

Science Long Term Plan 2022-2023

We follow the CUSP learning modules at Lanercost Church of England Primary School. As a mixed-class school, we teach to a two-year rolling curriculum, allowing each learning area to be taught for depth rather than breadth. The learning is based on becoming more expert as they progress through the curriculum, accumulating, connecting and making sense of the rich substantive and disciplinary knowledge.

1. **Substantive knowledge** is the subject knowledge and explicit vocabulary used to learn about the content. Common misconceptions are explicitly revealed as non-examples and positioned against known and accurate content. In our science curriculum, an extensive and connected knowledge base is constructed so that pupils can use these foundations and integrate it with what they already know. Misconceptions are challenged carefully and in the context of substantive and disciplinary knowledge.
2. **Disciplinary knowledge** is knowing how to collect, use, interpret, understand and evaluate the evidence from scientific processes. This is taught. It is not assumed that pupils will acquire these skills by luck or hope. Pupils construct understanding by applying substantive knowledge to questioning and planning, observing, performing a range of tests, accurately measuring, comparing through identifying and classifying, using observations and gathering data to help answer questions, explaining and reporting, predicting, concluding, improving, and seeking patterns. We call it '**Working Scientifically.**'

Scientific analysis is developed through IPROF criteria. We call it '**Thinking Scientifically.**'

- identifying and classifying
- pattern seeking
- research
- observing over time
- fair and comparative testing

We use simple images for the children to be able to identify the 'Thinking scientifically' skills across the learning.



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.

These are mapped throughout the science curriculum against each knowledge note.

3. **Substantive concepts** include concrete examples, such as 'plant' or more abstract ideas, such as 'biodiversity'. Concepts are taught through explicit vocabulary instruction and through the study's direct content and context.

Early Years Learning

Science in the Early Years

The table below demonstrates which Early Years objectives within Development Matters 2021 are prerequisite skills for Science within the National Curriculum. It outlines the most relevant outcomes from 3- and 4-year olds and Reception, taken from the Understanding of the World area of learning.

The EYFS Statutory Educational Programme states: Understanding the world involves guiding children to make sense of their physical world and their community. The frequency and range of children’s personal experiences increases their knowledge and sense of the world around them – from visiting parks, libraries and museums to meeting important members of society such as police officers, nurses and fire-fighters. In addition, listening to a broad selection of stories, non-fiction, rhymes and poems will foster their understanding of our culturally, socially, technologically and ecologically diverse world. As well as building important knowledge, this extends their familiarity with words that support understanding across domains. Enriching and widening children’s vocabulary will support later reading comprehension.

3 and 4 Year olds		Reception	
Use all their senses in hands-on exploration of natural materials.	Provide interesting natural environments for children to explore freely outdoors. Make collections of natural materials to investigate and talk about. Provide equipment to support these investigations. Encourage children to talk about what they see. Model observational and investigational skills. Ask out loud: “I wonder if...?” Plan and introduce new vocabulary, encouraging children to use it to discuss their findings and ideas	Explore the natural world around them.	Provide children with frequent opportunities for outdoor play and exploration. Encourage interactions with the outdoors to foster curiosity and give children freedom to touch, smell and hear the natural world around them during hands-on experiences. Create opportunities to discuss how we care for the natural world around us. Offer opportunities to sing songs and join in with rhymes and poems about the natural world.
Explore collections of materials with similar and/or different properties			After close observation, draw pictures of the natural world, including animals and plants. Observe and interact with natural processes, such as ice melting, a sound causing a vibration, light travelling through transparent
Talk about what they see, using a wide vocabulary.			

			material, an object casting a shadow, a magnet attracting an object and a boat floating on water.
Plant seeds and care for growing plants.	Show and explain the concepts of growth, change and decay with natural materials.	Describe what they see, hear and feel whilst outside.	Encourage focused observation of the natural world. Listen to children describing and commenting on things they have seen whilst outside, including plants and animals. Encourage positive interaction with the outside world, offering children a chance to take supported risks, appropriate to themselves and the environment within which they are in. Name and describe some plants and animals children are likely to see, encouraging children to recognise familiar plants and animals whilst outside.
Understand the key features of the life cycle of a plant and an animal	For example: plant seeds and bulbs so children observe growth and decay over time; observe an apple core going brown and mouldy over time; help children to care for animals and take part in first-hand scientific explorations of animal life cycles, such as caterpillars or chick eggs. Plan and introduce new vocabulary related to the exploration. Encourage children to use it in their discussions, as they care for living things. Encourage children to refer to books, wall displays and online resources. This will support their investigations and extend their knowledge and ways of thinking		
Begin to understand the need to respect and care for the natural environment and all living things.			
Explore and talk about different forces they can feel.	Draw children's attention to forces. Children could explore how the water pushes up when they try to push a plastic boat under it; how they can stretch elastic, snap a twig, but cannot bend a metal rod or magnetic attraction and repulsion. Plan and introduce new vocabulary related to the exploration and encourage children to use it.		

<p>Talk about the differences between materials and changes they notice</p>	<p>Provide children with opportunities to change materials from one state to another. E.g. Cooking – combining different ingredients, and then cooling or heating (cooking) them Melting – leave ice cubes out in the sun, see what happens when you shake salt onto them (children should not touch to avoid danger of frostbite) Explore how different materials sink and float. Explore how you can shine light through some materials, but not others. Investigate shadows. Plan and introduce new vocabulary related to the exploration and encourage children to use it</p>		
		<p>Understand the effect of changing seasons on the natural world around them</p>	<p>Guide children’s understanding by draw children’s attention to the weather and seasonal features. Provide opportunities for children to note and record the weather. Select texts to share with the children about the changing seasons. Throughout the year, take children outside to observe the natural world and encourage children to observe how animals behave differently as the seasons change. Look for children incorporating their understanding of the seasons and weather in their play.</p>

By the end of the Early Years Foundation Stage children will be assessed against the Early Learning Goal, **Understanding the World ELG: The Natural World**

Children at the expected level of development will:

- * Explore the natural world around them, making observations and drawing pictures of animals and plants.
- * Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class
- * Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.



Considerations when Planning Science

As our classes are mixed-age, when teachers are crafting their lessons, they consider four aspects:

1. Sequence

- When sequencing a learning unit, the teacher considers the whole unit from start to finish. Using the question, 'Who have I got in front of me?' They know their class best; therefore, they use all the units of work available for that area of science to differentiate accordingly.

2. Dual Knowledge Notes

- Sometimes, it will be necessary to use dual knowledge notes on the same unit. The youngest class may need a similar but different knowledge note to help them secure the learning in that unit.

3. Strong Start Lessons and Reference Lessons

- Strong start and reference lessons ensure that the essential knowledge is taught. Replacing a lesson or starting a unit with one of these may be essential. Teachers use these discerningly but with intelligence. The base question of this is, 'What do my class need?'

4. Activate Prior Learning

- The long-term plan allows for knowledge to be cumulative. Therefore, activating prior learning is valuable to build the schemas of knowledge for each unit and link these throughout understanding the world scientifically. Through a short 'Activation Four' recap set of questions at the beginning of each lesson and rooting planning within previous learning, teaching build on active prior learning where this is available.

Science Objectives (Two-Year Rolling Programme) - Year A

	Autumn One	Autumn Two	Spring One	Spring Two	Summer One	Summer Two
Class One - Early Years Learning	<p>The Natural World</p> <ul style="list-style-type: none"> Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their own experience and what has been read in class. Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter. 					
Class Two	Properties of Materials	Forces and Movement	Animals, including Humans (including keeping fit and healthy)	Plants	Plants	Animals including Humans
Class Three	Forces and Magnets	Electricity	Properties of Materials	Plants	Plants (Extension of previous unit with enrichment tasks)	Animals, including Humans (including keeping fit and healthy)
Class Four	Earth and Space	Animals including Humans	Properties of Materials	Forces and Movement	Plants and Living Things and their Habitats	Electricity

. Teachers take into consideration the prior learning within the mixed-age cycle and may use dual knowledge notes to adapt the links appropriately.

Science Objectives (Two-Year Rolling Programme) - Year B

	Autumn One	Autumn Two	Spring One	Spring Two	Summer One	Summer Two
Class One - Early Years Learning	<p>The Natural World</p> <ul style="list-style-type: none"> Explore the natural world around them, observing and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their own experience and what has been read in class. Understand some essential processes and changes in the natural world around them, including the seasons and changing states of matter. 					
Class Two	Animals including Humans	Ourselves and other animals <i>(Extension of previous unit with enrichment tasks)</i>	Materials Changing	Properties of Materials (with reference to Light and Sound)	Plants and Living Things and their Habitats	Plants and Living Things and their Habitats
Class Three	Materials Changing (Rocks)	Plants and Living Things and their Habitats	Plants and Living Things and their Habitats	Light	Animals, including Humans (including keeping fit and healthy) - Digestion and teeth	Sound
Class Four	Animals, including Humans (including keeping fit and healthy)	Light	Materials Changing	Animals, including Humans (including keeping fit and healthy) - water transportation	Evolution and Inheritance	Plants and Living Things and their Habitats

	Key stage 1	Lower Key stage 2	Upper Key stage 2
Plants and Living Things and their Habitats	<ul style="list-style-type: none"> 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 find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. observe and describe how seeds and bulbs grow into mature plants observe changes across the four seasons 	<ul style="list-style-type: none"> 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 role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. 	<ul style="list-style-type: none"> recognise that living things (plants) produce offspring of the same kind but normally offspring vary and are not identical to their parents describe the life process of reproduction in some plants
Animals, including Humans (including keeping fit and healthy)	<ul style="list-style-type: none"> explore and compare the differences between things that are living, dead, and things that have never been alive 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. 	<ul style="list-style-type: none"> 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 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. 	<ul style="list-style-type: none"> identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood (including the pulse and clotting). 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

Chemistry Cycle A

	Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Properties of Materials	<ul style="list-style-type: none"> ▪ distinguish between an object and the material from which it is made ▪ compare and group together a variety of everyday materials on the basis of their simple physical properties ▪ describe the simple physical properties of a variety of everyday materials ▪ identify and compare the uses of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses ▪ identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock 	<ul style="list-style-type: none"> ▪ compare and group together different kinds of rocks on the basis of their simple physical properties ▪ recognise that soils are made from rocks and organic matter ▪ compare and group materials together, according to whether they are solids, liquids or gases 	<ul style="list-style-type: none"> ▪ compare and group together everyday materials based on evidence from comparative and fair tests, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets ▪ give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic ▪ use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating

Physics Cycle A

	Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Electricity	<p><i>(No electricity in KS1; however, children could explore battery powered toys and carry out a variety of enquires related to these).</i></p>	<ul style="list-style-type: none"> identify common appliances that run on electricity construct a simple series electrical circuit identifying and naming the basic parts of a simple electrical circuit, 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 	<ul style="list-style-type: none"> 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
Forces and Movement	<ul style="list-style-type: none"> describe the simple physical properties of a variety of everyday materials <i>(attracted to a magnet or not)</i> compare and group together a variety of everyday materials on the basis of their simple physical properties <i>(attracted to a magnet or not)</i> <p><i>(explore toys that use magnets)</i></p>	<ul style="list-style-type: none"> compare how things move on different surfaces notice that some forces need contact between two objects but magnetic forces act at a distance observe how magnets attract or repel each other and attract some materials and not others compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials describe magnets as having two poles predict whether two magnets will attract or repel each other, depending on which poles are facing. 	<ul style="list-style-type: none"> explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object identify the effect 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

Biology Cycle B

	Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Animals, including Humans (including keeping fit and healthy)	<ul style="list-style-type: none"> identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. describe and compare the structure of a variety of common animals, fish, amphibians, reptiles, birds and mammals including pets) notice that animals, including humans, have offspring which grow into adults 	<ul style="list-style-type: none"> identify that humans and some animals have skeletons and muscles for support, protection and movement 	<ul style="list-style-type: none"> recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents describe the life process of reproduction in some animals describe the changes as humans develop to old age
Living Things and their Habitats	<ul style="list-style-type: none"> 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 identify and name a variety of plants and animals in their habitats, including micro-habitats 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 observe changes across the four seasons (<i>observe which animals are present in local habitats throughout the year</i>). 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 	<ul style="list-style-type: none"> 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 constantly changing and that this can sometimes pose dangers to specific habitats construct and interpret a variety of food chains, identifying producers, predators and prey 	<ul style="list-style-type: none"> 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 describe the difference in the life cycles of a mammal, an amphibian an insect and a bird identify how animals and plants are adapted to suit their environment in different ways and adaption leads to evolution

Chemistry Cycle B

	Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Materials Changing	<ul style="list-style-type: none"> find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching describe the simple physical properties of a variety of everyday materials (<i>Flexibility</i>) compare and group together a variety of everyday materials on the basis of their simple physical properties (<i>Flexibility</i>) 	<ul style="list-style-type: none"> observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) describe in simple terms how fossils are formed when things that have lived are trapped within rock identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature 	<ul style="list-style-type: none"> demonstrate that dissolving, mixing and changes of state are reversible changes. Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution 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.

Physics Cycle B

	Key Stage 1	Lower Key Stage 2	Upper key Stage 2
Light	<p><i>(explore looking for things in a dark "cave/area" erected from dark material in the classroom)</i></p> <ul style="list-style-type: none"> describe the simple physical properties of a variety of everyday materials (<i>opaque, translucent, transparent materials</i>) compare and group together a variety of everyday materials on the basis of their simple physical properties (<i>opaque, translucent, transparent material</i>) <p><i>(explore shadow play and possibly make shadow puppets)</i></p> <p><i>(observe and name a variety of sources of light, including electric lights, flames and the Sun)</i></p> <ul style="list-style-type: none"> observe and describe weather associated with the seasons and how day length varies. 	<ul style="list-style-type: none"> 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 shadows are formed when a light source is blocked by a solid object find patterns in the way that the size of shadows change recognise that light from the Sun can be dangerous and that there are ways to protect our eyes 	<ul style="list-style-type: none"> 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 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 sun's apparent movement across the sky.

<p>Sound</p>	<p><i>(explore different ways of making and altering sounds ... experiment making sounds of differing volume and pitch)</i> <i>(observe and name a variety of sources of sound, noticing that we hear with our ears)</i></p>	<ul style="list-style-type: none">▪ identify how sounds are made, associating some of them with something vibrating▪ recognise that vibrations from sound travel through a medium to the ear▪ recognise that sounds get fainter as the distance from the sound source increases▪ 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.	
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