



- The ability to think independently and raise questions about working scientifically and the knowledge and skills that it brings.
- Confidence and competence in the full range of practical skills, taking the initiative in, for example, planning and carrying out scientific investigations.
- Excellent scientific knowledge and understanding which is demonstrated in written and verbal explanations, solving challenging problems and reporting scientific findings.
- High levels of originality, imagination or innovation in the application of skills.
- The ability to undertake practical work in a variety of contexts, including fieldwork.
- A passion for science and its application in past, present and future technologies.



## To work scientifically

### Biology

To understand plants

To understand animals and humans

To investigate living things

To understand evolution and inheritance

### Chemistry

To investigate materials

### Physics

To understand movement, forces and magnets

To understand the Earth's movement in space

To investigate light and seeing

To investigate sound and hearing

To understand electrical circuits

## Working scientifically

Lower Key Stage 2 programme of study (statutory requirements)	Notes and guidance (non-statutory)
<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>Pupils in years 3 and 4 should be given a range of scientific experiences to enable them to raise their own questions about the world around them. They should start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions; recognise when a simple fair test is necessary and help to decide how to set it up; talk about criteria for grouping, sorting and classifying; and use simple keys. They should begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them. They should help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used.</p> <p>They should learn how to use new equipment, such as data loggers, appropriately. They should collect data from their own observations and measurements, using notes, simple tables and standard units, and help to make decisions about how to record and analyse this data. With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions. With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done. They should also recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations. Pupils should use relevant scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences.</p> <p>These opportunities for working scientifically should be provided across years 3 and 4 so that the expectations in the programme of study can be met by the end of year 4. Pupils are not expected to cover each aspect for every area of study.</p>

Year 3: Plants

Year 3 programme of study (statutory requirements)	Notes and guidance (non-statutory)	Working Scientifically ideas
<p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>• identify and describe the functions of different parts of flowering plants: roots, stem, leaves and flowers</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</li> <li>• investigate the way in which water is transported within plants</li> <li>• explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.</li> </ul>	<p>Pupils should be introduced to the relationship between structure and function: the idea that every part has a job to do. They should explore questions that focus on the role of the roots and stem in nutrition and support, leaves for nutrition and flowers for reproduction.</p> <p>Note: Pupils can be introduced to the idea that plants can make their own food, but at this stage they do not need to understand how this happens.</p> <p><b>Note:</b> Pupils can be introduced to the idea that plants can make their own food, but at this stage they do not need to understand how this happens.</p>	<ul style="list-style-type: none"> <li>• How does the amount of water/light/soil affect the height/number of leaves of a plant?</li> <li>• How is seed germination affected by seed size / temperature / moisture / soil?</li> <li>• How does the amount of space for roots affect the size of a plant?</li> <li>• What affects the speed that water rises up a plant stem?</li> </ul> <p>Pupils might work scientifically by: comparing the effect of different factors on plant growth, for example the amount of light, the amount of fertiliser; discovering how seeds are formed by observing the different stages of plant life cycles over a period of time; looking for patterns in the structure of fruits that relate to how the seeds are dispersed. They might observe how water is transported in plants, for example by putting cut, white carnations into coloured water and observing how water travels up the stem to the flowers.</p>

Year 3: Animals, including humans

Year 3 programme of study (statutory requirements)	Notes and guidance (non-statutory)	Working Scientifically ideas
<p>Pupils should be taught to:</p> <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</li> <li>• identify that humans and some animals have skeletons and muscles for support, protection and movement.</li> </ul>	<p>Pupils should continue to learn about the importance of nutrition (including a balanced diet) and should be introduced to the main body parts associated with the skeleton and muscles, finding out how different parts of the body have special functions.</p>	<ul style="list-style-type: none"> <li>• Do people with longer legs jump further/higher?</li> <li>• Do people with longer arms throw farther?</li> <li>• Which has stronger bones: chicken or fish, lamb or cow?</li> <li>• How many bones are there in a human body?</li> <li>• How many muscles are there in a human body?</li> <li>• Which is the longest bone in the body</li> <li>• Do people with large hands have big large feet?</li> </ul> <p>Pupils might work scientifically by: identifying and grouping animals with and without skeletons and observing and comparing their movement; exploring ideas about what would happen if humans did not have skeletons. They might compare and contrast the diets of different animals (including their pets) and decide ways of grouping them according to what they eat. They might research different food groups and how they keep us healthy and design meals based on what they find out.</p>

Year 3 : Rocks

Year 3 programme of study (statutory requirements)	Notes and guidance (non-statutory)	Working Scientifically ideas
<p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>• compare and group together different kinds of rocks on the basis of their appearance and simple physical properties</li> <li>• describe in simple terms how fossils are formed when things that have lived are trapped within rock</li> <li>• recognise that soils are made from rocks and organic matter.</li> </ul>	<p>Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment.</p>	<ul style="list-style-type: none"> <li>• How does the size of particles affect the flow rate of water through a funnel?</li> <li>• Which soil is best for seed germination?</li> <li>• Which is the hardest rock?</li> </ul> <p>Pupils might work scientifically by: observing rocks and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them.</p> <p>Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed. Pupils could explore different soils and identify similarities and differences between them and investigate what happens when rocks are rubbed together. They can raise and answer questions about the way soils are formed.</p>

Year 3: Light

Year 3 programme of study (statutory requirements)	Notes and guidance (non-statutory)	Working Scientifically ideas
<p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>• recognise that they need light in order to see things and that dark is the absence of light</li> <li>• notice that light is reflected from surfaces</li> <li>• recognise that light from the sun can be dangerous and that there are ways to protect their eyes</li> <li>• recognise that shadows are formed when the light from a light source is blocked by a solid object</li> <li>• find patterns in the way that the size of shadows change.</li> </ul>	<p>Pupils should explore what happens when light reflects off a mirror or other reflective surfaces, including playing mirror games to help them to answer questions about how light behaves. They should think about why it is important to protect their eyes from bright lights. They should look for, and measure, shadows, and find out how they are formed and what might cause the shadows to change.</p> <p><b>Note:</b> Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.</p>	<ul style="list-style-type: none"> <li>• How does distance of a shadow causing object from a screen affect the size of the shadow?</li> <li>• How does distance from the light source affect the size of the shadow?</li> <li>• How does the colour of a filter affect the colour of white/blue/red/green/yellow light?</li> <li>• How do overlapping shadows affect the darkness of the shadow?</li> </ul> <p>Pupils might work scientifically by: looking for patterns in what happens to shadows when the light source moves or the distance between the light source and the object changes.</p>

Year 3: Forces and magnets

Year 3 programme of study (statutory requirements)	Notes and guidance (non-statutory)	Working Scientifically ideas
<p>Pupils should be taught to:</p> <ul style="list-style-type: none"> <li>• compare how things move on different surfaces</li> <li>• notice that some forces need contact between two objects, but magnetic forces can act at a distance</li> <li>• observe how magnets attract or repel each other and attract some materials and not others</li> <li>• compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials</li> <li>• describe magnets as having two poles</li> <li>• predict whether two magnets will attract or repel each other, depending on which poles are facing.</li> </ul>	<p>Pupils should observe that magnetic forces can act without direct contact, unlike most forces, where direct contact is necessary (for example, opening a door, pushing a swing). They should explore the behaviour and everyday uses of different magnets (for example, bar, ring, button and horseshoe).</p>	<ul style="list-style-type: none"> <li>• How well does magnetism pass through or attract different materials?</li> <li>• Which magnet is strongest?</li> <li>• Are bigger magnets stronger?</li> <li>• Are all metal objects attracted to a magnet?</li> </ul> <p>Pupils might work scientifically by: comparing how different things move and grouping them; raising questions and carrying out tests to find out how far things move on different surfaces and gathering and recording data to find answers their questions; exploring the strengths of different magnets and finding a fair way to compare them; sorting materials into those that are magnetic and those that are not; looking for patterns in the way that magnets behave in relation to each other and what might affect this, for example, the strength of the magnet or which pole faces another; identifying how these properties make magnets useful in everyday items and suggesting creative uses for different magnets.</p>