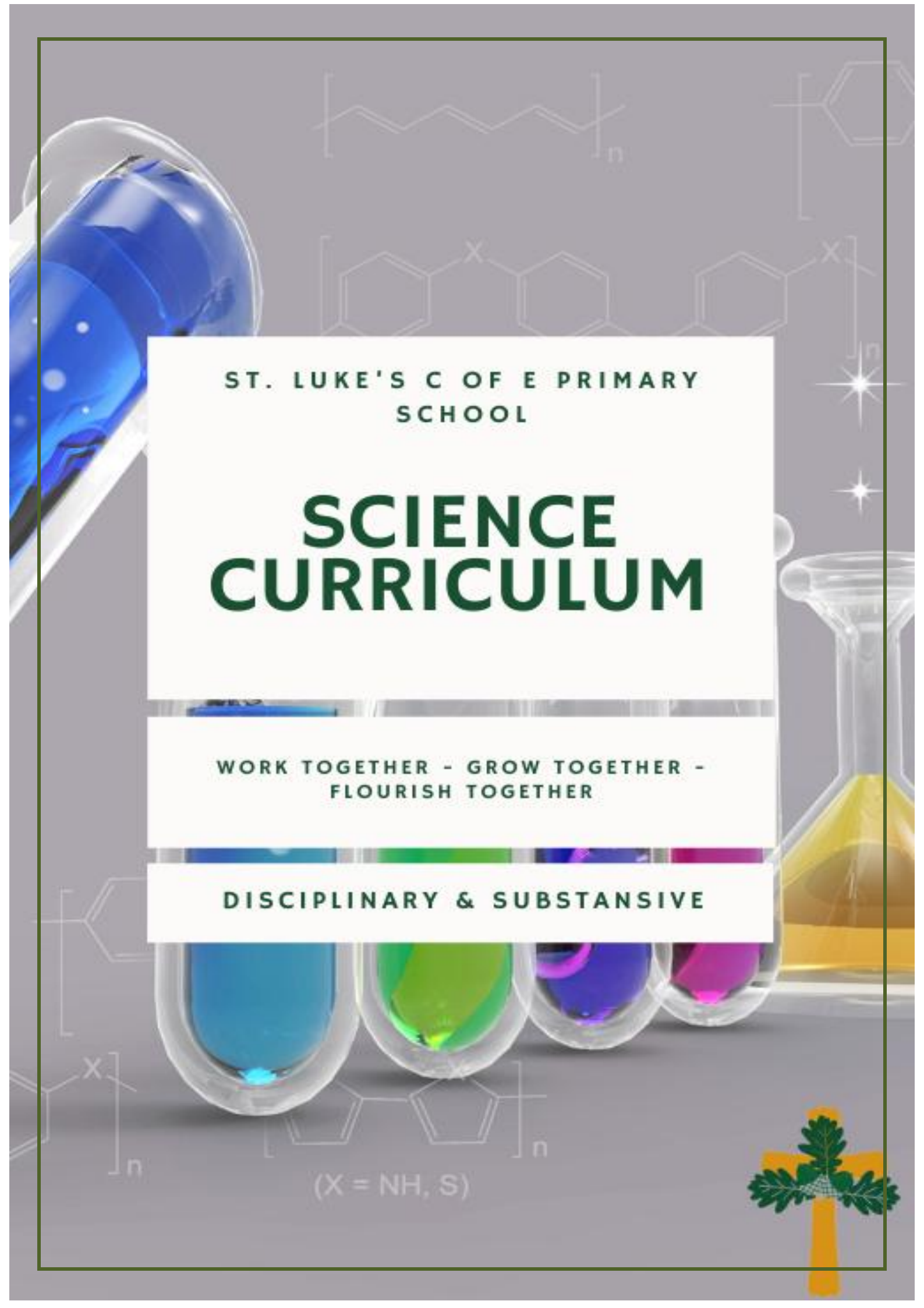
ST. LUKE'S C OF E PRIMARY SCHOOL

SCIENCE CURRICULUM

WORK TOGETHER - GROW TOGETHER - FLOURISH TOGETHER

DISCIPLINARY & SUBSTANSIVE



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SCIENCE: WHOLE SCHOOL JOURNEY

"The science of today is the technology of tomorrow"

- Edward Teller

LIFE SKILLS EDUCATION
Drug, Alcohol and Resilience Training

Year 6

D.A.R.T (Diet, drugs & exercise)

Light & seeing/ The heart & circulatory system

Changing Circuits/ Classifying Living Things

Year 5

Forces in Action/ Evolution & inheritance (Inc. plants)

Investigating materials and their properties/Space

Life cycles Inc. plants /Healthy Bodies

Year 4

Sound/What do scientists do?

Teeth & the digestive system / States of matter (Inc. the water cycle)

Electricity/ Classifying Living things & their habitats

Year 3

Fossils, rocks and Soils/Animals Inc. Humans

Reduce, Reuse, Recycle/Flowering

Forces and magnets/Light and Shadows

Year 2

Scientists & Inventors/ Growing Plants

Identifying animals/ Living Things & their habitats

Animals Inc. Humans/ Investigating Materials

Year 1

Seasonal change/ Animals Inc. Humans

Super Scientists/ Everyday Materials

Biodiversity/ Identifying plants

Year R

Space/ Animals and plants

Floating & Sinking/ Weather, Seasons & plants

Materials/Light and dark

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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.

Intent

What are we trying to achieve for our children in Science?

- We want our children to be inquisitive and passionate about science.
- We want our children to be investigative scientists.
- We want our children to revisit and build on their scientific knowledge, as well as have a better conceptual understanding of science's application in the real world (especially with regards to global issues).
- Knowledge will be linked, both within science and cross-curricularly to strengthen and deepen children's understanding of the sciences.
- Procedural fluency and semantic knowledge will be at the heart of our curriculum supported by a variety of appropriate experiences.
- We aim to embed reading into our delivery of science.
- We strive to ensure children receive high quality science lessons by monitoring and supporting teachers with their own subject knowledge.
- We want children to use reasoning and critical thinking vocabulary as well as questioning, clarifying and justifying ideas to develop their communication skills.

Implementation

How is the curriculum delivered?

- Science is taught for 2 hours per week in all year groups.
- Teaching input is reflective of stage of development.
- Content is grouped to help build knowledge links between similar points.
- Content is revisited and recapped using a spacing model and retrieval to embed knowledge.

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- Disciplinary [the methods that establish substantive facts] and substantive [established facts] knowledge is planned for. Progression in substantive knowledge is mapped out to specific classes of the school and disciplinary knowledge is layered to make clear expected progression by year group. Teacher's planning reflects this.
- Procedural fluency in Working Scientifically (achieved through repetition and practice) will be underpinned by semantic knowledge through appropriate tasks and experiences. Lessons provide appropriate links to threshold concepts within science, 'real life', prior knowledge and possible applications to STEM subjects.
- The local library service is used to ensure reading is embedded into science topics.

Impact

What difference is the curriculum making?

- Subject content is transferred to Long Term Memory through recall and retrieval strategies. Memory = Knowledge.
- Clarity of endpoints of each milestone.
- Knowledge is 'joined-up' making strong, semantically rich schemas for learners.
- Greater knowledge will allow for better thinking across all areas of the curriculum.
- Leaners have a foundation of knowledge ready for their next steps in education.

St. Luke's Values

Through their study of Science, the St. Luke's Values [FLOURISH] are realised.

Possessing Friendship: Working effectively with others towards a common goal, using individual strengths to achieve optimal outcomes, a key aspect of both scientific teams and close friendships.

Possessing Love: Demonstrating respect for others' ideas and viewpoints. Demonstrating respect for the equipment and materials they use in lessons and especially for the living things, they will encounter throughout their study.

Having Originality: Asking questions and problem solving; sometimes thinking outside the box to solve a problem.

Being Understanding: Showing concern for the environment and communities affected by emergency. Recognising how we care for each other by using scientific advancement to benefit all e.g. sharing vaccines with developing countries.

Possessing Resilience: Being resilient in adapting an approach to investigations to ensure a successful outcome, particularly in practical situations.

Possessing Integrity: Following rules and conventions when conducting investigations and presenting findings accurately.

Possessing Selflessness: Working as part of a group or team by sharing scientific knowledge to achieve a successful outcome.

Possessing Hard Work: Science promotes diligence through methodical investigation, accurate observations and careful recording of results.

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Progression in Disciplinary Concepts By Year Group	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Comparative and fair testing	• Know that we can investigate different areas of science practically. • Know that objects, materials and living things can be explored scientifically. • Know that simple predictions can be made.	• Know that predictions can be made. • Know that simple tests can be carried out with support.	• Know that explanations can be made based on what has happened during an investigation. • Know that simple tests can be carried out independently.	• Know that an investigation includes simple, practical enquiries. • Know that measurements can be taken using a range of equipment. • Know that comparative tests can be carried out.	• Know that an experiment has variables • Know that experiments have to be fair	• Know that some variables need to be controlled. • Know that results can lead to further prediction and the design of further comparative tests. • Know that methods can be improved.	• Know that there are explanations behind needing to control variables. • Know that there are reasons for improving methods. • Know that the correct units must be used when measuring accurately and precisely.
Identifying and classifying	• Know that living and non-living things can be classified.	• Know that living and non-living things can be classified and compared.	• Know that living and non-living things can be classified and compared through methods of sorting and grouping.	• Know that identified criteria will determine how living and non-living things are classified. • Know that keys can be used when grouping, sorting and classifying.	• Know that scientific ideas and processes determine how living and non-living things are classified and sorted using branching keys.	• Know that dichotomous classification models can be used to sort living and non-living things.	• Know that own classification methods [branching & dichotomous] can be chosen and developed in order to sort living and non-living things.
Gathering and recording	• Know that patterns exist within scientific phenomena.	• Know that patterns can be identified within scientific phenomena.	• Know that relationships can be identified within scientific phenomena.	• Know that patterns can be naturally occurring. • Know that conclusions can be formed based on findings.	• Know that patterns can be identified in results. • Know that patterns can be identified	• Know that causal relationships can be identified. • Know that data can be interpreted to find patterns.	• Know that patterns can be found in the natural environment. • Know that evidence can support / refute

				• Know that a range of bar charts, tables and pictograms are used to show measurements.	through data collection.	• Know that data can be gathered, recorded, classified and presented in a variety of ways which include scientific diagrams, labels, keys, graphs and tables. • Know that repeated and precise recordings must be taken.	causal relationships

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Progression in Substantive Knowledge By Mile Stone		Milestone 1 Years 1 & 2	Milestone 2 Years 3 & 4	Milestone 3 Years 5 & 6
Biology	**Understand plants** This concept involves becoming familiar with different types of plants, their structure and reproduction.	• Know and name a variety of common plants, including garden plants, wild plants and trees and those classified as deciduous and evergreen. • Know and describe the basic structure of a variety of common flowering plants, including roots, stem/trunk, leaves and flowers. • Know, observe and describe how seeds and bulbs grow into mature plants. • Know and describe how plants need water, light and a suitable temperature to grow and stay healthy.	• Know and describe the functions of different parts of flowering plants: roots, stem, leaves and flowers. • Know and 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. • Know and investigate the way in which water is transported within plants. • Know and explore the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.	*• Know and relate knowledge of plants to studies of evolution and inheritance.* *• Know and relate knowledge of plants to studies of all living things.*
	Understand animals and humans This concept involves becoming familiar with different types of animals, humans and the life processes they share.	• Know and identify and name a variety of common animals that are birds, fish, amphibians, reptiles, mammals and invertebrates. • Know and identify and name a variety of common animals that are carnivores, herbivores and omnivores. • Know, describe and compare the structure of a variety of common animals (birds, fish, amphibians, reptiles, mammals and invertebrates, including pets). • Know and identify name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. • Know that animals, including humans, have offspring which grow into adults. • Know, investigate and describe the basic needs of animals, including humans, for survival (water, food and air).	• Know and identify that animals, including humans, need the right types and amounts of nutrition, that they cannot make their own food and they get nutrition from what they eat. • Know, construct and interpret a variety of food chains, identifying producers, predators and prey. • Know and identify that humans and some animals have skeletons and muscles for support, protection and movement. • Know and describe the simple functions of the basic parts of the digestive system in humans. • Know and identify the different types of teeth in humans and their simple functions.	• Know and describe the changes as humans develop to old age. • Know, identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. • Know the importance of diet, exercise, drugs and lifestyle on the way the human body functions. • Know and describe the ways in which nutrients and water are transported within animals, including humans.

		• Know and describe the importance for humans of exercise, eating the right amounts of different types of food and hygiene.		
	Investigate living things This concept involves becoming familiar with a wider range of living things, including insects and understanding life processes.	• Know and compare the differences between things that are living, that are dead and that have never been alive. • Know 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. • Know and name a variety of plants and animals in their habitats, including microhabitats. • Know and 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.	• Know that living things can be grouped in a variety of ways. • Know, explore and use classification keys. • Know that environments can change and that this can sometimes pose dangers to specific habitats.	• Know and describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. • Know and describe the life process of reproduction in some plants and animals. • Know and describe how living things are classified into broad groups according to common observable characteristics. • Know reasons for classifying plants and animals based on specific characteristics.
	Understand evolution and inheritance This concept involves understanding that organisms come into existence, adapt, change and evolve and become extinct.	*• Know how humans resemble their parents in many features.*	*• Know how plants and animals, including humans, resemble their parents in many features.* *• Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.* *• Know how animals and plants are suited to and adapt to their environment in different ways.*	• Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. • Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. • Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

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Chemistry	**Investigate materials** This concept involves becoming familiar with a range of materials, their properties, and uses and how they may be altered or changed.	• Know and distinguish between an object and the material from which it is made. • Know and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock. • Know and describe the simple physical properties of a variety of everyday materials. • Know, compare and group together a variety of everyday materials based on their simple physical properties. • Know how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. • Know and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick/rock, and paper/cardboard for particular uses.	**Rocks and Soils** • Know, compare and group together different kinds of rocks based on their simple, physical properties. • Know and relate the simple physical properties of some rocks to their formation (igneous or sedimentary). • Know and describe in simple terms how fossils are formed when things that have lived are trapped within sedimentary rock. • Know that soils are made from rocks and organic matter. **States of Matter** • Know and compare and group materials together, according to whether they are solids, liquids or gases. • Know and observe that some materials change state when they are heated or cooled, and measure the temperature at which this happens in degrees Celsius (°C), building on their teaching in mathematics. • Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	• Know, compare and group together everyday materials based on evidence from comparative and fair tests, including their hardness, solubility, conductivity (electrical and thermal), and response to magnets. • Know how some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution. • Know and use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. • Know and reason, based on evidence from comparative and fair tests, the particular uses of everyday materials, including metals, wood and plastic. • Know and demonstrate that dissolving, mixing and changes of state are reversible changes. • Know and 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, oxidisation and the action of acid on bicarbonate of soda.

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Physics	**Understand movement, forces and magnets** This concept involves understanding what causes motion.	• *Know and describe how things move, using simple comparisons such as faster and slower.* • *Know and compare how different things move.*	• Know and compare how things move on different surfaces. • Know that some forces need contact between two objects, but magnetic forces can act at a distance. • Know and observe how magnets attract or repel each other and attract some materials and not others. • Know, 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. • Know and describe magnets as having two poles. • Know and predict whether two magnets will attract or repel each other, depending on which poles are facing.	**Magnets** • Know and describe magnets as having two poles. • Know and predict whether two magnets will attract or repel each other, depending on which poles are facing. **Forces** • Know and explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. • Know and identify the effect of drag forces, such as air resistance, water resistance and friction that act between moving surfaces. • *Know and describe, in terms of drag forces, why moving objects that are not driven tend to slow down.* • *Know that force and motion can be transferred through mechanical devices such as gears, pulleys, levers and springs.* • Know that some mechanisms including levers, pulleys and gears, allow a smaller force to have a greater effect.
	Understand light and seeing This concept involves understanding how light and reflection affect sight.	• Know, observe and name a variety of sources of light, including electric lights, flames and the Sun, explaining that we see things because light travels from them to our eyes.	• Know that they need light in order to see things and that dark is the absence of light. • Know that light is reflected from surfaces. • Know that light from the sun can be dangerous and that there are ways to protect their eyes. • Know that shadows are formed when the light from a light source is blocked by a solid object. • Know and find patterns in the way that the size of shadows change.	• Know that light appears to travel in straight lines. • Know that light travels in straight lines and explain that objects are seen because they give out or reflect light into the eyes. • Know that light travels in straight lines and explain why shadows have the same shape as the objects that cast them, and to predict the size of shadows when the position of the light source changes. • Know and 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.

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	Investigate sound and hearing This concept involves understanding how sound is produced, how it travels and how it is heard.	• Know, observe and name a variety of sources of sound, noticing that we hear with our ears.	• Know how sounds are made, associating some of them with something vibrating. • Know that vibrations from sounds travel through a medium to the ear.	• Know and find patterns between the pitch of a sound and features of the object that produced it. • Know and find patterns between the volume of a sound and the strength of the vibrations that produced it. • Know that sounds get fainter as the distance from the sound source increases.
	Understand electrical circuits This concept involves understanding circuits and their role in electrical applications.	*• Know common appliances that run on electricity.* *• Know and construct a simple series electrical circuit.*	• Know common appliances that run on electricity. • Know and construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. • Know 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. • Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • Know some common conductors and insulators, and associate metals with being good conductors.	• Know and associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. • Know, compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. • Know and recognise symbols when representing a simple circuit in a diagram.
	Understand the Earth's movement in space This concept involves understanding what causes seasonal changes, day and night.	*• Know and observe the apparent movement of the Sun during the day.* • Know and observe changes across the four seasons. • Know, observe and describe weather associated with the seasons and how day length varies.	*• Know and describe the movement of the Earth relative to the Sun in the solar system.* *• Know and escribe the movement of the Moon relative to the Earth.*	• Know and describe the movement of the Earth, and other planets, relative to the Sun in the solar system. • Know and describe the movement of the Moon relative to the Earth. • Know and describe the Sun, Earth and Moon as approximately spherical bodies. • Know and understand the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Items in italics are not statutory in the national curriculum

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	Nursery	R1 September to January	R2 February to July
Progression milestones	• Is interested to explore familiar and new experiences in nature, e.g. looking at plants, animals, puddles, mud. • Talks about what they see. • Describes, in simple terms, life cycles of plants and animals. • Explores and talks about forces. • Can identify differences between some materials.	• Explores the natural world, using their five senses. • Describes the impact of weather and seasons on their daily life. • Names and describes familiar plants and animals. • Investigates forces, light and vibrations. • Is beginning to talk about why things happen. • Predicts what might happen and explains why. • Records findings in a simple way.	• Looks closely at similarities and differences in nature. • Participates in guided investigations and makes observations. • Asks and responds to questions about familiar objects. Talks about observable changes. • Understands that objects move in different ways depending on size and weight. • Asks questions such as 'What would happen if …?'. • Records ideas and observations.

	Background	Purposeful pedagogy
Observing	• The ability to observe accurately is crucial in science. Young children pay attention with all their senses. Their observational skills increase as they gradually start to move from simple to complex: they note more details and start to make connections. As their confidence and vocabulary increases they become more verbal. Children classify objects according to attributes (a maths skill) and use this skill in science to help them to predict and to draw conclusions.	• Children need objects and events to observe and a safe place to do this in. Create a sensory rich environment both indoors and outdoors. Think about materials that will engage all the senses. Choose materials that are: rough, knobbly, smooth, smelly, sweet, sour, etc. Provide tools for children to use: magnifying glasses, cameras, microscopes, etc. Provide scientific vocabulary for children to use. Begin by using simple labelling words, e.g. big, blue, before moving on to other less obvious qualities, e.g. cold, dry. Provide lots of objects for children to sort and classify. Go on nature walks to collect objects. Draw attention to similarities and differences in objects and movements. At snack time, provide foods that are different in look, taste or texture.

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Predicting	• Predicting involves using prior knowledge to anticipate what will happen. Predicting helps young children to think about what they already know in new ways. The more children engage in predictive thinking the better they get at it.	• Remind children of previous experiences. Help them to remember what they observed before by asking them if they think it might happen again. Ask children to say what they think and why. This gives you a wider insight into what they are thinking. Encourage children to check out their predictions. Ask questions such as 'How can we be sure?'. Encourage children to ask 'What if?', 'Why?' and 'How?' questions. Respond to questions from children – you don't have to know the answer, just share in their curiosity. Use sophisticated scientific vocabulary, e.g. questioning, predicting and hypothesizing.
Checking	• Children are naturally curious and want to find out how and why something works or doesn't work. They generate ideas and then experiment to check whether their ideas were valid. In this way, they learn to reflect upon their assumptions.	• Guide children who have been using trial and error to a more systematic approach. Do not start off with showing them what to do as children need to have played with the materials to gain some background knowledge before they can predict.
Recording	• Recording in Early Years may take many forms: drawing, taking photographs, using their emerging abilities to work with data, or verbal or written reports	• Encourage children to draw what they see. This is a scientific, rather than a creative art opportunity. Nonverbal recording can be valuable for some, including children whose first language is not English. However, the aim is to try to furnish children with a rich, scientific vocabulary as soon as possible. Explain to children the importance of recording so they can check results again or compare their results to someone else's.
Concluding	• Concluding involves children looking at what worked and what didn't, comparing what happened to what they thought would happen.	• Encourage children to talk about their results in relation to their prediction or hypothesis. Encourage them to use the correct vocabulary. Allow children to compare their results with others in small groups. Call children's attention to things that contradict their hypothesis if they don't notice them themselves. Your role is not to give facts, but to promote a spirit of scientific enquiry
Communicating	• Communicating ideas encourages children to use the language of cause and effect. Communication is an important science skill and highlights the integration of science and literacy skills	• Communicating findings from scientific experiences has been found to be undervalued in the Early Years. The very act of talking makes children more observant. Just being able to describe their findings can be a significant event for pre-school children. As with recording, provide a variety of opportunities for children to share their scientific discoveries

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	Continuous Provision	• Provide non-fiction books about plants. Often children will not class trees, vegetables or weeds as plants, so point out that they are. Show some plants that grow in water not soil	• Show children Masters of Disguise: Camouflaging Creatures & Magnificent Mimics by Marc Martin and any other books you have about camouflage. Ask children to choose an object and find a good place to hide it in the classroom	• Plant sunflower seeds in containers and water them. Ask children to recall the order you did things and write an instruction card. Following on from children's initial discussions about what seeds need to grow, provide the seeds with different conditions: sunlight and water, sunlight without water, and darkness. Observe what happens to the seeds.
	Outdoor Environment	• Take children on a plant treasure hunt to see what they can find and what they notice	• Ask children to hide objects in the outdoor area for a partner to find. Ask them to explain why they chose that particular hiding place	• Give children an instruction card with words and pictures for planting sunflowers. Provide equipment: a container (which can be decorated), cotton wool and some sunflower seeds. Ask children to follow the instructions and water them. Leave them in a safe place, reminding children to water them every day

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	Purposeful pedagogy	• Talk to children about plants, including trees and grasses. Many children will have the misconception that plants only grow in pots, indoors. Ask children what they notice about each plant. Ask children to draw another plant and ask them to note how their drawings have changed as a result of their observations. Give children lots of opportunities to see different types of plants. Only after repeated experiences and discrepancies between their predictions and what they see do children adjust their thinking.	• Talk to children about camouflage and why they think animals use it. (There are some excellent camouflage photographs available on the internet to share with children.) As a contrast to camouflage, show children some animals that are brilliantly coloured to scare off predators, such as coral snakes or poison dart frogs.	• . Give children lots of time to discuss and explain their predictions for what will happen to plants in different conditions. Listen to what children say to correct any misconceptions. Remind children to water their plants every couple of days and encourage them to chart the progress of their plants by taking photographs or drawing pictures. Children can build frames to support their sunflowers. Place some celery in a glass containing water and food colouring. Let them see that water is absorbed by the roots of a plant, not its leaves
	Learning Conversations	• Ask questions such as 'What do you notice?' and 'What makes you say that?'.	• Ask questions such as, 'Where do you think these animals might live?' and 'Why do you think a polar bear is white?'.	• Ask questions such as, 'Where do you think these animals might live?' and 'Why do you think a polar bear is white?'.

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Chemistry	Learning Experiences	• Show children some ice shapes you have prepared in advance. Ask them what they know about ice.	• Read Alan's Big Scary Teeth by Jarvis. Discuss with children how to keep teeth healthy. Show children some hard-boiled eggs. Explain to them that the shell is like our teeth. Put one egg each into a glass of coffee, tea, fizzy drink, vinegar and water. Ask children what they think will happen to them. Protect another egg in toothpaste and put it in tea or coffee. Leave for three days and observe what happens.	• Explore dissolving and mixing. Demonstrate dissolving sugar in water and ask children what they think has happened to the sugar. Dilute some squash with water and ask what they think has happened. Show children two beakers of water. Tell them you are going to put a sugar cube in one and a rock in the other and stir them up. Ask them what they think will happen
	Continuous Provision	• Provide moulds for children to make their own ice shapes. They can add food colouring, hide a small world character inside, or make an egg-shaped one with a dinosaur inside. Freeze the shapes and ask children how long they think it will take for their shapes to melt.	• Provide non-fiction texts so children can look at animals' teeth. Provide props for children to role-play being dentists. Make a giant mouth out of recycled materials and teeth out of the bottoms of milk bottles. Make marks on the teeth for children to brush off. Take out some of the teeth to talk about losing milk teeth.	• Provide jam jars with lids. Explain to children that they are going to add some water to their jar and then some oil. What do they think will happen? What might they do to mix them up? Encourage them to try out their predictions. Encourage children to make mixtures in different areas.
	Outdoor Environment	• Provide moulds for children to make ice shapes containing some natural materials. Add a piece of string to them before they are frozen. Once the shapes are frozen, ask children to hang them up in different places in the outdoor area. Ask them to make and explain predictions about which one will melt first	• Make marks on walls with paint and encourage children to brush them off. Stick play dough around the bottom of Mega Blocks and give children string (floss) to try and get the dough off.	• Ask children what they can mix with water in the outdoor area. Ask them to explain what they discovered.

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	Purposeful pedagogy	• Ask children what they have discovered about the rate that ice melts. Explain to children that you are going to add something different to each of the ice shapes to see if this affects the speed at which they melt. Add equal quantities of salt, turmeric, bicarbonate of soda and cayenne pepper to each shape, labelling each one, and leaving one ice shape as a control. (To be clear, only one of each substance is added to each ice shape). Ask children to predict what might happen, then observe. Take photographs as the shapes melt.	• Plan for and systematically use scientific words that children will use. Use images in fiction and non-fiction texts to introduce, discuss and reinforce topical vocabulary that is relevant to children's own investigations. After carrying out investigations (such as the egg investigation, above) ask children what they notice and what they have concluded.	• . Bring children together (perhaps in small groups) to find out what they have discovered about mixtures. Listen carefully and ask lots of questions, such as 'What did you discover about oil and water?'. Give children the option of adding some salt, sugar, liquid soap or mustard powder to their jars of oil and water. Ask them to watch carefully to see what happens. To end with a bang, show children the 'fireworks in a jar' experiment: www.youtube.com/watch?v=JgnOuNh0okg
	Learning Conversations	• Ask questions such as, 'Which one did you think would melt fastest?', 'Were your predictions correct?' and 'What makes ice melt faster?'.	• Ask questions such as, 'Why do we need to clean our teeth?', 'Which drinks are not good for teeth and therefore we should only have occasionally?' and 'If we do have a sugary drink what might we do to protect our teeth?'	• Ask questions such as, 'What do you think will happen?', 'Why do you think that?', 'What happens when …?' and 'Were your predictions correct?'.

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Physics	Learning Experiences	• Ensure children have had lots of opportunities to play with containers in the water tray before embarking on this activity. Read Mr Gumpy's Outing by John Burningham. Talk to children about why the boat turned over, and what they think makes things sink. Encourage children to share their ideas	• Read Push and Pull! Learn about Magnets by Julia Vogel. Discuss with children what they know about magnets. Many may have magnets on their fridges. Ask them which things magnets attract.	• This activity is best started on a sunny day and can go on over a week. Ask children what they notice about their shadows. Take photos and draw around shadows. Take children out on an overcast day. What do they notice? What are their predictions about shadows? After the initial activities, read Moonbear's Shadow by Frank Asch.
	Continuous Provision	• Encourage children to test out their hypotheses about what makes things sink in the water tray. Provide a variety of different containers and objects for children to experiment with. Ensure there are some small objects that will sink and large ones that will float	• Provide a variety of magnets. Encourage children to test out different things around the classroom, asking them to record three magnetic and three non-magnetic items. Show them a magnet maze: on a simple road map attach a paper clip to a card car. Show how to move the car by moving a magnet underneath. Ask them to make their own	• Encourage children to make and test out their predictions about shadows. Provide torches for children to experiment with making shadows of objects; project a light onto a white sheet for children to make shadow characters with their bodies
	Outdoor Environment	• Draw an outline of a boat in the playground. Ask children to predict how many people can fit in the boat. Encourage them to try out their ideas	• Provide magnets for children to test materials in the outdoors. Attach paper clips to small items and place them in a large bucket. Ask children to fish them out with a magnetic fishing rod.	• Ask children to investigate shadows made by things outside.

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	Purposeful pedagogy	• Bring children together to discuss their findings. Encourage the development of children's scientific enquiry skills by reminding them of their predictions and comparing them to what they found out. Encourage all children to share what they have noticed. Summarise by saying 'So our hypothesis was …', 'We checked it by …' and 'We found out that …'. Show children three rocks of different sizes and three foam balls of different sizes. Ask them to predict which will float or sink, and to explain why.	• Bring children together to discuss their findings. Encourage the development of children's scientific enquiry skills by reminding them of their predictions and comparing them to what they found out. Model how to present their findings: 'We predicted that …', 'We experimented by …', 'We found out that …' and 'So we think …'. Ask children to share their recordings. Show children a gold ring and ask them if they think it is magnetic. (They may think that all things made of metal are magnetic.)	• The theories children contribute don't have to be scientifically sound. What's important is helping children think about their experiences and challenging them to construct explanations based on their existing knowledge. It will take many experiences for children to develop conceptual understanding of a topic of study. These activities promote their scientific enquiry skills and increase their natural curiosity. Grasp every opportunity to introduce and reinforce scientific vocabulary
	Learning Conversations	• Use questions and comments such as, 'Let's check our ideas.', 'How can we be sure?' and 'What else might you check?'. If children use simple language, model scientific vocabulary.	• Ask questions such as, 'How did you decide which items you were going to test?' and 'What have you concluded about magnets?'.	• Ask questions such as, 'What happens if I turn out the light?', 'What do you need to make a shadow?', 'Do all things make shadows?' and 'Can you make the shadow of the toy bigger or smaller?'.

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	Nursery	R1 September to January	R2 February to July
	Ecology		
Progression milestones	• Is curious about things in nature. Is beginning to appreciate being in nature, e.g. the feeling of the wind and sun on their face. Enjoys being outside. Is beginning to understand that we need to take care of things.	• Looks closely at things in nature, e.g. animals and plants, and talks about what they have seen. Can talk about how being outside makes them feel. Knows that plants and animals need water and animals need food. Knows we need to take care of materials, e.g. putting things away properly.	• Shows a basic understanding of how they might have an impact on the environment. Shows concern for living things, e.g. is careful not to damage plants. Knows that being outside can make them feel better if they are anxious or upset. Knows that plants and animals need to be looked after to survive. Takes responsibility for materials – using them properly, putting them away and performing basic repairs, e.g. sticking down a torn book cover.
Learning Experiences	• Read Somebody Swallowed Stanley by Sarah Roberts. Maximise opportunities to immerse children in nature. Take them out every day and encourage them to explore, looking under rocks and leaves to see what lives there.	• Read Grandpa's Garden by Stella Fry. Take children out every day and encourage them to use their senses. For example, show them how to make 'deer ears' by cupping their hands behind their ears, and ask 'What can you hear?'. Encourage children to use 'splatter vision' – looking around, side to side, up and down, eyes sweeping around. Ask 'What can you smell?', etc.	• Read Greta and the Giants by Zoë Tucker. Take children out for frequent walks. Ask 'What natural things do you see?' and 'What dangers to the environment do you see?'.
Continuous Provision	• Use recycled materials in continuous provision areas. Plastic bottles can become skittles or be cut up to make ball catchers. Encourage children to make things that will move in the wind – windmills, streamers, chimes.	• Provide a range of natural materials for children to use indoors. They can use these to make impressions in salt dough, etc.	• Provide photos of things that are good or bad for the environment. Ask children to sort them. Talk about people who work to save the environment and then encourage role–play of these endeavours.

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Outdoor Environment	• Make fat-ball bird feeders. Hang these up in the outdoor environment. Provide birdwatching books and binoculars. Provide tools for digging and looking for worms.	• Encourage children to plant, label, water and weed the class garden.	• Make a wormery. Leave books around for children to discover why worms are important.
Purposeful pedagogy	• Explain to children that we are all on a mission to save our planet. Some environmental concerns are too huge for Early Years children to comprehend and as a result they think they have nothing to contribute. Break it down into small things that they can do, e.g. turning off lights when they leave a room, turning off the tap while brushing their teeth.	• Talk to children about taking responsibility. Encourage them to take care of both their indoor and outdoor environments, e.g. by putting tops on pens, dressing up clothes away and sit-and-ride vehicles in the right place. Show children the impact of plastic on animals (National Geographic has some photos) and ask them what they think about the photos and what they can do to help.	• Ask children, working in small groups, to come up with a list of things they could be responsible for. Discuss the various ideas as a class. Discuss a local environmental problem, or one that is currently in the news. Talk to children about it and listen to their views.
Learning Conversations	• Encourage children to notice things in the environment. Ask them which plants/animals they can see, etc. Use the correct names for these and use retrieval practice to ensure children remember them.	• Ask children how it makes them feel when others don't take care of things in the classroom. Talk to them about what empathy means.	• Ask children some big questions, e.g. 'Where does our food come from?', 'Is it local?' and 'Why is it important to have lots of different plants and animals?'.