn more about human body transport systems and also transport in plants. Students start with the organisation of living organisms, which is revisited from KS3 Organisms. They then use their KS3 knowledge of this topic to look at the human digestive system again, in particular the transport across the small intestine. They revisit the different food groups and carry out food tests on the main groups. This is a required practical. They also look in more depth at the role of digestive enzymes and factors that affect the rate, including another required practical. Students then move on to the structure of the lungs, heart, blood vessels and the composition of the blood. This enables them to revisit their KS3 knowledge of this and gain a full understanding of the circulatory system and its role in exchange

	and transport. There are also links here to Bioenergetics for respiration and Cell Biology with regards to diffusion, active transport and exchange surfaces. Coronary heart disease is looked at, together with other heart problems, non-communicable health issues and the links with risk factors. Students also learn about cancer as a non-communicable disease. This links in with infection and response. Students then look at plant tissues and organs starting with revisiting their KS3 knowledge of Ecosystems. They revisit the structure of a leaf and how it links to the process of photosynthesis. Students learn about plant transport systems relating to the transport of water to the leaf for photosynthesis, and the transport of sugars away from the leaf to other parts of the plant. They look at transpiration and the factors that affect it. This again links with Cell Biology and the process of diffusion, active transport and osmosis, as well as exchange surfaces. The knowledge on plants can then be developed further in the topic of Infection and response with regards to diseases and Bioenergetics.
Infection and Response	This unit builds on students knowldege of diseases from both the KS2 Science curriculum and also KS3 Organisation and Ecosystems. Knowledge of organisation of body systems and transport also helps students understand how diseases affect the body. In addition, this links to non communicable diseases covered in the last Biology unit. Students start with defining a pathogen and how they are spread, they investigate the differences, prevention and reduction of pathogens. They describe viral, bacterial and fungal diseases in humans giving examples. They also look at protist diseases – describe malaria including lifecycle, symptoms, mode of transmission, prevention and treatment. They then look at human Defence systems, starting with the 1st line of defence, how pathogens cause illness, immune defence system, what white blood cells do and action of antibodies/antigens. Students also look at other methods of treating and preventing disease starting with Antibiotics – the importance of progress made and the effects of health, the development of antibiotic resistance, which is revisited in the unit of Inheritance, variation and evolution and the problems treating viruses. They learn about painkillers, what they do and relate this to treatment of disease. Students look at vaccinations, how they work and the importance of herd immunity. Finally, they learn about the discovery & development of new drugs, that they come from plant origins giving specific examples. They look at how drugs are developed specifying stages involved. They define placebo and double blind trial and the importance in drug development. Together with non-communicable diseases from Organisation, students gain a good understanding of communicable diseases and the difference between the two. Separate Biologists start the unit revisiting the structure of a bacteria from Cell Biology. They learn about how bacteria reproduce, aseptic technique and the required practical of investigating the effect of antiseptics or antibiotics on bacterial growth, using agar plates and measuring zones of inhibition, before moving on to the rest of the unit. This content is from the Cell Biology specification, however is more suitably placed in this unit.

	Students also look at monoclonnal antibody production and uses as well as detection and identification of plant diseases, plant deficiency and defences.
Bioenergetics	In this short unit students revisit KS3 Ecosystems and the concepts of photosythesis and both aerobic and anaerobic respiration. To start with students 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. They use their knowldege of plant tissues and transport from Organisation to understand where and how this takes place in a leaf. They look at limiting factors, investigating the effect of light on the photosynthesis of pondweed. This is a required practical that is also done at KS3. They also look at the many different uses of glucose. Higher tier students look at the inverse square law and the interaction of limiting factors, plus the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit. Students then make the link that both animals and plants use the Oxygen from Photosynthesis to oxidise glucose, 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. This links with the heart and lungs from the unit organisation, where students can appreciate why breathing and heart rates increase during exercise and compare levels of fitness in people. Higher tier students are expected to be able to explain Oxygen debt in detail. Finally, students briefly look at metabolism as the sum of all the reactions in a cell or the body. They make the link to respiration and the conversion of glucose into other useful products. However, all the aspects of metabolism are covered in more detail in the unit of Homeostasis and response. This is after all the examples have been covered in detail and can be understood more easily.
Homeostasis	Students in this chapter will explore the structure and function of the nervous system and how it can bring about fast responses. They will also explore the hormonal system which usually brings about slower changes. They will look at hormonal control of the menstrual cycle and links to fertility and contraception. Separates students will look at the brain and the eye and the control of body temperature, water and nitrogen balance. They look at hormonal control in plant growth.
Inheritance and Variation	In this unit students' draw upon knowledge learned during the "Genes" unit during KS3, "Cell Biology" and "Infection and Response" units earlier in their GCSE studies. The students initially look in to the concept of cell division learned previously during the GCSE Cell Biology unit, comparing the two types of cell division by identifying how mitosis is aligned to asexual reproduction while meiosis brings about the formation of gametes (sex cells) and is therefore linked to asexual reproduction. Student's look at the structure of the chromosomes, genes and DNA within adult cells and gametes, building upon knowledge previously gained during the Genes unit during KS3. They learn how genetic material contributes to the synthesis of proteins that bring about characteristics, allowing them to make the link between how the inheritance of genetic material alongside environmental factors results in variation. The girls learn a variety of new terms including homologous

	chromosomes, mutation, dominant alleles, recessive alleles, genotype and phenotype and use their new-found knowledge along with maths skills to calculate the probability of inheriting a variety of characteristics as well as sex determination. The consequences and probability of inheriting genetic disorders including Cystic Fibrosis, is studied in this topic and the girls learn about embryo screening and the role of genetic counsellors. The application of the developing understanding of DNA and inheritance in Science is studied, as the girls develop knowledge about selective breeding, genetic engineering and the Human Genome Project. Evolution is covered in this unit and students build on the knowledge learned during the KS3 Genes unit, learning how Charles Darwin explained how Natural Selection was the mechanism behind his theory of evolution that leads to the diversity of the species present on Earth. The unit also looks in to the evidence that supports Darwin's theory including fossils, extinction, DNA and antibiotic resistant bacteria. Finally, the girls learn about classification and taxonomy, looking at the relationships between different species and how Carl Linnaus and Carl Woese developed the most commonly used systems of taxonomy. Those studying Separate Biology look into the structure of DNA in greater detail, learning how sequences of DNA base pairs within a gene, code for a specific sequence of amino acids that build proteins. They look into modern scientific advances in the development of cloning techniques as well as looking at more depth at how new species are formed during the process of evolution.
Ecology	In the summer term of Year 10, students' study AQA Unit 7 Ecology, this unit builds upon many concepts learned during KS3 Science. Initially the girls learn about how organisms that make up communities within ecosystems are interdependent upon each other, this builds upon the work related to food webs and the importance of insects during the Ecosystems unit during KS3. This topic introduces new terminology such as biotic and abiotic factors and students learn how these factors affect population sizes and the adaptations different species have to survive in their given environment. Studying Ecology relies on monitoring population sizes and species distribution, the students learning how to apply random and systematic sampling to determine species distribution and how different abiotic factors affect this distribution, these practical skills are employed during a required practical. Cycling of resources allow ecosystems to thrive and students learn about the water cycle and the carbon cycle, these concepts link with the "Earth" unit studied at KS3 Science along with topics covered in Geography. Detailed studies of the carbon cycle allow the girls to draw upon knowledge gained in the 'Bioenergetics' unit focusing on how photosynthesis and respiration interact, and how human activities can interfere with the carbon cycle, resulting in an increase in carbon dioxide in the atmosphere. Building on from the KS3 "Earth" unit and linking with AQA GCSE Chemistry of the atmosphere unit, students learn about the impact of the greenhouse effect leading to global warming and the impact this has on ecosystems. Students move on to learn about the importance of biodiversity and how human activities can have impact of lowering biodiversity focusing on deforestation and the destruction of peat bogs as examples. Finally, they discover strategies that can be employed to conserve biodiversity. Separate Biology students learn in more depth about the transfer of energy within food chains and how this impacts the biomass at each trophic level. They build on concepts learned during the 'Ecosystems' unit in KS3 to understand how farmers

	maximise food production and how this impact upon food security. The importance of micro-organisms in the process of decomposition is also studied and the students demonstrate their knowledge in an additional required practical.

Chemistry	
Atomic Structure and the periodic table	Throughout this unit in year 9, students will further develop what they learned in Key Stage 3 in the Matter unit. Initially students will recap atoms, elements, compounds and mixtures. Students will then look at separation techniques in more detail. Two new concepts are then studied. Students will explore how atomic models developed as new data became available. Students will also learn about the structure of atoms and students use a range of different models to describe both the atoms themselves and the physical and chemical properties of the elements and compounds they form. Finally, students will extend their knowledge of the Periodic table and groups 1, 7 and 0 and enhance their working scientifically skills. They will learn how testing predictions can support or refute new scientific ideas. They will also learn to identify, recognise and describe patterns and trends in data, allowing them to make predictions and conclusions. Separate science students will explore transition elements and will compare the properties of these elements with group 1.
Bonding, structure and properties of matter	Students will learn about the different types of bonding – ionic, covalent and metallic. They will find out how to represent ionic and covalent bonding using dot and cross diagrams. They will use suitable diagrams to show metallic bonding and find out about delocalised electrons. They will learn how to calculate the charge on the ions in an ionic compound. Students will explore the types of structures produced by the different types of bonding. This includes giant ionic structures, small molecules, polymers, giant covalent structures, metals and alloys. Students acquire a more in-depth understanding of what a 'formula' means for different substances. Next, students will investigate the properties of each type of substance, concentrating on explanations involving the bonding and structure. This includes knowledge of intermolecular forces, which is backed up by a lesson on the states of matter in which students use the particle theory and explanations of change of state. They study specific examples of giant covalent substances, namely diamond and graphite. Students find out about their specific properties and explain them in terms of bonding and structure. Finally, students explore the new developments of graphene and fullerenes. This concentrates on their structure, properties and possible uses. Separate students explore the new developments of nanoparticles. This concentrates on their structure, properties and possible uses.
Quantitative Chemistry	As they work through the unit students will improve their ability to work with symbols and equations. They will learn to calculate relative formula masses and will be introduced to moles. They will use moles to calculate reacting masses and to balance equations. They will also look at the industrial implications, meaning manufacturers can be very efficient in producing the exact amounts of products,

	given the amounts of reactants added. They will look at conservation of mass and they will find out how concentration is expressed. Separate students will learn how to calculate theoretical and percentage yields. They will find out how concentration is expressed and use this in simple titration calculations. They will also learn about gas volumes and how they apply in equations.
Chemical Changes	In this chapter, students will explain the oxidation and reduction of metals in terms of loss or gain of oxygen or electrons. They will deduce a reactivity series for metals based on experimental results, and relate this to the tendency of metals to form positive ions and the extraction method used to extract each metal. They will also make soluble salts by neutralising acids with metals, metal oxides, carbonates or alkalis and write equations for these reactions. They will distinguish between strong acids and concentrated acids, and explain what happens during neutralisation. Students will also identify the products formed when molten or dissolved binary compounds are electrolysed, and write equations for the reactions at each electrode. Separate students will learn how to carry out a titration leading on from previous units.
Energy Changes	Throughout this unit in year 9, students will further develop what they learned in Key Stage 3 in the Reactions unit. Initially students will recap exothermic and endothermic reactions using reaction profiles to describe these reactions. Students will then investigate the variables that affect the temperature changes in solutions by carrying out a required practical. Students studying higher tier will additionally calculate theoretical energy transfers using bond energies. In year 10, after electrolysis and half-equations has been taught in Unit 4 Chemical changes, Chemistry students will learn about and investigate voltaic cells and fuels cells. Students will also evaluate the usefulness of these types of cells as sources of energy. Separate students explore chemical cells and fuel cells.
Rate and extent of chemical reactions	In this unit, students will . use a range of methods to measure reaction rates; identify ways of speeding up reactions, and use collision theory and ideas about activation energy to make predictions. They will explore reversible reactions and use Le Chatelier's principle to predict the effects of changing temperatures, pressures and concentrations on equilibrium systems.
Organic chemistry	In this unit, students will learn about the chemistry of carbon. They will find out how the fractional distillation of crude oil and its cracking are used to produce many of our fuels and petrochemicals. Students will study the alkanes. Separate students explore the structure and reactions of more complex organic molecules, including: alkenes, alcohols and carboxylic acids. They also look at esters and amino acids, in particular their use in making polymers.
Chemical Analysis	Students learn about the four gas tests, key content for this topic. Students will learn what is meant by 'pure substances' in chemistry and how they can be distinguished from mixtures. They will learn about formulated mixtures. They will investigate chromatography.

	Separate students will do lots of practical work in this topic, with flame tests, anion test and cation tests all being covered, including the required practical. End of topic covers emission tests and flame emission spectroscopy.
Chemistry of the atmosphere	Students will learn about the composition of the atmosphere and use ideas and evidence about the Earth's early atmosphere to evaluate theories about its composition, linking these to the current atmospheres of planets such as Venus or Mars. In the process they will learn why the data needed to answer scientific questions may be uncertain, incomplete or unavailable. This will lead to discussion on peer review, and why climate change is a controversial area of Science. They will then explore the way the atmosphere has changed over geological time scales; evaluate the environmental implications of greenhouse gas emissions and how this impact on the greenhouse effect and other pollutants; explore the use of computer models to make predictions; evaluate the quality of evidence in reports about global climate change. This will lead onto an exploration of how greenhouse gas emissions could theoretically be reduced and why these reductions are difficult to achieve in practice, and the implications if we don't reduce these emissions. Students will also explore the pollutants released from burning fuels, their environmental implications and their role in damaging human health, and the health of aquatic life through acid rain.
Using resources	Students learn about different aspects of sustainable development. They find out what is required to produce potable water and to treat waste water. They consider alternative methods to extract a metal from low grade ores that avoid the environmental impact of mining. Students fit their knowledge of recycling in to a wider framework of life cycle assessments, in which the impact of products from their raw materials through to their disposal are compared. They study recycling alongside reusing and reducing resource use. Separates students will study corrosion, and the impact of this. They will look at ways to prevent this. They will look at Alloys, ceramics, polymers and composites as useful products and the benefits. They will finally look at the Haber process and production of ammonia to ultimately produce NPK fertisilers.

Physics	
Energy	In this unit, pupils will revisit the many different types of energy from KS3. Pupils will use the law of conservation of energy and will look at both useful and wasted energies and how these can be displayed in Sankey diagrams. They will learn about efficiency; not just how to calculate it but also the importance of improving the efficiency of devices and various ways in which this can be done. Pupils will look at work done and power and how they can be calculated and how they are useful in different ways. They will look at transfers between different types of energy, especially elastic potential energy, gravitational potential energy and kinetic energy. Pupils will also investigate temperature and how this relates to energy. Within this context, they will recognise that different substances have different specific heat capacities and different thermal conductivities. They will carry out a

	required practical to determine the specific heat capacity of different materials. Separates students will also explore the concept of thermal insulation and carry out a required practical in order to compare the effectiveness of different thermal insulators and the factors that may affect the thermal insulation properties of a material. Finally, pupils will look at the different renewable and non-renewable energy resources. They will explore the advantages and disadvantages of the different resources and how our use of such resources may change in the future, both on a local and global scale. Pupils will begin to be able to make informed decisions about their own energy use in the future and be able to consider the environmental issues that may arise from the use of different energy resources.
Electricity	In this unit students will start by revisiting circuit symbols and diagrams studied in KS3 whilst introducing some new components to these ideas. Students will be reintroduced to the ideas of current, charge, potential difference and resistance. Students will be able to recognise, describe and calculate each of these variables. There are also various required practicals in this unit, students will first find the resistance of a length of wire at constant temperature and the resistance of combinations of resistors in series and parallel circuits. They will then construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature. Students will then start to study the domestic uses of electricity and safety. Mains electricity will be explored as an alternating current, students will also study plugs focussing on the safety features of plugs. Power will then be introduced as well as energy transfers in everyday appliances. Finally, students will learn about the national grid and how electrical energy reaches our homes. Separates students will study static electricity, focussing on how static electricity is produced, static charge from transfer of electrons and electric fields.
Particle Model of matter	In this unit, students will learn about the role of particles when thinking about changes between states of matter, density, pressure and volume. Students will carry out a required practical investigation to use appropriate apparatus to make and record the measurements needed to determine the densities of regular shaped objects, irregular shaped objects and liquids. Students will also learn how to apply their understanding of particle behaviour to the energy in closed systems of solids, liquids and gases, with a particular focus on internal energy, specific heat capacity and specific latent heat. Finally, students will explore particle motion in gases and will be able to explain how the motion of the molecules in a gas is related to both its temperature and its pressure. Separates students will cover gas pressure and increasing gas pressure, they will also learn how to calculate the change in the pressure of a gas or the volume of a gas.
Atomic Structure	In this unit, students will learn about the current model and the structure of the atom. Students will explore how ideas about the structure of the atom

	have changed over time as scientists have provided new experimental evidence, such as the alpha scattering experiment. Students will then be introduced to the three types of ionising radiation: alpha, beta and gamma and they will consider hazards related to each type of radiation, current uses of each type of radiation and understand the concept of half-life. They will appreciate that ionising radiation is hazardous yet useful. They will also be able to use the names and symbols of common nuclei to write balanced equations that show the decay of radioactive substances. Separates students will cover nuclear fission and nuclear fusion whilst focussing on more hazards and uses of radioactive emissions and background radiation.
Forces	In this unit, students will learn about what forces are and what they do. They will start by revisiting contact and non-contact forces from KS3. Resultant forces will then be studied and how to calculate resultant forces acting on an object and how to use vector diagrams to illustrate resolution of forces. Students will develop their understanding of how forces cause work to be done on objects whilst recapping elastic potential energy from the Energy unit. Here students will carry out a required practical to investigate the relationship between force and extension for a spring. Separates students will then study moments, levers and gears focussing on how a force or a system of forces may cause an object to rotate. They will then explore pressure and pressure differences in fluids. Students will then study forces and motion. They will look at speed and how the speed of a journey can be calculated and displayed graphically as a distance time graph or a velocity time graph. This then leads onto students studying acceleration and uniform acceleration. Students will also carry out another required practical to investigate the effect of varying the force and the mass on the acceleration of an object. They will then study Newton's three laws of motion as well as stopping distances, braking distances and reaction times. Finally, students will study momentum as a property of moving objects and the law of conservation of momentum. Separates students will also study changes in momentum and how these can be calculated.
Magnetism and electromagnetism	In this unit, students will learn about the link between electricity and magnetism. They will begin to explore the difference between permanent magnetism and induced magnetism whilst focussing on magnetic fields and forces. They will then explore electromagnetism, the effect of a magnetic field on a wire when current is moving and what happens when this wire is also placed in another magnetic field. Students will then apply this knowledge to the concept of the motor effect and how a magnetic field causes the rotation of the coil in an electric motor. Separates students will then take their knowledge slightly further by then studying loudspeakers, microphones, induced potential the generator effect and transformers.
Waves	In this unit, students will learn about light and sound as examples of waves, as well as how other electromagnetic waves behave like light. They will start by exploring why light and sound are different types of wave and be able to give some further examples of both transverse and longitudinal waves. They will investigate the properties and the behaviour of waves. Students will carry out a required practical to make observations to identify and measure the frequency, wavelength and speed of waves in a ripple tank. Separates students will explore reflection in waves and carry out a

	another required practical to investigate the reflection and refraction of light by different types of surface and substances. They will then study lenses, visible light, black body radiation and perfect black bodies. Separates students will also explore sound waves and how sound waves can be used in detection and exploration. Students will then develop their understanding of electromagnetic waves by exploring the electromagnetic spectrum, they will learn about the properties and uses of each type of electromagnetic wave and learn about some applications of waves in medicine and other situations.
Space* Separates only	Only separates students will study the Space unit. In this unit, students will learn about the origin and life cycles of stars. They will discover how we are able to state that the Universe is expanding, and at an increasing rate. They will investigate phenomena such as red-shift and the Big Bang. The students will learn about the role of gravity in space physics, linking this to the life cycle of stars. They will discover how and why our ideas about the Universe have developed over time. This unit also offers a number of opportunities for the students to investigate phenomena through practical work, working collaboratively with peers and the opportunity to critically evaluate evidence before drawing conclusions.