Benjamin Adlard Primary School
Science Key Knowledge Progression Document (KKP)

Curriculum Rationale

This Science Key Knowledge Progression (KKP) sets out the essential scientific knowledge pupils will learn from Nursery to Year 6. Knowledge is introduced sequentially, builds cumulatively, and reflects the ambition of the National Curriculum. It ensures that all pupils develop a secure understanding of the big ideas in science across biology, chemistry and physics.

Substantive Knowledge

(What pupils learn about the world in science)

Substantive knowledge includes the key facts, concepts, laws and vocabulary that pupils need in order to understand:

- Biology: animals including humans, plants, habitats, classification, evolution
- Chemistry: materials and their properties, changes of state, reversible and irreversible changes
- Physics: forces, sound, light, electricity, Earth and space

Substantive knowledge is organised in two forms:

Sticky Knowledge

This is the most important, enduring knowledge that pupils must retain long-term because it underpins future learning. Sticky knowledge represents the non-negotiable scientific ideas pupils should leave each year group knowing securely.

Fingertip Knowledge

This is supporting knowledge that helps access a concept within a unit but does not need to be retained long-term. It provides useful context, examples and detail but does not carry forward as a core idea.

Disciplinary Knowledge

(How pupils learn to think like scientists)

Disciplinary knowledge refers to how scientific knowledge is established, tested and validated. It develops pupils' understanding of:

- asking scientific questions and making testable predictions
- observing closely and using equipment accurately
- collecting, recording and presenting data
- looking for patterns and forming evidence-based explanations

- evaluating the strength of evidence and recognising limitations

Disciplinary knowledge is woven through all units so pupils learn not only what scientists know, but how they know it.

Science in Early Years Foundation Stage (EYFS)

Foundations for science begin in the EYFS statutory area Understanding the World, with strong links to Physical Development and Expressive Arts and Design. Children explore early knowledge such as:

- noticing patterns in nature, weather, plants and animals
- observing changes such as melting, freezing, decaying and growth
- exploring materials and forces through play (rolling, sliding, pushing, pulling)
- asking simple questions and talking about what they observe

This ensures children enter Key Stage 1 with the conceptual building blocks needed for scientific understanding.

Ambition and Curriculum Alignment

The KKP ensures that:

- knowledge becomes increasingly complex and abstract (progressive)
- sticky knowledge is revisited and strengthened through retrieval
- scientific vocabulary is taught with precision and used confidently
- children encounter real scientific evidence and examples from the world around them
- pupils are well prepared for KS3 science and for being scientifically informed citizens

Ambition Beyond the National Curriculum

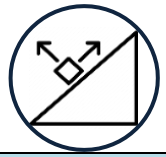
This curriculum extends beyond statutory expectations to secure deeper scientific understanding. Across several units, pupils develop knowledge that is not explicitly required by the NC but is vital for modern scientific literacy, including:

- human impact on ecosystems and biodiversity
- rewilding, conservation and sustainable land management
- pollution, climate change and carbon reduction behaviours

- renewable vs non-renewable energy sources

Key Concepts

Through collaboration with subject leaders and subject specialists across our secondary schools, each subject has identified key concepts (big ideas) for their subject. These key concepts are the skills and knowledge essential to pupils achieving and exceeding expected standards in that specific subject. Key concepts are subject specific and build progressively as pupils move through the school. When pupils encounter a key concept, they will revisit other topics where they learnt about the same concept to enable them to make connections between different learning and build the schema they need.

Science								
								
Working Scientifically	Animals and humans	Plants	Living things and their habitats (including genetics and evolution)	Objects	Particles	Forces	Energy	Earth Science
	Biology			Chemistry		Physics		

*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:

- **Asking questions:** (Asking questions and recognising that they can be answered in different ways)
- **Observe and measure:** (Making observations and taking measurements)
- **Setting up tests:** (Engaging in practical enquiry to answer a question)
- **Recording data:** (Recording and presenting evidence)
- **Answering questions and concluding:** (Answering questions and concluding)
- **Making predictions:** (Evaluating and further questions and predictions)

Enquiry types:

- **Observing over time:** (observing or measuring how one variable changes over time)
- **Identifying, comparing and classifying:** (identifying and naming materials/living things and making observations or carrying out tests to organise them into groups.)
- **Pattern seeking:** (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)
- **Research using secondary sources of evidence:** (answering questions using data or information that they have not collected first hand)
- **Ideas over time:** (Research and find out how ideas about a concept have changed over a period of time)

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: **Objects**  **Particles** 

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** 

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.

Animals: Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.

Earth: The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate**.**

Energy: The total amount of energy in the Universe is always the same, but energy can be transformed when things change or are made to happen.
Evolution: Diversity of organisms, living and extinct, is the result of evolution.
Force: Changing the movement of an object requires a net force to be acted on it.
Genetics: Genetic information is passed down from one generation of organisms to another.
Objects: Objects can affect each other at a distance.
Organisms: Organisms are organised on a cellular basis.
Particles: All materials in the universe is made of very small particles.
Solar system: Our solar system is a very small part of one of millions of galaxies in our universe.

Science Curriculum Intent

Our young scientists will acquire life-long enquiry science skills, in order to explore and understand the world they live in, alongside the vast knowledge of the disciplines of biology, physics and chemistry. They will also develop an understanding of the vital role that major scientific ideas and scientists have played in society. In doing so, all our children, regardless of their starting points, will be fully prepared for their next stage of science education, and beyond.

Science is taught discretely, with a focus on substantive knowledge-rich content and the development of essential disciplinary knowledge. The National Curriculum programmes of study and Early Years Foundation Stage framework are fully adhered to and then supplemented with additional knowledge-rich content. This provides a coherent science curriculum that both prepares children extremely well for future learning and gives them the tools to independently investigate and explore the world further. The science curriculum encourages children to be curious about natural phenomena and to be excited by the process of understanding the world around them. We want our children to remember the concepts they learn. Therefore, the curriculum focuses on the sequential development of essential substantive knowledge underpinning biology, chemistry and physics, as per the science progression map below.

Procedures and concepts that underpin scientific methods are developed through the systematic focus on disciplinary knowledge. Every unit of work contains opportunities to develop the Working Scientifically skills of asking questions, planning enquiries, observing, measuring, recording, presenting and interpreting results, drawing conclusions, predicting and evaluating, according to the progression in these skills as per the science progression map. Thus, essential science concepts are developed whilst children investigate the world around them. The different approaches to science enquiry, such as fair testing, research and classifying are also systematically developed in the disciplinary knowledge section of the progression map. Each science unit of work is then framed around an enquiry question, ensuring a systematic, contextualised development of both substantive and disciplinary knowledge.

Discplinary Knowledge and skills sequencing SCIENCE

		EYFS	KS1	LKS2	UKS2
WORKING SCIENCTIFAL	**Asking questions**	While playing and exploring, the children demonstrate their curiosity. While playing and exploring, the children begin to ask 'I wonder …' questions. With support, the children think of ideas for answering their questions. .	Children ask simple questions and recognising that they can be answered in different ways. While exploring the world, the children develop their ability to ask questions (such as what something is, how things are similar and different, the ways things work, which alternative is better, how things change and how they happen). Where appropriate, they answer these questions. The children answer questions developed with the teacher often through a scenario.	Children ask relevant questions and use different types of scientific enquiries to answer them. The children consider their prior knowledge when asking questions. The children answer questions posed by the teacher. Children are given a range of resources; the children decide for themselves how to gather evidence to answer the question. They recognise when secondary sources can be used to answer questions that cannot be answered through practical work. The children are given a range of scientific experiences to enable them to raise their own questions about the world around them.	Children independently ask scientific questions. This may be stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry. Given a wide range of resources the children decide for themselves how to gather evidence to answer a scientific question. They choose a type of enquiry to carry out and justify their choice. They recognise how secondary sources can be used to answer questions that cannot be answered through practical work.
	Observe and measure	With support, explore the natural and made world using their senses. With support, the children use magnifying glasses or tablets with magnifiers to make observations. The children explore using beakers/scoops etc.	Children explore the world around them. They make careful observations to support identification, comparison and noticing change, patterns or relationship. They use appropriate senses, aided by equipment such as magnifying glasses or digital microscopes, to make their observations.	The children make systematic and careful observations. They use a range of equipment for measuring length, time, temperature and capacity, including data loggers and thermometers.	The children take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeated reading where appropriate. During an enquiry, they make decisions

		Make comparisons between objects ("This leaf is bigger than that one.") and quantities ("There are more flowers on this one." While playing and exploring, the children select and use resources for a particular task. With support, the children sort and group object.	They begin to take measurements, initially by comparisons, then using non-standard units. They use their observations and ideas to suggest answers to questions.	They use standard units for their measurements.	e.g. whether they need to: take repeat readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); or check further secondary sources (researching); in order to get accurate data (closer to the true value).
	Setting up enquiry		The children use practical resources provided to gather evidence to answer questions generated by themselves or the teacher. They perform simple tests: tests to classify; comparative tests; pattern seeking enquiries; and make observations over time. Children use their observations and testing to compare objects, materials and living things. They sort and group these things, identifying their own criteria for sorting and classifying. They use simple secondary sources (such as identification sheets) to name living things. They describe the characteristics they used to identify a living thing.	The children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher. They follow their plan to carry out: observations and tests to classify; comparative and simple fair tests; observations over time; and pattern seeking. They should start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions and recognise when a simple fair test is necessary and help to decide how to set it up.	The children select from a range of practical resources to gather evidence to answer their questions. They carry out fair tests, recognising and controlling variables. They decide what observations or measurements to make over time and for how long. They plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.

	Recording data	With support, the children talk about what they have observed. They sometimes draw and make marks to record their observations. With support, they use sorting rings and boxes.	The children gather and record their observations and data e.g. using photographs, videos, drawings, labelled diagrams or in writing to answer a question. They record their measurements e.g. using prepared tables, pictograms, tally charts and block graphs. They classify using simple prepared tables and sorting rings.	The children sometimes decide how to record and present evidence. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams. Children are supported to record findings in different ways in order to help with answering the question using simple scientific language e.g. drawings, labelled diagrams, keys, bar charts and tables.	The children decide how to record and present evidence. Use and develop keys and other information records to identify, classify and describe living things. They record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
	Making predictions			They identify ways in which they adapted their method as they progressed or how they would do it differently if they repeated the enquiry. Children use their evidence to suggest values for different items tested using the same method e.g. the distance travelled by a car on an additional surface. Following a scientific experience, the children ask further questions which can be answered by extending the same enquiry. Children use results to make predictions for new values.	They evaluate, for example, the choice of method used, the control of variables, the precision and accuracy of measurements and the credibility of secondary sources used. They identify any limitations that reduce the trust they have in their data. They use test results to make predictions to set up further comparative and fair tests.

	Interpret and report			Children communicate their findings to an audience both orally and in writing, using appropriate scientific vocabulary. Children identify patterns, differences, similarities in data or changes related to simple scientific ideas and processes.	They communicate their findings to an audience using relevant scientific language and illustrations and justify their scientific ideas. They report and present 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 They identify scientific evidence that has been used to support or refute ideas or arguments. Recognise when secondary sources will be most useful to research their ideas.
	Evaluate	With support, the children demonstrate and talk about what they have done and noticed. With support, the children notice how they made a difference to an outcome, e.g. "My car went further when I pushed it harder.", and answer the question, where appropriate. With support, the children make comparisons between objects e.g. "My plant is taller than Sarah's."	Children use their experiences of the world around them to suggest appropriate answers to questions. They are supported to relate these to their evidence e.g. observations they have made, measurements they have taken or information they have gained from secondary sources. The children recognise 'biggest and smallest', 'best and worst' etc. from their data. Children communicate their findings in a range of ways and use simple scientific language.	Children answer their own and others' questions based on observations they have made, using straightforward scientific evidence. The answers are consistent with the evidence. Children use results to suggest improvements and raise further questions.	Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. When doing this, they discuss whether other evidence e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer. Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas and talk about how ideas have developed over time. They talk about how new discoveries change scientific understanding.

Working Scientifically Skills Progression: KEY STAGE 1

	To ask scientific questions	To plan an enquiry	To observe closely	To take measurements	To gather and record results	To present results	To interpret results	To draw conclusions	To make a prediction	To evaluate an enquiry
Classification	Be able to ask yes/no questions to aid sorting	Identify the headings for the two groups (it is..., it is not...)	Be able to compare objects or living things, based on obvious features e.g. size, shape, colour			Sort objects and living things into two groups using a basic Venn diagram or simple table.	Talk about the number of objects in each group i.e. which has more or less.	Children in KS1 are not expected to draw conclusions. They are expected to make observations which will help them answer questions. They do not have the subject knowledge yet to give reasons for what they observe so they cannot draw scientific conclusions.	Children in KS1 are not expected to make scientific predictions as they do not have the subject knowledge to do this. That does not mean that you should not ask children what they think may happen, but this will be based on experience or may simply be a guess.	Children in KS1 are not expected to evaluate. However, children should be encouraged to consider their method (what they did) and adapt this where necessary.
Research	Ask one or two simple questions linked to a topic.					Present what they have learnt verbally or using pictures.	Be able to answer their questions using simple sentences.			
Comparative / fair testing	Identify the question to investigate from a scenario or choose a question from a range provided.	Choose equipment to use and decide what to do and what to observe or measure to answer a question.	Make observations linked to answering the question.	Measure using non-standard units	Record data in simple prepared tables, pictorially or by taking photographs.	Present what they learnt verbally, using pictures or block diagrams.	Answer their question in simple sentences using their observations or measurements.			
Observation over time	Ask a question about what might happen in the future based on an observation.				Record data in simple prepared tables, pictorially or by taking photographs.	Present what they learnt verbally or using pictures.				

Pattern seeking	Ask a question that is looking for a pattern based on observations.				Record data in simple, prepared tables and tally charts.	Present what they learnt verbally.				

Working Scientifically Skills Progression: LOWER KEY STAGE 2

	To ask scientific questions	**To plan an enquiry**	**To observe closely**	**To take measurements**	**To gather and record results**	**To present results**	**To interpret results**	**To draw conclusions**	**To make a prediction**	**To evaluate an enquiry**
Classification	Be able to ask a yes / no question to aid sorting.	Be able to put appropriate headings into intersecting Venn and Carroll diagrams.	Be able to compare objects based on more sophisticated, observable features. Present observations in labelled diagrams.			Sort objects and living things into groups using intersecting Venn diagrams and Carroll diagrams.	Spot patterns in the data particularly two criteria with no examples.	Draw simple conclusions, when appropriate, for patterns.		Suggest improvements. Suggest new questions arising from the investigation.
Research	Ask a range of questions linked to a topic.	Choose a source from a range provided.				Present what they learnt verbally or using labelled diagrams.	Be able to answer their questions using simple scientific language.			Suggest limitations. Suggest new questions arising from the investigation.
Comparative / fair testing		Decide what to change and what to measure / observe.	Make observations linked to answering the question.	Measure using standard units where not all the numbers are marked on the scale. Take repeat readings if needed.	Prepare own tables to record data.	Prepare own tables to record data.	Refer directly to their evidence when answering their question.	Where appropriate provide oral or written explanations for their findings.	Use results from an investigation to make a prediction about a further result.	Suggest improvements e.g. to method of taking measurement

Observation over time		Decide what to measure / observe. Decide how often to take measurements.	Make a range of relevant observations.	As above. Use dataloggers to measure over time.						s. Suggest new questions arising from the investigation.
Pattern seeking		Decide what to measure or observe.	Make observations linked to answering the question.	Measure using standard units where not all the numbers are marked on the scale.						

Working Scientifically Skills Progression: UPPER KEY STAGE 2

	To ask scientific questions	**To plan an enquiry**	**To observe closely**	**To take measurements**	**To gather and record results**	**To present results**	**To interpret results**	**To draw conclusions**	**To make a prediction**	**To evaluate an enquiry**
Classification	Be able to ask a range of questions to aid sorting and decide which ways of sorting will give useful information.	Identify specific clear questions that will help to sort without ambiguity.	Be able to compare not only based on physical properties but also on knowledge gained through previous enquiry.			Use and create branching databases and keys to enable others to name living things and objects	Be able to talk about the features that objects and living things share and do not share based on information from keys etc.	Be able to use data to show that living things and materials that are grouped together have more things in common than with things in other groups.		Be able to explain using evidence that the branching database or key will only work for the living things or materials it was created for.
Research	Ask a range of questions recognising that some can be answered through research	Choose suitable sources to use. Use a range of sources.				Present what they learnt in a range of ways. .	Be able to answer questions using scientific evidence gained from a			Be able to talk about their degree of trust in the sources they used.

	and others may not.						range of sources.			
Comparative / fair testing	Ask a range of questions and identify the type of enquiry that will help to answer the questions. Ask further questions based on results and research.	Recognise and control variables where necessary.	Make observations linked to answering the question.	Measure using standard units using equipment that has scales involving decimals.	Prepare own tables to record data including columns for repeated results.	Choose an appropriate form of presentation, including line graphs.	Be able to answer their questions, describing casual relationships.	Provide oral or written explanations for their findings.	Use test results to make predictions for further investigation	Explain their degree of trust in their results e.g. precision in taking measurement, variables that may not have been controlled and accuracy of results.
Observation over time			Make a range of relevant observations.		Prepare own tables to record data.		Be able to answer their questions describing the change over time.			
Pattern seeking			Make observations linked to answering the question.			As above- including scatter graphs.	Be able to answer their questions, identifying patterns			

		Nursery	Reception	Y2	Y3	Y4	Y5	Y6
	Living things and their habitats (including genetics and evolution) Substantive Knowledge **Pupils will know …** 	Living things grow and change. Animals live in different places where they find what they need. People can see clues from the past such as bones or footprints.	Minibeasts and other animals live in different habitats. The weather and seasons change what plants and animals do. Some animals rest or hide in winter (hibernate).	A habitat provides what a living thing needs to survive. Some habitats are hot, some cold, some wet or dry. A food chain shows how living things depend on each other. Things can be alive, dead or never alive.	Animals cannot make their own food; they need nutrition from plants or other animals. Rocks can change and may contain fossils.	Living things can be grouped (e.g., vertebrates and invertebrates). Classification keys help identify living things. Environments change, and this can affect living things.	Life cycles show the stages of growth of a plant or animal. Sexual reproduction involves two parents and produces non-identical offspring. Asexual reproduction involves one parent and produces identical offspring.	Living things have characteristics that help classify them. Microorganisms are tiny living things, some helpful, some harmful.

BIOLOGY	**Living things and their habitats (including genetics and evolution)** Sticky knowledge **Pupils will know ...** 	The names of some common animals that live in a hot and cold place. (Penguin, polar bear, camel, snake) That dinosaurs need to live in different environments to survive. Some of the things that were discovered to prove that dinosaurs existed.	Where minibeasts can be found. That some animals hibernate during colder weather. That many animals are born when the weather becomes warmer.	A habitat is where a plant or animal lives. A habitat provides everything a plant or animal needs to survive All animals and plants have a habitat. An animal's habitat provides the food it needs to survive. A food chain shows how different living things rely on each other. Animals, plants and humans are living things. Living things need certain things to survive, such as water, food, shelter and air. Living things can die. When something is dead, it was once living. Some things were never alive, such as rocks, water or toys. .	A fossil is the remains or trace of a living thing that lived a long time ago. Both animals and plants can become fossils. Fossilisation is the process that explains how a fossil is formed. The process of fossilisation takes thousands of years. Organic matter is the remains of dead plants and animals.	Animals with a spine are called vertebrates. Animals without a spine are called invertebrates. All mammals, birds, fish, amphibians and reptiles are vertebrates. Each animal group has different physical features. Classification keys are used to classify animals accurately. Animals live within different habitats, depending on what they need to survive. Humans can have both positive and negative effects on the natural environment.	The life cycle of a mammal has four main stages: foetus, young, adolescent and adult. Most mammals give birth to live young. When mammals become adults, they are able to reproduce. Sexual reproduction involves two parents producing offspring. Fertilisation is the process by which a sperm cell joins with an egg cell to create a new life.	A living organism moves, reproduces, grows and excretes. Most scientists use seven life processes or characteristics to determine whether something is living or non-living. These are movement, respiration, sensitivity, growth, reproduction, excretion and nutrition. Scientists group organisms to organise animals and plants based on their features. Some bacteria can cause diseases and infections. Humans have good bacteria in their bodies which help to digest food. Viruses are invisible (to the eye) microorganisms and need a host. They can cause diseases such as flu or a common cold. Some fungi are microorganisms which may cause infections. Some can be involved in bread making.

	Living things and their habitats (including genetics and evolution) Fingertip knowledge 			There are different habitats in my local area Woodlice like to be in dark, damp, and cool places where they can stay moist and find lots of food. A food chain normally starts with plants. Some animals eat other living things for energy. Some polar animals are carnivores. Some polar animals are herbivores. Some plants can survive for a long time without water. Animals and plants live in woodland habitats. In woodlands, some animals eat plants and others use plants for shelter. Polar animals can survive in extremely cold weather. Desert animals can survive in extremely hot weather. Ocean animals include fish, mammals and reptiles.	Older fossils are found deeper underground. Animal footprints and tracks can also form fossils. Fossilisation is a rare process that only occurs under certain conditions.	There are variety of living things living in the Benjamin Adlard area. Examples of this would include trees, shrubs, flowers, grasses, mammals, birds, reptiles and amphibians. In spring, plants start to grow due to the increase in temperature and the amount of sunlight received throughout the day The number of some living things varies through the year, because of the changes in the seasons Rewinding increases biodiversity by providing a greater range of habitats by returning a damaged habitat. Nature reserves offer a protected space for plants and animals to live and grow. Natural resources can be limited, and over-using them can damage the environment You would find different types of animals such as deers, foxes, pheasants, owls, frogs, butterflies and fish in a rural habitat. You would find different types of animals such as rats, mice, pigeons,	The life cycle of a frog has four main stages: frogspawn, tadpole, froglet and adult frog. The life cycle of birds includes five stages: egg, hatchling, nestling, fledgling and adult bird. Offspring produced by sexual reproduction are not identical to the parents. Offspring produced by asexual reproduction are identical to the parent. A starfish is an example of an animal that reproduces asexually Tadpoles have gills to help them to breathe under water, a tail to help them to swim and a mouth to feed. Tadpoles take around 14 weeks to transform into frogs. An adult frog has no tail and is fully equipped to live both on land and in water. Birds are vertebrates with wings, feathers and a beak Birds reproduce by laying eggs. Eggs are incubated by parents until they hatch.	Microorganisms such as bacteria, viruses and fungi can be classified. The classification of microorganisms is based on their features or characteristics such as shape. Bacteria, viruses and fungi have different shapes. Carl Linnaeus was a Swedish botanist who wrote a book called Systema Naturae or System of Nature. Linnaeus was famous for developing the first system to classify animals. The classification was based on physical characteristics. Carl Linnaeus divided animals into six classes. These were mammals, birds, amphibians, fish, insects and worms The skeleton is buried by sediment which compacts over time. Water seeps down into the rock and replaces the skeleton with minerals found in the water. This produces an imprint in a rock of a living thing. Older fossils tend to be smaller and simpler

				A microhabitat is a very small habitat. Insects, snails, worms and spiders all live and survive in microhabitats		starlings, spiders and ants in a urban habitat. There are lots of different types of habitat, including fields, woodland, urban areas and aquatic habitats. Rural and urban habitats can both be biodiverse but are not suitable for every animal.	An adult bird is able to reproduce and will have all its feathers	compared to newer fossils. Newer fossils tend to be larger and more complex. This supports Charles Darwin's theory of evolution that simple organisms evolved into more complex ones. Mary Anning was a famous palaeontologist who discovered many fossils during the 1800s. She made many discoveries such as finding plesiosaur, ichthyosaur and pterosaur fossils. Mary Anning's discoveries made her famous but, because she was a woman, her findings were often presented as male scientists' work A microorganism is tiny and can be seen using a powerful microscope. Bacteria are simple, invisible (to the eye) microorganisms.

Animals including humans Substantive knowledge **Pupils will know …** 	**Nursery** Humans need food and self-care to stay healthy (eating well, brushing teeth, moving our bodies). Different animals live in different places (e.g., farm animals, animals from hot or cold places). Animals grow and change, and some have babies.	**Reception** Exercise keeps our bodies healthy, and rest and routines also support health. Animals have offspring that grow into adults (e.g., lambs, chicks). Minibeasts and other animals live in different habitats (e.g., safari animals, garden minibeasts).	**Year 1** Humans have body parts with different functions, including five senses. Animals can be grouped (mammals, birds, fish, amphibians, reptiles). Animals eat different types of food (carnivores, herbivores, omnivores).	**Year 2** Humans and animals need air, water, food and shelter to survive. Good hygiene protects health (handwashing, dental care). Exercise supports physical and mental health.	**Year 3** Skeletons support and protect bodies, and some animals have backbones (vertebrates) or exoskeletons. Nutrition comes from what we eat, and a balanced diet includes different food groups.	**Year 4** Teeth have different shapes for different jobs (incisors, canines, molars). Digestion breaks food down so the body can use nutrients. Food chains show how energy moves between living things.	**Year 5** Humans grow through life stages (baby → child → adolescent → adult → older adult). Puberty is a stage of change that prepares the body for reproduction. Reproduction creates new life, and offspring are not identical to parents.	**Year 6** The circulatory system (heart, blood, vessels) moves oxygen and nutrients around the body. Blood carries oxygen and nutrients to cells and removes waste. Lifestyle choices (diet, exercise, sleep, harmful substances, technology use) affect physical and mental health.

Animals including humans Sticky knowledge **Pupils will know ...** 	Songs associated with body parts: head, shoulders, knees, toes and facial features The name of some basic foods and drinks that are healthy. Some basic things can help our health and wellbeing (healthy foods, brushing teeth and activity) Know the names of common animals found on a farm. (Pig, horse, dog, cat, cow) Know the names of some common animals that live in a hot and cold place. (Penguin, polar bear, camel, snake)	That exercise means moving our body and is important. Some things that can help our health and wellbeing (sensible amounts of screen time, having a good sleep routine, being a safe pedestrian) Tthe names of some common animals that live in the Safari. (Leopard, lion, tiger, elephant, cheetah, crocodile, giraffe) The name of some minibeasts. The names of some animal offspring (lambs, chicks)	The body has lots of parts. Each of these body parts has a name. Most bodies have a neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth and teeth. Humans use their ears to hear sounds. The tongue helps humans to taste. The tongue is in the mouth. Humans use their eyes to see. You can see when there is light. You cannot see in the dark. The skin is the body part that helps us to sense touch. The nose helps us to sense smell The nose is on the face. Mammals have fur or hair on their bodies. Birds have beaks, wings and feathers.	All mammals, birds, amphibians , reptiles need air, water, food and shelter to survive. Reptiles need direct heat to survive. Humans are mammals. Humans need air, water, food and shelter to survive. Exercise improves physical health. Exercise improves mental health. You should brush your teeth twice a day with water, a toothbrush and toothpaste. Plaque can build up on your teeth and can damage your teeth and gums	Skeletons are made of bones. The skull, spine, ribcage, pelvis and femur are bones within the skeleton. The skull protects the brain. The femur helps humans to stand and move. The pelvis helps to support the spine. The spine helps humans to twist and be held upright. The ribcage protects the heart and lungs. Mammals, birds, fish, amphibians and reptiles have a skeleton. Some animals have a spine. Some animals do not have a spine. Some animals have exoskeleton. Humans get their nutrition from what they eat. Food can be sorted into five food groups – fruit and vegetables,	Humans have four different types of teeth – incisors, canines, premolars and molars. Digestion is the breaking down of larger pieces of food into smaller pieces so the body can use it for energy. The digestion process begins when food is bitten by the teeth. Saliva turns smaller pieces of food into a more liquid substance, so it travels smoothly down the oesophagus to the stomach. The stomach churns the food and adds acid to break it down further before the partially digested food passes to the small intestine. The small intestine absorbs nutrients from the food and passes the remaining food to the large intestine. The large intestine absorbs water from the remaining food, and then passes the remaining waste to the rectum. The digestive system allows the body to take in nutrients from food	The human life cycle has six main stages – foetus, baby, child, adolescent, adult and elderly adult. Every human goes through the same life stages in the same order. Puberty is the process that prepares humans for reproduction. Humans are mammals because they are warm-blooded, give birth to live young and feed their offspring on milk. Fertilisation is the process by which a sperm cell joins with an egg cell to create a new life. Gestation is the period of time that a foetus develops in its mother's womb.	The circulatory system moves blood around the body. It is made up of the heart, blood vessels and blood. The blood vessels that move blood towards the heart are called veins. The blood vessels that move blood away from the heart are called arteries. Capillaries are small blood vessels that link veins and arteries together. Blood transports nutrients and oxygen to all parts of the body, and takes waste, such as carbon dioxide, away. Oxygen is carried in red blood cells from the lungs to all cells in our body. White blood cells help to fight bacteria and viruses in our body to prevent illness. The heart is part of the circulatory system. The heart is a muscle which beats regularly.

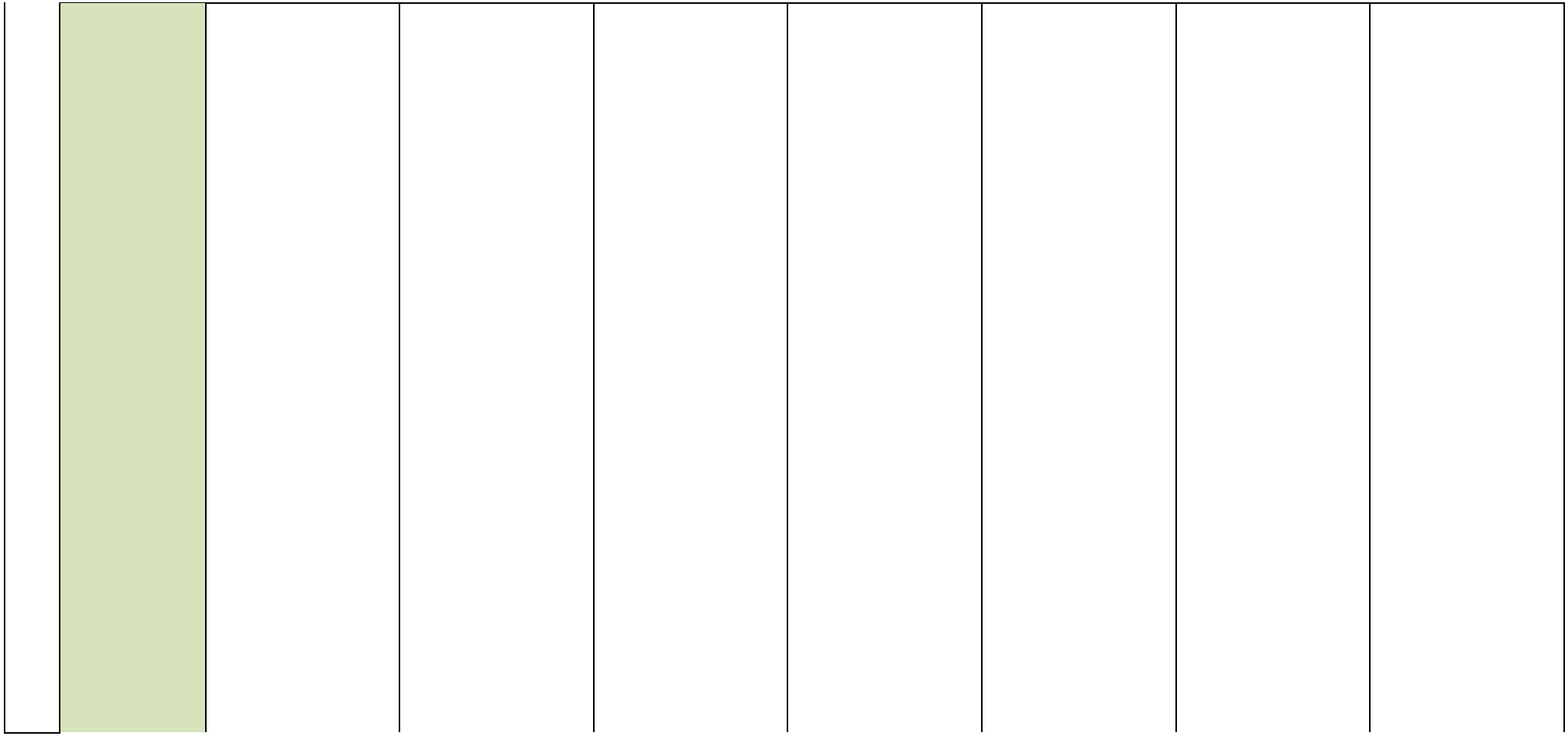
			Fish live in water. Amphibians live on land and in water. Frogs, toads and newts are amphibians. Reptiles have dry skin. Lizards, snakes, crocodiles and turtles are reptiles. Carnivores eat other animals. Herbivores eat plants including grass, fruits and vegetables. Omnivores eat other animals and plants.		carbohydrates, protein, dairy and alternatives and fats and sugars. Fruit and vegetables provide the body with essential vitamins. Carbohydrates provide the body with energy. Protein helps with muscle growth and repair. Dairy products contain calcium, which is good for teeth and bones. Fats can be grouped into healthy and unhealthy fats. All humans need a balanced diet including food from all five food groups.	as it passes through the body. Each organ within the digestive system has a function to help the body break down food. A food chain shows an order of living things, to show how energy is transferred when one living thing eats another. Food chains begin with a producer. Producers are living things such as plants that make their own food. Consumers eat plants and/or animals.		As the heart beats, it pumps blood around the body. Blood flows through the heart as part of its journey through the circulatory system. Veins carry blood towards the heart. They have valves to stop the blood flowing in the wrong direction. Blood then flows through the right atrium, then out of the right ventricle to the lungs. Blood from the lungs then flows into the left atrium and out of the left ventricle towards the rest of the body. Oxygenated blood is blood that carries lots of oxygen. Deoxygenated blood is blood that has little oxygen in it. The effects technology can have on mental health. (PSHE) The risks associated with drugs and drinking alcohol. (PSHE)

Animals including humans Fingertip knowledge **Pupils will know ...** 			When sounds are quiet, they can be hard to hear. When sounds are loud, they are easier to hear. Some herbivores eat seeds and nuts. Herbivores have flat teeth for chewing plants Some items have a stronger smell than others. Some mammals can be kept as pets. Some mammals live in the wild. Some birds can fly. Some birds cannot fly. Some fish have scales on their bodies. Fish have fins to help them swim. Most fish have gills that help them breathe underwater. Amphibians have webbed feet. Reptiles have scales on their bodies.	Exercising daily makes your heart stronger. Germs can make you unwell. Germs are spread easily from unwashed hands. You should wash your hands, sneeze into a tissue and have regular baths or showers.	There are 206 bones in the human body. The largest is the femur and the smallest are the bones of the inner ear. Bones are strong, light and rigid. They do not bend. Humans need to eat a healthy, balanced diet to maintain good health. Humans should eat a wide variety of foods and consume the right amount to maintain a healthy body weight. The Eatwell Guide shows how much of each food group we should eat to achieve a healthy and balanced diet. There are a variety of human diets including vegan, vegetarian, pescatarian and omnivorous diets. People who eat a vegan diet get protein from sources that are not animal products.	Carnivores have long, sharp teeth to help them with ripping and tearing through meat. Herbivores have large, flat teeth to grind and chew through grasses and plants. Omnivores have a combination of sharp and flat teeth, allowing them to tear through meat and grind plants The incisors are used for biting into food. The canine teeth are sharp and pointed to help with ripping and tearing. The premolars are teeth between the canines and molars. They are used for guiding food towards the molars at the back of the mouth. The molars are the large teeth at the back of the jaw. They are used for grinding and chewing food. Enamel protects the sensitive parts of the tooth underneath. The human mouth is full of different germs which feed on sugar in the mouth and can	All humans start their life as a foetus inside their mother's womb. After puberty, humans can reproduce. Babies are dependent on adults for food, warmth and comfort. Most babies and toddlers hit certain milestones in their first two years of life, such as crawling and walking. Throughout childhood, children grow and develop at a rapid rate in terms of their mass, height and brain development. Hormones are chemicals that are released by your body during puberty which cause physical and emotional changes. Key changes that happen to females during puberty include the start of periods, growth of underarm and pubic hair, mood swings, spots and growth of breasts. Key changes that happen to males during puberty include growth of body hair, growth of the penis and testicles, spots, mood swings and deepening of the voice. When a person enters adulthood, their rate of	Nutrients are carried in the plasma to provide the nourishment cells need to repair themselves and grow. Oxygenated blood mostly travels from the heart through the arteries. Deoxygenated blood mostly travels from the parts of the body back to the heart, through veins. The left ventricle is thicker than the right ventricle because moving blood around the whole body requires more force than moving blood to the lungs

			Animals have different features. Many carnivores have sharp teeth and claws. Some people cannot see.			cause plaque to build up. If plaque is not removed from the teeth, it can cause the enamel layer to rot away, exposing the sensitive layers underneath. The arrows in a food chain show the energy transfer from one food source to another. Food chains can be different lengths depending on the living things within a habitat.	growth slows down and their body is fully developed. The human body gradually changes with age. For example, skin loses elasticity, resulting in wrinkles, bones may become weaker and height may decrease. Mammals have different gestation periods. The gestation period of a human is approximately nine months. The lifespan of an animal is how long the animal is alive. Usually, the longer the gestation period of an animal, the longer the lifespan. Humans have a relatively short gestation period compared to their lifespan.	

	Plants Substantive knowledge **Pupils will know …** 	**Nursery** Plants are living things that grow from seeds or bulbs. Plants need care such as water and time to grow. Some plants die if they are not looked after. We can help the environment by caring for plants and nature.	**Reception** Plants have different parts that we can describe (e.g., stem, leaves, flowers). Plants grow in natural environments and we can observe them outdoors. Plants change over time as they grow.	**Year 1** A plant is a living thing with parts such as roots, stem, leaves and flowers. Trees are plants; some are deciduous (lose leaves) and some are evergreen (keep leaves). Plants and trees grow in different seasons and have different shapes and sizes. Some plants grow wild, others are grown by people in gardens.	**Year 2** Plants need water, light and the right temperature to grow and stay healthy. Plants grow from seeds or bulbs, which come in different shapes and sizes. If plants do not get what they need, they may not grow well or may die. Some plants have flowers or fruit, and some parts of plants can be eaten.	**Year 3** Plants have roots, stems, leaves and flowers, each with a function (roots anchor and absorb water; leaves make food; stems transport water; flowers support reproduction). A seed begins to grow through germination when conditions are right. Pollination helps plants reproduce, and seeds are dispersed in different ways (wind, water, animals, explosion). A plant's life cycle includes germination, growth, flowering, pollination, seed formation and dispersal.	**Year 5** Flowering plants reproduce sexually through pollination, fertilisation and seed formation. Male parts (stamen: anther and filament) produce pollen; female parts (pistil: stigma, style, ovary) contain ovules. Asexual reproduction creates identical offspring (e.g., runners, bulbs, tubers).	**Year 6** Plants can be classified into groups based on observable features. Plants can be flowering (produce flowers and fruits) or non-flowering. Scientists classify plants to organise and compare living things.

	Plants Sticky knowledge **Pupils will know ...** 	How to look after their environment. How to care for a plant. A seed and bulbs are planted to grow into a plant. Know some plants die over time	How plants look and feel different. .	A plant is a living thing that usually grows in soil. Some plants have roots, a stem, leaves and flowers. Flowering plants have flowers, stems, roots and leaves.	There are many different types of plants. Plants need water to grow and stay healthy. Plants need light to grow and stay healthy. If plants do not have water and light, they may become weak and not grow properly. Many plants grow from bulbs or seeds. Plants need water, light and a suitable temperature to grow.	The roots absorb water from the soil and hold the plant in place. The stem carries water to different parts of the plant. The leaves absorb sunlight to make food for the plant. The flowers help the plant to reproduce and create new life. The stamen is the male parts of a plant. The stamen produces pollen. The pistil is the female parts of a plant. The pistil receives the pollen in the fertilisation process. Pollination is the transfer of pollen from the male part of a flowering plant to the female part of a plant, so that the plant can reproduce. The stages In a plant's life are called its life cycle.	A style is a tube from the stigma to the ovary. An ovary contains ovules. An ovule is the female sex part found in the ovary. The male part of a flowering plant is called the stamen, which consists of the anther and filament. The female sex cells In a plant are called ovules and are found in the ovary. The male sex cells in a plant are called pollen grains and are found on the anthers. Plants reproduce sexually through pollination. .	



	Plants Fingertip knowledge **Pupils will know ...** 			Some seeds can be planted in winter but must be kept warm to grow. Trees are a type of plant. Deciduous trees lose their leaves in autumn. Evergreen trees keep their leaves all year round. Some trees are evergreen. Holly and pine trees are evergreen. In summer, the weather is warmer so seeds and plants grow outside. Trees can be different shapes and sizes. Trees have roots, a trunk, branches and leaves. Some trees have fruit. Wildflowers have not been chosen by humans to grow in their garden. Most wildflowers have not been planted by humans. Garden plants have been chosen by humans to grow in their gardens.	Many plants have flowers or fruit. Parts of some plants can be eaten. Bulbs and seeds come in different shapes and sizes. Seeds can be found inside the fruit or on the outside of the fruit. Bulbs store food for plants to use when they grow again. Some plants grow from bulbs. Some plants grow from seeds. Oak trees are big trees with strong branches. You can find them in many forests and parks in Britain. Bluebells are pretty blue flowers that grow on the ground. They like to live in shady forests all over Britain. Ivy is a green plant that climbs walls and trees. It can be seen in gardens and parks everywhere in Britain	A dissection is the method of separating something into its parts. Too many seeds can lead to overcrowding, which means the plants will have to compete for water, nutrients, and sunlight, potentially stunting their growth As a seed absorbs water, the seed coating swells and breaks. As plants grow, they produce flowers and can reproduce through pollination. Once a seed is produced it can be dispersed to start the life cycle again.	The anther contains pollen. The filament holds up the anther. Fertilisation occurs when a male pollen grain joins with a female ovule inside an ovary. Offspring produced by asexual reproduction are identical to the parent. Some plants reproduce asexually by producing new plants at the end of runners or by producing bulbs or tubers. .	Plants can be classified in several ways. Plants can be grouped as flowering and non-flowering. Scientists group organisms to organise plants based on their features.

	Materials Substantive knowledge **Pupils will know ...** 	**Nursery** Objects are made from different materials found in nature (e.g., wood, water, rock, sand). Some materials change when we mix, heat or cool them (e.g., ingredients changing when cooked). Some things float and some sink in water. Words can be used to describe what materials do (e.g., float, sink, top, bottom).	**Reception** Materials can be similar or different, and we can describe them using words (e.g., rough, smooth, hard, soft). An object is what something is (e.g., a cup), and a material is what it is made from (e.g., plastic, metal).	**Year 1** Objects are made from different materials chosen for their use (e.g., wood, metal, glass, plastic, fabric, rock). Materials have properties such as hard/soft, stretchy/stiff, waterproof/not waterproof, transparent/opaque. When water freezes or melts, it changes between solid ice and liquid water. Some materials float and some sink.	**Year 2** Different materials are chosen for objects because of their suitability (strong, flexible, waterproof, transparent, warm, etc.). Some materials can change shape by bending, squashing, twisting or stretching. Some materials are natural and some are man-made.	**Year 3** Rocks are natural materials with different properties (hard, soft, permeable, crumbly). Soils are made from rock, organic matter and water. Rocks and soils can change over time through processes like weathering. Soils support life and provide habitats for some living things.	**Year 5** Materials have properties such as hardness, transparency, magnetism, solubility, conductivity. Conductors allow electricity or heat to pass through; insulators do not. Only some metals are magnetic (e.g., iron and steel). A harder material scratches a softer one.
	Materials Sticky knowledge **Pupils will know ...** 	The name of some natural materials. When an ingredient has changed That some things stay on the top of the water and some things go underneath. Words to describe what is happening e.g. top, bottom, down, sink, float	The similarities and differences between a collection of materials. The difference between what an object is and what a material is.	Objects are made from different materials. Materials can have different textures. There are different types of rocks. Rocks come in different shapes, sizes and textures. Some objects can be made from different materials depending on what they are used for. Some materials are waterproof and don't let water through them. Some materials block light. Some materials let light through.	Materials have different properties and are used for different suitability. Some materials can change shape and some cannot. Some materials can be bent, twisted, squashed, stretched..	Rocks are natural materials. Rocks have different properties. Rocks have different textures and appearances. Some rocks change over time. Soils are made from rocks, organic matter and water. There are different types of soil including sandy, chalk, clay and peat soil.	Most metals are non-magnetic. An electrical conductor is a material that allows electricity to flow through it. An electrical insulator is a material that does not allow electricity to flow through it. A thermal insulator is a material that slows down or prevents the transfer of heat.

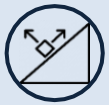
CHEMISTRY	Materials Fingertip knowledge **Pupils will know ...** 			Rocks can also be used to build things such as walls or buildings. When water freezes, it turns to ice. When ice melts, it turns to water. Some materials float in water. This means they stay at the top.	Different houses in Gainsborough are made from rocks and brick. Charles Macintosh discovered that rubber could be turned into a liquid using a chemical called naphtha, making it soft, flexible, and waterproof. He painted this rubber onto fabric, creating a "sandwich" with rubber in the middle. This new fabric was both flexible and waterproof, ideal for making clothes .	Some rocks have grains, crystals and layers. . Soils can act as a habitat for many small animals. Soils provide nutrients for plants. Soils can also prevent flooding, as they absorb water. This soil loss makes it hard for plants to grow, which affects the animals and people who depend on them for food and shelter. . Peat soil absorbs the most water because it is rich in organic matter and has a spongy texture that holds a lot of moisture. Human activity, like farming and deforestation, causes soil loss by removing plants that hold the soil together	Only a few metals are magnetic, such as iron and steel. Metals are good electrical conductors. Plastic, wood and paper are electrical insulators.

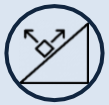
	States of matter Substantive knowledge 	**Year 4** Solids, liquids and gases are states of matter with different properties. Solids keep their shape; liquids change shape to fit a container but keep their volume; gases spread to fill all available space. Heating and cooling can cause materials to change state (melting, freezing, evaporating, condensing). Water exists as ice, liquid water and water vapour, changing state at 0°C (freezing) and 100°C (boiling). Evaporation (liquid → gas) and condensation (gas → liquid) are key parts of the water cycle.	**Year 5** Some materials are soluble and form a solution when they dissolve in a liquid; others are insoluble. Filtering, sieving and evaporation can be used to separate mixtures, depending on the materials involved. Some changes are reversible (dissolving, melting, evaporating, condensing). Some changes are irreversible and create new substances (e.g., burning, some reactions that produce gas).

	States of matter Sticky knowledge 	Solids have a defined shape and volume. A solid material will keep its shape if it is transferred from one container to another. Liquids have no fixed shape and will take on the shape of the container they are transferred into. The volume will remain the same. Gases have no fixed shape and no fixed volume. They will spread out and fill any available space. Some materials can change states between solids, liquids and gases. Water can be a solid (ice), liquid (water) or a gas (water vapour). When heat is applied to ice, it melts and turns to water. When water is heated it turns into a gas. A thermometer is used to measure temperature. A stopwatch is used to measure intervals of time. Evaporation is where a liquid changes state to a gas. Condensation is when a gas changes state to a liquid.	A soluble substance can dissolve in a liquid. An insoluble substance cannot dissolve in a liquid. Some changes can be reversed, such as dissolving, mixing and changes of state. Changes of state include freezing, melting, evaporation and condensation. An irreversible change is when a change cannot be undone to get the same substances back again. Irreversible changes result in new substances being made.

	States of matter Fingertip knowledge **Pupils will know ...** 	Some solids, such as sand, salt, flour and rice, can be poured but they are still classified as solid materials. Water has a boiling point of 100°C. A large amount of planet Earth is covered in water. As the water moves it can be in different states of matter.	Salt and sugar are soluble in a liquid. Sand and flour are insoluble in a liquid. Sieving can be used to separate a mixture of different-sized solids. Filtering can be used to separate an insoluble solid from a liquid. Increasing the temperature of the liquid increases the rate of dissolving. Stirring the liquid increases the rate of dissolving. A liquid will pass through filter paper, but an insoluble solid will not. Filtering cannot be used to separate a soluble solid from a liquid. When a new substance is made, a chemical reaction has taken place. Burning and reactions with acid are examples of an irreversible change.

	Forces Substantive knowledge **Pupils will know …** 	**Nursery** Objects can move in different ways (e.g., rolling, sliding, bouncing). Pushing and pulling can change how things move. Some products can be changed to make them move differently.	**Reception** A magnet can attract some objects. Some materials stick to magnets and some do not.	**Year 3** A force is a push or a pull and can change an object's speed, direction or shape. Contact forces happen when objects touch, including friction. Friction slows or stops movement, and rough surfaces create more friction than smooth surfaces. Magnetism is a non-contact force that can attract or repel objects without touching. Magnets have north and south poles; opposite poles attract, and like poles repel. Only some materials are magnetic (including iron and steel).	**Year 5** Friction produces heat and can cause materials to wear away. Air resistance is a friction force between air and a moving object, increasing with speed and surface area. Water resistance is a friction force between water and an object; streamlined shapes reduce resistance. Gravity is a non-contact force that pulls objects towards Earth. Levers, pulleys and gears are mechanisms that make a smaller force have a greater effect.

PHYSICS	Forces Sticky knowledge **Pupils will know ...** 	Some objects move by pushing and pulling them .	The name of a magnet. That some materials stick to magnets and some do not.	Forces are pushes or pulls. A contact force is a push or a pull that affects objects which are touching. Friction is a contact force that is caused by one object being pushed across the surface of another. Friction can stop or slow down a moving object. A magnetic force is a non-contact force. Magnets have two poles – a north and south pole. The opposite poles on two magnets will attract each other. The same poles on two magnets will repel each other.	Friction can stop or slow down a moving object. Air resistance is a friction force between the air and a moving object. Water resistance means the fictional force of water acting against an object. Gravity is an invisible force that pulls things to the centre of the Earth (or other planets). Levers, pulleys and gears are all mechanisms that will allow a smaller force to have a greater effect. Gears are wheels with teeth that allow a small force to produce a larger force with greater speed. A lever is a machine that allows movement of heavy objects. Pulleys use a rope or cable through a wheel to allow lifting of heavy object

	Forces Fingertip knowledge **Pupils will know ...** 			Smooth surfaces, such as ice, wood, and plastic, have lower levels of friction. Rough surfaces, such as concrete, sand and carpet, have higher levels of friction Magnets can have different shapes, such as a bar magnet or a horseshoe magnet. Magnets are objects that can attract some other metals.	A stationary object will only move when the force applied is greater than the friction, which acts in the opposite direction to the movement. Friction has many useful applications, such as in vehicle brakes, using sandpaper and walking on firm ground. Air resistance is greater when the surface area of the moving object is large. Parachutes have a large surface area, so they have a greater air resistance and slow the skydiver down. Air resistance increases with speed.

	Energy Substantive knowledge 	**Nursery** Objects can make different sounds. A sound can be loud or quiet. Hitting or shaking something harder makes a louder sound. Hitting or shaking something gently makes a quieter sound.	**Reception** When the sun shines, it can create a shadow behind an object. A shadow is a dark area where light is blocked.	**Year 3** Light is needed to see; darkness is the absence of light. The Sun is a natural light source. Light travels from a source, reflects off objects and then enters our eyes. Shadows form when an object blocks light. Opaque objects block light; transparent objects do not. A shadow becomes bigger when the light source is closer and smaller when it is further away.	**Year 4** Sounds are made by vibrations. These vibrations travel through air and reach our ears. The louder the sound, the bigger the vibrations. The quieter the sound, the smaller the vibrations. Pitch means how high or low a sound is. High-pitched sounds have faster vibrations; low-pitched sounds have slower vibrations. Sounds are louder when closer to the sound source and quieter when further away.	**Year 6** Light travels in straight lines. Light travels from a source to an object and is then reflected into the eye. Shadows form when light is blocked by an opaque object. The shape of a shadow matches the shape of the object blocking the light. Refraction happens when light changes speed and bends as it passes between different materials (e.g., air → water). White light is made of different colours (spectrum).

	Energy Sticky knowledge **Pupils will know ...** 	That objects make different sounds. What a loud and quiet sound is. Hitting an object harder will make a louder sound. Hitting an object gently will make a quiet sound	That when the sun shines, people and objects create shadows	**Light** Humans and other animals need light to see. Natural light sources are objects in nature that give out light, such as the Sun. Artificial light sources are made by humans. The Sun is a light source. Light from the Sun can be dangerous. Light travels from a light source to an object. The light is then reflected from the object into our eyes. Reflection is the return of light from a material or surface Shadows are formed when the light from a light source is blocked by an object Transparent objects, like clear glass, do not block light and therefore don't make a shadow.	**Sound** A vibration is a quick back-and-forth movement. Sounds are made when objects vibrate. The vibrations travel from the object to our ears. Sound vibrations travel through the air. If humans are exposed to loud sounds too often, their hearing can be damaged. **Electricity** Many appliances use electricity and must be plugged into a socket for the electricity to pass through the circui. Other appliances may need batteries to power the energy around a circuit. Electricity can be extremely harmful. Liquids and wet hands should be kept away from electrical appliances and circuits. A circuit must have a closed path so that electrical energy can pass through. Circuits can include bulbs, wires, switches, buzzers and cells connected in one loop. If a circuit does not have a source of energy, such as a cell or battery, then electricity cannot flow around.	**Light** Light travels in straight lines. Light travels from a light source to an object. The light rays reflect from the object to the eye. When light rays from a light source travel to an opaque object, they cannot pass through and a shadow is formed. When light passes from one medium to another, it can change direction. This is called refraction. White light is composed of a mixture of colours. **Electricity** A series circuit is where all the components are in one continuous loop. Current is the flow of electricity in a circuit. Voltage causes the current to flow To isolate a circuit, you have to break the wires, a switch may be open or the battery is the wrong way in the holder. The more components there are in a circuit, the more difficult it is for current to flow.

	Energy Fingertip knowledge **Pupils will know ...** 			There are ways to protect your eyes from the Sun. When the light source is closer to the object, the shadow is larger. When the light source is further away, the shadow is small	Sounds are made when objects vibrate. The louder the sound, the bigger the vibration. The quieter the sound, the smaller the vibration. Pitch means how high or low a sound is. High-pitched sounds produce faster or more frequent vibrations. Low-pitched sounds produce slower or less frequent vibrations. The outer ear funnels the vibrations into the ear canal. The vibrations move down the ear canal. The vibrations are passed to the ear drum. The vibrations from the ear drum are passed along the ear bones and into the cochlea. Signals are then sent to the brain, where they are processed and interpreted as sounds we understand. Sound volume is measured in decibels (dB). Some appliances use electricity to heat things up (cooker hobs) and cool things down (fridges and freezers).	**Light** Luminous objects emit light and non-luminous objects do not emit light. Light reflects from an object to the eye. Light passes through the pupil to the retina. As the distance between the light source and the object increases, the size of the shadow becomes smaller. As the distance between the light source and the object decreases, the size of shadow becomes larger. Refraction happens because light travels at different speeds in different substances. Isaac Newton and Ibn Al-Haytham discovered that white light is made up of different colours. A rainbow is a spectrum of light formed when sunlight passes through, and is refracted by, raindrops. **Electricity** Electricity starts at a power plant. They use coal, oil and water. Michael Faraday produced an electric current from a magnetic field by using a magnet inside a coil. Joseph Swan invented the light bulb but it was not efficient. The more components there are in a circuit, the dimmer the bulbs and the quieter the buzzers. Increasing the voltage increases the brightness of a bulb and the loudness of the buzzer.

						Decreasing the voltage decreases the brightness of a bulb and the loudness of the buzzer.

	Earth science Substantive Knowledge **Pupils will know ...** 	**Nursery** It is light in the daytime because the Sun is in the sky. It is dark at night because the Sun is not in the sky.	**Reception** There are different kinds of weather (e.g., rain, sun, snow, ice, clouds). Weather changes across the year. When weather is warm, ice melts; when weather is freezing, water becomes ice. When the Sun shines, objects can make shadows. Weather can be observed using senses (seeing, hearing, feeling).	**Year 1** There are four seasons: spring, summer, autumn and winter. Daylight length changes across the seasons. Winter has fewer daylight hours and is usually colder. Summer has the most daylight and is usually warmer. Spring is when many plants begin to grow. Autumn is when many trees lose their leaves.	**Year 5** The Sun, Earth, Moon and planets are spherical. The Sun is a star at the centre of the Solar System and gives out light and heat. The Earth orbits the Sun in one year (about 365 days). The Earth rotates once every 24 hours, causing day and night. The Earth's tilted axis causes the four seasons. The Moon orbits the Earth in about 27 days and reflects sunlight (it is not a light source). The Solar System contains eight planets which orbit the Sun at different distances. Gravity is the force that keeps planets in orbit. Our ideas about the Solar System have changed over time through scientific evidence.

	Earth science Sticky knowledge **Pupils will know ...** 	It is light at night because the sun is in the sky. It is dark at night because the sun isn't in the sky.	Know the name of different types of weather. (raining, sunny, icy, snowy, cloudy) Know the weather changes throughout the year. When weather is warm, ice melts. When the weather is freezing, water turns to ice. Describe what they can hear and see when observing the weather. When the sun shines, people and objects create shadows.	There are four seasons in one year. The seasons are spring, summer, autumn and winter. In autumn, the days are starting to become shorter and the nights are starting to become longer. The weather changes often in autumn In winter, there are fewer hours of daylight and the nights are longer. In spring, there are more hours of daylight and the nights start to become shorter. Summer is usually the warmest season. There are the most daylight hours in summer and the nights are shorter.	The Sun, Earth, Moon and other planets are approximately spherical bodies. The Solar System is a collection of planets, moons and the Sun. The Sun is at the centre of the Solar System. There are eight planets that orbit the Sun. The Sun is the largest object in the Solar System and has the greatest gravitational pull. This keeps all the planets in orbit around the Sun. The Earth takes 365 days, or one year, to complete one full orbit. Other planets take different amounts of time to complete a full orbit around the Sun. The Earth's axis is an imaginary line (that is slightly tilted) that runs from the North to the South Pole. The Earth rotates once around its axis in a 24 hour period. When part of the Earth faces the Sun, it is day. When part of the Earth faces away from the Sun, it is night. The Earth has one Moon, and it takes approximately 27 days for the Moon to orbit the Earth.

	Earth science Fingertip knowledge **Pupils will know ...** 			Some trees lose their leaves in autumn. The weather is often colder in winter. In spring, plants start to grow. In spring, some trees regrow their leaves. Many plants grow in summer. There are more animals active in summer. Summer is usually warmer than spring.	Mercury, Venus, Earth and Mars all have solid surfaces. Jupiter, Saturn, Uranus and Neptune have gas surfaces. Pluto is considered a dwarf planet. Different scientists and mathematicians have contributed to our understanding of the Solar System over time. Aristotle believed that the Earth was the centre of the universe and that everything, including the Sun and planets, went around it in a perfect circle. Ptolemy said that planets moved in small circles called epicycles, which were attached to bigger circles around the Earth. Galileo discovered that Jupiter had moons going around it, which showed that not everything went around Earth. He also saw Venus had phases like the Moon, which meant it went around the Sun. Newton discovered gravity, and explained that gravity is what keeps the planets orbiting around the Sun and the Moon orbiting around Earth. His idea helped people understand how the whole solar system works. The Moon is not a light source, it reflects light from the Sun.

Curriculum End of Year Points

SCIENCE

Curriculum End Points

The KKPs are the input to the curriculum. The curriculum end points are the output. Curriculum end points capture the knowledge, skills and understanding that children should have at the end of each year. They build progressively over time so that children leave Year 6 well-prepared for the next stage of education as competent and capable geographers.

For subject leaders, they provide a clear overview of the end of year expectations for each year group, which will support the planning and assessment of the curriculum.

For teachers, they provide further clarity around what children should be able to do at the end of each year, using the knowledge they have gained from being taught the KKPDs. They support teachers to plan activities that help to develop children as effective geographers. They should be used to check what children know and how well they can apply this knowledge across the curriculum.

For children, they ensure that they receive an equitable curriculum which gives them the substantive, procedural and disciplinary knowledge needed to be successful in their future studies.

Year group	By the end of the year, children should be able to ....
Nursery	• Recall the knowledge specified within the KKPD for Nursery. • Notice changes in the natural world and talk about what they see. • Explore materials and objects and describe simple differences. • Explore how objects move and what happens when they push, pull or drop them. • Talk about simple changes when things melt, freeze or mix. • Ask simple questions about what they observe.
Reception	• Recall the knowledge specified within the KKPD for Reception. • Observe living things and talk about how they grow or change. • Sort objects and materials using simple properties. • Talk about ways people stay healthy. • Notice patterns in the weather and seasons. • Explore simple phenomena (light/dark, floating/sinking, melting/freezing) and describe what happened. • Ask questions and talk about possible answers based on their observations.
Year 1	• Recall the knowledge specified within the KKPD for Year 1. • Use observations to identify features of humans, animals, plants and materials. • Group things based on simple similarities and differences. • Describe how objects move and what happens when they are pushed or pulled. • Notice seasonal changes and talk about patterns they see.

	• Use simple recording methods (drawings, tally charts, verbal conclusions). • Answer simple questions from their own observations.
Year 2	• Recall the knowledge specified within the KKPD for Year 2. • Use observations to describe how living things change or grow. • Compare materials and explain how they can change shape or be used. • Group things as living, dead or never alive using observable clues. • Use simple tests to explore ideas and make predictions. • Record results in tables/pictograms and talk about patterns. • Use their observations to answer questions and suggest reasons.
Year 3	• Recall the knowledge specified within the KKPD for Year 3. • Use observations and measurements to explain how plants, animals and materials behave. • Compare and group materials using more detailed properties. • Use ideas about light, forces and magnets to explain what they see happening. • Take accurate measurements using standard equipment. • Present findings using tables, diagrams or bar charts. • Draw simple conclusions and identify whether results match predictions.
Year 4	• Recall the knowledge specified within the KKPD for Year 4. • Group living things using criteria and classification keys. • Use ideas about states of matter, sound and electricity to explain observed changes. • Use thermometers and data loggers to collect more precise measurements. • Record results using bar charts and other graphs. • Use evidence to explain patterns or relationships.

	• Suggest improvements to their methods.
Year 5	• Recall the knowledge specified within the KKPD for Year 5. • Compare life cycles and describe processes by applying observational evidence. • Use ideas about forces and mechanisms to explain effects in real contexts. • Investigate mixtures and changes using fair tests and controlled variables. • Select appropriate equipment and measure accurately. • Present results clearly and identify relationships or patterns. • Explain conclusions using scientific vocabulary.
Year 6	• Recall the knowledge specified within the KKPD for Year 6. • Classify living things using broader criteria and justify their groupings. • Use ideas about evolution, inheritance and adaptation to explain evidence. • Use models of light and electricity to explain what they observe. • Plan and carry out increasingly independent enquiries, choosing methods appropriately. • Analyse data, spotting patterns, differences or anomalies. • Evaluate the reliability of their results and suggest how to improve investigations.
Progressive summary	**Nursery** In Nursery, children begin developing the earliest scientific ideas that later learning builds on. They learn that the Sun gives us light during the day and that it becomes dark at night when the Sun is not in the sky. They start to understand biological ideas by learning that animals, plants and people need care to live and grow. Naming familiar animals and natural materials introduces the foundations of later classification work. Children explore pushing, pulling, rolling, floating and sinking, giving them their first experiences of forces and material behaviour. They also begin to notice change in the world around them — melting, freezing, growth and simple weather changes — forming the roots of their later understanding of states of matter, seasonal change and life cycles. **Reception** Reception builds directly on Nursery knowledge and experiences. Children deepen their understanding of weather by describing different weather types and noticing that weather changes across the year, extending their early awareness of light and dark from Nursery. Their observations of melting and freezing in Nursery help them understand that water turns to ice when cold and melts when warm. The early ideas about caring for living things develop into talking about looking after plants and nature. Naming animals in Nursery grows into identifying common animals and their young. Their awareness of healthy bodies from Nursery becomes more specific as they learn that sleep, exercise and healthy choices help them. Seasonal observations through the senses extend the early noticing of change children began in Nursery. **Year 1**

	Year 1 builds on the biological and material knowledge gained in EYFS. Naming animals in Nursery and Reception develops into classifying them as carnivores, herbivores or omnivores. The healthy choices work from Reception supports children in identifying the main parts of the human body and linking them to the five senses. Seasonal change learning from Nursery and Reception develops into recognising the four seasons and describing weather patterns. Material exploration from Nursery forms the basis for identifying what materials objects are made from and describing their simple properties. Plant work from EYFS extends into identifying the basic parts of flowering plants and trees and recognising the differences between deciduous and evergreen trees. **Year 2** Year 2 builds on earlier biological and materials learning. The understanding from Nursery and Reception that living things need care develops into identifying living, dead and never-alive things and knowing that all living things have basic needs such as air, water, food and shelter. Observing animals and environments in Reception links to learning about habitats, microhabitats and how they provide for animals' needs. Animal classification from Year 1 supports understanding simple food chains, including producer and consumer roles. Earlier plant learning from EYFS and Year 1 develops into knowing that plants need water, light and suitable temperature to grow well. Material change work from Nursery and Year 1 grows into describing how materials can be changed by squashing, bending, twisting or stretching and identifying the uses of everyday materials. **Year 3** Year 3 extends ideas developed earlier across biology, forces, materials and light. Children's EYFS understanding of caring for bodies and Year 1 work on body parts develops into learning about skeletons, the support and protection they provide and which animals have backbones. Healthy eating and nutrition understanding from EYFS and Year 2 grows into recognising that humans need nutrients from food. The early exploration of pushing, pulling and rolling objects in Nursery links directly to learning about forces and magnets, including attraction and repulsion. Material exploration from Nursery, Year 1 and Year 2 supports understanding the differing properties of rocks, simple fossil formation and that soils are a mixture of rock and organic matter. Light learning builds directly on the Nursery understanding of day and night and develops into knowing that humans need light to see, that light is reflected and that shadows form when light is blocked. **Year 4** Year 4 builds on scientific knowledge developed in EYFS and KS1. Children extend their understanding of living things by learning about the digestive system, drawing on their earlier knowledge of eating, healthy choices and skeletons from Nursery, Reception and Year 3. States of matter work grows from the melting/freezing observations in Nursery and the material changes explored in Year 2, now extending into solids, liquids and gases, heating and cooling, evaporation, condensation and the water cycle. Sound learning builds on children's sensory exploration in EYFS by explaining that sounds are caused by vibrations that travel through materials and can change in pitch and volume. Understanding electrical circuits builds on early play with battery-operated toys in EYFS and KS1 and also links to DT mechanical systems such as the moving-part models explored in Reception and wheel-and-axle mechanisms in Year 1, where pupils first saw how components work together. This supports Year 4 learning that circuits must be complete for electricity to flow and connects back to earlier materials work when identifying conductors and insulators. **Year 5** Year 5 builds on knowledge developed over several earlier years. Understanding that humans grow and change extends the early care-for-living-things work in EYFS as well as the skeleton and nutrition work in Year 3. Material change understanding from Nursery (melting/freezing) and Year 2 (bending/stretching) develops into understanding dissolving, mixtures, reversible changes and irreversible changes. Forces learning extends directly from Nursery's pushing and pulling and Year 3's introduction to forces, now including gravity, friction, air resistance, water resistance and the role of levers, pulleys and gears. Understanding the Sun in Nursery and seasonal change in Reception and Year 1 supports knowledge of the Earth's orbit around the Sun, the Moon's orbit around the Earth and the Earth's rotation causing day and night and its tilt causing seasonal changes. Plant knowledge developed in EYFS and Year 1 supports learning how flowering plants reproduce through pollination, fertilisation and seed dispersal. **Year 6** Year 6 draws together scientific ideas built from Nursery through Key Stage 2. Understanding the circulatory system builds on early ideas of how to care for the body in EYFS, as well as the skeleton, nutrition and human development learning in Years 3 and 5. Classification knowledge links directly back to naming animals in Nursery and Reception and the formal grouping of animals and plants in Years 1 and 2. Evolution and inheritance build on fossil learning from Year 3 and the observations of variation in living things across earlier years. Light learning from Nursery (day and night) and Year 3 (reflection and shadows) now develops into knowing that light travels in straight lines, reflects, refracts and enables vision because light travels from a

	source, off objects and into the eye. Electrical circuit learning from Year 4 is extended into understanding how components function in more complex circuits, including the effect of voltage and the use of circuit symbols.