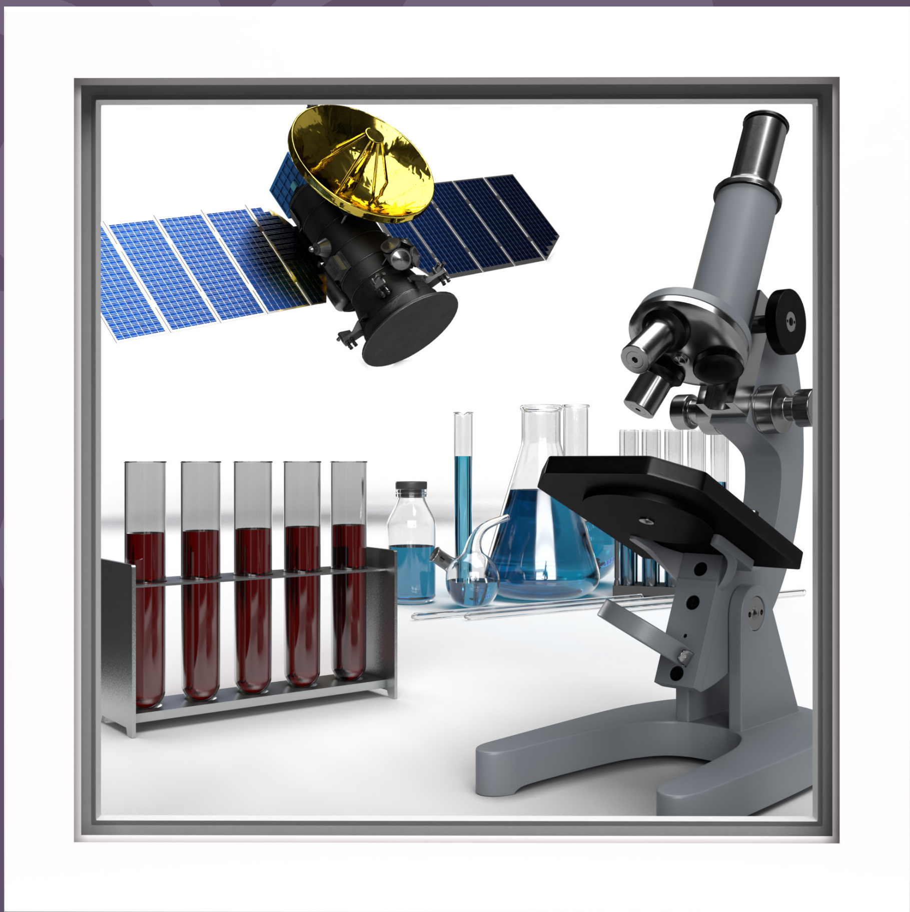
OUR CURRICULUM



SCIENCE

PHILOSOPHY & NARRATIVE

Science is a way of thinking much more than it is a body of knowledge.

Carl Sagan

OUR PHILOSOPHY

Science underpins our understanding of how life on Earth survives in balance with the Earth's resources, the interactions within and between species and the available resources.

Biology investigates how plant and animal species can survive and reproduce; considering the cell as the basic unit of life.

This expands to the functioning of unicellular and multicellular organisms as they interact with the flow of energy and particles within the varied ecosystems on Earth.

Chemistry considers how particles behave, from states of matter to bonding, chemical structure to the relationships between particle behaviour and energy in chemical reactions.

Physics explores the Earth's place in the universe, considering Earth's unique nature and how energy can be transferred sustainably to maintain balanced ecosystems within the Earth's biosphere.

Together, these disciplines help students to see that humans, as the dominant species on Earth, have a duty to move towards a fully sustainable society which ensures that the natural equilibrium within the biosphere is maintained, and that all species can survive and thrive.

KEY STAGE THREE

Year 7

We begin by building a good foundation of knowledge: the grammar of Science.

In Biology, students learn what is needed to be alive and we start with the single unit of all life on Earth: the cell, discovered by Hooke. Next, we consider the development of multicellular animals via reproduction, taking time to look at the changes students will experience themselves as they move through puberty. Exploration of how multicellular organisms carry out the processes of life allows students to look at movement and sensitivity in animals and, another kingdom, plants.

In Chemistry students explore how the particle model explains the properties of the states of matter and the properties of materials. This leads into how we can separate mixtures of particles, and how particles behaviour influences the characteristics of elements and compounds.

As energy flow controls all processes on Earth, in Physics students begin with energy stores and transfers. We then consider Newton's ideas about the way energy helps cause contact and non-contact forces, before moving on to look at the place of the Earth in our universe and how planetary forces act on the Earth to make it a unique planet which can support life.

We learn the building blocks of the first three big ideas in Science: cells, particles and energy.

Year 8

In Biology, we look more deeply at the systems that help complex multicellular organisms to stay alive, and our interactions with another kingdom, the unicellular bacteria. Students continue to look at what it is to be alive as an animal, considering the role of cells in the complex body systems of the digestive system, the circulatory system, the respiratory system and the immune system, and in plants we look at the cells in the leaf, the organ of photosynthesis.

We also delve deeper into how particles are arranged in the elements, looking at the role of the periodic table developed by Mendeleev, and how it can be used to make predictions about elements in groups 1, 7 and 0, as well as considering the physical properties and reactions of metals and non-metal elements.

KEY STAGE THREE

Students then look at a specific group of chemicals, the acids and alkalis, and their reactions before moving onto other types of reactions and the flow of energy in combustion, thermal decomposition, exothermic and endothermic reactions.

The Earth is unique as it controls the temperature within a range that can support life. We begin by looking at how heating energy is transferred by particles in conduction and convection, as a wave in radiation, and then move onto waves, considering the way light and sound travel on Earth. Finally we look at electricity, and how, as humans, we utilise electricity, an energy store, to power our daily lives. Adding to the building blocks from year 7, we increase the complexity of our understanding and begin to make dialectic links between the three big ideas: cells, particles and energy.

Year 9

The fourth big idea of Science, ecosystems, adds connections to the other three.

We explore Darwin's ideas about what makes all species different and distinct, considering the role of the cell, and DNA specifically, in reproduction and development. This leads into discussing the interactions all species have with each other and with their ecosystems on Earth, considering how vital resources such as carbon, water and energy are recycled through the ecosystem.

Students continue their study of Chemistry using their knowledge of particles and particle behaviour to look at how metals are extracted, and the role of humans in managing the sustainability of these resources. Students then look at how the rate of a reaction, a method of energy transfer, can be altered using the particle model to explain the effect of concentration, pressure, temperature, surface area and the use of a catalyst on the rate of a reaction.

Students look at how energy transfers and stores result in forces affecting factors such as speed, acceleration, momentum and moments to allow us to move, and create structures to build infrastructures on Earth. Students then consider the force of magnetism; how humans manipulate this knowledge to generate electricity, an energy transfer, with electromagnets; how the Earth's magnetic field creates north and south.

We build on the grammar of Science linking ideas together developing the dialectic aspects of the subject, and using discussion, written work and the formal methods of reporting on practical work as we establish the rhetoric of Science.

KEY STAGE FOUR

As scientific methods and theories develop over time, students learn to appreciate that science has limitations and boundaries determined by the knowledge of the current generation, with new advancements built on the gathered ideas from many contributors. Not all advancements are for the betterment of the human race, which makes it very important to consider any ethical issues which may arise. Such weighty issues are prevalent throughout the topics of evolution and the work of Darwin, the history of the atom and the work of Rutherford, the influence of Mendeleev on the periodic table, and issues such as climate change, stem cell research and genetic testing.

Students are encouraged to develop their understanding of scientific phenomena, building on their secure grammar in the subject and the application of scientific models. The flow of scientific ideas supports students in building a deep understanding of the dialectic of the subject, whether it be evaluation methods, investigating, observing, experimenting or testing out ideas for all aspects of science. Students fine-tune their expression of scientific ideas including writing practical reports.

In Biology, students consider the development of the cell, and how humans can manipulate life, through the use of stem cells, the immune system and genetic engineering, to revolutionise human health and our food supplies. This leads onto bioenergetics, learning about energy flow in photosynthesis, in respiration and, as a consequence, through ecosystems. Finally we focus on the maintenance of the internal environment of humans and plants, considering homeostasis, control and inheritance at both cellular and organism level.

In Chemistry students start at the nanoscopic level looking at atomic structure, bonding and the behaviour of particles. We then move on to learn about quantitative chemistry which bridges the nanoscopic and macroscopic segments of chemistry. The chemical and energy change topics continue to develop the links between substances we can see and the particles and energy that we cannot. We look at the role of the chemist in shaping the world around us through naturally available resources and organic chemistry. Controlling reactions and making sustainable use of these resources provides an opportunity to look at the issues arising from poor decisions made by humans in the past, particularly concerning the atmospheric pollution of our ecosystem by industrial processes and transportation.

In Physics we continue our study of the atom and particles, and build on our knowledge of energy stores and transfers. This leads us to study electricity; how to generate it; the problems with using it and some of the important components of circuits. Atomic structure leads onto radioactive sources, and into the fine details of the particle model to inform ideas around gas pressure, heat transfer and latent heat. We develop the ideas of Newton's Laws and factors influencing speed and momentum, before moving onto wave theory.

This progresses through electromagnetic waves to sound waves and then to earthquake waves. Finally we study magnetism and electromagnetism, linking back to the generation of electricity to complete our journey. Those studying separate sciences move beyond our Earth, learning about the energy and forces that create and maintain our universe. We look at how stars form and how the ideas of our universe are constantly changing as exploration and knowledge expands ever outwards.

KEY STAGE FIVE

Our students will go on to make the scientifically informed decisions which shape the future of our planet and secure our sustainable use of its resources.

A-level sciences challenge many earlier preconceptions, encouraging students to cast a more critical eye over existing theories, practical data and suggested evidence, using dialectic and rhetoric to demonstrate and reinforce scientific understanding, current best practice and thinking. Although the three disciplines are discrete paths of study, there is a significant shared knowledge base between Biology and Chemistry with dialectical links between the two, whilst Physics shares much of its content and skills with the mechanical world of Mathematics.

A-level Biology delves into the workings of animals and plants, considering in greater detail the biochemistry, physiology and genetics of living organisms and the survival of each species within the Earth's ecosystems. Students begin with the molecules of life and cell structure and the movement of substances between cells before learning about the gas-exchange, transport, digestive and immune systems in animals and plants. Students consider the impact of the cell's genetics on species and their interactions. Finally students consider the energy transfers between organisms, homeostasis, evolution and the ecosystem and how gene expression is controlled within the cell.

Chemistry is divided into the three main areas of the subject, physical, organic and inorganic chemistry. Physical chemistry develops the idea of how structure and bonding between particles determine the fundamental properties of materials, and students will also consider how chemists work quantitatively, energetics, equilibria and Le Chatelier's principle, and reaction kinetics: the how far and how fast of chemistry.

Organic chemistry is the detailed mechanism writing expected of the synthetic chemist, and students will draw links between different functional groups and molecules enabling them to devise synthetic routes to new materials, and use spectroscopic techniques to analyse products for purity. Finally, inorganic chemistry examines how the properties of elements are linked to their position in the periodic table and ultimately their electronic structure. There are strong dialectic links between the three branches throughout the course, and a significant focus on developing practical skills, as well as overlap with core ideas from Biology.

The A-Level Physics course stretches the boundaries of the students' understanding of the world around them. From the smallest sub-atomic particles known to man, to the infinite effect of gravitational fields, A-Level Physics aims to answer the question 'why?' using both real-world and conceptual ideas. The course looks at the particles that make up everything in the universe and how they interact with each other and how we can manipulate them using nuclear fission and fusion. The unique properties of light that allow it to behave like both a particle and a wave are investigated through experimentation using the photoelectric effect and diffraction.

The course develops an understanding of Newtonian forces and how they affect the motion and behaviour of materials through force fields and energy transfers, integral to Engineering Physics. Experimentation throughout the course encourages students to analyse and interpret results, as well as calculate and reduce errors and uncertainties in their methodologies and measurements.

BUILDING ON THE KNOWLEDGE OF THE PAST
TO HELP THE CHILDREN OF TODAY
MEET THE CHALLENGES OF TOMORROW