

**HCAT**

**Working Scientifically**

## Purpose of study

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

## Aims

The national curriculum for science aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must always be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content

## Key Stage 1

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking simple questions and recognising that they can be answered in different ways
- observing closely, using simple equipment
- performing simple tests
- identifying and classifying
- using their observations and ideas to suggest answers to questions
- gathering and recording data to help in answering questions.

## Lower Key Stage 2

During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking relevant questions and using different types of scientific enquiries to answer them
- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- identifying differences, similarities or changes related to simple scientific ideas and processes
- using straightforward scientific evidence to answer questions or to support their findings.

## Upper Key Stage 2

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:


- planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- using test results to make predictions to set up further comparative and fair tests
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments

		KS1	LKS2	UKS2
<b>Working Scientifically</b>	<b>Framing Questions</b>	<p>I ask questions about what I see.</p> <p>I contribute to class discussion in science.</p> <p>I ask a range of simple questions about what they notice.</p> <p>I find information from books or other printed and screen sources.</p>	<p>I ask relevant questions about what they notice</p> <p>I use a range of texts to investigate science topics.</p> <p>I know how to generate further questions to test results.</p> <p>I begin to use relevant information from text and sources.</p>	<p>I select the most appropriate ways to answer science questions using different types of scientific enquiry</p> <p>I select appropriate sources from a range of information</p>
	<b>Planning Enquiries</b>	<p>I recognise that my questions about what I notice can be answered</p> <p>I know how to suggest ways to answer my question.</p> <p>I know why I am trying to find things out.</p> <p>I recognise that my questions about what I notice can be answered in different ways</p> <p>I begin to give reasons to support my ideas</p> <p>I act on suggestions about how to find things out</p>	<p>I use different types of scientific enquires to answer my questions about what I notice</p> <p>I predict what might happen before I carry out any tests.</p> <p>I act on suggestions and put forward my own ideas about how to improve my enquiry methods</p>	<p>I plan different types of scientific enquiries to answer questions.</p> <p>I find and discuss the controlling variables to be considered</p> <p>I use the key factors to decide on the variables for my experiment</p> <p>I make predictions based on my scientific knowledge and understanding</p> <p>I know how to give scientific reasons, using my past knowledge, to give reasons for predictions</p> <p>I plan to use appropriate apparatus effectively in my scientific enquiries</p> <p>I make practical suggestions about how my enquiry methods can be improved</p>
	<b>Observing</b>	<p>I observe things closely</p> <p>I give some reasons why some things might happen.</p>	<p>I make systematic and careful observations using a range of equipment</p> <p>I give reasons for my observations.</p>	<p>I record observations systematically</p> <p>I make a series of precise observations and comparisons when completing scientific tasks</p>

	<p>I use all my senses to observe so that I know how to try to answer questions.</p> <p>I describe my observations using scientific vocabulary.</p>	<p>I use scientific vocabulary to describe my observations.</p>	<p>I repeat observations and offer explanations for any differences I encounter</p>
<b>Classifying</b>	<p>I know how to identify things in the natural and man-made world.</p> <p>I know how to identify differences, similarities or changes relating to natural and man-made things.</p>	<p>I know how to sort animals and objects accurately according to a given criteria.</p> <p>I know how to use a variety of ways to classify information.</p>	<p>I know how to identify differences, similarities or changes that may impact upon simple scientific ideas and processes</p>
<b>Measuring</b>	<p>I make measurements using simple equipment.</p>	<p>I measure length, mass and time using suitable equipment and standard units</p> <p>I know how to use thermometers to record standard units of temperature.</p>	<p>I take and record measurements with increasing accuracy and precision</p> <p>I repeat measurements and offer explanations for any differences I encounter</p>
<b>Testing</b>	<p>I know how to use simple equipment to investigate.</p> <p>I know how to use simple equipment to carry out a range of tests.</p>	<p>I know how to use a variety of ways to gather information.</p> <p>I know how to use a variety of ways to record my findings.</p> <p>With help, I know how to carry out simple practical enquires, comparative and fair tests.</p>	<p>I select appropriate apparatus to set up further enquiries, comparative and fair tests.</p> <p>I experiment with a range of methods to ensure I have the correct approach to a given task.</p> <p>I use test results to ask further questions within a scientific enquiry.</p>
<b>Gathering Observations</b>	<p>I know how to put information on a chart.</p> <p>I record my observations on screen and paper using text, tables, drawings, and labelled diagrams.</p> <p>I compare observations using scientific vocabulary.</p>	<p>I record my observations, comparisons and measurements using tables, charts, text, and labelled diagrams.</p> <p>I know how to present data in different ways.</p> <p>I know how to report my findings to others in a variety of ways.</p>	<p>I use appropriate scientific language and conventions to communicate both quantitative and qualitative data.</p> <p>I know how to select appropriate charts and tables to present my findings.</p>

	<b>Scientific Evidence</b>		<p>I use straightforward scientific evidence to answer questions or to support my findings.</p> <p>I know some of the work of key scientists to support my enquiry.</p>	<p>I know how to identify opinions and facts that have been used to support or refute scientific ideas or arguments.</p> <p>I identify scientific evidence that has been used to support or refute scientific ideas or arguments.</p> <p>I describe how experimental evidence and creative thinking have been combined to provide a scientific explanation (Jenner's work on vaccination).</p>
	<b>Presenting Conclusions</b>	<p>I know how to use a simple chart to record my findings.</p> <p>I know how to tell others what I have found out.</p> <p>I say whether what happened was what I expected.</p>	<p>I know how to use my findings to draw simple conclusions.</p> <p>I know how to make predictions from my conclusions.</p> <p>I refer to my observations and measurements when giving explanations.</p> <p>I look for patterns in my data and try to explain them.</p>	<p>I draw conclusions which are consistent with the evidence and relate these to scientific knowledge.</p> <p>I use my comparisons to inform my conclusions.</p> <p>I give reasons and explanations to support my conclusions.</p> <p>I explain causal relationships and the degree of trust in my results.</p>

# Working Scientifically

 <p style="text-align: center;"><b>Science Curriculum in EYFS</b></p>			
<p><b>Understanding the world (educational programme) The natural world :</b> Understanding the world involves guiding children to make sense of their physical world and their community. The frequency and range of children’s personal experiences increases their knowledge and sense of the world around them – from visiting parks, libraries, and museums to meeting important members of society such as police officers, nurses, and firefighters. In addition, listening to a broad selection of stories, non-fiction, rhymes, and poems will foster their understanding of our culturally, socially, technologically and ecologically diverse world. As well as building important knowledge, this extends their familiarity with words that support understanding across domains. Enriching and widening children’s vocabulary will support later reading comprehension.</p>			
<u>Skills and knowledge (Fluid across FS1 FS2)</u>	<u>What does this look like in provision/adult interactions?</u>	<u>Transition into Year 1</u>	<u>Characteristics of effective learning</u>
<ul style="list-style-type: none"> <li>- Explore materials with different properties.</li> <li>- Explore natural materials, indoors and outside (0-3).</li> </ul>	<ul style="list-style-type: none"> <li>- Treasure Baskets for repeated exploration of textures, sounds, smells, and tastes.</li> <li>- Offer lots of different textures for exploration with fingers, feet, and whole body e.g. wet and dry sand, water, paint, and playdough.</li> </ul>	<p><u>Biology</u></p> <ul style="list-style-type: none"> <li>- I can explain what a plant is (A plant is a living organism that usually grows in a permanent site, using water for food).</li> <li>- I can identify and name some common plants and trees.</li> <li>- I can name some native plants to the UK.</li> <li>- I can describe the basic structures of a plant.</li> <li>- I can name some common animals.</li> <li>- I can identify and name different animals that are carnivorous, herbivorous, or omnivorous.</li> <li>- I can name the different parts of an animal’s body.</li> <li>- I can recognise and name parts of the body.</li> <li>- I can name the five senses.</li> <li>- I can say which part of the body is associated with each sense.</li> </ul>	<p>Children in EYFS learn at different rates and abilities through:</p> <ul style="list-style-type: none"> <li>• <b>Playing and exploring</b> – children investigate and experience things, and ‘have a go’.</li> <li>• <b>Active learning</b> – children concentrate and keep on trying if they encounter difficulties and enjoy achievements.</li> <li>• <b>Creating and thinking critically</b> – children have and develop their own ideas, make links between ideas, and develop strategies for doing things.</li> </ul>
<ul style="list-style-type: none"> <li>- Use all their senses in hands on exploration of natural materials.</li> <li>- Explore collections of materials with similar and/or different properties.</li> <li>- Explore how things work (3-4).</li> </ul>	<ul style="list-style-type: none"> <li>- Provide interesting natural environments for children to explore freely outdoors. Make collections of natural materials to investigate and talk about.</li> <li>- Provide equipment to support these investigations: magnifying glasses. Encourage children to talk about what they see. Model observational and investigational skills. Ask out loud: “I wonder if...?” Plan and introduce new vocabulary, encouraging children to use it to discuss their findings and ideas.</li> <li>- Provide mechanical equipment for children to play with and investigate e.g., wind-up toys, pulleys, sets of cogs with pegs and boards.</li> </ul>	<p><u>Chemistry</u></p> <ul style="list-style-type: none"> <li>- I can identify what material an object is made from.</li> <li>- I can identify a range of common materials.</li> <li>- I know the names of different everyday materials.</li> <li>- I can describe materials by saying what they look like and what they feel like.</li> <li>- I can compare materials using the physical properties of them.</li> <li>- I can use my knowledge of the properties of materials to sort them into groups.</li> <li>- I can explain how I have grouped materials based on their physical properties.</li> </ul>	
<ul style="list-style-type: none"> <li>- Plant seeds and care for growing plants.</li> <li>- Understand the key features of the life cycle of a plant and an animal.</li> <li>- Begin to understand the need to respect and care for the natural environment and all living things (3-4).</li> </ul>	<ul style="list-style-type: none"> <li>- Show and explain the concepts of growth, change and decay with natural materials: plant seeds and bulbs so children observe growth and decay over time, eggshell experiment on science week (seeing how different liquids effect eggshells).</li> <li>- Life cycle of a chick, have incubators in linked around learning and topic. Plan and introduce new vocabulary related to the exploration. Other options to investigate life cycle e.g. butterfly.</li> </ul>		
<ul style="list-style-type: none"> <li>- Talk about the differences between materials and changes they notice (3-4).</li> <li>- Explore and talk about different forces they can feel (3-4).</li> </ul>	<ul style="list-style-type: none"> <li>- Draw children’s attention to forces e.g., how the water pushes up when they try to push a plastic boat under it, how they can stretch elastic, snap a twig, but cannot bend a metal rod.</li> <li>- Provide children with opportunities to change materials from one state to another e.g. cooking – combining different ingredients, and then cooling or heating (cooking) them melting – leave ice cubes out in the sun, see what happens when you shake salt onto them. Link to science week.</li> </ul>		
<ul style="list-style-type: none"> <li>- Explore the natural world around them.</li> <li>- Describe what they see, hear, and feel whilst outside.</li> <li>- Understand the effect of changing seasons on the natural world around them (4-5).</li> </ul>	<ul style="list-style-type: none"> <li>- Provide children with have frequent opportunities for outdoor play and exploration.</li> <li>- Create opportunities to discuss how we care for the natural world around us.</li> <li>- Offer opportunities to sing songs and join in with rhymes and poems about the natural world. After close observation, draw pictures of the natural world, including animals and plants.</li> <li>- Look for children incorporating their understanding of the seasons and weather in their play.</li> </ul>		
<p><b>Early Learning Goals</b></p> <ul style="list-style-type: none"> <li>• Explore the natural world around them, making observations and drawing pictures of animals and plants</li> <li>• Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.</li> </ul>			