

### Key concepts (Big Ideas) in Science

*Pupils build substantive knowledge of the main **concepts, models, laws and theories** across the three disciplines of science: biology, chemistry and physics. They will also learn about significant scientists and discoveries and the impact of these on our lives. Through each unit, pupils will develop their disciplinary knowledge as they learn how to work scientifically.*



#### Working scientifically\*

This is embedded through all units. Pupils will learn how scientific enquiry is used to grow and develop knowledge in science. They will learn how scientists use a variety of enquiry strategies to answer scientific questions. Different questions lead to different types of enquiry and are not limited to fair testing. Pupils will learn to use these enquiry strategies confidently and know that different strategies may be needed at different times. Through different units of science, pupils will learn the following:

- **Observing over time:** (observing or measuring how one variable changes over time)
- **Identifying and classifying:** (identifying and naming materials/living things and making observations or carrying out tests to organise them into groups.)
- **Looking for patterns:** (making observations or carrying out surveys of variables that cannot be easily controlled and looking for relationships between two sets of data)
- **Comparative and fair testing:** (observing or measuring the effect of changing one variable when controlling others)
- **Answering questions using secondary sources of evidence:** (answering questions using data or information that they have not collected first hand)
- **Using models:** (Developing or evaluating a model or analogy that represents a scientific idea, phenomenon or process)
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#### Biology:

Animals including humans



Plants



Living things and their habitats



Pupils will develop an understanding of **living things and their environments** through the study of animals, humans, plants and habitats. They will learn about reproductions, inheritance and evolution through the study of life processes and life cycles.

**Chemistry:** Materials



States of matter

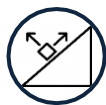


Pupils will learn about states of matter through the study of solids, liquids and gases. They will look at the properties of materials including rocks and fossils and will study reversible and irreversible changes in materials.

**Physics:** Energy



Forces



Earth Sciences



Pupils will develop an understanding of the concepts and laws that apply to physics. They will study the concept of **energy** by learning about light, sound and electricity. They will develop an understanding of **forces** by studying and investigating friction, air resistance, gravity and magnets. They will learn about **Earth and space**, studying seasons, day and night, the solar system and beyond.

Knowledge and skills sequencing			SCIENCE					
		EYFS	Y1	Y2	Y3	Y4	Y5	Y6
WORKING SCIENTIFICALLY	Observing over time	I can make observations and explain what I can see	I can use observations and ideas to suggest answers to questions	I can observe changes over time  I can ask questions about what I notice	I make careful and systematic observations and take accurate measurements using standard units  I can use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions	I can take measurements, using a wider range of scientific equipment, with increasing accuracy and precision and taking repeat reading when appropriate  I can report and present findings from enquiries including conclusions, explanations, data and diagrams including scatter graphs and line graphs.	I use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate  I ask my own questions about the scientific phenomena that I am studying, and select the most appropriate ways to answer these questions including observing changes over different periods of time	
	Using observations and data to draw conclusions							I can record findings using bar charts keys, tables and labelled diagrams

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							I am evaluate my results
	Identifying /classifying	I can sort objects into groups	I can identify and classify according to simple criteria	I can group and classify things	I can gather, record, classify and present information in a variety of different ways to help me answer questions	I can classify materials and identify why they are / are not fit for purpose	I ask my own questions about the scientific phenomena that I am studying, and select the most appropriate ways to answer these questions, recognising and controlling variables and grouping and classifying things
	Looking for patterns		I can perform simple tests, involving observations and the gathering and recording of data	I can use different types of Scientific enquiry to gather and record data, using simple equipment  I notice patterns in my observations or data	I can identify differences, similarities or changes related to simple scientific ideas and processes	I ask my own questions about the scientific phenomena that I am studying, and select the most appropriate ways to answer these questions, recognising and controlling variables and noticing patterns	


	Comparative and fair testing			<p>I can carry out simple comparative tests</p>	<p>I can ask relevant questions and use different types of scientific enquiry to answer them, including comparative and fair tests</p> <p>I can record findings and present data using simple scientific language, explanations, diagrams, pictures, keys, bar charts and tables.</p>	<p>I can plan and carry out scientific enquiry using a range of scientific equipment and variables in order to answer questions</p> <p>I can use test results to make predictions to set up further comparative and fair tests</p>	<p>I ask my own questions about the scientific phenomena that I am studying, and select the most appropriate ways to answer these questions, recognising and controlling variables where necessary and carrying out comparative and fair tests</p> <p>I draw conclusions, explain and evaluate my methods and findings, communicating these in a variety of ways</p>
	Using secondary sources of evidence			<p>I can find things out using secondary sources of information</p>	<p>I can identify scientific evidence that has been used to support or refute ideas or arguments</p>	<p>I describe and evaluate my own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources</p> <p>I ask my own questions about the scientific phenomena that I am studying, and select the most appropriate ways to answer these questions including finding things out using a wide range of secondary sources</p>	




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	Using models				<p>Understand how models can explain progresses that can't be fully observed eg: how light/sound travel, magnetism, the water cycle</p> <p>Understand how models explain how molecules behave when substances change shape.</p>	<p>Understand how models about space and the solar system explain processes that can't be observed.</p>	
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		EYFS	Y1	Y2	Y3	Y4	Y5	Y6
<b>BIOLOGY</b>	Living things and their habitats  	<p>To understand the difference between plants and animals through observation (similarity and difference)</p>		<p>To identify whether things are alive, dead or have never lived</p>	<p>To describe in simple terms how fossils are formed when things that have lived are trapped within rock.</p>	<p>To explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.</p>	<p>To describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.</p>	<p>To group, classify and identify plants, animals and micro-organisms using keys or other methods based on their observable features</p>
		<p>To understand the need to respect and care for the natural environment and all living things (responsibility)</p>		<p>To name different plants and animals and describe how they are suited to different habitats</p>	<p>To recognise that living things can be grouped in a variety of ways</p>	<p>To recognise that environments can change and that this can sometimes pose dangers to living things.</p>	<p>To describe the life process of reproduction in some plants and animals.</p>	<p>To describe how living things have changed over time and evolved using the basic ideas of inheritance, variation and adaptation</p>

									To recognise that living things produce offspring of the same kind but that offspring normally vary and are not identical to their parents.
	Animals including humans 	<p>To talk about lifecycles (continuity and change)</p> <p>To use my senses in hands on explanations (similarity and difference)</p> <p>To name my 5 senses (similarity and difference)</p> <p>To explain what my 5 senses are</p>	<p>To describe and compare the features of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).</p> <p>To identify, name, draw and label the basic parts of the human body.</p> <p>To say which part of the body</p>	<p>To describe the basic needs of animals for survival and the main changes as young animals (including humans) grow into adults</p> <p>To notice that animals, including humans, have offspring that grow into adults.</p>	<p>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.</p> <p>To identify that humans and some other animals have skeletons and muscles for</p>	<p>To describe the simple functions of the basic parts of the digestive system in humans.</p> <p>To identify the different types of teeth in humans and their simple functions.</p> <p>To construct and interpret a variety of food chains, identifying producers,</p>	<p>To describe the changes as humans develop to old age.</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 describe the effects of diet, exercise, drugs and lifestyle on how the body functions</p>	





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		(similarity and difference)	is associated with each sense.  To group animals according to what they eat	To describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.	support, protection and movement.	predators and prey.		
	Plants 	To plant seeds and care for growing plant with support (responsibility)  To say what a plant needs to survive (cause and consequence)  To talk about lifecycles (continuity and change)	To name, identify and describe the basic structure of a variety of common flowering plants including trees.	To describe the basic needs of plants for survival and the impact of changing these  To observe and describe the main changes as seeds and bulbs grow into mature plants.	To identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers  To 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		To name, locate and describe the functions of the main parts of plants, including those involved in reproduction	

					<p>To understand 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>			
		EYFS	Y1	Y2	Y3	Y4	Y5	Y6
<b>CHEMISTRY</b>	<p>Materials</p> 	<p>To explore collections of materials and talk about similarities and differences</p> <p>To talk about the differences between</p>	<p>To name, compare and group a variety of everyday materials and describe their simple, physical properties.</p>	<p>To identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and</p>	<p>To compare and group together different kinds of rocks and soil on the basis of their appearance and simple physical properties.</p>		<p>To compare and group together everyday materials on the basis of their properties</p> <p>To give reasons, based on</p>	

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		materials and talk about the changes I see (cause and consequence)	To distinguish between an object and the materials from which it is made	cardboard for particular uses.			evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.	
	States of matter  						<p>To describe the characteristics of different states of matter and group materials on this basis</p> <p>To describe how materials change state at different temperatures</p> <p>To observe that some materials change state when they are heated or cooled and measure or research the temperature at</p>	<p>To know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.</p> <p>To use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.</p>


						<p>which this happens in degrees Celsius.</p> <p>To identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.</p>	<p>To identify, with reasons, whether changes in materials are reversible or not</p> <p>To explain that some changes of state result in the formation of new material and that this kind of change is not usually reversible.</p>	
<b>PHYSICS</b>	<p>Forces</p> 	<p>To explore how things work e.g. toys</p> <p>To explore pushes and pulls</p> <p>To talk about forces and concepts such as</p>			<p>To notice contact and non-contact forces and observe similarities and differences.</p> <p>To describe how magnetic forces act at a distance</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>	



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		floating and sinking, magnetism and light.			<p>To describe magnets as having two poles.</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 predict and explain whether two magnets will attract or repel each other, depending on which poles are facing.</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>	
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		EYFS	Y1	Y2	Y3	Y4	Y5	Y6
	<p>Energy</p> <ul style="list-style-type: none"> <li>• Light</li> <li>• Sound</li> <li>• Electricity</li> </ul> 				<p><b>Light</b></p> <p>To recognise and understand the properties of light.</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 changes.</p>	<p><b>Sound</b></p> <p>To identify how sounds are made, associating some of them with something vibrating.</p> <p>To recognise that vibrations from sounds travel through a medium to the ear.</p> <p>To recognise that sounds get fainter as the distance from the sound source increases</p> <p>To describe the relationship between the pitch of a sound</p>		<p><b>Light</b></p> <p>To use the idea that light travels in straight lines and enters our eyes to explain how we see things</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> <p>To explain that we see things because light travels from light sources to our eyes or from light sources to objects</p>



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						<p>and the features of its source</p> <p>To describe the relationship between the volume of a sound, the strength of the vibrations and the distance from its source</p> <p><b>Electricity</b></p> <p>To construct and name the basic parts of a simple series circuit, including cells, wires, bulbs, switches and buzzers.</p> <p>To identify whether or not a lamp will light in a</p>	<p>and then to our eyes</p> <p><b>Electricity</b></p> <p>To use simple apparatus to construct &amp; control a series circuit, and describe how the circuit may be affected when</p>
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						<p>simple series circuit</p> <p>To recognise that a switch opens and closes a circuit</p> <p>To recognise and explain why materials are good conductors and insulators.</p>		<p>changes are made to it</p> <p>To use recognised symbols when representing a simple circuit in a diagram.</p>
	<p>Earth science</p> 	<p>To name and identify some different types of weather</p>	<p>To explain how the weather changes throughout the year and name the seasons (link to geography)</p> <p>To use a globe to identify the equator and north and south</p>				<p>To describe the movement of the Earth, and other planets, relative to the Sun in the solar system.</p> <p>To describe the movement of the Moon relative to the Earth.</p>	<p>To describe and explain the key physical features of different climate zones and biomes (link to geography)</p>



			poles (Link to geography)				To use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.	
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### Second Order Concepts

Second order concepts are fundamental knowledge and skills which are transferable across a range of curriculum subjects. For example, we introduce pupils to the concept of 'similarity and difference' early in their education, developing the observational skills and language needed to make comparisons. This is developed and applied as pupils move through the school so they can confidently apply this in all areas of the curriculum by upper Key Stage Two.

A summary of the second order concepts and how they apply to different subjects are provided in the table below.

Curriculum subject	Significance	Similarity and difference	Cause and consequence	Continuity and change	Responsibility	Communication (Oracy & Written)	Enquiry
<b>Science</b>	Significant scientists, discoveries, laws, models and theories	Making comparisons, finding patterns, noting differences, drawing conclusions	Models and laws, reactions between materials, observing processes	Observing what changes and what stays the same	Working safely, climate change and sustainability, how science solves problems	Using scientific terms, evaluating, drawing conclusions, explaining patterns and processes, presenting and interpreting data	Working scientifically, observing, classifying, patterns, fair testing, using evidence