

The beauty of living things is not the atoms that go into it, but the way those atoms are put together – Carl Sage

Biology is more than describing living things; biology is the product of chemistry

Biology: Phase 5 (Y12-13) Outcomes

Key Knowledge Pupils will know:	Key Skills Pupils will be able to:
<p>Key Threshold Concepts</p> <ul style="list-style-type: none"> • The different fields of biology are intertwined and cannot be studied in isolation. • A cell is the basic unit of life and all organisms are composed of one or more cells. There are two fundamental types of cell: prokaryotic and eukaryotic. • Cells are dynamic: biochemistry and molecular biology help to explain how and why cells function as they do. • Cells contain the molecule of heredity, DNA. Heredity is based on the inheritance of genes. Natural selection is the major mechanism to explain the theory of evolution. • All organisms interact with their biotic and abiotic environment. <p>Subject-specific Knowledge</p> <ul style="list-style-type: none"> • Biological Molecules • Cells, Viruses and Reproduction of Living Things • Classification and Biodiversity • Exchange and Transport • Energy for Biological Processes • Microbiology and Pathogens • Modern Genetics. • Origins of Genetic Variation • Control Systems • Ecosystems <p>Cross –Curricular Knowledge</p> <ul style="list-style-type: none"> • How society makes decisions about scientific issues and how the sciences contribute to the success of the economy and society • Consider ethical issues in the treatment of humans, other organisms and the environment 	<p>Apply understanding</p> <ul style="list-style-type: none"> - In a theoretical context - In a practical context - When handling qualitative data - When handling quantitative data <p>Analyse and Evaluate</p> <ul style="list-style-type: none"> - Make judgements and reach conclusions using primary and secondary experimental results - Develop and refine practical design and procedures. <p>Independent thinking:</p> <ul style="list-style-type: none"> - Solve problems set in practical contexts - Apply scientific knowledge to practical contexts. <p>Use and application of scientific methods:</p> <ul style="list-style-type: none"> - Comment on experimental design and evaluate scientific methods - Present data in appropriate ways. - Evaluate results and draw conclusions with reference to measurement uncertainties and errors - Identify variables including those that must be controlled. - <p>Numeracy and the application of mathematical concepts in a practical context:</p> <ul style="list-style-type: none"> - Plot and interpret graphs - Process and analyse data using appropriate mathematical skills - Consider margins of error, accuracy and precision of data. <p>Instruments and equipment:</p> <ul style="list-style-type: none"> - Use a wide range of experimental and practical instruments, equipment and techniques.

“The scientist is not a person who gives the right answers, he's one who asks the right questions.” – Claude Levi-Strauss

The possibilities presented by progress in biology are endless, but the ethical considerations are significant.

Biology: Phase 4 (Y9 - 11) Outcomes

Key Knowledge	Key Skills
Pupils will know:	Pupils will be able to:
<p>Key Threshold Concepts</p> <ul style="list-style-type: none"> - Life processes depend on molecules whose structure is related to their function. - The fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling living processes to be performed effectively. - Living organisms are interdependent and show adaptations to their environment. - Life on Earth is dependent on photosynthesis in which green plants and algae trap light from the Sun to fix carbon dioxide and combine it with hydrogen from water to make organic compounds and oxygen. - Organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life. - The characteristics of a living organism are influenced by its genome and its interaction with the environment. <p>Subject-specific Knowledge</p> <ul style="list-style-type: none"> - Cell biology and organism organisation - Infection and response - Bioenergetics - Homeostasis and response - Inheritance, variation and evolution - Ecology <p>Cross –Curricular Knowledge</p> <ul style="list-style-type: none"> - Ethics of cloning, fertility control, stem cell research - Healthy diet - Vaccinations throughout time at school - Smallpox scars dictating fashion in Elizabethan times. - Darwin’s journey - Opinions of the Church to oppose scientific discover 	<p>Apply understanding:</p> <ul style="list-style-type: none"> - Apply and make sense of all aspects of working scientifically in situations that might be unfamiliar. - Includes using observations and processing data <p>Analyse and evaluate:</p> <ul style="list-style-type: none"> - Evaluate evidence, both data and literature, to draw conclusions <p>Use and application of scientific methods:</p> <ul style="list-style-type: none"> - Understand the development of scientific thinking. - Use appropriate methods to conduct and evaluate practical investigations - Apply the cycle of collecting, presenting and analysing data - Use appropriate scientific vocabulary, quantities, units, symbols and nomenclature. <p>Numeracy and the application of mathematical concepts in a practical context:</p> <ul style="list-style-type: none"> - Apply arithmetic and numerical computation - Use data handling, algebra, graphs, geometry and trigonometry to interpret and analyse data

Zoom in on tangible processes to better understand scientific concepts

Science: Phase 3 (Y6 - 8) Outcomes

Key Knowledge Pupils will know:	Key Skills Pupils will be able to:
Key Threshold Concepts <ul style="list-style-type: none">- Science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review.- The fundamental units of living organisms are cells, which may be part of highly adapted structures.- Living organisms are interdependent and show adaptations to their environment- Matter is composed of tiny particles called atoms- Elements show periodic relationships in their chemical and physical properties.- Physical laws and models are expressed in mathematical form.	Scientific attitudes <ul style="list-style-type: none">- Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
Subject-specific Knowledge <ul style="list-style-type: none">- Structure and function of living organisms- Material cycles and energy- Interactions and interdependencies- Genetics and evolution- The particulate nature of matter- The periodic table- Pure and impure substances- Chemical reactions and energetics- Earth and atmosphere- Energy- Forces and motion- Waves- Electricity and electromagnetism- Space physics	Experimental skills and investigations <ul style="list-style-type: none">- Ask questions and develop a line of enquiry.- Make predictions using scientific knowledge and understanding- Select, plan and carry out the most appropriate types of scientific enquiries to test predictions- Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work- Make and record observations and measurements using a range of methods for different investigations- Evaluate the reliability of methods and suggest possible improvements
Cross –Curricular Knowledge <ul style="list-style-type: none">- Rearranging equations- The environmental impacts of the industrial revolution- Human reproduction within PSHE	Analysis and evaluation <ul style="list-style-type: none">- Present observations and data using appropriate methods- Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions- Present reasoned explanations, including explaining data in relation to predictions and hypotheses- Evaluate data, showing awareness of potential sources of random and systematic error Measurement <ul style="list-style-type: none">- Use SI units and IUPAC nomenclature- Use and derive simple equations and carry out appropriate calculations- Undertake basic data analysis including simple statistical techniques

*Science is a way of thinking much more than it is a body of knowledge –
Carl Sager*

Reconciling observations of the world with current scientific understanding

Science: Phase 2 (Y2 - 5) Outcomes

Key Knowledge	Key Skills
<p>Pupils will know:</p> <p>Key Threshold Concepts</p> <ul style="list-style-type: none"> - Science is about working objectively, modifying explanations to take account of new evidence and ideas and subjecting results to peer review. - Living things can be classified into broad groups based on similarities and differences. - Everyday materials can be grouped together on the basis of their properties. - Some changes result in the formation of new materials and this is not usually reversible. <p>Subject-specific Knowledge</p> <ul style="list-style-type: none"> - Living things and their habitats - Plants - Animals, including humans - Uses of everyday materials - Rocks - Light - Forces and magnets - States of matter - Sound - Electricity - Properties and changes of materials - Earth and space <p>Cross –Curricular Knowledge</p> <ul style="list-style-type: none"> - Human reproduction within PSHE - Rocks and earth within geography 	<p>Pupils will be able to:</p> <p>Scientific attitudes</p> <ul style="list-style-type: none"> - Understand the world scientifically by exploring, talking about, testing and developing ideas about everyday phenomena and the relationships functions and interactions between living things and familiar environments <p>Experimental skills and investigations</p> <ul style="list-style-type: none"> - Ask relevant questions and use different types of scientific enquiries to answer them - Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary - Set up simple practical enquiries, comparative and fair tests - Make systematic and careful observations <p>Analysis and evaluation</p> <ul style="list-style-type: none"> - Gather, record, classify and present data of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs - Report and present findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations - Use results to draw simple conclusions, make predictions for new values, suggest improvements and set up further comparative and fair tests - Identify scientific evidence that has been used to support or refute ideas or arguments <p>Measurement</p> <ul style="list-style-type: none"> - Take measurements with increasing accuracy, using a range of equipment, including thermometers and data loggers

*The world is beautiful to look at, but even more beautiful to understand –
Brian Cox*

Looking curiously at the world around us

Science: Phase 1 (N - 2) Outcomes

Key Knowledge Pupils will know:	Key Skills Pupils will be able to:
Key Threshold Concepts <ul style="list-style-type: none">- Science is about looking closely at the world around us, making observations, asking questions, and thinking about how we could find the answers.- We can affect the things around us.- Not every object, place, living thing, and material is the same.- There are often explanations for the changes, events, and other observations we make of the world around us.- If we look closely at the world around us, we can often find explanations for what we see.- Materials have different properties and these affect what they are used for.- Living things find what they need to stay healthy in the environment around them.- Different living things need different things to stay healthy and survive. Subject-specific Knowledge <ul style="list-style-type: none">- Living things and their habitats- Basic structure of common plants and animals, including humans- Properties of everyday materials- Changes across the four seasons- Differences between things that are living, dead, and things that have never been alive- Simple food chains- What animals and plants need to survive, grow, and stay healthy, and how they obtain these things- The shapes of solids can be changed by squashing, bending, twisting and stretching Cross-curricular Links <ul style="list-style-type: none">- PSHE: healthy lifestyles- Maths: bar charts, venn diagrams, carroll diagrams,	Scientific attitudes <ul style="list-style-type: none">- Know that science can help us to understand what we observe in the world around us- Look at the world with curiosity and a desire to understand more Experimental skills and investigations <ul style="list-style-type: none">- Ask relevant questions and know that they can be answered in different ways- Make careful observations- Perform simple tests- Observe things carefully using simple equipment Analysis and evaluation <ul style="list-style-type: none">- Identify and classify living things and materials by their basic structures or properties- Use observations to suggest answers to questions- Gather and record data to help answer questions Measurement <ul style="list-style-type: none">- Take measurements using simple equipment