Subject Curriculum Intent: Science

Ambition for the subject

Have you ever wondered why the sky is blue? Are there are more than 118 elements? How many more undiscovered species of plant or animal are there? Could they be answered by the brightest minds in science? The curiosity that lies behind these questions and the drive to find the answers is what makes us human and it lies at the heart of Science. Answering questions is essentially the whole purpose of science and answering these questions simply brings more questions to the surface.

Science begins with curiosity and daring to ask questions, seek answers, work through problems and arrive at conclusions. Science is not a subject that stops - no one person will ever know everything about Science. As our understanding of life, the universe (and everything else!) deepens we realise that there is even more we don't understand.

Definition of Subject

The concise oxford dictionary defines science as ‘systematic and formulated knowledge that is based on mainly observation, experiment and induction’. Science consists of the interrelated discipline of knowledge and skills - but those of us who have ever questioned the world around us see it as so much more than that. Through science you can learn to develop your own ideas, attitudes and interpretations and not simply acquire a set of skills and knowledge. Throughout our science curriculum you’ll see that science skills and knowledge are important but it’s the application of these ideas that lead onto the great discoveries. Understanding the scientific process is a way of thinking and working.

Nature of Subject

In Biology you will explore cell structure, organisation, infection and response, bioenergetics, homeostasis ecology, inheritance selection and evolution. In Chemistry you will study acids and alkalis, quantitative chemistry, atomic structure, bonding, the Earth, electrolysis, enthalpy, equilibria, organic chemistry, particles, periodic table, rates of reaction and redox reactions. In Physics you will examine the Earth and space, electricity, energy, forces, magnetism, matter and radioactivity, speed and motion and waves.

As a citizen of this world you need to know how the natural and modern world works. Science will teach you to:

• Understand theories that explain phenomena

• Apply basic ideas and models that support understanding

• Evaluate models and theories

• Present theories in mathematical form

• Recall quantitative relationships

• Derive quantitative relationships between various measured quantities

• Explain how theories are borne out by experiment.

• Apply experimental procedure and understand that it is a measure of success of a theory

• Present, interpret and evaluate experimental data

• Apply mathematical skills to solve problems

• Develop a deeper understanding of everyday experiences including the natural world and modern devices.

Design of Subject

Our Key Stage 3 curriculum follows the threads of the KS2 National curriculum and makes explicit links with science from the Primary phase, both in terms of planning and classroom resources. The KS3 curriculum is based around 10 big ideas in Science – Forces, Electromagnets, Energy, Waves, Matter, Reactions, Earth, Organisms, Genes, Ecosystems. Each big idea contains four subtopics that start with more concrete content and move towards the more abstract. This forms the heart of learning at Key Stage 3 and this key conceptual understanding is built on at Key Stage 4 through further development of detail and application. They are then selectively developed in terms of conceptual demand, detail and further application through study at Key Stage 5.

The essential elements that form the basis of investigative science are present throughout all years – use of variables, generating and recording data, analysing, concluding, mathematical analysis and evaluating. The curriculum is designed to offer students the chance to learn the fundamental concepts and associated skills in Year 7 which are consolidated through regular, planned lessons with a focus on investigative science skills. As well as the development of the individual skills in specific lessons, students are also given the opportunity to combine them in full investigations. This process is further refined through the completion of ‘Required Practicals’ that are present in GCSE science and through PAGs that form the practical endorsement in A Level Sciences and the specific development of the same skills in Unit 2 and Unit 3 of BTEC Applied Science. The understanding and skills that accrue are further enhanced through the regular practice and application of appropriate exam questions.

Homework is set regularly and is designed to direct students to grasp the fundamentals of all three sciences by focussing on learning key knowledge. This knowledge builds over time and is interleaved through ‘Do it Now’ questions and throughout our assessments (both formal and informal).

Subject Overviews

Biology

Biology is the branch of science which endeavours to explore and gain understanding of the complex and diverse wonders of living organisms within the natural world, looking at origin, morphology, physiology, anatomy, behaviour and distribution. Key biological concepts are:

* Organisms are organised on a cellular basis.
* Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
* Genetic information is passed down from one generation of organisms to another.
* The diversity of organisms, living and extinct, is the result of evolution
* Life is sustained through the recycling of molecules between the living world and the environment

Chemistry

Chemistry is the study of matter—what it consists of, what its’ properties are, and how it changes. Matter is anything that has mass and takes up space. In developing an understanding of this phenomena Chemistry has led to the discovery and production of materials, structures, processes and devices some of which can have productive ends, or some that can be catastrophically destructive. Some key questions posed in Chemistry are:

* How do elements join together?
* What can this tell us about elementary particles?
* How can an understanding the structure of an atom lead to a further understanding of why a chemical reacts the way it does?
* How can we link this to the environment and the future of our planet?
* How can an understanding of atomic structure can lead to some of the most advanced medical techniques whilst at the same time lead to catastrophic contamination and hazards?

Physics

When studying Physics, we aim to understand the nature of the world around us. This often involves challenging our pre-existing ideas and re-evaluating them in the light of new observable evidence. From the incredibly small (particles and radioactivity) to the enormously large (space and the universe) a good physicist explains phenomena using theories based on experimental evidence. They apply scientific models to make predictions and have the skills to collect and interpret results. Thinking critically, they evaluate methods and processes in order to judge the validity of results and make conclusions. Some of the key principles include:

* All physical processes can be modelled using the transfer of energy following a fundamental law of nature: The Law of Conservation of Energy.
* Electrical devices work because of the flow of charge-carrying particles through conductors. Their motion and interaction can be characterised through physical quantities such as current, potential difference and resistance.
* The behaviour of solids, liquids and gases can be explained using the particle model of matter. Phenomena such as materials maintaining a constant temperature whilst changing state can be explained by making links with prior learning on energy.
* The atoms that make up matter are not always stable. Nuclear decay emits dangerous radiation that can also be greatly useful if harnessed correctly.
* The motion and interaction of objects can be described numerically and graphically. Forces acting on objects can change their motion or deform the materials they are made of.
* A means of transferring energy, waves can be described through properties such as frequency and wavelength. As well as being naturally occurring, their use in fields such as communication is far reaching.
* Magnetism is caused by objects interacting with magnetic fields. It’s links to electricity make it supremely useful in fields such as electricity generation and transmission.

Extension of Subject

In teaching Science we expect to open student’s eyes to the working of the world around them by linking their learning with current themes and news items. Bringing the outside world into the classroom we aim to raise all student’s awareness of the ways in which science informs all our lives, from communications to Covid and recycling to radioactive decay.

Our curriculum is supported by a weekly Science clubs as well as a farm club focussed on the seasonal activities of our school farm and a team that enters the annual CanSat challenge. All of this is underpinned by our lead role in a newly formed STEM Enthuse partnership which has the specific focus of raising our student’s awareness of wider STEM-related careers, as well as increasing the number of students opting to study sciences at GCSE and Post-16. This programme is due to run from September 2021 to December 2023 but its’ legacy will be evident far beyond that date.