



## Progression in Science

### Knowledge, Skills and Understanding breakdown for Working Scientifically

	Observing closely	Performing Tests	Identifying and Classifying	Recording findings
Year 1	<p>To talk about what they &lt;see, touch, smell, hear or taste&gt;.SUM</p> <p>To use simple equipment to help them make observations. SUM</p>	<p>To perform a simple test. SUM</p> <p>To tell other people about what they have done. SUM</p>	<p>To identify and classify things they observe. (Sp) SUM</p> <p>To think of some questions to ask.(Sp) SUM</p> <p>To answer some scientific questions.(Sp) SUM To give a simple reason for their answers.(Sp) SUM</p> <p>To explain what they have found out.(Sp) SUM</p>	<p>To show their work using pictures, labels and captions SUM.</p> <p>To record their findings using standard units.</p> <p>To put some information in a chart or table. SUM</p>
<b>Year 1 (Challenging)</b>	To find out by watching, listening, tasting, smelling and touching.	To give a simple reason for their answers.	To talk about similarities and differences. To explain what they have found out using scientific vocabulary.	To use ICT to show their working. To make accurate measurements.
	Plants	Animals, including humans	Everyday materials (classifying and grouping)	Seasonal Changes
Year 1	<p>To name the petals, stem, leaf, bulb, flower, seed, stem and root of a plant.</p> <p>To identify and name a range of common plants and trees.</p> <p>To recognise deciduous and evergreen trees.</p> <p>To name the trunk, branches and root of a tree.</p> <p>To describe the parts of a plant (roots, stem, leaves, flowers).</p>	<p>To point out some of the differences between different animals.</p> <p>To sort photographs of living things and non-living things.</p> <p>To identify and name a variety of common animals. (birds, fish, amphibians, reptiles, mammals, invertebrates)</p> <p>To describe how an animal is suited to its environment.</p> <p>To identify and name a variety of common animals that are carnivores, herbivores and omnivores.</p> <p>To name the parts of the human body that they can see.</p> <p>To draw &amp; label basic parts of the human body.</p> <p>To identify the main parts of the human body and link them to their senses.</p> <p>To name the parts of an animal's body.</p> <p>To name a range of domestic animals.</p> <p>To classify animals by what they eat. (carnivore, herbivore, omnivore)</p> <p>To compare the bodies of different animals.</p>	<p>To distinguish between an object and the material from which it is made.</p> <p>To describe materials using their senses.</p> <p>To describe materials using their senses, using specific scientific words.</p> <p>To explain what material objects are made from.</p> <p>To explain why a material might be useful for a specific job.</p> <p>To name some different everyday materials. e.g. wood, plastic, metal, water and rock</p> <p>To sort materials into groups by a given criteria.</p> <p>To explain how solid shapes can be changed by squashing, bending, twisting and stretching.</p>	<p>To observe changes across the four seasons.</p> <p>To name the four seasons in order.</p> <p>To observe and describe weather associated with the seasons.</p> <p>To observe and describe how day length varies.</p>
<b>Year 1 (Challenging)</b>	To name the main parts of a flowering plant.	To begin to classify animals according to a number of given criteria. To point out differences between living things and non-living things. To name some parts of the human body that cannot be seen. To say why certain animals have certain characteristics. To name a range of wild animals.	To describe things that are similar and different between materials. To explain what happens to certain materials when they are heated, e.g. bread, ice, chocolate. To explain what happens to certain materials when they are cooled, e.g. jelly, heated chocolate.	To observe features in the environment and explain that these are related to a specific season. To observe and talk about changes in the weather. To talk about weather variation in different parts of the world.



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<b>Year 2</b>	<p>To use &lt;see, touch, smell, hear or taste&gt; to help them answer questions.</p> <p>To use some scientific words to describe what they have seen and measured. SUM SUM</p> <p>To compare several things.</p>	<p>To carry out a simple fair test.. SUM</p> <p>To explain why it might not be fair to compare two things.</p> <p>To say whether things happened as they expected.</p> <p>To suggest how to find things out.</p> <p>To use prompts to find things out. SUM</p>	<p>To organise things into groups. (Sp) SUM</p> <p>To find simple patterns (or associations).</p> <p>To identify animals and plants by a specific criteria, eg. if lay eggs or not; have feathers or not.</p>	<p>To use &lt;text, diagrams, pictures, charts, tables&gt; to record their observations.. SUM</p> <p>To measure using &lt;simple equipment&gt;.</p>
<b>Year 2 (Challenging)</b>	<p>To suggest ways of finding out through listening, hearing, smelling, touching and tasting.</p>	<p>To say whether things happened as they expected and if not why not.</p>	<p>To suggest more than one way of grouping animals and plants and explain their reasons.</p>	<p>To use information from books and online information to find things out.</p>
	Living Things & their Habitats	Animals, including humans	Plants	Classifying, grouping and changing materials
<b>Year 2</b>	<p>To match certain living things to the habitats they are found in.</p> <p>To explain the differences between living and non-living things.</p> <p>To describe some of the life processes common to plants and animals, including humans.</p> <p>To decide whether something is living, dead or non-living.</p> <p>To describe how a habitat provides for the basic needs of things living there.</p> <p>To describe a range of different habitats.</p> <p>To describe how plants and animals are suited to their habitat.</p>	<p>To describe what animals need to survive.</p> <p>To explain that animals grow and reproduce.</p> <p>To explain why animals have offspring which grow into adults.</p> <p>To describe the life cycle of some living things. (e.g. egg, chick, chicken)</p> <p>To explain the basic needs of animals, including humans for survival. (water, food, air)</p> <p>To describe why exercise, balanced diet and hygiene are important for humans.</p>	<p>To describe what plants need to survive.</p> <p>To observe and describe how seeds and bulbs grow into mature plants.</p> <p>To find out &amp; describe how plants need water, light and a suitable temperature to grow and stay healthy.</p>	<p>To describe the simple physical properties of a variety of everyday materials.</p> <p>To compare and group together a variety of materials based on their simple physical properties.</p> <p>To explore how the shapes of solid objects can be changed. (squashing, bending, twisting, stretching)</p> <p>To find out about people who developed useful new materials. (John Dunlop, Charles Macintosh, John McAdam)</p> <p>To identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper, cardboard for particular uses.</p> <p>To explain how things move on different surfaces.</p>
<b>Year 2 (Challenging)</b>	<p>To name some characteristics of an animal that help it to live in a particular habitat.</p> <p>To describe what animals need to survive and link this to their habitats.</p>	<p>To explain that animals reproduce in different ways.</p>	<p>To describe what plants need to survive and link it to where they are found.</p> <p>To explain that plants grow and reproduce in different ways.</p>	<p>To describe the properties of different materials using words like, transparent or opaque, flexible, etc..</p> <p>To sort materials into groups and say why they have sorted them in that way.</p> <p>To say which materials are natural and which are man made.</p> <p>To explain how materials are changed by heating and cooling.</p> <p>To explain how materials are changed by bending, twisting and stretching.</p> <p>To tell which materials cannot be changed back after being heated, cooled, bent, stretched or twisted.</p>



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<b>Year 3</b>	<p>To use different ideas and suggest how to find something out.</p> <p><b>To make and record a prediction before testing.</b></p> <p>To plan a fair test and explain why it was fair.</p> <p>To set up a simple fair test to make comparisons.</p> <p><b>To explain why they need to collect information to answer a question.</b></p>	<p>To measure using different equipment and units of measure.</p> <p>To record their observations in different ways. &lt;labelled diagrams, charts etc&gt;</p> <p>To describe what they have found using scientific language.</p> <p>To make accurate measurements using standard units.</p>			<p>To explain what they have found out and use their measurements to say whether it helps to answer their question.</p> <p>To use a range of equipment (including a data-logger) in a simple test.</p> <p>To use different ideas and suggest how to find something out.</p>
<b>Year 3 (Challenging)</b>	<p>To record and present what they have found using scientific language, drawings, labelled diagrams, bar charts and tables.</p>	<p>To explain their findings in different ways (display, presentation, writing).</p> <p>To use their findings to draw a simple conclusion.</p> <p>To suggest improvements and predictions for further tests.</p>			<p>To suggest how to improve their work if they did it again.</p>
	Animals including Humans	Plants	Rocks	Forces and Magnets	Light
<b>Year 3</b>	<p>To explain the importance of a nutritionally balanced diet.</p> <p>To describe how nutrients, water and oxygen are transported within animals and humans.</p> <p>To identify that animals, including humans, cannot make their own food: they get nutrition from what they eat.</p> <p>To describe and explain the skeletal system of a human.</p> <p>To describe and explain the muscular system of a human.</p>	<p>To identify and describe the functions of different parts of flowering plants. (roots, stem/trunk, leaves and flowers).</p> <p>To explore the requirement of plants for life and growth (air, light, water, nutrients from soil, and room to grow).</p> <p>To explain how they vary from plant to plant.</p> <p>To investigate the way in which water is transported within plants.</p> <p>To explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.</p>	<p>To compare and group together different rocks on the basis of their appearance and simple physical properties.</p> <p>To describe and explain how different rocks can be useful to us.</p> <p>To describe and explain the differences between sedimentary and igneous rocks, considering the way they are formed.</p> <p>To describe in simple terms how fossils are formed when things that have lived are trapped within rock.</p> <p>To recognise that soils are made from rocks and organic matter.</p>	<p>To compare how things move on different surfaces.</p> <p>To observe that magnetic forces can be transmitted without direct contact.</p> <p>To observe how some magnets attract or repel each other.</p> <p>To classify which materials are attracted to magnets and which are not.</p> <p>To notice that some forces need contact between two objects, but magnetic forces can act at a distance.</p> <p>To compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet.</p> <p>To identify some magnetic materials.</p> <p>To describe magnets have having two poles (N &amp; S).</p> <p>To predict whether two magnets will attract or repel each other depending on which poles are facing.</p>	<p>To recognise that they need light in order to see things.</p> <p>To recognise that dark is the absence of light.</p> <p>To notice that light is reflected from surfaces.</p> <p>To recognise that light from the sun can be dangerous and that there are ways to protect their eyes.</p> <p>To recognise that shadows are formed when the light from a light source is blocked by a solid object.</p> <p>To find patterns in the way that the size of shadows change.</p>
<b>Year 3 (Challenging)</b>	<p>To explain how the muscular and skeletal systems work together to create movement.</p> <p>To classify living things and non-living things by a number of characteristics that they have thought of.</p> <p>To explain how people, weather and the environment can affect living things.</p> <p>To explain how certain living things depend on one another to survive.</p>	<p>To classify a range of common plants according to many criteria (environment found, size, climate required, etc.).</p>	<p>To classify igneous and sedimentary rocks.</p> <p>To begin to relate the properties of rocks with their uses.</p>	<p>To investigate the strengths of different magnets and find fair ways to compare them.</p>	<p>To explain why lights need to be bright or dimmer according to need.</p> <p>To explain the difference between transparent, translucent and opaque.</p> <p>To explain why lights need to be bright or dimmer according to need.</p> <p>To make a bulb go on and off.</p> <p>To say what happens to the electricity when more batteries are added.</p> <p>To explain why their shadow changes when the light source is moved closer or further from the object.</p>



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<b>Year 4</b>	<p>To set up a simple fair test to make comparisons.</p> <p>To plan a fair test and isolate variables, explaining why it was fair and which variables have been isolated.</p> <p>To suggest improvements and predictions.</p> <p>To decide which information needs to be collected and decide which is the best way for collecting it.</p> <p>To use their findings to draw a simple conclusion.</p>		<p>To take measurements using different equipment and units of measure and record what they have found in a range of ways.</p> <p>To make accurate measurements using standard units.</p> <p>To explain their findings in different ways (display, presentation, writing).</p>		<p>To find any patterns in their evidence or measurements.</p> <p>To make a prediction based on something they have found out.</p> <p>To evaluate what they have found using scientific language, drawings, labelled diagrams, bar charts and tables.</p> <p>To use straightforward scientific evidence to answer questions or to support their findings.</p> <p>To identify differences, similarities or changes related to simple scientific ideas or processes.</p>
<b>Year 4 (Challenging)</b>	<p>To plan and carry out an investigation by controlling variables fairly and accurately.</p> <p>To use test results to make further predictions and set up further comparative tests.</p>		<p>To record more complex data and results using scientific diagrams, classification keys, tables, bar charts, line graphs and models.</p>		<p>To report findings from investigations through written explanations and conclusions.</p> <p>To use a graph or diagram to answer scientific questions.</p>
	Animals including Humans	Living Things and their Habitats	States of Matter	Sound	Electricity
<b>Year 4</b>	<p>To identify and name the basic parts of the digestive system in humans.</p> <p>To describe the simple functions of the basic parts of the digestive system in humans.</p> <p>To identify the simple function of different types of teeth in humans.</p> <p>To compare the teeth of herbivores and carnivores.</p> <p>To explain what a simple food chain shows.</p> <p>To construct and interpret a variety of food chains, identifying producers, predators and prey.</p>	<p>To recognise that living things can be grouped in a variety of ways.</p> <p>To explore and use a classification key to group, identify and name a variety of living things. (plants, vertebrates, invertebrates)</p> <p>To compare the classification of common plants and animals to living things found in other places. (under the sea, prehistoric)</p> <p>To recognise that environments can change and this can sometimes pose a danger to living things.</p>	<p>To compare and group materials together, according to whether they are solids, liquids or gases.</p> <p>To explain what happens to materials when they are heated or cooled.</p> <p>To measure or research the temperature at which different materials change state in degrees Celsius.</p> <p>To use measurements to explain changes to the state of water.</p> <p>To identify the part that evaporation and condensation has in the water cycle.</p> <p>To associate the rate of evaporation with temperature.</p>	<p>To describe a range of sounds and explain how they are made.</p> <p>To associate some sounds with something vibrating.</p> <p>To compare sources of sound and explain how the sounds differ.</p> <p>To explain how to change a sound (louder/softer).</p> <p>To recognise how vibrations from sound travel through a medium to an ear.</p> <p>To find patterns between the pitch of a sound and features of the object that produce it.</p> <p>To find patterns between the volume of the sound and the strength of the vibrations that produced it.</p> <p>To recognise that sounds get fainter as the distance from the sound source increases.</p> <p>To explain how you could change the pitch of a sound.</p> <p>To investigate how different materials can affect the pitch and volume of sounds.</p>	<p>To identify common appliances that run on electricity.</p> <p>To construct a simple series electric circuit.</p> <p>To identify and name the basic part in a series circuit, including cells, wires, bulbs, switches and buzzers.</p> <p>To 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.</p> <p>To recognise that a switch opens and closes a circuit.</p> <p>To associate a switch opening with whether or not a lamp lights in a simple series circuit.</p> <p>To recognise some common conductors and insulators.</p> <p>To associate metals with being good conductors.</p>
<b>Year 4 (Challenging)</b>	<p>To classify living things and non-living things by a number of characteristics that they have thought of.</p> <p>To explain how people, weather and the environment can affect living things.</p> <p>To explain how certain living things depend on one another to survive.</p>	<p>To give reasons for how they have classified animals and plants, using their characteristics and how they are suited to their environment.</p> <p>To explore the work of pioneers in classification. (e.g. Carl Linnaeus)</p> <p>To name and group a variety of living things based on feeding patterns. (producer, consumer, predator, prey, herbivore, carnivore, omnivore)</p>	<p>To group and classify a variety of materials according to the impact of temperature on them.</p> <p>To explain what happens over time to materials such as puddles on the playground or washing hanging on a line.</p> <p>To relate temperature to change of state of materials.</p>	<p>To explain why sound gets fainter or louder according to the distance.</p> <p>To explain how pitch and volume can be changed in a variety of ways.</p> <p>To work out which materials give the best insulation for sound.</p>	<p>To explain how a bulb might get lighter.</p> <p>To recognise if all metals are conductors of electricity.</p> <p>To work out which metals can be used to connect across a gap in a circuit.</p> <p>To explain why cautions are necessary for working safely with electricity.</p>



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	Planning		Obtaining and presenting evidence		Considering evidence and evaluating
<b>Year 5</b>	<p>To plan and carry out a scientific enquiry to answer questions, including recognising and controlling variables where necessary.</p> <p><b>To make a prediction with reasons.</b></p> <p>To use test results to make predictions to set up comparative and fair tests.</p> <p><b>To present a report of their findings through writing, display and presentation.</b></p>		<p><b>To take measurements using a range of scientific equipment with increasing accuracy and precision.</b></p> <p><b>To take repeat readings when appropriate.</b></p> <p><b>To record more complex data and results using scientific diagrams, labels, classification keys, tables, scatter graphs, bar and line graphs.</b></p>		<p><b>To report and present findings from enquiries through written explanations and conclusions.</b></p> <p>To use a graph to answer scientific questions.</p> <p><b>To use scientific evidence that has been used to support or refute ideas or arguments</b></p>
<b>Year 5 (Challenging)</b>	<p>To explore different ways to test an idea, choose the best way and give reasons.</p> <p>To vary one factor whilst keeping the others the same in an experiment.</p> <p>To use information to help make a prediction.</p> <p>To explain, in simple terms, a scientific idea and what evidence supports it.</p>		<p>To decide which units of measurement they need to use.</p> <p>To explain why a measurement needs to be repeated.</p>		<p>To find a pattern from their data and explain what it shows.</p> <p><b>To link what they have found out to other science.</b></p> <p>To suggest how to improve their work and say why they think this.</p>
	Animals including Humans	Living Things and their Habitats	Properties and Changes to Materials	Earth and Space	Forces
<b>Year 5</b>	<p>To describe the changes as humans develop to o age.</p>	<p>To describe the differences in the life cycles of a mammal, an amphibians, an insects and a bird.</p> <p>To describe the life cycles of common plants.</p> <p>To explore the work of well know naturalists and animal behaviourists. (David Attenborough and Jane Goodall)</p>	<p>To compare and group together everyday materials on the basis of their properties, including hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.</p> <p>To explain how some materials dissolve in liquid to form a solution.</p> <p>To describe how to recover a substance from a solution.</p> <p>To use their knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving, evaporating.</p> <p>To give reasons, based on evidence for comparative and fair tests for the particular uses of everyday materials, including metals wood and plastic.</p> <p>To describe changes using scientific words. (evaporation, condensation)</p> <p>To demonstrate that dissolving, mixing and changes of state are reversible changes.</p> <p>To explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.</p> <p>To use the terms 'reversible' and 'irreversible'.</p>	<p>To identify and explain the movement of the Earth and other planets relative to the sun in the solar system.</p> <p>To explain how seasons and the associated weather is created.</p> <p>To describe and explain the movement of the Moon relative to the Earth.</p> <p>To describe the sun, earth and moon as approximately spherical bodies.</p> <p>To use the idea of the earth's rotation to explain day and night and the apparent movement of the sun across the sky.</p>	<p>To explain that unsupported objects fall towards the earth because of the force of gravity acting between the earth and the falling object.</p> <p>To identify the effects of air resistance, water resistance and friction that act between moving surfaces.</p> <p>To recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.</p>
<b>Year 5 (Challenging)</b>	<p>To create a timeline to indicate stages of growth in certain animals, such as frogs and butterflies.</p> <p>To describe the changes experienced in puberty.</p> <p>To draw a timeline to indicate stages in the growth and development of humans.</p>	<p>To observe their local environment and draw conclusions about life-cycles, e.g. plants in the vegetable garden or flower border.</p> <p>To compare the life cycles of plants and animals in their local environment with the life cycles of those around the world, e.g. rainforests.</p>	<p>To describe methods for separating mixtures. (filtration, distillation)</p> <p>To work out which materials are most effective for keeping us warm or for keeping something cold.</p> <p>To use their knowledge of materials to suggest ways to classify. (solids, liquids, gases)</p> <p>To explore changes that are difficult to reverse, e.g. burning, rusting and reactions such as vinegar with bicarbonate of soda.</p> <p>To explore the work of chemists who created new materials, e.g. Spencer Silver (glue on sticky notes) or Ruth Benerito (wrinkle free cotton).</p>	<p>To compare the time of day at different places on the earth.</p> <p>To create shadow clocks.</p> <p>To begin to understand how older civilizations used the sun to create astronomical clocks, e.g. Stonehenge.</p> <p>To explore the work of some scientists. (Ptolemy, Alhazen, Copernicus)</p>	<p>To describe and explain how motion is affected by forces. (including gravitational attractions, magnetic attraction and friction)</p> <p>To design very effective parachutes.</p> <p>To work out how water can cause resistance to floating objects.</p> <p>To explore how scientists, such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.</p>



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<b>Year 6</b>	<p>To explore different ways to test an idea, choose the best way, and give reasons.</p> <p>To vary one factor whilst keeping the others the same in an experiment. To explain why they do this.</p> <p>To plan and carry out an investigation by controlling variables fairly and accurately.</p> <p>To make a prediction with reasons.</p> <p>To use information to help make a prediction.</p> <p>To use test results to make further predictions and set up further comparative tests.</p> <p>To explain, in simple terms, a scientific idea and what evidence supports it.</p> <p>To present a report of their findings through writing, display and presentation.</p>	<p>To explain why they have chosen specific equipment. (incl ICT based equipment)</p> <p>To decide which units of measurement they need to use.</p> <p>To explain why a measurement needs to be repeated.</p> <p>To record their measurements in different ways. (incl bar charts, tables and line graphs)</p> <p>To take measurements using a range of scientific equipment with increasing accuracy and precision.</p>	<p>To find a pattern from their data and explain what it shows.</p> <p>To use a graph to answer scientific questions.</p> <p>To link what they have found out to other science.</p> <p>To suggest how to improve their work and say why they think this.</p> <p>To record more complex data and results using scientific diagrams, classification keys, tables, bar charts, line graphs and models.</p> <p>To report findings from investigations through written explanations and conclusions.</p> <p>To identify scientific evidence that has been used to support to refute ideas or arguments.</p> <p>To report and present 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.</p>		
<b>Year 6 (Challenging)</b>	<p>To choose the best way to answer a question.</p> <p>To use information from different sources to answer a question and plan an investigation.</p> <p>To make a prediction which links with other scientific knowledge.</p> <p>To identify the key factors when planning a fair test.</p> <p>To explain how a scientist has used their scientific understanding plus good ideas to have a breakthrough.</p>	<p>To plan in advance which equipment they will need and use it well.</p> <p>To make precise measurements.</p> <p>To collect information in different ways.</p> <p>To record their measurements and observations systematically.</p> <p>To explain qualitative and quantitative data.</p>	<p>To draw conclusions from their work.</p> <p>To link their conclusions to other scientific knowledge.</p> <p>To explain how they could improve their way of working.</p>		
	Evolution And Inheritance	Living Things and their Habitats	Animals including Humans	Electricity	Light
<b>Year 6</b>	<p>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.</p> <p>To recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.</p> <p>To give reasons why offspring are not identical to each other or to their parents.</p> <p>To explain the process of evolution and describe the evidence for this.</p> <p>To identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.</p>	<p>To 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.</p> <p>To give reasons for classifying plants and animals based on specific characteristics.</p>	<p>To identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.</p> <p>To recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.</p> <p>To describe the ways in which nutrients and water and transported within animals, including humans.</p>	<p>To identify and name the basic parts of a simple electric series circuit. (cells, wires, bulbs, switches, buzzers)</p> <p>To compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers, the on/off position of switches.</p> <p>To use recognised symbols when representing a simple circuit in a diagram.</p>	<p>To recognise that light appears to travel in straight lines.</p> <p>To 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.</p> <p>To explain that we see things because light travels from light sources to our eyes or from light sources to object s and then to our eyes.</p> <p>To use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.</p>
<b>Year 6 (Challenging)</b>	<p>To talk about the work of Charles Darwin, Mary Anning and Alfred Wallace.</p> <p>To explain how some living things adapt to survive in extreme conditions.</p> <p>To analyse the advantages and disadvantages of specific adaptations, such as being on two rather than four feet.</p> <p>To begin to understand what is meant by DNA.</p>	<p>To explain why classification is important.</p> <p>To readily group animals into reptiles, fish, amphibians, birds and mammals.</p> <p>To sub divide their original groupings and explain their divisions.</p> <p>To group animals into vertebrates and invertebrates.</p> <p>To find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification.</p>	<p>To explore the work of medical pioneers, for example, William Harvey and Galen and recognise how much we have learnt about our bodies.</p> <p>To compare the organ systems of humans to other animals.</p> <p>To make a diagram of the human body and explain how different parts work and depend on one another.</p> <p>To name the major organs in the human body.</p> <p>To locate the major human organs.</p> <p>To make a diagram that outlines the main parts of a body.</p>	<p>To make their own traffic light system or something similar.</p> <p>To explain the danger of short circuits.</p> <p>To explain what a fuse is.</p> <p>To explain how to make changes in a circuit.</p> <p>To explain the impact of changes in a circuit.</p> <p>To explain the effect of changing the voltage of a battery.</p>	<p>To explain how different colours of light can be created.</p> <p>To use and explain how simple optical instruments work. (periscope, telescope, binoculars, mirror, magnifying glass, Newton's first reflecting telescope)</p> <p>To explore a range of phenomena, including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters.</p>



## Progression in Science

### National Curriculum Requirements of 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.



## Progression in Science

### 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.



## Progression in Science

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

#### Working scientifically

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

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,



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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**

#### **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**

#### **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;



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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

#### Pupils should be taught to:

- observe changes across the 4 seasons
- 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

#### 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 microhabitats
- 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 'microhabitat' (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.



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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 like: '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 (eg, grass, cow, human). They could describe the conditions in different habitats and microhabitats (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

#### Pupils should be taught to:

- 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 plants grow. Pupils should be introduced to the requirements of plants for germination, growth and survival, as well as 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

#### 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.



## Progression in Science

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.

### Uses of everyday materials

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.



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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

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 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.



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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

##### 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

##### 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.



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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

**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

**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
- 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.



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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

- compare how things move on different surfaces
- notice that some forces need contact between 2 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 2 poles
- predict whether 2 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 recording data to find answers to 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

##### 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, flowering plants and non-flowering plants. Pupils could begin to put vertebrate animals into groups, for example: fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects.



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Note: plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, for example 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**

**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**

**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 ( $^{\circ}\text{C}$ )
- 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



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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

**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
- 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

**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.



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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.

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

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 a 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)



## Progression in Science

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**

##### **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**

##### **Pupils should be taught to:**

- describe the changes as humans develop to old age



## Progression in Science

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.

### Properties and changes of materials

**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.



## Progression in Science

### Earth and space

#### 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 8 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 1 moon; Jupiter has 4 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

#### 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)



## Progression in Science

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 cupcake 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**

##### **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**

##### **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.



## Progression in Science

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

#### 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 2 feet rather than 4, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers.

### Light

#### Pupils should be taught to:

- 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
- 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



## Progression in Science

### 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

#### 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.



## Progression in Science

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