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Science Curriculum Intent

Overview

The aim of our Science curriculum is to encourage pupils to become well-informed and yet forever curious citizens of our planet and beyond. The curriculum is written in such a way as to inspire curiosity beyond the classroom, allowing pupils to grow into life-long learners of Science. As a knowledge-based curriculum, we believe in scaffolding learning, so that pupils can continually revisit substantive knowledge and build on it each year, increasing the challenge of deepening knowledge and concept as students learn and progress through the key stage.

Key Stage 3

The Science curriculum at Key Stage 3 is a three-year curriculum that seeks to give pupils a solid foundation of substantive knowledge and a broad overview of important discoveries and theories in the world of Science. The curriculum gives pupils a strong grounding by teaching thematically what we consider to be the 10 'Big Ideas' in science. Each big idea consists of four components which get progressively harder across the key stage. The 10 big ideas are carefully developed across key stage 3 so that pupils gain an increasingly sophisticated understanding of them. For instance, Genes or Ecosystems. Each big idea is regularly revisited and then elaborated on throughout Key Stage 3.

We begin with the idea of 'Organisms' - that all organisms are organised on a cellular basis. We draw on pupils' experiences from their Food Technology and Physical Education curriculum to teach the processes of digestion and breathing respectively. This work is built on in the idea of 'Ecosystems' - that organisms require a supply of material for which they are often dependent on, or in competition with, other organisms. We again refer to the Physical Education curriculum to discuss why our bodies may switch from aerobic to anaerobic respiration to release energy.

In the idea of 'Genes' we introduce the revolutionary work of Charles Darwin. Pupils learn that genetic information is passed from one generation of organisms to another and that the diversity of organisms, both living and extinct is the result of evolution. As well as highlighting to pupils the advances in society that Science can bring, we also encourage them to question how the development of scientific knowledge may lead to moral dilemmas, such as how genetic screening may be used differently by different countries across the world.

Studying the big idea of 'Earth' informs pupils with knowledge of the structure of the Earth and how both natural and human processes have caused changes in our atmosphere. We look out of our windows to see the mills of Manchester and explore how the Industrial Revolution contributed to climate change and whether the economic benefits were worth the environmental costs. We invite pupils to question the role of both previous and current generations– particularly Greta Thunberg – in helping to mitigate the consequences of global warming. We explore the career of an archaeologist and how their work can bring the past to life.

Within the big idea of 'Matter', pupils learn that all material in the universe is made from very small particles. Also, how the resilience of Dmitri Mendeleev led to the development of the Periodic Table of Elements -showing us how elements belong in families based on their chemical properties. Pupils explore this idea further in the big idea of 'Reactions' by carrying out experiments to show how different elements and compounds can combine together to produce the everyday substances we see around us. We also spend time looking at how the police use techniques such as chromatography to analyse evidence.

Within the idea of 'Energy' we invite pupils to reflect on their own energy use and to use their knowledge and skills from maths in order to calculate both the financial cost of their energy use as well as their carbon footprint. We reflect on how our knowledge of the total amount of energy in the Universe is the same, but that energy can be transformed has resulted in far reaching consequences such as the Chernobyl disaster, as well as being used to positively transform communities across the world. This could be supported by the use of solar panels to generate electricity. Pupils are shown how knowledge about energy can lead to a career in engineering or a wind turbine engineer.

The idea of 'Waves' focusses on how light and sound waves transfer energy as they travel through different mediums and how light and sound engineers and opticians for instance uses this knowledge in their working lives. Within the idea of 'Forces' pupils are able to reflect on Tim Peake's space expeditions and how gravity affects the weight of objects. The electromagnetic force that exists around our planet as well as magnetic materials is explored in the idea of 'Electromagnetism'. We relate this to the vital work of electricians that provide the infrastructure needed for places such as hospitals to be a success.

Key Stage 4

All Key stage 4 students will study Biology, Chemistry and Physics either as part of the Trilogy or separate course. The 10 Big Ideas from Key Stage 3 are revisited, developed, explored and further extended upon in order to give pupils a powerful knowledge of Science. Where the KS3 curriculum introduces pupils to the 10 big ideas and initially provides substantive knowledge, the Key Stage 4 curriculum seeks to allow pupils to explicitly see the world through a Scientist's eyes. Students will develop an awareness of some of the best that has been thought and said within our discipline, but also the difficulties Scientists have faced in order to get their ideas heard, accepted and supported by empirical evidence. Practical work is at the heart of Science and throughout the course, pupils will complete not only the twenty-one required practical sessions but also additional practical lessons in order to enhance learning.

Biology will highlight the amazing complexity of life processes through studying 'Cells and Organisation', 'Disease and Biogenetics', 'Biological Responses', 'Genetics' and Reproduction' and Ecology. Pupils will become aware of how cells multiply uncontrollably to produce tumours and how our body responds to fight against diseases. They will dissect a heart and see for themselves the organ that beats approximately 100, 000 times a day, making links to their anatomy work in P.E. They will marvel at our local hospital in Oldham producing the first IVF baby, understanding what a great scientific accomplishment this was whilst appreciating the social and ethical debates surrounding the use of IVF. Armed with powerful and specialist knowledge of their own bodies and the complexities of all living organisms, pupils will be encouraged through visits to local hospitals and universities, to consider the different career paths available to them within the NHS for instance.

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Chemistry will bring the world around us to life. Through the study of 'Atom, bonding and moles', 'Chemical reactions and energy changes', 'Rates equilibrium and organic chemistry' and 'Earth's resources', the nature of different substances in terms of their physical and chemical properties and how they interact with each other to build the world we live in, will be discovered. Pupils will carry out numerous experiments to investigate, for instance, how to slow down and speed up a reaction, how to use a titration to calculate concentration of an acid or alkali and how to make pure crystals from an acid and base. Pupils will discover the rich scientific history of Manchester – from John Dalton and his ideas that developed our understanding of the structure of the atom. Also, Ernest Rutherford who changed the world when he split the atom at the University of Manchester and led the way for the development of nuclear power and cancer-fighting radiotherapy. Pupils will be encouraged to join the plethora of Manchester scientists by continuing their studies at A Level.

Physics will open our students' minds to the fundamental principles that govern all energy and matter in the universe, from the scale of sub-atomic particles to the inter-galactic scale of the universe. Lessons will focus on 'Energy and Energy Resources' 'Particles at work', 'Forces in action' and 'Waves and electromagnetism'. Pupils will construct electrical circuits to investigate Ohm's Law, and use their experiences from PSHCE to help them consider the ethical, social and economic considerations surrounding energy use and how on a global scale we meet the energy demands of developing countries. Whilst studying particles, pupils will investigate how water can be used to calculate density – as realised by Archimedes When studying 'Forces in action' pupils will be required to investigate the acceleration of an object and the relationship between force and the extension of a spring that led to Hooke's Law. Pupils will be able to reflect on the uses of the different waves in the electromagnetic spectrum and the dangers they can pose. The knowledge that pupils have gained throughout their Maths curriculum will allow pupils to use and manipulate the laws of Isaac Newton and other scientists.

Our five-year science curriculum has been designed with the focus to create independent, curious and critical thinkers of Science. We want to bring the science knowledge alive with stories of resilience and triumph from the great historical thinkers that have developed our understanding of our planet and beyond. By continually revisiting the big ideas in Science and consolidating their learning, pupils will be able to both appreciate the wonders of scientific discoveries made thus far and debate the issues that new scientific advances bring to us all.