Science

Curriculum Intent

- **Knowledge based curriculum-**We use a knowledge based curriculum to ensure students' success at all levels. Students learn the most fundamental knowledge first, laying the foundations on hich all which other understanding rest. they will feel confident in explaining the key scientific principles that govern everything that occurs within our universe. **Concepts are revisited throughout their their curriculum** We want to ensure that student are equipped with a wide range of **scientific vocabulary** have the opportunity to **apply their knowledge in the real world** and understand that scientific knowledge is fundamental to making ground-breaking discoveries and improving our lives.
- **Working scientifically** - We provide opportunities for every student to **experience experimental work in science,** developing an ability to manipulate and operate **equipment and use chemicals safely**. Students complete work accurately and precisely in order to develop their procedural knowledge of the scientific method, giving deeper meaning to their understanding. We want stude students to have **mastered the disciplinary knowledge that they understand how to be '*a scientist*'**
- **Scientifically literate citizens** - We will encourage every child to think critically about what they read and hear about the world ensuring that they can understand and challenge the claims made in debates about vital issues such as public health, disease, energy needs and climate change and to develop a feeling of shared responsibility for our sustainable existence on the planet. They should should be able to use their knowledge of science to make **intelligent and informed decisions** that impact themselves and their local and global community and be able to communicate and justify these to those around them.
- **Awe and wonder** - We will stimulate every child's curiosity about the world and the universe that they inhabit. We want to inspire, enthuse and provide students a passion about the natural world world.
- **Cultural capital and Further study** -We encourage every child to learn about the rich global history of scientific discovery, they can apply their knowledge to a range of different situations and see see science as relevant to their everyday life. We encourage them to participate in out of school learning contexts such as museums, clubs and fairs. We provide opportunities for them to see how how science is applied in the workplace,careers education and offer advanced courses that allow them to pursue degrees and careers in STEM disciplines

We will also develop students' literacy and numeracy skills through explaining scientific phenomena and be able to use correct scientific terminology. We intend students to achieve excellent outcomes in AQA GCSE Separate and Combined (Trilogy) Sciences, OCR A Level Biology, OCR A Level Chemistry and AQA A Level Physics and BTEC Applied Science Extended Diploma.

Year 7	Year 8	Year 9	Year 10 & 11	Year 12 & 13
Our Key stage three curriculum in Science is rooted in inspiring pupils to develop their key knowledge and practical skills and a deeper understanding of a range of scientific ideas in Biology, Chemistry and Physics. Pupils will begin to see the connections between these subjects	**Secure Substantive Knowledge:** The Year 8 curriculum builds on the foundational knowledge established in Year 7. whilst embedding this procedural knowledge into the long-term memory.This model allows students to build upon their prior knowledge and increases their	**Secure Substantive Knowledge:** Students will develop their understanding of atomic structure, the periodic table, and chemical reactions and learn to apply them to more challenging contexts.Students build on their chemistry knowledge of elements and compounds, looking	**Year 10** **Secure Substantive Knowledge:** Students look further at humans being complex systems, looking at the different types of respiration and how the body is designed to ensure that these systems work effectively together. They use their knowledge of enzymes from Year 8 to look at the impact of different factors on enzymes and therefore rates of reaction in the body. Developing	**Biology** A Level in Biology allows students to develop relevant practical skills alongside essential knowledge and understanding of a range of biological concepts and scientific methods. Biological mathematics and problem-solving skills can be fully integrated into teaching and learning. Content is in six modules:

and become aware of some of the big ideas underpinning scientific knowledge and understanding. Pupils begin by learning the cornerstones of Scientific understanding across all three disciplines such as the Structure of the Atom, Cells, and Forces. In year 7 we start with Chemistry (requires an understanding of atoms) because this is a threshold concept which, once grasped, will allow students to understand a broad range of knowledge and ideas that can be used to explain lots of phenomena in all disciplines of science. Students will also be introduced to the concept of physical and chemical changes and the periodic table which allows us to organise elements based on their structure and in turn their properties. During the physics unit, students will be introduced to the fundamentals of forces – that objects have an effect on each other. This is put into context through the effect of forces on motion, stretching of an object and in space. They will also be introduced to the concept that energy cannot be created or destroyed, simply transferred from one store to another. They are introduced to generating electricity and how humans utilise energy transfers to our advantage. This leads nicely into the Biology unit that looks at the transfer of energy through food chains and food web within Biology, students will gain an understanding of how we classify organisms into categories based on	enthusiasm for the topics During Year 8 Physics, students visit the concept of transferring energy from one place to another through waves. They also investigate how these waves behave in different scenarios and the effect that we are then able to see with our eyes or hear with our ears. Students also begin to look at the transfer of energy within electrical circuits and the use of a circuit to create electromagnets. Within the chemistry unit, students build on their knowledge of atoms and the periodic table to look at the structure of atoms and the arrangement of elements in the periodic table based on their properties and the effect of their structure on reactivity. They also begin to look at common chemical reactions and our representation of these using word and symbol equations. They conduct experiments to rank metals in order of their reactivity and use this knowledge to explain how metals can then be extracted from their ores. This links to a closer look at the structure of the Earth and discussions about how humans use the Earth's resources and the impact that we have on our planet. - Students go on to study humans and plants as organisations, looking in particular at the systems that have evolved within both types of organism that allow them to grow and survive. Students build on their knowledge of different types of organisms on a cellular level and how organisms interact with each other from Year 7 to explain how pathogens cause communicable diseases in humans and how our bodies have evolved to protect us from dying from these diseases. They also begin to look at how science has allowed us	at compounds and formulae used to represent these substances. They also begin to look at how our concept of an atom has changed over time. They look at patterns and how different groups in the periodic table react and bond together and how this can be modelled using different types of diagram. This unit also builds on the knowledge of common reactions in Year 8 so that students are able to predict which substances will be produced in different reactions and how they would prove that these substances have been made. - Within Physics, students take a deeper look at waves and energy transfers, in particular looking at efficiency of these transfers and the GPE, kinestic energy and elastic potential energy store and how calculations allow us to predict the amount of energy that should be held in that store. Students also start to observe and measure physical properties of waves, representing these using diagrams. Students will be introduced to the different types of quantity within science (scalar and vector). We will build on the skills and knowledge from the unit on Forces in Year 7 by students applying these concepts to explain phenomena that occur in the real world such as objects reaching terminal velocity, moments and levers and gears.They will look at the quantitative effect of different forces	their knowledge of how substances can move from one place to another, they look at examples of this happening in both humans and plants and how this is determined by concentration and the size of particles. Building on the work in Year 7, students also look at how complex the interactions between organisms can be and the effect that humans can have on disrupting these relationships**.** Students should also be introduced to how damaging this can be and how science can be used to help us to prevent this having a truly negative impact on ecosystems. - Within the physics unit, students will look in more details at radiation. They will the interaction of light waves with different surfaces and substances, radiation from unstable radioactive atoms and the impact of gaining and losing kinetic energy on temperature and state of substances. **T**his unit is designed to bring together student's knowledge of particles from years 7-9 and apply them to a range of contexts to explain different scientific phenomena including radiation, nuclear fusion, changes in temperature, states of matter and pressure.Finally, they will look at the impact of forces on different surfaces both in solids and fluids. Building on knowledge of circuits from Year 8, students will look at the relationship between current, potential difference and resistance. They will link this to transfer of energy across the country. Finally, triple science students will revisit the magnitude of space and the role of different forces in the phenomenon that exist within our universe. - Finally, students will use their knowledge of chemical reactions to look at factors affecting reactions quantitatively and qualitatively. They will look further at the changes that have occurred to our planet since it's creation and the impact that humans are having during our life time. They will also learn about the use of resources by humans and how science has enabled us to manufacture new materials that allow us to live our lives with more ease. **Secure Disciplinary Knowledge:**	Module 1: Development of practical skills in biology Module 2: Foundations in biology Module 3: Exchange and transport Module 4: Biodiversity, evolution and disease Module 5: Communication, homeostasis and energy Module 6: Genetics, evolution and ecosystems **Chemistry** Our A Level Chemistry A qualification is a content-led course designed to develop theoretical and practical chemistry skills, knowledge and understanding. Content is in six modules: Module 1 – Development of practical skills in chemistry Module 2 – Foundations in chemistry Module 3 – Periodic table and energy Module 4 – Core organic chemistry Module 5 – Physical chemistry and transition elements Module 6 – Organic chemistry and analysis **Physics** Our Physics qualification is designed to inspire students, nurture their passion for the subject and lay the foundations for further study and the workplace. It is nine topics and we choose astrophysics as our option. 1 Measurements and their errors 2 Particles and radiation 3 Waves 4 Mechanics and materials 5 Electricity 6 Further mechanics and thermal physics 7 Fields and their consequences 8 Nuclear physics

their features and behaviour. They will also begin to discern between different types of organism based on their cellular structure and how these cells are organised to form complex organisms. They learn how to use a microscope and how we can use this to compare plant and animal cells. During Year 7, we also begin to look at reproduction and how characteristics are passed on via an organisms genetics and how this can lead to evolution of organisms over time. **Secure Disciplinary Knowledge:** Students are introduced to the key experimental vocabulary during the first half term of this year. This is then built on through practicals where students follow simple methods, conduct safe practicals process results, and begin to draw valid conclusions.. They will be able to identify independent, dependent and control variables . They are taught to draw simple graphs & describe simple relationships. They also begin to apply mathematical concepts such as substituting into a given equation, calculating means.. They also begin to use simple unit conversions. Students also begin to look at historical figures in science and there is the option to have discussions around the lack of diversity within this community of scientists. Students also begin to look at the impact of science on our lives & how we as humans have had an impact on other organisms, habitats and the environment.	to develop medication and vaccinations to prevent illness. In addition we build science capital through enrichment, practical activities, STEM-based competitions and challenges. An additional dimension to this is the promotion of STEM careers within lessons. **Secure Disciplinary Knowledge:** Students are further supported to develop and use a range of skills including observations, planning and investigation They begin to write their own scientific predictions and hypotheses that they test using simple experiments, using data from these to write conclusions. They will start to draw scientific diagrams such as ray diagrams and circuit diagrams. They will begin to use data to draw simple graphs independently, complete simple calculations without help and expand their range of unit conversions. Students will continue to have discussions around topics such as vaccinations and lifestyle choices. They will continue to develop their knowledge of transmissible diseases and the composition of the Earth. **Term Themes** 1. Periodic table and Materials 2. Energy from food groups 3. Waves and Pressure 4. Chemical Reactions and the environment 5. Electricity and Magnetism 6. Keeping Healthy	on an object's motion and shape and begin to complete more complex calculations and graphical representations of data. - Building on the use of the microscope in Year 7, students will look in more details at the types of cells. They will begin to discuss how humans use replication of cells to their advantage and how our concept of the human genome has had an impact on our knowledge of inheritance. They will also look more closely at specific types of communicable disease and how new drugs are developed. They will begin to analyse more complex data sets, using this to draw conclusions. Finally, students will go on to look at the brain and eye and how these complex organs in our body function and are susceptible to damage. **Secure Disciplinary Knowledge:** Within the chemistry unit, students are given plenty of opportunities to practise representing elements, compounds and general reactions using symbols. They begin to evaluate the limitations of using particular types of model to represent substances. Students' practical skills will build on the basics of safety, justifying conclusions, planning, identifying variables, evaluation, and scientific enquiry explored in KS3. They write their own scientific hypotheses and test these using the evidence to support	Students use models to represent a range of different scientific phenomenon and can discuss the limitations of using these. They test hypotheses using more complicated scientific investigations and use the data from these quantitatively and qualitatively. They are able to suggest a range of techniques that would be appropriate to use within an investigation and are able to discuss why they have chosen one over another. Students can decide on the most appropriate method to present data and are able to evaluate their data sets based on repeatability, reproducibility, accuracy and precision. Students can complete multi step calculations, round numbers to a number of decimal places and calculate the volume of different 3D shapes. They will also be able to use a tangent to complete quantitative analysis of data presented in a graph. Data analysis skills will also build to include rearranging equations, describing the patterns of non-linear graphs and drawing tangents to curves. Students will have discussion around the start of life, changing models of the solar system and our understanding of electricity. There will also be further opportunities to develop students knowledge of their impact on the world around them (e.g. distribution of organisms) and how scientific developments have impacted our lives (e.g. use of fertilisers, development of streetlights/automatic car lights etc). **Term 1 Human Biology and Nuclear Physics, Radiation** **Term 2 : Plant Biology and Reacting substances** **Term 3: Humans and The Earth and Electricity and Astrophysics** **Year 11** **Secure Substantive Knowledge:** These units of work have been placed here as they require students to have good conceptual understanding of a wide range of different topics. They require students to have this	9 Astrophysics BTEC Applied Science This course promotes progression to higher education, an Apprenticeship or entry level employment in the science sector. It begins with the fundamentals of level three biology chemistry and physics including cell structure, trends in the periodic tables and quantitative chemistry and the role of physics in communication before sovers working in the science industry and practical science. Assessment methods range from written exams to structured and unstructured assignments.

Term Themes 1. Particles 2. Forces 3. Interdependence and Cells 4. Energy 5. Types of Reactions 6. Reproduction and Variation		their conclusions. They begin to identify anomalies and describe how to deal with them. They start to look at more complete relationships on a graph and use lines of best fit to extract data. They develop their bank of scientific diagrams to include wave diagrams and free body diagrams. They build on their use of the microscope in year 7 to discuss the use of one type of microscope over another. They continue to complete calculations of increasing difficulty, calculating means, rounding to a given number of decimal places and significant figures and converting a wider range of units without being prompted. There are opportunities to revisit the concept of an evolving scientific knowledge base with discussions around the structure of the atom, developments in microscopes and how these have supported our understanding of scientific concepts. Students also begin to apply their knowledge of science to explain how we have used this to extract resources from the Earth and how this has, at times, been wasteful. **Term 1: Cell Biology and Atomic Structure/Periodic Table** **Term 2: Energy and Waves and Investigative Chemistry** **Term 3: Forces and Communicable Diseases**	understanding as they link multiple topics together and without secure knowledge of each contributing area, students will struggle to have the working memory to be able to make these connections. Students start by looking at the use of biology to our advantage. They briefly revisit natural selection and evolution and then look at two outcomes of evolution – the nervous and endocrine system that have allowed us to control a multitude of factors within the body. Within the chemistry unit. **Students look at extraction and use of fossil fuels students revisit bonding** Students move onto chemistry where there is a recap of the three types of bonding **and study the electrolysis process. and for separate science students examine the different types of organic compounds and how these can join together in the process of polymerisation.** a huge range of properties and therefore uses. for triple students Finally, within the physics unit, students look at the application of forces and energy in our lives. The content in this year is designed to finish by February in Year 11 to allow for some time to revise and practice core concepts that students may need additional support with. **Secure Disciplinary Knowledge:** During this final unit, students are expected to be able to pull together all of the skills that they have developed over the previous five years. They build on their concepts of how scientific theories have developed, discussing investigative processes such as Dolly the sheep and by looking at what has gone wrong	

			and using this to develop hypotheses that can then be tested. They also make use of their knowledge of scientific diagrams to draw organic compounds and use these models to represent reactions that happen within organic chemistry. Students are expected to process data quantitatively and qualitatively from graphs and tables. They have opportunities to develop their use of multistep equations Students have opportunities to discuss fertility and contraception and the debates that occur between science and religion. They also learn more about the impact of science on our lives for example in looking at our use of motor effect within Physics and stem cells within Biology and treatment of medical conditions using these. **Term 1: Evolution and Systems and Organic Chemistry and Polymers** The unit focuses on the classification and evolution of species and moves onto the nervous and endocrine system and finally the menstrual cycle, fertility and types of contraception. These biological systems are complicated with significant vocabulary needed to understand and so are ideal nearer the end of the course. Students llok at the extraction and use of fossil fuels understand a major source of feedstock for the petrochemical industry. Separate science students 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. **Term 2 and Term 3: Application of Forces** This unit builds on students' knowledge of electricity and magnetism that is taught in years 7-10. It allows students to apply the concepts to explain electromagnets, the motor effect, generator effect	

			and for separate science students, to apply this to explain how loudspeakers and microphones work Students have a very structured revision program. They revisit key topics, core skills and practice application of these to a wider range of scenarios. The breadth of the GCSE Science curriculum is huge and we want to ensure students feel confident that they have had time to return to challenging concepts, identify gaps in their subject knowledge and work hard to fix them Terms 4 and 5 of Y11 are used for exam preparation and intervention	