



# ***Bolton Primary School*** ***Science***

***2024-2026***

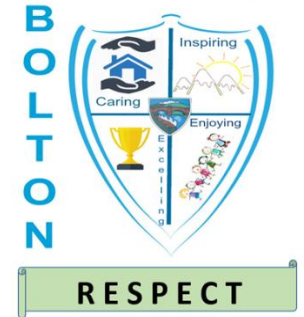
## Bolton Primary School

### Intent

- Through the teaching of Science in a fun and engaging way, we hope that pupils will:
- enjoy science
- remain curious about the world around them
- know of and aspire towards careers in STEM
- develop secure scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop their scientific enquiry skills enabling them to apply their knowledge of science when using equipment, conducting experiments, building arguments and explaining concepts
- use different methods of scientific enquiry to help them to answer scientific questions about the world around them
- be equipped with the scientific skills required to understand the uses and implications of science, today and for the future including moral dilemmas.
- deepen their respect, care and appreciation for the natural world and all its phenomena.

### Implementation

A specialist science teacher (and lead teacher for science) delivers our science curriculum throughout the school. This helps to ensure that children build on their knowledge and skills as they progress through the school. The science teacher also teaches Science at another primary school in the cluster which helps them compare a greater number of pupils when assessing. The science teacher creates a positive attitude to science learning within their classrooms and reinforces an



expectation that all pupils are capable of achieving high standards in science. Our whole school approach to the teaching and learning of science involves the following;

- Science will be taught in planned and arranged topic blocks. The National curriculum objectives are grouped into topics and adapted and extended for Bolton Primary School. Each topic is taught in: Early Years, Class 1, Class 2 and Class 3 at the same time to: ensure progression, coverage, allow resources to be evaluated and to provide the opportunity for whole-school trips or topic days. Families with children in more than one class can also visit places out of school, get library books etc that appropriately support the science topic for all of their children.
- Home-based activities are available for the topic being taught on the school website.
- Through our planning, we involve problem solving opportunities that allow children to apply their knowledge, and find out answers for themselves. Children are encouraged to ask their own questions and be given opportunities to use their scientific skills and research to discover the answers. This curiosity is celebrated within the classroom. Planning involves teachers creating engaging lessons, often involving high-quality resources to aid understanding of conceptual knowledge. Teachers use precise questioning in class to test conceptual knowledge and skills, and assess pupils regularly to identify those children with gaps in learning, so that all pupils keep up.
- We build upon the knowledge and skill development of the previous years. As the children's knowledge and understanding increases, and they become more proficient at; planning investigations (making predictions, selecting equipment, method-writing, controlling variables), recording results in tables and graphs, drawing conclusions, evaluating evidence and evaluating, conducting research and understanding key concepts.
- Working Scientifically skills are embedded into lessons to ensure these skills are being developed throughout the children's school career and new vocabulary and challenging concepts are introduced through direct teaching. This is developed through the years, in-keeping with the topics. The key knowledge and skills of each science topic is informed by the PLAN scheme which is available on our website.

Teachers model how to use scientific equipment, and the various Working Scientifically skills in order to embed scientific understanding. New vocabulary and challenging concepts are introduced through direct teaching. This is developed through the years, in-keeping with the topics. The teacher has access to a developing central store of high-quality resources shared with another primary school in our cluster.

Teachers ask a range of questions, which enable all children to take part, listening carefully to answers and taking learning forward, using open and closed questions and allowing children time to think. Teachers find opportunities to develop children's understanding by accessing outdoor learning.

We adapt and extend the curriculum to match the unique circumstances of our school.

- Events, such as project days provide a broader provision encouraging the acquisition and application of knowledge and skills. These are purposeful, linking with the knowledge being taught in class and where appropriate involve the wider community.

### Impact

The approach at Bolton Primary School results in a fun, engaging, high-quality science education that provides children with the foundations and knowledge for understanding the world. Our engagement with the local environment ensures that children learn through varied and first-hand experiences of the world around them. Through various workshops, trips and interactions, children have the understanding that science has changed our lives and that it is vital to the world's future. Children learn the possibilities for careers in science, from a range of different scientists from various backgrounds, allowing all children to feel they are scientists and capable of achieving.

### **Early Years Foundation Stage**

We teach science to Reception children as an integral part of the topic work covered during the year and in a weekly lesson. As the reception pupils are part of the Early Years Foundation Stage of the National Curriculum, we relate the scientific aspects of the children's work to the objectives set out in the Early Learning Goals (ELGs) which underpin the curriculum planning for children aged three to five. Science makes a significant contribution to the objective in the ELGs of developing a child's knowledge and understanding of the world, e.g. through investigating what floats and what sinks when placed in water.

## Spiritual, moral, social and cultural development

Science teaching offers children many opportunities to examine some of the fundamental questions in life, for example, the evolution of living things and how the world was created. Through many of the amazing processes that affect living things, children develop a sense of awe and wonder regarding the nature of our world. Science raises many social and moral questions. Through the teaching of science, children have the opportunity to discuss, for example, the effects of smoking and the moral questions involved in this issue. We give them the chance to reflect on the way people care for the planet and how science can contribute to the way we manage the earth's resources. Science teaches children about the reasons why people are different and, by developing the children's knowledge and understanding of physical and environmental factors, it promotes respect for other people.

## Equal opportunities in science

- We ensure that all our children have the opportunity to gain science knowledge and understanding regardless of gender, race, class, physical or intellectual ability.
- Our expectations do not limit pupil achievement and assessment does not involve cultural, social, linguistic or gender bias.
- We aim to teach science in a broad global and historical context, using the widest possible perspective and including the contributions of people of many different backgrounds.
- We draw examples from other cultures, recognising that simple technology may be superior to complex solutions.
- We value science as a vehicle for the development of language skills, and we encourage our children to talk constructively about their science experiences.

## Children with SEND:

At Bolton Primary School we teach science to all children, whatever their ability. Science forms part of the school curriculum policy to provide a broad and balanced education to all children. Through our science teaching we provide learning opportunities that enable all pupils to make progress. We do this by setting suitable learning challenges and responding to each child's different needs.

Intervention through School Support will lead to the creation of a Support Plan for children with special educational needs or those requiring Intervention. The support plan may include, as appropriate, specific targets relating to science.

We enable pupils to have access to the full range of activities involved in learning science. Where children are to participate in activities outside the classroom, for example, a trip to a science museum, we carry out a risk assessment prior to the activity, to ensure that the activity is safe and appropriate for all pupils.

**Disadvantaged:** The school is committed to raising achievement for disadvantaged young people. Teachers and teaching assistants will ensure an equitable approach and give more support, guidance and challenge to our disadvantaged in all our lessons.

## **Assessment and recording in science**

Assessment for learning is continuous throughout the planning, teaching and learning cycle.

- Formative assessment is used to guide the progress of individual pupils in Science. It involves identifying each child's progress in each area of the Science curriculum, determining what each child has learnt and what therefore should be the next stage in his/her learning. Teachers in the course of their teaching usually carry out formative assessment informally. Suitable tasks include:

- o Small group discussions, usually in the context of a practical task.
- o Specific arrangements for particular pupils.
- o Individual discussions in which children are encouraged to approve their own work and progress.
- A whole school summative assessment system (Green box tracking) allows for the following of children's progression in science. This occurs through the use of Head Start 'End of Topic' assessments or the teacher's own assessments. Teachers use the data to plan and teach the appropriate next steps for each child.
- The school science leader monitors progress through school and the data is available for all teachers to view on Teams.
- Reports to parents are provided 3 times a year. A short report in autumn and summer and a longer written report in Spring.

### Resources

We continue to develop our teaching resources for all areas of science taught in the school. In addition to the science resources owned by the school, we have access to a collection of science equipment from schools in our cluster and local secondary schools.

### Monitoring and review

It is the responsibility of the science subject leader, the headteacher and the governor responsible for science to monitor the standards of children's work and the quality of teaching in science. The science subject leader is also responsible for being informed about current developments in the subject and for providing a strategic lead and direction for the subject in the school.

The current governor with responsibility for Science is Jane Morris (Since September 2024)  
Subject Co-ordinator: Heather Lowthian (Since September 2019)

## Strengths and Next Steps

Strengths	Next Steps
<ol style="list-style-type: none"><li>1. Taught by a science lead teacher with 20 years experience of teaching science and who worked as a scientist before becoming a teacher.</li><li>2. Same specialist teacher from Reception to Year 6 facilitates good progression and knowledge of learning styles.</li><li>3. Excellent results at the end of KS2.</li><li>4. Good resources shared between two schools in the cluster.</li><li>5. A strong emphasis on practical activities, working scientifically and group work.</li><li>6. The specialist teacher works at another primary schools which helps with moderation of results.</li><li>7. Children enjoy the subject.</li><li>8. The same topics are taught to different classes at the same time to ensure progression.</li><li>9. Topics are taught in KS1 to ensure secure foundations.</li><li>10. Use of PLAN science matrices from EYFS to Yr6.</li><li>11. Member of the Association for Science.</li></ol>	<ol style="list-style-type: none"><li>1. Through the Enthuse Partnership with Ullswater Community College:<ul style="list-style-type: none"><li>• Build a bank of 'wow' resources.</li><li>• Use funds to provide magical and memorable experiences.</li><li>• Attend CPD.</li><li>• Collaborate with other schools.</li><li>• Utilise STEM ambassadors.</li></ul></li><li>2. Implement the new 'Mary Myatt' units as per the long-term plan for Science.</li><li>3. Make the curriculum even more fun and memorable through exciting experiments.</li><li>4. Develop the children's oracy skills with the use of concept cartoons.</li></ol>

# ENTHUSE PARTNERSHIP WITH ULLSWATER COMMUNITY COLLEGE

## ENTHUSE Partnerships for schools and colleges

ENTHUSE Partnerships improve young people's attainment and engagement in STEM subjects and develop awareness and understanding of STEM careers, contributing to the Gatsby Careers Benchmarks.

### How it works

At the heart of every ENTHUSE Partnership is a collaboration between 8-10 schools or colleges, supported by £25,000 worth of support over a year. (Additional funding is available for larger partnerships).

Each Partnership will develop a tailored two-year action plan, including:

- teacher CPD combining residential, local and online courses
- free, curated and quality-assured resources
- teacher placements in a STEM-related industry or university department
- engaging with STEM Ambassadors to inspire young people
- STEM Clubs to engage young people and develop practical skills

### Benefits and impact

Impact on young people:

- increased attainment in STEM subjects, narrowing the gap for disadvantaged students.
- increased interest in STEM careers: more students interested in working in STEM industries.
- increased understanding of STEM careers: more students aware of the qualifications and routes to progress in STEM

Impact on teachers:

- increased subject and pedagogical knowledge
- more confident and able to link their teaching to STEM careers
- better equipped to draw on the opportunities offered by STEM employers
- more able to support STEM enrichment activities

**<https://www.stem.org.uk/secondary/cpd/enthuse-partnerships-for-schools-and-colleges>**

## Bolton Long Term Planning – Science 2024-2025

Year	Autumn			Spring			Summer		
A	Year 1/2	Year 3/4	Year 5/6	Year 1/2	Year 3/4	Year 5/6	Year 1/2	Year 3/4	Year 5/6
	Seasons & Electricity  <b>Tree (Seasons come and Seasons go)</b>	Electricity	Electricity & Earth and Space	Seasons & Everyday materials and their uses  <b>The Growing Story</b>	States of matter	Properties and changes of materials	Seasons & Animals including humans  <b>Home</b>	Living things including humans (digestive system, teeth, food chains)  <b>Living things - Amazing animals</b>	Living things focusing on humans (circulatory system and lifestyle choices)
B	Year 1/2	Year 3/4	Year 5/6	Year 1/2	Year 3/4	Year 5/6	Year 1/2	Year 3/4	Year 5/6
	Seasons & Forces  <b>A walk in the woods</b>	Forces and magnets	Forces  <b>Science of infographics -forces</b>	Seasons & Light and sound  <b>In the garden</b>	Light & Sound	Light & Sound	Seasons & Living things and their habitats & Plants  <b>Small speckled egg</b>	Living things and their habitats (grouping, plants, rocks)  <b>Rocks - The street beneath my feet</b>	Living things (life cycles, reproduction, evolution, inheritance)  <b>Evolution - Origin of species</b>

- The red-coloured units are new Mary Myatt units.
- The highlighted topics have been introduced early to ensure pupils reach the required endpoints in Years 4 and 6 and to keep the children safe.
- The same topics are taught to different classes at the same time to ensure progression.



### Science topics covered through school

Topic	Year 1 and 2	Year 3 and 4	Year 5 and 6
Seasons	✓	X	X
Forces	✓	✓	✓
Electricity	✓	✓	✓
Earth and Space	X	X	✓
Materials	✓	✓	✓
Light	✓	✓	✓
Sound	✓	✓	✓
Living things (plants)	✓	✓	✓
Living things (animals)	✓	✓	✓
Working Scientifically	✓	✓	✓

PLAN is used to plan and assess pupils. More information can be found here and on our website.

<https://www.planassessment.com/>

### Topics at a glance (which children use to self-assess)

#### Progression within Seasons

Year 1	Year 2
Order the four seasons	Describe how day length varies between seasons
Observe and describe weather associated with the seasons	Observe and describe weather associated with the seasons in more detail
Observe and describe changes to plants between seasons	Observe and describe changes to plants between seasons in more detail
Identify & describe the clothes you wear during different seasons	Describe the foods that are eaten more during different seasons and about in-season produce
Observe and describe changes to animals between seasons	Recognise animals that hibernate for the winter and explain why
Know how to look after pets differently according to the season/weather	Know the celebrations that occur in each season

### Progression within Forces

Year 1 & 2	Year 3 & 4	Year 5 & 6
Recognise push, pull, squash movements.	Investigate how things move on different surfaces - rough/smooth	Gravity - explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
Investigate pushing/pulling – big or small push v distance	Describe magnets as having two poles	Gravity in different places, life without gravity.
Investigate pushing/pulling – steepness of slope v furthest	Observe how magnets attract or repel each other and attract some materials and not others	Water resistance/upthrust - identify the effects of air resistance, water resistance and friction, that act between moving surfaces – streamline animals/man-made objects in water
Investigate dropping objects in air – heavy/light	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	Weight distribution
Investigate dropping objects in air – weight v shape	Notice that some forces need contact between two objects, but magnetic forces can act at a distance	Pulleys - recognise that some mechanisms, including levers & pulleys allow a smaller force to have a greater effect
Investigate floating and sinking – float/sink and materials & shape.	Observe the effect on the poles – compasses, spread of iron filings.	Gears - recognise that some mechanisms, including gears allow a smaller force to have a greater effect
Investigate moving objects with air – amount of push and distance	Compare magnet strength – one method. Compare magnet strength – 3 methods.	Air resistance – horizontal and vertical movement. Identify/design objects that are aerodynamic.
Investigate moving objects with air – source of air and distance.	Know where magnets are used in everyday life and their function.	Friction – Useful/unhelpful effects of friction.
Identify objects that are moved by water.	Springs – where springs are used in everyday life.  Why are springs used in places?	Force labelling with arrows – two labels per diagram.
Investigate moving objects with magnets – move/not move/best magnet for moving objects.	Springs – compress, stretch and the direction of force.	Force labelling with arrows – >2 labels per diagram.
	Springs – use to create movement.	

**Progression within Materials**

Year 1 & 2	Year 3 and 4	Year 5 & 6
<p>Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.</p> <p>Know ore specific names e.g. cotton, sandstone, wool,</p> <p>Know where these materials come from.</p>	<p>Compare and group materials together, according to whether they are solids, liquids or gases</p> <p>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)</p>	<p>Dissolving -know that some materials will dissolve in liquid to form a solution and some will not.</p> <p>To recognise the solvent, solute and solution.</p>
<p>Describe the simple physical properties of a variety of everyday materials – hard, soft, rough, smooth, flexible, rigid etc</p>	<p>Freezing: Understand that freezing is a change from a liquid to a solid. To understand that not all liquids freeze. To understand that different liquids freeze at different temperatures.</p>	<p>To know when a solution is saturated and what that means.</p> <p>To know that dissolving speed is increased with temperature, stirring and a weak solution.</p>
<p>Distinguish between an object and the material from which it is made. Complete bar charts showing what objects are made of.</p>	<p>Melting: Understand that melting is a change from a solid to a liquid. To understand that not all solids melt. To understand that different solids melt at different temperatures.</p>	<p>To know that dissolving is a physical, reversible change.</p> <p>To know that the solid can be recovered from a solution by evaporating the solvent.</p>
<p>Compare and group together a variety of everyday materials on the basis of their simple physical properties- bubble maps and Venn diagrams.</p>	<p>To know where evaporation and condensation happen in everyday life.</p> <p>To understand the water cycle.</p> <p>Identify the part played by evaporation and condensation in the water cycle</p>	<p>Filtering – to know that undissolved solids can be recovered by filtering.</p> <p>To know that dissolved solids will pass through filter paper.</p>

	<p>Know that the rate of evaporation is linked with temperature, movement and surface area.</p> <p>Know how condensation is formed and where it is likely to happen.</p>	
<p>Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses – choose best material</p> <p>Evaluate different material and explain.</p>	<p>Sieving – to be able to select and use appropriate sieves to separate different mixtures of materials.</p>	<p>Reversible changes - demonstrate that dissolving, mixing and changes of state are reversible changes</p> <p>Separating - use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving, magnetism, dissolving and evaporating.</p>
<p>Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.</p>	<p>Thermal insulators/conductors - to know which materials conduct and insulate from heat.</p>	<p>Irreversible changes - know 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. To know this is a chemical change.</p>
<p>Separating mixtures – tweezers, rubbish pickers, pegs, magnet, sieve, fingers</p>	<p>To know useful applications of the above.</p>	

### Progression within Light

<b>Year 1 &amp; 2</b>	<b>Year 3 &amp; 4</b>	<b>Year 5 &amp; 6</b>
Recognise that they need light in order to see things and that dark is the absence of light	Recognise that they need light in order to see things and that dark is the absence of light – light pollution	Parts of the eye/functions.
Identify sources of light Identify bike reflectors and reflective strips on book bags – travelling safely to school, playing out.	Notice that light is reflected from surfaces	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
Recognise that light from the sun can be dangerous and that there are ways to protect their eyes	Recognise that light from the sun can be dangerous and that there are ways to protect their eyes – sunglasses and SPF	Recognise that light appears to travel in straight lines.  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.
Identify objects from their shadows	Recognise that shadows are formed when the light from a light source is blocked by an opaque object – shadow location.  Shadows cast by translucent and transparent objects.	Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
Identify colours that show up well in the dark.	Find patterns in the way that the size of shadows change- light source distance	Seasons and shadows
Know how to be seen and why it is important – road safety.	Find patterns in the way that the size of shadows change- light source angle	Splitting white light - rainbows
Identify people that help them and how colour/light is important e.g. police	Convex/concave mirrors	Flashing lights to send messages.

### Progression within Sound

<b>Year 1 &amp; 2</b>	<b>Year 3 &amp; 4</b>	<b>Year 5 &amp; 6</b>
Recognise everyday sounds	Identify how sounds are made, associating some of them with something vibrating	Parts of the ear.
Sounds that alert us of danger	Recognise that vibrations from sounds travel through a medium to the ear	How we hear sounds.
Find the sound by listening	Find patterns between the pitch of a sound and features of the object that produced it	Sound insulators/conductors. Safety.
Loud/quiet	Find patterns between the volume of a sound and the strength of the vibrations that produced it	Identify how to change the pitch of instruments
High/low	Recognise that sounds get fainter as the distance from the sound source increases.	Recognise that high-pitched sounds travel further.
Ways of making sounds/playing instruments		Label sound waves
Recognising instruments		Identify the effect of location on sound – resonance
Making percussion instruments – shakers and drums.		Pitched instrument design, making and playing.

### Progression within Plants

<b>Year 1 &amp; 2</b>	<b>Year 3 &amp; 4</b>	<b>Year 5 &amp; 6</b>
Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees	Recognise that living things can be grouped in a variety of ways	Understand what we obtain from plants – how they are used.
Identify and describe the basic structure of a variety of common flowering plants, including trees – root, stem/stalk, flower, petals, leaves, trunk	Identify and describe the functions of different parts of flowering plants: as in Yr 1 & 2 but also sepal, pollen, stamen and stigma.	Identify and describe the functions of different parts of flowering plants: as in Yr 3 & 4 but also filament, anther, style, ovary, ovules, nectaries, nectar, root hairs, root nodules, petriole and leaf veins.
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	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	Describe the life process of reproduction in some plants.
Identify and name a variety of plants in their habitats, including microhabitats	Explore and use classification keys to help group, identify and name plants in their local and wider environment	Photosynthesis and transpiration.
Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.	Investigate the way in which water is transported within plants	The parts of plants that we eat.
Observe and describe how seeds and bulbs grow into mature plants	Recognise that environments can change and that this can sometimes pose dangers to plants.	Identify how plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.
	Construct and interpret a variety of food chains, identifying producers, predators and prey.	Describe how living plants are classified into broad groups according to common observable characteristics and based on similarities and differences
	Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.	Give reasons for classifying plants based on specific characteristics

### Progression within Animals

<b>Year 1 &amp; 2</b>	<b>Year 3 &amp; 4</b>	<b>Year 5 &amp; 6</b>
Explore and compare the differences between things that are living, dead, and things that have never been alive	Recognise that living things can be grouped in a variety of ways	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
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	Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment	Give reasons for classifying plants and animals based on specific characteristics
Identify and name a variety of animals in their habitats, including microhabitats	Describe the simple functions of the basic parts of the digestive system in humans	Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
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.	Recognise that environments can change and that this can sometimes pose dangers to living things.	Describe the ways in which nutrients and water are transported within animals, including humans.
Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.	Construct and interpret a variety of food chains, identifying producers, predators and prey.	Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
Notice that animals, including humans, have offspring which grow into adults	Identify the different types of teeth in humans and their simple functions	Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago
Find out about and describe the basic needs of animals, including humans, for survival (water, food and air)	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	Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.	Identify that humans and some other animals have skeletons and muscles for support, protection and movement	Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals	Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties	Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird
Identify and name a variety of common animals that are carnivores, herbivores and omnivores	Recognise that soils are made from rocks and organic matter.	Describe the changes as humans develop to old age.
Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets)	Describe in simple terms how fossils are formed when things that have lived are trapped within rock	Describe the life process of reproduction in some animals.

### **Progression within Earth and Space**

<b>Year 5 &amp; 6</b>
Describe the Sun, Earth and Moon as approximately spherical bodies
Describe the movement of the Earth, and other planets, relative to the Sun in the solar system
Describe the movement of the Moon relative to the Earth
Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky
Explore natural space phenomenon
Explore man-made objects in space
Space explorations

**Progression within Electricity**

<b>Year 1 &amp; 2</b>	<b>Year 3 &amp; 4</b>	<b>Year 5 &amp; 6</b>
Identify objects that use mains electricity.	How to be safe with electricity indoors and outside	Associate the brightness of a lamp or the volume of a buzzer or the speed of a motor with the number and voltage of cells used in the circuit
Identify objects that use batteries and know that batteries can be dangerous.	Apply knowledge of how to save electricity	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
Know why some objects use mains and some batteries to power them.	Group common appliances that run on electricity according to whether they use mains/batteries and produce a temperature change, movement or light – Venn diagrams	Use recognised symbols when representing a simple circuit in a diagram.
Know that larger batteries are not necessarily stronger.	Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers	Draw circuit diagrams using the conventional symbols
How to be safe with electricity indoors and outside	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	Understand how length of the wire affects bulb brightness.
Know ways to save electricity	Recognise that buzzers need to be a specific way in a circuit to work but lights do not.	Explore how different metals conduct electricity.
Imagine life without electricity.	Recognise that as the number of batteries in a circuit is increased, the brightness/volume/speed also increases.	Understand how light bulbs work, their structure and the development of the light bulb throughout history.
Enjoy making simple series circuits with support	Recognise that the direction motors spin in is dependent on which way it is connected in a circuit.	Understand how fuses work.
Make models incorporating electrical circuits.	Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit	Climate change – saving energy.
	Recognise some common conductors and insulators, and associate metals with being good conductors.	Non-renewable and renewable energy sources – advantages and disadvantages.

# 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.

## Scientific knowledge and conceptual understanding

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content.

Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

## The nature, processes and methods of science

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources.

Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

## Spoken language

The national curriculum for science reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

## School curriculum

The programmes of study for science are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study. In addition, schools can introduce key stage content during an earlier key stage if appropriate. All schools are also required to set out their school curriculum for science on a year-by-year basis and make this information available online.

## Attainment targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

**Schools are not required by law to teach the content indicated as being 'non-statutory'.**

## Key stage 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.

# Key stage 1 programme of study – years 1 and 2

## Working scientifically

### Statutory requirements

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.

### Notes and guidance (non-statutory)

Pupils in years 1 and 2 should explore the world around them and raise their own questions. They should experience different types of scientific enquiries, including practical activities, and begin to recognise ways in which they might answer scientific questions. They should use simple features to compare objects, materials and living things and, with help, decide how to sort and group them, observe changes over time, and, with guidance, they should begin to notice patterns and relationships. They should ask people questions and use simple secondary sources to find answers. They should use simple measurements and equipment (for example, hand lenses, egg timers) to gather data, carry out simple tests, record simple data, and talk about what they have found out and how they found it out. With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language.

These opportunities for working scientifically should be provided across years 1 and 2 so that the expectations in the programme of study can be met by the end of year 2. Pupils are not expected to cover each aspect for every area of study.

# Year 1 programme of study

## Plants

### Statutory requirements

Pupils should be taught to:

- identify and name a variety of common wild and garden plants, including deciduous and evergreen trees
- identify and describe the basic structure of a variety of common flowering plants, including trees.

### Notes and guidance (non-statutory)

Pupils should use the local environment throughout the year to explore and answer questions about plants growing in their habitat. Where possible, they should observe the growth of flowers and vegetables that they have planted.

They should become familiar with common names of flowers, examples of deciduous and evergreen trees, and plant structures (including leaves, flowers (blossom), petals, fruit, roots, bulb, seed, trunk, branches, stem).

Pupils might work scientifically by: observing closely, perhaps using magnifying glasses, and comparing and contrasting familiar plants; describing how they were able to identify and group them, and drawing diagrams showing the parts of different plants including trees. Pupils might keep records of how plants have changed over time, for example the leaves falling off trees and buds opening; and compare and contrast what they have found out about different plants.

## Animals, including humans

### Statutory requirements

Pupils should be taught to:

- identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals
- identify and name a variety of common animals that are carnivores, herbivores and omnivores
- describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets)
- identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.

### Notes and guidance (non-statutory)

Pupils should use the local environment throughout the year to explore and answer questions about animals in their habitat. They should understand how to take care of animals taken from their local environment and the need to return them safely after study. Pupils should become familiar with the common names of some fish, amphibians, reptiles, birds and mammals, including those that are kept as pets.

Pupils should have plenty of opportunities to learn the names of the main body parts (including head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth) through games, actions, songs and rhymes.

Pupils might work scientifically by: using their observations to compare and contrast animals at first hand or through videos and photographs, describing how they identify and group them; grouping animals according to what they eat; and using their senses to compare different textures, sounds and smells.

## Everyday materials

### Statutory requirements

Pupils should be taught to:

- distinguish between an object and the material from which it is made
- identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock
- describe the simple physical properties of a variety of everyday materials
- compare and group together a variety of everyday materials on the basis of their simple physical properties.

### Notes and guidance (non-statutory)

Pupils should explore, name, discuss and raise and answer questions about everyday materials so that they become familiar with the names of materials and properties such as: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent. Pupils should explore and experiment with a wide variety of materials, not only those listed in the programme of study, but including for example: brick, paper, fabrics, elastic, foil.

Pupils might work scientifically by: performing simple tests to explore questions, for example: 'What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast's leotard?'

## Seasonal changes

### Statutory requirements

Pupils should be taught to:

- observe changes across the four seasons

### Statutory requirements

- observe and describe weather associated with the seasons and how day length varies.

### Notes and guidance (non-statutory)

Pupils should observe and talk about changes in the weather and the seasons.

**Note:** Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.

Pupils might work scientifically by: making tables and charts about the weather; and making displays of what happens in the world around them, including day length, as the seasons change.

# Year 2 programme of study

## Living things and their habitats

### Statutory requirements

Pupils should be taught to:

- explore and compare the differences between things that are living, dead, and things that have never been alive
- 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
- identify and name a variety of plants and animals in their habitats, including micro-habitats
- 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.

### Notes and guidance (non-statutory)

Pupils should be introduced to the idea that all living things have certain characteristics that are essential for keeping them alive and healthy. They should raise and answer questions that help them to become familiar with the life processes that are common to all living things. Pupils should be introduced to the terms 'habitat' (a natural environment or home of a variety of plants and animals) and 'micro-habitat' (a very small habitat, for example for woodlice under stones, logs or leaf litter). They should raise and answer questions about the local environment that help them to identify and study a variety of plants and animals within their habitat and observe how living things depend on each other, for example, plants serving as a source of food and shelter for animals. Pupils should compare animals in familiar habitats with animals found in less familiar habitats, for example, on the seashore, in woodland, in the ocean, in the rainforest.

Pupils might work scientifically by: sorting and classifying things according to whether they are living, dead or were never alive, and recording their findings using charts. They should describe how they decided where to place things, exploring questions for example: 'Is a flame alive? Is a deciduous tree dead in winter?' and talk about ways of answering their questions. They could construct a simple food chain that includes humans (e.g. grass, cow, human). They could describe the conditions in different habitats and micro-habitats (under log, on stony path, under bushes) and find out how the conditions affect the number and type(s) of plants and animals that live there.

## Plants

### Statutory requirements

Pupils should be taught to:

### Statutory requirements

- observe and describe how seeds and bulbs grow into mature plants
- find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.

### Notes and guidance (non-statutory)

Pupils should use the local environment throughout the year to observe how different plants grow. Pupils should be introduced to the requirements of plants for germination, growth and survival, as well as to the processes of reproduction and growth in plants.

**Note:** Seeds and bulbs need water to grow but most do not need light; seeds and bulbs have a store of food inside them.

Pupils might work scientifically by: observing and recording, with some accuracy, the growth of a variety of plants as they change over time from a seed or bulb, or observing similar plants at different stages of growth; setting up a comparative test to show that plants need light and water to stay healthy.

## Animals, including humans

### Statutory requirements

Pupils should be taught to:

- notice that animals, including humans, have offspring which grow into adults
- find out about and describe the basic needs of animals, including humans, for survival (water, food and air)
- describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.

### Notes and guidance (non-statutory)

Pupils should be introduced to the basic needs of animals for survival, as well as the importance of exercise and nutrition for humans. They should also be introduced to the processes of reproduction and growth in animals. The focus at this stage should be on questions that help pupils to recognise growth; they should not be expected to understand how reproduction occurs.

The following examples might be used: egg, chick, chicken; egg, caterpillar, pupa, butterfly; spawn, tadpole, frog; lamb, sheep. Growing into adults can include reference to baby, toddler, child, teenager, adult.

Pupils might work scientifically by: observing, through video or first-hand observation and measurement, how different animals, including humans, grow; asking questions about what things animals need for survival and what humans need to stay healthy; and suggesting ways to find answers to their questions.

### Statutory requirements

Pupils should be taught to:

- 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.

### Notes and guidance (non-statutory)

Pupils should identify and discuss the uses of different everyday materials so that they become familiar with how some materials are used for more than one thing (metal can be used for coins, cans, cars and table legs; wood can be used for matches, floors, and telegraph poles) or different materials are used for the same thing (spoons can be made from plastic, wood, metal, but not normally from glass). They should think about the properties of materials that make them suitable or unsuitable for particular purposes and they should be encouraged to think about unusual and creative uses for everyday materials. Pupils might find out about people who have developed useful new materials, for example John Dunlop, Charles Macintosh or John McAdam.

Pupils might work scientifically by: comparing the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs); observing closely, identifying and classifying the uses of different materials, and recording their observations.

## Lower key stage 2 – years 3 and 4

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.

# Lower key stage 2 programme of study

## Working scientifically

### Statutory requirements

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.

### Notes and guidance (non-statutory)

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.

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

#### Notes and guidance (non-statutory)

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.

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.

# Year 3 programme of study

## Plants

### Statutory requirements

Pupils should be taught to:

- identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers
- 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
- investigate the way in which water is transported within plants
- explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

### Notes and guidance (non-statutory)

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.

**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.

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.

## Animals, including humans

### Statutory requirements

Pupils should be taught to:

- 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
- identify that humans and some other animals have skeletons and muscles for support, protection and movement.

### Notes and guidance (non-statutory)

Pupils should continue to learn about the importance of nutrition 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.

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.

## Rocks

### Statutory requirements

Pupils should be taught to:

- compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- describe in simple terms how fossils are formed when things that have lived are trapped within rock
- recognise that soils are made from rocks and organic matter.

### Notes and guidance (non-statutory)

Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment.

Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, 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. 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 or what changes occur when they are in water. They can raise and answer questions about the way soils are formed.

## Light

### Statutory requirements

Pupils should be taught to:

- recognise that they need light in order to see things and that dark is the absence of light
- notice that light is reflected from surfaces

### Statutory requirements

- recognise that light from the sun can be dangerous and that there are ways to protect their eyes
- recognise that shadows are formed when the light from a light source is blocked by an opaque object
- find patterns in the way that the size of shadows change.

### Notes and guidance (non-statutory)

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.

**Note:** Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.

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.

## Forces and magnets

### Statutory requirements

Pupils should be taught to:

- compare how things move on different surfaces
- notice that some forces need contact between two objects, but magnetic forces can act at a distance
- observe how magnets attract or repel each other and attract some materials and not others
- 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
- describe magnets as having two poles
- predict whether two magnets will attract or repel each other, depending on which poles are facing.

### Notes and guidance (non-statutory)

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).

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

### Notes and guidance (non-statutory)

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.

# Year 4 programme of study

## Living things and their habitats

### Statutory requirements

Pupils should be taught to:

- recognise that living things can be grouped in a variety of ways
- explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment
- recognise that environments can change and that this can sometimes pose dangers to living things.

### Notes and guidance (non-statutory)

Pupils should use the local environment throughout the year to raise and answer questions that help them to identify and study plants and animals in their habitat. They should identify how the habitat changes throughout the year. Pupils should explore possible ways of grouping a wide selection of living things that include animals and flowering plants and non-flowering plants. Pupils could begin to put vertebrate animals into groups such as fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects.

**Note:** Plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, such as ferns and mosses.

Pupils should explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population and development, litter or deforestation.

Pupils might work scientifically by: using and making simple guides or keys to explore and identify local plants and animals; making a guide to local living things; raising and answering questions based on their observations of animals and what they have found out about other animals that they have researched.

## Animals, including humans

### Statutory requirements

Pupils should be taught to:

- describe the simple functions of the basic parts of the digestive system in humans
- identify the different types of teeth in humans and their simple functions
- construct and interpret a variety of food chains, identifying producers, predators and prey.

### Notes and guidance (non-statutory)

Pupils should be introduced to the main body parts associated with the digestive system, for example, mouth, tongue, teeth, oesophagus, stomach and small and large intestine and explore questions that help them to understand their special functions.

Pupils might work scientifically by: comparing the teeth of carnivores and herbivores, and suggesting reasons for differences; finding out what damages teeth and how to look after them. They might draw and discuss their ideas about the digestive system and compare them with models or images.

## States of matter

### Statutory requirements

Pupils should be taught to:

- compare and group materials together, according to whether they are solids, liquids or gases
- 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)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

### Notes and guidance (non-statutory)

Pupils should explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container). Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.

**Note:** Teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning.

Pupils might work scientifically by: grouping and classifying a variety of different materials; exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice-cream for a party). They could research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid. They might observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line, and investigate the effect of temperature on washing drying or snowmen melting.

## Sound

### Statutory requirements

Pupils should be taught to:

- identify how sounds are made, associating some of them with something vibrating
- recognise that vibrations from sounds travel through a medium to the ear

### Statutory requirements

- find patterns between the pitch of a sound and features of the object that produced it
- find patterns between the volume of a sound and the strength of the vibrations that produced it
- recognise that sounds get fainter as the distance from the sound source increases.

### Notes and guidance (non-statutory)

Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways.

Pupils might work scientifically by: finding patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. They might make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. They could make and play their own instruments by using what they have found out about pitch and volume.

## Electricity

### Statutory requirements

Pupils should be taught to:

- identify common appliances that run on electricity
- construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers
- 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
- recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit
- recognise some common conductors and insulators, and associate metals with being good conductors.

### Notes and guidance (non-statutory)

Pupils should construct simple series circuits, trying different components, for example, bulbs, buzzers and motors, and including switches, and use their circuits to create simple devices. Pupils should draw the circuit as a pictorial representation, not necessarily using conventional circuit symbols at this stage; these will be introduced in year 6.

**Note:** Pupils might use the terms current and voltage, but these should not be introduced or defined formally at this stage. Pupils should be taught about precautions for working safely with electricity.

### Notes and guidance (non-statutory)

Pupils might work scientifically by: observing patterns, for example, that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit.

## Upper key stage 2 – years 5 and 6

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.

# Upper key stage 2 programme of study

## Working scientifically

### Statutory requirements

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.

### Notes and guidance (non-statutory)

Pupils in years 5 and 6 should use their science experiences to: explore ideas and raise different kinds of questions; select and plan the most appropriate type of scientific enquiry to use to answer scientific questions; recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why. They should use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment. They should make their own decisions about what observations to make, what measurements to use and how long to make them for, and whether to repeat them; choose the most appropriate equipment to make measurements and explain how to use it accurately. They should decide how to record data from a choice of familiar approaches; look for different causal relationships in their data and identify evidence that refutes or supports their ideas. They should use their results to identify when further tests and observations might be needed; recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact. They should use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas and should talk about how scientific ideas have developed over time.

These opportunities for working scientifically should be provided across years 5 and 6 so that the expectations in the programme of study can be met by the end of year 6. Pupils are not expected to cover each aspect for every area of study.

# Year 5 programme of study

## Living things and their habitats

### Statutory requirements

Pupils should be taught to:

- describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird
- describe the life process of reproduction in some plants and animals.

### Notes and guidance (non-statutory)

Pupils should study and raise questions about their local environment throughout the year. They should observe life-cycle changes in a variety of living things, for example, plants in the vegetable garden or flower border, and animals in the local environment. They should find out about the work of naturalists and animal behaviourists, for example, David Attenborough and Jane Goodall.

Pupils should find out about different types of reproduction, including sexual and asexual reproduction in plants, and sexual reproduction in animals.

Pupils might work scientifically by: observing and comparing the life cycles of plants and animals in their local environment with other plants and animals around the world (in the rainforest, in the oceans, in desert areas and in prehistoric times), asking pertinent questions and suggesting reasons for similarities and differences. They might try to grow new plants from different parts of the parent plant, for example, seeds, stem and root cuttings, tubers, bulbs. They might observe changes in an animal over a period of time (for example, by hatching and rearing chicks), comparing how different animals reproduce and grow.

## Animals, including humans

### Statutory requirements

Pupils should be taught to:

- describe the changes as humans develop to old age.

### Notes and guidance (non-statutory)

Pupils should draw a timeline to indicate stages in the growth and development of humans. They should learn about the changes experienced in puberty.

Pupils could work scientifically by researching the gestation periods of other animals and comparing them with humans; by finding out and recording the length and mass of a baby as it grows.

### Statutory requirements

Pupils should be taught to:

- 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
- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- 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.

### Notes and guidance (non-statutory)

Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and about electricity in year 4. They should explore reversible changes, including, evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes. Pupils should explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda. They should find out about how chemists create new materials, for example, Spencer Silver, who invented the glue for sticky notes or Ruth Benerito, who invented wrinkle-free cotton.

**Note:** Pupils are not required to make quantitative measurements about conductivity and insulation at this stage. It is sufficient for them to observe that some conductors will produce a brighter bulb in a circuit than others and that some materials will feel hotter than others when a heat source is placed against them. Safety guidelines should be followed when burning materials.

Pupils might work scientifically by: carrying out tests to answer questions, for example, 'Which materials would be the most effective for making a warm jacket, for wrapping ice cream to stop it melting, or for making blackout curtains?' They might compare materials in order to make a switch in a circuit. They could observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes. They might research and discuss how chemical changes have an impact on our lives, for example, cooking, and discuss the creative use of new materials such as polymers, super-sticky and super-thin materials.

## Earth and space

### Statutory requirements

Pupils should be taught to:

- describe the movement of the Earth, and other planets, relative to the Sun in the solar system
- describe the movement of the Moon relative to the Earth
- describe the Sun, Earth and Moon as approximately spherical bodies
- use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

### Notes and guidance (non-statutory)

Pupils should be introduced to a model of the Sun and Earth that enables them to explain day and night. Pupils should learn that the Sun is a star at the centre of our solar system and that it has eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Pluto was reclassified as a 'dwarf planet' in 2006). They should understand that a moon is a celestial body that orbits a planet (Earth has one moon; Jupiter has four large moons and numerous smaller ones).

**Note:** Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses.

Pupils should find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model by considering the work of scientists such as Ptolemy, Alhazen and Copernicus.

Pupils might work scientifically by: comparing the time of day at different places on the Earth through internet links and direct communication; creating simple models of the solar system; constructing simple shadow clocks and sundials, calibrated to show midday and the start and end of the school day; finding out why some people think that structures such as Stonehenge might have been used as astronomical clocks.

## Forces

### Statutory requirements

Pupils should be taught to:

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

### Notes and guidance (non-statutory)

Pupils should explore falling objects and raise questions about the effects of air resistance. They should explore the effects of air resistance by observing how different objects such as parachutes and sycamore seeds fall. They should experience forces that make things begin to move, get faster or slow down. Pupils should explore the effects of friction on movement and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel. Pupils should explore the effects of levers, pulleys and simple machines on movement. Pupils might find out how scientists, for example, Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.

Pupils might work scientifically by: exploring falling paper cones or cup-cake cases, and designing and making a variety of parachutes and carrying out fair tests to determine which designs are the most effective. They might explore resistance in water by making and testing boats of different shapes. They might design and make products that use levers, pulleys, gears and/or springs and explore their effects.

# Year 6 programme of study

## Living things and their habitats

### Statutory requirements

Pupils should be taught to:

- describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals
- give reasons for classifying plants and animals based on specific characteristics.

### Notes and guidance (non-statutory)

Pupils should build on their learning about grouping living things in year 4 by looking at the classification system in more detail. They should be introduced to the idea that broad groupings, such as micro-organisms, plants and animals can be subdivided. Through direct observations where possible, they should classify animals into commonly found invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals). They should discuss reasons why living things are placed in one group and not another.

Pupils might find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification.

Pupils might work scientifically by: using classification systems and keys to identify some animals and plants in the immediate environment. They could research unfamiliar animals and plants from a broad range of other habitats and decide where they belong in the classification system.

## Animals including humans

### Statutory requirements

Pupils should be taught to:

- identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
- recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
- describe the ways in which nutrients and water are transported within animals, including humans.

### Notes and guidance (non-statutory)

Pupils should build on their learning from years 3 and 4 about the main body parts and internal organs (skeletal, muscular and digestive system) to explore and answer questions that help them to understand how the circulatory system enables the body to function.

### Notes and guidance (non-statutory)

Pupils should learn how to keep their bodies healthy and how their bodies might be damaged – including how some drugs and other substances can be harmful to the human body.

Pupils might work scientifically by: exploring the work of scientists and scientific research about the relationship between diet, exercise, drugs, lifestyle and health.

## Evolution and inheritance

### Statutory requirements

Pupils should be taught to:

- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago
- recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
- identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

### Notes and guidance (non-statutory)

Building on what they learned about fossils in the topic on rocks in year 3, pupils should find out more about how living things on earth have changed over time. They should be introduced to the idea that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, labradors are crossed with poodles. They should also appreciate that variation in offspring over time can make animals more or less able to survive in particular environments, for example, by exploring how giraffes' necks got longer, or the development of insulating fur on the arctic fox. Pupils might find out about the work of palaeontologists such as Mary Anning and about how Charles Darwin and Alfred Wallace developed their ideas on evolution.

**Note:** At this stage, pupils are not expected to understand how genes and chromosomes work.

Pupils might work scientifically by: observing and raising questions about local animals and how they are adapted to their environment; comparing how some living things are adapted to survive in extreme conditions, for example, cactuses, penguins and camels. They might analyse the advantages and disadvantages of specific adaptations, such as being on two feet rather than four, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers.

## Light

### Statutory requirements

Pupils should be taught to:

- recognise that light appears to travel in straight lines

### Statutory requirements

- 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
- 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
- use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

### Notes and guidance (non-statutory)

Pupils should build on the work on light in year 3, exploring the way that light behaves, including light sources, reflection and shadows. They should talk about what happens and make predictions.

Pupils might work scientifically by: deciding where to place rear-view mirrors on cars; designing and making a periscope and using the idea that light appears to travel in straight lines to explain how it works. They might investigate the relationship between light sources, objects and shadows by using shadow puppets. They could extend their experience of light by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters (they do not need to explain why these phenomena occur).

## Electricity

### Statutory requirements

Pupils should be taught to:

- associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- 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
- use recognised symbols when representing a simple circuit in a diagram.

### Notes and guidance (non-statutory)

Building on their work in year 4, pupils should construct simple series circuits, to help them to answer questions about what happens when they try different components, for example, switches, bulbs, buzzers and motors. They should learn how to represent a simple circuit in a diagram using recognised symbols.

**Note:** Pupils are expected to learn only about series circuits, not parallel circuits. Pupils should be taught to take the necessary precautions for working safely with electricity.

Pupils might work scientifically by: systematically identifying the effect of changing one component at a time in a circuit; designing and making a set of traffic lights, a burglar alarm or some other useful circuit.

