

# Science

## 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.

## Main focus for each phase

### Phase 1

The principal focus of science teaching in key stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly-constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos.

'Working scientifically' is described separately in the programme of study, but must **always** be taught through and clearly related to the teaching of 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.

Pupils should read and spell scientific vocabulary at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

### Phase 2

The principal focus of science teaching in lower key stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out.

'Working 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.

Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word reading and spelling knowledge.

### Phase 3

The principal focus of science teaching in upper key stage 2 is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this through exploring and talking about their ideas; asking their own questions about scientific phenomena; and analysing functions, relationships and interactions more systematically. At upper key stage 2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use their scientific knowledge and understanding to explain their findings.

'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.

Pupils should read, spell and pronounce scientific vocabulary correctly.

Working scientifically		
Phase 1	Phase 2	Phase 3
<p>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:</p> <ul style="list-style-type: none"> <li>- Asking simple questions and recognising that they can be answered in different ways.</li> <li>- Observing closely, using simple equipment.</li> <li>- Performing simple tests.</li> <li>- Identifying and classifying.</li> <li>- Using their observations and ideas to suggest answers to questions.</li> <li>- Gathering and recording data to help in answering questions.</li> </ul>	<p>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:</p> <ul style="list-style-type: none"> <li>- Asking relevant questions and using different types of scientific enquiries to answer them.</li> <li>- Setting up simple practical enquiries, comparative and fair tests.</li> <li>- Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.</li> <li>- Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.</li> <li>- Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.</li> <li>- Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.</li> <li>- Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.</li> <li>- Identifying differences, similarities or changes related to simple scientific ideas and processes.</li> <li>- Using straightforward scientific evidence to answer questions or to support their findings.</li> </ul>	<p>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:</p> <ul style="list-style-type: none"> <li>- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.</li> <li>- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.</li> <li>- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.</li> <li>- Using test results to make predictions to set up further comparative and fair tests.</li> <li>- 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.</li> <li>- Identifying scientific evidence that has been used to support or refute ideas or arguments.</li> </ul>

Biology - Living things and their habitats					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	<ul style="list-style-type: none"> <li>- Explore and compare the differences between things that are living, dead, and things that have never been alive.</li> </ul> <p><b>(Sp - Dinosaurs)</b></p> <ul style="list-style-type: none"> <li>- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.</li> </ul> <p><b>(Sp - Dinosaurs)</b></p> <ul style="list-style-type: none"> <li>- Identify and name a variety of plants and animals in their habitats, including microhabitats.</li> </ul> <p><b>(Sp - Dinosaurs)</b></p> <ul style="list-style-type: none"> <li>- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.</li> </ul> <p><b>(Sp - Dinosaurs)</b></p>		<ul style="list-style-type: none"> <li>- Recognise that living things can be grouped in a variety of ways.</li> </ul> <p><b>(Su - Being Me)</b></p> <ul style="list-style-type: none"> <li>- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.</li> </ul> <p><b>(Su - Being Me)</b></p> <ul style="list-style-type: none"> <li>- Recognise that environments can change and that this can sometimes pose dangers to living things.</li> </ul> <p><b>(Su - Being Me)</b></p>	<ul style="list-style-type: none"> <li>- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.</li> </ul> <p><b>(Covered in Y6 - Au - Out of Africa)</b></p> <ul style="list-style-type: none"> <li>- Describe the life process of reproduction in some plants and animals.</li> </ul> <p><b>(Covered in Y6 - Au - Out of Africa)</b></p>	<ul style="list-style-type: none"> <li>- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.</li> </ul> <p><b>(Au - Out of Africa)</b></p> <ul style="list-style-type: none"> <li>- Give reasons for classifying plants and animals based on specific characteristics.</li> </ul> <p><b>(Au - Out of Africa)</b></p>

Biology - Plants					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<ul style="list-style-type: none"> <li>- Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees <b>(Su - Flora and Fauna)</b></li> <li>- Identify and describe the basic structure of a variety of common flowering plants, including trees. <b>(Su - Flora and Fauna)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Observe and describe how seeds and bulbs grow into mature plants. <b>(Su - Plants)</b></li> <li>- Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. <b>(Su - Plants)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. <b>(Sp - Rainforest)</b></li> <li>- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. <b>(Sp - Rainforest)</b></li> <li>- Investigate the way in which water is transported within plants. <b>(Sp - Rainforest)</b></li> <li>- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. <b>(Sp - Rainforest)</b></li> </ul>			
Biology - Animals, including humans					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<ul style="list-style-type: none"> <li>- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. <b>(Su - Flora and Fauna)</b></li> <li>- Identify and name a variety of common animals that are carnivores, herbivores and omnivores. <b>(Su - Flora and Fauna)</b></li> <li>- Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). <b>(Su - Flora and Fauna)</b></li> <li>- Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. <b>(Su - Flora and Fauna)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Notice that animals, including humans, have offspring which grow into adults. <b>(Au - Superhumans)</b></li> <li>- Find out about and describe the basic needs of animals, including humans, for survival (water, food and air). <b>(Au - Superhumans)</b></li> <li>- Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. <b>(Au - Superhumans)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. <b>(Sp - Rainforest)</b></li> <li>- Identify that humans and some other animals have skeletons and muscles for support, protection and movement. <b>(Sp - Rainforest)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Describe the simple functions of the basic parts of the digestive system in humans. <b>(Su - Being Me)</b></li> <li>- Identify the different types of teeth in humans and their simple functions. <b>(Su - Being Me)</b></li> <li>- Construct and interpret a variety of food chains, identifying producers, predators and prey. <b>(Su - Being Me)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Describe the changes as humans develop to old age. <b>(Covered in Y6 - Au - Out of Africa)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. <b>(Au - Out of Africa)</b></li> <li>- Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. <b>(Au - Out of Africa)</b></li> <li>- Describe the ways in which nutrients and water are transported within animals, including humans. <b>(Au - Out of Africa)</b></li> </ul>
Biology - Evolution and inheritance					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6

					- Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. <b>(Au - Out of Africa)</b> - Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. <b>(Au - Out of Africa)</b> - Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. <b>(Au - Out of Africa)</b>
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### Chemistry - Rocks

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
		- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. <b>(Su - Active Planet)</b> - Describe in simple terms how fossils are formed when things that have lived are trapped within rock. <b>(Su - Active Planet)</b> - Recognise that soils are made from rocks and organic matter. <b>(Su - Active Planet)</b>			

### Chemistry - Everyday materials

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
- Distinguish between an object and the material from which it is made. <b>(Au - Transport &amp; Travel)</b> <b>(SP - Wonderful Weather)</b> - Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. <b>(Au - Transport &amp; Travel)</b> - Describe the simple physical properties of a variety of everyday materials. <b>(Au - Transport &amp; Travel)</b>	- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (?) - Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (?)				

(Sp - Wonderful Weather) - Compare and group together a variety of everyday materials on the basis of their simple physical properties. (SP - Wonderful Weather)					
Chemistry - Properties and changes of materials					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
				<p>- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.</p> <p><b>(Su - Materials)</b> - Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.</p> <p><b>(Su - Materials)</b> - Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.</p> <p><b>(Su - Materials)</b> - Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.</p> <p>- Demonstrate that dissolving, mixing and changes of state are reversible changes.</p> <p><b>(Su - Materials)</b> - Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.</p>	
Chemistry - States of matter					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			- Compare and group materials		

			<p>together, according to whether they are solids, liquids or gases.  <b>(Sp - Traders and Invaders)</b>  - Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).  <b>(Sp - Traders and Invaders)</b>  - Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.  <b>(Sp - Traders and Invaders)</b></p>		
Physics - Light					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
		<p>- Recognise that they need light in order to see things and that dark is the absence of light.  <b>(Au - Egyptians)</b>  - Notice that light is reflected from surfaces.  <b>(Au - Egyptians)</b>  - Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.  <b>(Au - Egyptians)</b>  - Recognise that shadows are formed when the light from a light source is blocked by an opaque object. <b>(Au - Egyptians)</b>  - Find patterns in the way that the size of shadows change.  <b>(Au - Egyptians)</b></p>			<p>- Recognise that light appears to travel in straight lines.  <b>(Sp - AD 900)</b>  - Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.  <b>(Sp - AD 900)</b>  - Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.  <b>(Sp - AD 900)</b>  - Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.  <b>(Sp - AD 900)</b></p>
Physics - Sound					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			<p>- Identify how sounds are made, associating some of them with something vibrating.  <b>(Au - Inventions and Progress)</b>  - Recognise that vibrations from sounds travel through a medium to the ear.  <b>(Au - Inventions and Progress)</b></p>		

			<ul style="list-style-type: none"> <li>- Find patterns between the pitch of a sound and features of the object that produced it.</li> </ul> <p><b>(Au - Inventions and Progress)</b></p> <ul style="list-style-type: none"> <li>- Find patterns between the volume of a sound and the strength of the vibrations that produced it.</li> </ul> <p><b>(Au - Inventions and Progress)</b></p> <ul style="list-style-type: none"> <li>- Recognise that sounds get fainter as the distance from the sound source increases.</li> </ul> <p><b>(Au - Inventions and Progress)</b></p>		
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Physics - Earth and space

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
				<ul style="list-style-type: none"> <li>- Describe the movement of the Earth, and other planets, relative to the Sun in the solar system.</li> </ul> <p><b>(Sp - Space Explorers)</b></p> <ul style="list-style-type: none"> <li>- Describe the movement of the Moon relative to the Earth.</li> </ul> <p><b>(Sp - Space Explorers)</b></p> <ul style="list-style-type: none"> <li>- Describe the Sun, Earth and Moon as approximately spherical bodies.</li> </ul> <p>(?)</p> <ul style="list-style-type: none"> <li>- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.</li> </ul> <p><b>(Sp - Space Explorers)</b></p>	

Physics - Forces and magnets

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
		<ul style="list-style-type: none"> <li>- Compare how things move on different surfaces.</li> </ul> <p><b>(Su - Active Planet)</b></p> <ul style="list-style-type: none"> <li>- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.</li> </ul> <p><b>(Su - Active Planet)</b></p> <ul style="list-style-type: none"> <li>- Observe how magnets attract or repel each other and attract some materials and not others.</li> </ul> <p><b>(Su - Active Planet)</b></p> <ul style="list-style-type: none"> <li>- Compare and group together a variety of everyday materials on the basis of whether they are</li> </ul>		<ul style="list-style-type: none"> <li>- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.</li> </ul> <p><b>(Sp - Space Explorers)</b></p> <ul style="list-style-type: none"> <li>- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.</li> </ul> <p>(?)</p> <ul style="list-style-type: none"> <li>- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.</li> </ul>	

		<p>attracted to a magnet, and identify some magnetic materials.  <b>(Su - Active Planet)</b>  - Describe magnets as having two poles.  <b>(Su - Active Planet)</b>  - Predict whether two magnets will attract or repel each other, depending on which poles are facing. <b>(Su - Active Planet)</b></p>		(?)	
Physics - Seasonal changes					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
<p>- Observe changes across the four seasons.  <b>(Sp - Wonderful Weather)</b>  - Observe and describe weather associated with the seasons and how day length varies.  <b>(Sp - Wonderful Weather)</b></p>					
Physics - Electricity					
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			<p>- Identify common appliances that run on electricity.  <b>(Au - Inventions and Progress)</b>  - Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.  <b>(Au - Inventions and Progress)</b>  - Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.  <b>(Au - Inventions and Progress)</b>  - Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.  <b>(Au - Inventions and Progress)</b>  - Recognise some common conductors and insulators, and associate metals with being good conductors.  <b>(Au - Inventions and Progress)</b></p>		<p>- Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.  <b>(Su - Lights, Camera, Action)</b>  - Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches.  <b>(Su - Lights, Camera, Action)</b>  - Use recognised symbols when representing a simple circuit in a diagram.  <b>(Su - Lights, Camera, Action)</b></p>

