

## Science

### Intent

- Encourage children to be inquisitive about the world around them through varied and first-hand experiences
- Encourage children to ask their own questions and be given opportunities to use their scientific skills and research to discover the answers
- Develop an understanding of vocabulary and challenging concepts
- Gain insight into the work of scientists

Our Science teaching pays close attention to guidance provided by the National Curriculum sequence and content. It is infused with evidence-led practice and enriched with retrieval studies to ensure long-term retention of foundational knowledge.

Through excellent teaching and generative tasks, the connection between the scientific content and the context is relevant to the everyday lives of children.

The foundations of science are cemented in the Early Years Foundation Stage (EYFS) through learning within the Natural World and about People, Culture and Communities. Our ambitious interpretation of the National Curriculum places knowledge, vocabulary, working and thinking scientifically at the heart of our principles, structure and practice.

#### **Substantive knowledge**

This is the subject knowledge and explicit vocabulary used to learn about the content. Misconceptions are challenged carefully and in the context of the substantive and disciplinary knowledge. They are not introduced too early, as pupils need to construct a mental model in which to position that new knowledge.

#### **Disciplinary knowledge**

This is knowing how to collect, use, interpret, understand and evaluate the evidence from scientific processes. This is taught. It is not assumed that pupils will acquire these skills by luck or hope. Pupils construct understanding by applying substantive knowledge to questioning and planning, observing, performing a range of tests, accurately measuring, comparing through identifying and classifying, using observations and gathering data to help answer questions, explaining and reporting, predicting, concluding, improving, and seeking patterns. We call it '**Working Scientifically.**'

**Scientific analysis** is developed through IPROF criteria. We call it '**Thinking Scientifically.**'

- Identifying and classifying
- Pattern seeking
- Research
- Observing over time
- Fair and comparative testing

These 'Thinking Scientifically' skills are used throughout the curriculum in all years.

**Substantive concepts** include concrete examples. Concepts are taught through explicit vocabulary instruction, as well as through the direct content and context of the study.

## Principles

A guiding principle of our Science is that each study draws upon prior learning.

For example, in the EYFS, pupils may learn about **The Natural World** through daily activities and exploring their locality and immediate environment. This is revisited and positioned so that new and potentially abstract content in Year 1, such as Animals, including humans, is related to what children already know. This makes it easier to cognitively process. This helps to accelerate new learning as children integrate prior understanding.

Our Science is organised into three distinct subject domains: biology, physics and chemistry.

	EYFS Understanding the World	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<b>Biology</b>	<b>The Natural World</b>  Explore the natural world around them, making observations and drawing pictures of animals and plants.  Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.		Living things and their habitats (+ revisit module)	Rocks	Living things and their habitats (+ revisit module)	Living things and their habitats (+ revisit module)	Living things and their habitats (+ revisit module)
		Plants	Plants	Plants			
		Animals, including humans (+ revisit module)	Animals, including humans (+ revisit modules)	Animals, including humans (+ revisit modules)	Animals, including humans (+ revisit modules)	Animals, including humans (+ revisit modules)	Animals, including humans (+ revisit modules)
							Evolution and Inheritance
<b>Physics</b>	Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	Seasonal Changes		Light	Sound	Earth and Space	Light
				Forces and Magnets	Electricity	Forces	Electricity
<b>Chemistry</b>		Everyday materials	Use of everyday materials		States of Matter	Properties and Changes of Materials	

### **Sequencing**

- Our Science curriculum is sequenced into meaningful and connected ‘chunks’ of content to reduce the load on the working memory, as well as creating coherent and strong long-term memories.
- The sequence of substantive and disciplinary knowledge enables pupils to become ‘more expert’ with each study and grow an ever broadening and coherent mental model of the subject. This guards against superficial, disconnected and fragmented scientific knowledge and weak disciplinary knowledge.
- High frequency, multiple meaning words are taught explicitly and help make sense of subject specific words.
- We have planned both vertically and horizontally across our science curriculum, giving thought to the optimum knowledge sequence for building secure schemes of learning. Our curriculum is well thought out and linked to other areas of the curriculum, using the Cornerstones Maestro Curriculum Plan. Our science curriculum offers links with maths to include statistics, sorting and classifying. There are also links to computing and our Literary Tree books.
- Our long-term plan has determined which term to place each unit in to provide optimum learning opportunities to sequence lessons and optimised this to make connections between subjects such as the time of year, seasonal change, and links with literacy and geography.

### **Spaced retrieval approach**

- Our science curriculum is delivered through a series of modules which are deliberately spaced throughout the academic year with opportunities to introduce and revisit key concepts. This approach enables staff to deepen pupil understanding and embed learning.
- The cumulative nature of the curriculum, retrieval and spaced retrieval practice, word-building and deliberate practice tasks make learning more memorable. It is designed to increase substantive knowledge and accelerate learning within and between study modules. New content is connected to prior learning. The effect of this cumulative model supports opportunities for children to associate and connect significant scientific concepts, over time, and with increasing expertise and knowledge.
- Our curriculum covers the National Curriculum expectations for science within and across year groups. All Science modules are identified on year group specific yearly overviews.

### **Early Years**

In Early Years, Science is taught through **Understanding the World**. The children learn about the scientific world around them in their play and adult led activities. Our curriculum is designed to enable children to make sense of their physical world and community. Please see the Early Years Curriculum overview.

## Implementation

- Through great teaching of science, we encourage pupils to be curious learners who are inquisitive, ask questions and think hard.
- Science enables pupils to ask relevant scientific questions, as well as begin to answer them using subjective and disciplinary knowledge.

### Modular Approach – Knowledge

- Science is taught across each year group in modules that enable pupils to study key scientific understanding, skills and vocabulary.
- Each module aims to activate and build upon prior learning, including EYFS, to ensure better cognition and retention.
- Each module is carefully sequenced to enable pupils to purposefully layer learning from previous sessions to facilitate the acquisition and retention of key scientific knowledge.
- Each module is revisited either later in the year or in the following year as part of a spaced retrieval practice method to ensure pupils retain key knowledge and information.

### KEY STAGE 1

- Pupils study the **Seasons** and develop an early conceptual understanding of how **day becomes night**. An understanding of change over time, connects to the study of **Plants, including trees**. This focus enables children to associate trees as belonging to the plant kingdom and notice the changes deciduous trees go through connected to the seasons.
- Contrasting that study, pupils learn about **Animals, including humans**. Non-examples of plants are used to contrast the features of an animal.
- Pupils are introduced to **identifying and classifying materials**. Scientific terms, such as transparent, translucent and opaque are taught explicitly through vocabulary instruction and pupils make further sense by applying it to what they know and then to working and thinking scientifically tasks. This substantive knowledge is enriched by pupil's use of disciplinary knowledge through scientific enquiry.
- To sophisticate their understanding, Year 1 pupils revisit the study **Animals, including humans** as a retrieval module and deepen their knowledge through revisiting and thinking hard through increasingly challenging tasks.
- As pupils progress through KS1, new knowledge is integrated with pre-existing understanding. For example, in Year 2, the study of **Living things and their habitats** and **Uses of everyday materials**, engages pupils to integrate and draw upon their knowledge of **Animals, including humans** as well as **Plants**, and the study of **Materials**. New substantive knowledge is constructed and made sense of through '**Working and Thinking Scientifically**' tasks.

National Curriculum objectives, and how these link to prior learning, are evident at the beginning of every module.

### Development of Scientific skills

- As well as ensuring pupils are taught key knowledge, each module is designed to offer pupils the opportunity to undertake scientific enquiries and develop their skills as a Scientist in asking questions, planning and carrying out experiments, collecting and analysing information and drawing conclusions. The objectives that are being taught within a specific module enable full coverage and allow for skills to be built upon.

### Cumulative Quizzing Model (Supporting Cognitive Load)

- Pupils are given opportunities to retrieve their knowledge at regular intervals throughout the unit, using a range of strategies. The aim of this model is to reinforce and revisit previously taught knowledge and vocabulary.

### Minimum lesson expectations

All science lessons will incorporate the following elements:

- **Connect:** prior learning from the sequence
- **Explain:** introduce & explain new vocabulary required for the lesson
- **Example:** use a worked example to model the intended learning
- **Attempt:** practice using what they now know in a scaffolded task
- **Apply:** independently show what you know
- **Challenge:** encourage them to elaborate using key vocabulary or greater explanations

### Vocabulary

**EYFS:** We want our children to have an expansive vocabulary and through teacher modelling and planning, children are given opportunity to use and apply appropriate vocabulary. Scientific language is taught and built upon with vocabulary being a focus. This is also encouraged through planning trips and having visitors in school.

**KS1 & KS2:** Vocabulary instruction is at the heart of the curriculum and subject specific words are incorporated in each module.

### Knowledge Organisers

- Accompanying each module is a **Knowledge Organiser** which contains key vocabulary, information and concepts which all pupils are expected to understand and retain. We support vocabulary and concept acquisition through a well-structured sequence that is cumulative.
- Lesson planning is completed with the use of a suggested lesson sequence, in conjunction with prior quizzing and content from the Knowledge Organisers.

### Home Learning

- Science home learning will be given on a regular basis as part of 'Theme based' home learning.

### Tailoring for SEND / <20%

- We aim for all science lessons and learning questions to be accessible to all pupils
- QFT for pupils with SEND will typically include any of these 5 effective strategies:
  - *Scaffolding e.g. sentence stems*
  - *Explicit instruction e.g. small steps*
  - *Cognitive & metacognitive strategies e.g. knowledge notes*
  - *Flexible grouping*
  - *Use of technology e.g. curriculum visions, voice recording digital magnifiers*

**Oracy:** When discussing their findings or presenting information, pupils are encouraged to speak using full sentences and incorporating key scientific vocabulary. This is modelled by teachers e.g. using my turn, your turn.

**Writing:** Pupils are expected to write across all areas of the curriculum, with teachers modelling how to write purposefully in each subject.

**Maths:** Data handling is used in science investigations, along with sorting and classifying skills.

## Impact

### Teacher assessment

#### Formative

- Teachers use formative assessments within lessons, as children are required to demonstrate their knowledge and the intended outcomes of the unit
- Following cumulative quiz outcomes, staff will adapt their teaching in response to this feedback
- Each unit ends with a practical investigation, allowing the children to apply their prior learning and vocabulary and the teacher to observe the children's scientific knowledge and scientific skills.

#### Summative

- Evidence of pupil outcomes are used to check on pupil understanding

#### Monitoring

- Pupil Book Looks and Pupil Voice are used to investigate how and when pupils are using the expected vocabulary, and to ensure that all learners have been able to access the content to know more and remember more. The subject leader will assess their use of and understanding of the subject specific vocabulary for that unit of work, and use this assessment to feedback to staff about gaps in knowledge and understanding, and ensure progress for all from individual starting points.
- Learning walks
- Year group timetables
- Lesson Plans
- Lesson Drop Ins