



# Whitby School

## Science

### Our Intent

Science offers an endless world of discovery to develop our understanding of the matter, forces, and life around us. It invites children to innovate and explore the beauty of nature and understand our own technological advancements as society.

Children will build a body of knowledge - and learn how that same knowledge can be proven and how discoveries are made, tested, and refined. Our Science curriculum ensures that students are equipped with the necessary skills and knowledge to be able to ask and answer scientific questions about the world around them.

Our science curriculum fuels curiosity and promotes independence and allows for students to understand the uses and implications of science, today and for the future – for observing phenomenon in their day to lives and, as they grow, to the ends of the earth.

Science is part of our **core** discipline at Whitby School.

*“I will endeavour to be a person of great **character** who has the **courage** to realise my **ambitions**.”*

<p>Character</p> <p><b>RATIONAL</b></p>	<p>Practical work is a vital part of our practice as science teachers. It brings the subject alive and fuels the passion of our children who know thrive on hands-on learning. However, the process of practical work is also crucial to helping pupils understand the concept of ‘proof.’</p> <p>By understanding the rigor of the scientific method we aim to create rational adults who are able to identify what is fact and can be proven in a world where we find a wide range of views presented as the truth.</p>
<p>Courage</p> <p><b>ACTIVE</b></p>	<p>In Science learning is active. Scientists often begin with uncertainty – they start with things that they do not know or, in some cases, make discoveries by accident when experiments do not behave the way that they expect. What makes a scientist is their willingness to be active in solving problems.</p> <p>Consequently, at Whitby School we are active in looking for and addressing misconceptions. We reward effort – we enjoy it when pupils have a go at working through uncertainties. Even if a child is not sure, they can make a prediction and base it on a hypothesis and in doing so they start to think like a scientist.</p>
<p>Value</p> <p><b>DISCOVERER</b></p>	<p>At Whitby School we aim to spark curiosity and hunger for further knowledge. By teaching the skills required to be an effective scientist - problem solving, analysis, evaluation – we aim to fuel their interest and curiosity. In each topic we look for the hook that will drive the lesson and spark wonder, curiosity, and interest. In doing so we aim to ensure transition to further study and create the scientists of the future.</p> <p>We are passionate about participation and the development of equality of opportunity and believe science can be for everyone.</p>

## Our teaching:

To accomplish these aims, children learn scientific knowledge and scientific methods in growing complexity through their time at Whitby School. Along the way they learn these aspects of the curriculum through development of facts and processes.

## Science as a process

At Whitby School, practical work aims to teach children the processes and information that underpin the way scientists work so that they understand how scientific breakthroughs are made.

Consequently, ensuring children are confident at working with and creating graphs, validating experimental data or using apparatus is important to helping them to fully become alive to the subject. As a result, teaching of practical skills and knowledge work is carefully matched to the content children are learning so that the right methods are matched to the correct aspect of science.

This includes knowledge of methods that scientists use. These include:

- **testing**, models, chemical synthesis, classification, description and the identification of correlations (pattern-seeking)
- **data analysis**, including how to process and present scientific data in a variety of ways to explore relationships and communicate results to others
- **apparatus, techniques, and measurement**. This covers how to carry out specific procedures and protocols safely and with proficiency in the laboratory and field. Children will learn that all measurement involves some error and scientists put steps in place to reduce this
- **use of evidence**. This covers how evidence is used, alongside knowledge, to draw careful but valid conclusions. It includes the distinction between correlation and causation.

## Science as knowledge

As children progress through the science curriculum they will cover a broad range of topics specific to each area of science and will appreciate their differences. These particular differences will be reflected in the practical and process learning above:

- **Biology** helps children to understand living organisms and life. It must take account of complex systems involving interactions between genes, the environment and random chance.
- **Physics**, in contrast, typically assumes things will behave identically and so it relies of measurable quantities and laws. It explores forces and energy that surround us.
- **Chemistry** differs again in that it draws heavily on the use of models and modelling to explain the behaviour of matter to explore the substances and matter around us.

However, our colleagues aim to help pupils also see the way these areas interact with each other to help them build a meaningful understanding. This is done by organizing knowledge

according to major scientific principles, such as conservation of energy. Pupils will then use these principles to solve problems.

Our teachers aim to deliver the subject in a way that revisits and builds on prior learning to develop an extensive and connected knowledge base. When pupils learn new knowledge, it should become integrated with the knowledge they already have. This ensures that learning is meaningful.

At Whitby, this is done by organising knowledge around the most important scientific concepts, which predict and explain the largest number of phenomena. Our curriculum therefore identifies the most important concepts and connects these across lower and middle school before developing them at upper school and beyond.

### **Practical work**

At Whitby School the curriculum is sequenced so that pupils have the necessary knowledge to carry out practical work successfully and learn from it. Practical work is incorporated into the sequence of the learning so it is not simply a demonstration of a principle but a consolidation of their learning and an activity that helps them to show they understand the scientific method.

The practical work – and the way that it is built into the curriculum – is linked to the various disciplines of Physics, Biology, and Chemistry so that it acknowledges the different methods, as well as overlap, between these disciplines.

Pupils will, over time, encounter the full range of objects and phenomena they are studying through both laboratory and practical work to take them beyond their everyday experiences to develop a sense of wonder and curiosity about the world.

## **Our Curriculum**

Our curriculum is structured so that children can see connections between topics and concepts across the three disciplines of science - both in terms of the way they learn scientific knowledge and the way they learn to think like scientists.

### **Thinking like a scientist**

The skills aspect of the curriculum has also been considered carefully so that children learn new knowledge in line with their understanding of the scientific method. For example, the particle nature of matter provides an excellent context for pupils to learn aspects of

disciplinary knowledge about scientific models. The best combination of scientific knowledge and skills (otherwise known as disciplinary and substantive knowledge) is made at all times. For example, knowledge of the concept 'variable' can be used alongside substantive knowledge when pupils draw graphs to reveal scientific laws such as Hooke's Law in Physics, or when planning an experiment to investigate how light affects the rate of photosynthesis in Biology. In this way, at Whitby School we ensure disciplinary knowledge about how scientists work is not forgotten but is built on.

### **Exploring scientific knowledge.**

We are keen to ensure that your child's understanding of Science is structured. In addition to understanding the differences and principles of Biology, Chemistry, and Physics our curriculum structures learning so that pupils and students see the connections between them.

This might, for example, involve explaining what is happening at the cellular level in biology by referring to what molecules are doing at the sub-microscopic level by applying their chemistry knowledge. To enable this to happen, our curriculum identifies the most important concepts for pupils to learn. In lower school, for example, our key concepts include:

- **The particle model**
- **Energy**
- **Waves**
- **Forces**
- **Interdependence**

These strands weave throughout the delivery of all sciences, strengthening links, building understanding, and helping children to 'sort' and make sense of the information they will learn. Making repeated links to these wider concepts also helps them to build their understanding by systematically revising the concepts over time. This is reinforced by the way the department uses assessment.

### **Assessment**

We recognise that pupils are more likely to remember knowledge if they practise retrieving that knowledge over extended periods of time. Consequently, our prepare activities revisit prior learning but in our assessments we also revisit relevant prior learning to ensure knowledge has been retained. Teacher feedback is important for these assessments feedback so even incorrect answers can be corrected and retrieved in the future.

Our revision and re-visiting of prior topics focuses especially on our key concepts as these are the powerful knowledge that 'holds together' the content that children will learn.

For each unit, pupils are tested on segments of content delivered with feedback after each to pick up misconceptions. Consequently, when preparing for an end of topic test, pupils understand the content they need to revise and can see exactly which areas they need to revise to improve. In doing so, we give them the tools to succeed.

Assessment consists of regular end of topic tests which are designed to not only challenge the pupils on their factual knowledge but on their ability to apply that knowledge to novel situations and subsequently show full understanding of a variety of scientific phenomena.

Routine assessment occurs through marking of homework and classwork. Pupils are encouraged to actively engage by responding to green pen comments in their books using their purple pens. Peer assessment is also utilised with red pen marking of specific content such as objective answers to particular problems.

### **How families can support**

Families are encouraged to support their child's scientific development in a variety of ways. In particular pupils are encouraged to discuss their work at home and to attempt to explain their newly learned knowledge and skills to their parents.

Families can help develop their child's scientific development through: Visits to Museum and Exhibitions whenever possible. Encouraging pupils to explore their own scientific investigations in a safe and controlled environment. Encouraging their children to explore the Internet to find quality information and presentations from a vast resource.

Possible suggestions include: [www.bbc.co.uk/education/subjects/zng4d2p](http://www.bbc.co.uk/education/subjects/zng4d2p)

[www.cgpbooks.co.uk/interactive\\_ks3\\_science](http://www.cgpbooks.co.uk/interactive_ks3_science)

[www.topmarks.co.uk/Search.aspx?Subject=26](http://www.topmarks.co.uk/Search.aspx?Subject=26)

[www.stellarium.org/en\\_GB/](http://www.stellarium.org/en_GB/)