Wroxall PrimarySchool Curriculum Policy and Skills Progression for Science - Updated July 2023

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. (Science Programmes of Study, DfE)*

Intent

Our science curriculum at Wroxall Primary is centred on practical, hands-on learning experiences within the context of scientific enquiry. We believe that children will achieve a deeper level of scientific understanding by persevering to find things out for themselves, and by experimenting with techniques and methods that have enabled the secrets of our bodies, environment and universe to be discovered.

Throughout the school, children will work together to tackle different types of scientific enquiry (observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing; researching using secondary sources), and will increasingly plan, undertake and evaluate their own enquiries. Ultimately, our aim is that high-quality, practical learning will not only engage students with the processes of scientific inquiry, but also stimulate a curiosity, excitement and wonder of the subject.

Curriculum coverage and progression of skills in Science

Within each academic year, children will study a range of topics. In both Key Stage 1 and Key Stage 2, children are taught science as a freestanding subject, covering a specific topic each term. As classes are currently mixed age within school, a two-year rolling programme is in place. The topics have been carefully chosen to group together the progressive skills and knowledge from each year group. The progression document (included below) shows the science topics that are covered in each year group, as well as the development of skills and knowledge.

To ensure coverage across flexible mixed-year groups, the final half term in each cycle will be left open to provide time to fill any gaps caused by children moving between classes at different times. The focus will be around providing rich, investigative tasks to practise working scientifically. The content of these tasks will be informed by careful assessment using the progression documents to 'plug any gaps' and will give children a chance to further embed or extend their understanding of concepts.

How we plan learning in Science

Lessons are planned to ensure an inquiry-led approach is undertaken, with a mixture of creative investigations and experiments, as well as focused recording and opportunities for problem solving. Teachers also encourage children to make real world links within science, so the topic is always relevant, engaging and informative.

Firstly, teachers will focus on the prior learning and recap any knowledge necessary for the topic. Once completed, they will use the skills and substantive knowledge progression overviews (within this document) to guide their planning, ensuring clear progression across the school.

Children will also be encouraged to use the topic specific vocabulary throughout their work. Teachers will do 'checks on learning' regularly, to ensure that the correct level of detail and skill is being used by the children, and that the children are grasping the key principles of the topic in science that they are focusing on.
To enable concepts to be embedded within the long-term memory, lessons will often begin with quick, starter activities based on prior learning (sticky teaching). These activities are designed to give children a chance to recap and discuss the concepts covered in previous units.

How we assess learning in Science
Within each class, children will study a range of scientific topics. In mixed age classes, the progression of skills and knowledge taught will reflect the needs of children from different year groups, ensuring that all skills and knowledge are taught. In both Key Stage 1 (KS1) and Key Stage 2 (KS2), children are taught science as a freestanding subject, covering a specific topic each half term. Cross-curricular links will be made where appropriate to the topic. Each science topic is primarily based around one of the three core disciplines (Biology, Physics and Chemistry) with the aim that children are exposed to different methods of working scientifically throughout all topic areas.
To enable children to take ownership over the development of their knowledge and skills within science, they will have a copy of the unit overview at the beginning of each topic. These will be stuck into books and used to assess attainment which is recorded on Sonar.

Health and Safety
Science lessons usually take place within the children's own classroom environments, with visits to outside areas where appropriate for the lesson. The risk of harm is low, as the experiments/investigations tend to be on a smaller scale. However, it is vital that children and staff follow the key principles of health and safety during a science lesson. It is our aim to ensure that all pupils feel safe and secure in science lessons and do not come to any harm. Children are actively encouraged to be sensible at all times during a science lesson and to carefully follow the teacher's instructions and the following basic laboratory rules:

- Never run during a practical activity
- Stand where appropriate for practical activities
- Have hair tied back during a practical activity
- Ensure chairs are fully tucked under tables during a practical activity
- Ensure hands are washed thoroughly after practical activity
- Clean equipment correctly after practical
- Follow instructions/guidance carefully during practical activity
- Report accidents to teacher immediately
- Never leave equipment unattended during a practical activity
- Keep work area clear and tidy

Children with SEND
At Wroxall, our aim is that a broad and balanced curriculum with support and challenge should be accessible to all children, including those with SEND. Children who are identified as having SEND or additional needs will have an individual support plan. The provision and targets identified within the plan may well have relevance to learning in science as well as English or maths. As such the class teacher will seek to vary learning within science lessons to ensure its accessibility to all children. Support could include: finding alternative ways of recording understanding, reducing the need for writing if possible/appropriate; using visual cues/checklists to support learning; overtly teaching associated vocabulary; providing split-inputs/pre-teaching where needed.

Science in EYFS

‘Encouraging Curiosity, Exploration and Confidence in young Scientists’

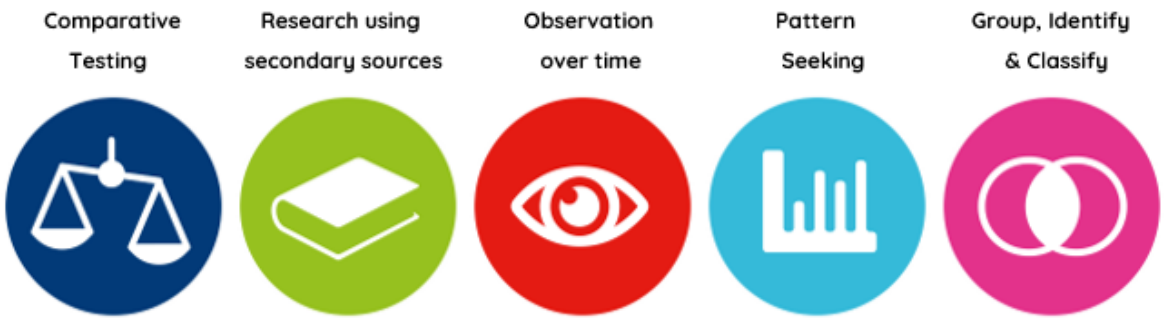
Our Vision

In early years, we provide all of our children with a myriad of opportunities to ask questions, be independently inquisitive, experience and explore the world around them whilst developing their curiosity. Through in-class topic learning, outdoor play and forest school, we foster a love of Science. Science is introduced as a discrete subject, through activities that encourage all children to explore, problem solve, observe, predict, think, make decisions and talk about the world around them.

Our expectations for all learners leaving Early Years are:

- To understand science is a discrete subject which asks questions and explores the world around them.
- To be able to make and describe simple observations.
- To be able to physically sort, identify and classify objects.
- To be able to identify and describe changes in their environment across the seasons.
- To be able to use simple equipment, such as; hand lens, plastics, pipettes, forceps
- To be able to use basic scientific vocabulary as indicated in the science vocabulary progression grid.

Scientific Enquiry - All investigations will be child-led, with the teacher following the questions and interests of the children. In the summer term, they will be exposed to all five types of enquiry, and will be familiar with the symbols in preparation for Year 1.



Year group:	EYFS				
Term:	**In EYFS, Science is not taught in discrete blocks, but through continuous provision. Through a range of opportunities, both indoors and outdoors, children are encouraged to be curious, discover and explore. Some of the themes and skills are explored below.**				
Early Learning Goal:	**ELG14:** Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and talk about changes				
Theme:	**All About Me**	**Animals & Plants**	**Materials**	**Forces**	**Seasonal Changes**
Skill/process:	•be able to identify different parts of their body. •Have some understanding of healthy food and the need for variety in their diets. •Know the effects exercise has on their bodies. •Have some understanding of growth and change.	**Animals** •Can talk about things they have observed including animals •Be able to show care and concern for living things. •Comments and questions about the place they live or the natural world. **Plants** •Make observations of plants •Know some names of plants, trees and flowers •May be able to name and describe different plants, trees and flowers •Show some care for their world around them **Our Environment** •Notices features of objects in their environment. •Comments and asks questions about their familiar world.	•be able to ask questions about the place they live. •Talk about why things happen and how things work. •Discuss the things they have observed such as natural and found objects. •Manipulates materials to achieve a planned effect.	•know about similarities and differences in relation to places, objects, materials and living things. •talk about the features of their own immediate environment and how environments might vary from one another. •make observations of animals and plants and explain why some things occur, and talk about changes. •Look closely at similarities, differences, patterns and change.	•Developing an understanding of change. •Observe and explain why certain things may occur (e.g leaves falling off trees, weather changes). •Look closely at similarities, differences, patterns and change. •Comments and questions about the place they live or the natural world.

Key Stage 1 and 2 Curriculum coverage

Year 1/2 Cycle A

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
Aspect	Physics	Physics	Chemistry		Biology	Biology
Theme	Seasonal change	Pushes and Pulls	Materials		Animals	Plants
Coverage	Changes over 4 seasons Weather/daylight changes		Naming different materials Using materials for different tasks Sorting objects by material		Classifying animals	Parts of trees and plants
Key Knowledge	Observe changes across 4 seasons Describe weather associated with the seasons. Describe how the length of day varies dependent on the season.	Objects can move (be in Motion) in various ways- roll, slide and bounce The pushing or pulling of an object can affect its motion. Pushing or pulling can do three things, slow down, speed up or change the direction of an object. The larger the push/pull the bigger the effect on motion	Distinguish between an object and the material from which it is made. Identify and name a variety of materials, including wood, plastic, glass, metal, water and rock. Describe the simple physical properties of a variety of everyday materials. Compare and group materials by their properties.		Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. Identify animals by diet – carnivore/herbivore/omnivore Describe and compare the structure of a variety of common animals.	Recognise and name a variety of common wild and garden plants. Recognise and name the parts of a plant – petals, leaves, flower, stem, root Recognise and name the parts of a tree – leaves, branches, trunk and root Compare living/dead/never been alive.
Main Investigation	Do seasons affect habitats?	Why and how do objects move?	Can we describe the properties of different materials?		How do animals survive?	How do plants grow?

Year 1/2 Cycle B

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
Aspect	Biology		Chemistry	Biology	Biology	
Theme	Living things and their habitats		Use of Everyday Materials	Animals including Humans	Plants	
Coverage	Habitats Food chains		Properties of material	Exercising and keeping healthy Life cycles	How plants grow Healthy plants	
Key Knowledge	Compare the differences between things that are living, dead and things that have never been alive. Find out about basic needs of animals including humans. Identify and name a variety of plants and animals in their habitats, including microhabitats. Describe how different habitats provide basic needs of animals and plants and how they depend on each other. Describe how animals obtain their food from plants and other animals – food chains Match living things to their habitat		Identify and compare the suitability of materials including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. Find out how the shape of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.	Identify, name, draw and label basic parts of the human body. Senses – which body parts are associated with which sense Find out about and describe the basic needs of animals, including humans, for survival (water, food and air) Describe the importance of exercise, balanced diet and hygiene. Animals, including humans have offspring which grow into adults.	Observe and describe how seeds grow into plants – changes over time. Grow and care for own plants – observe and compare plants that do not have sunlight/water/temperature. Find out and describe how plants need sunlight, water and a suitable temperature to grow and stay healthy.	
Main Investigation	What is a habitat?		Why do we choose materials to do certain jobs?	What is the life cycle of an animal?	How are new plants made?	

Year 3/4 Cycle A

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y3	Y4	Y4	Y4	Y3	
Aspect	Physics	Biology	Physics	Physics	Biology	Working scientifically
Theme	Rocks and soil	Animals including humans	Sound	States of Matter	Plants	Coverage
Coverage	Fossil formation Compare and group rocks Soil	Skeletons, muscles and nutrition	Sound vibrations Pitch and volume	Changing state Water cycle Classification of materials	Parts of a plant Water transportation Pollination and seed dispersal	Generating own enquiry
Key Knowledge	Compare and group rocks based on appearance and simple physical properties. Recognise that soils are made from rocks and organic matter. Describe in simple terms how fossils are formed.	Identify that animals need the right amount of nutrition from the food they eat. Identify that humans and some other animals have skeletons and muscles for support, protection and movement –(Y3)	Identify how sounds are made – associating some with something vibrating. Recognise that vibrations made from sounds travel through a medium to the ear. Find patterns between the pitch/volume of a sound and features of the object that produced it. Recognise that sounds get fainter as distance from sound source increases.	Compare and group materials – solids, liquids, gases. Observe changes of state – hot and cold- Measuring temperature at which changes happen. Identify part played by evaporation and condensation in water cycle.	Identify and describe functions of different parts of flowering plants – root, stem/trunk, leaves and flowers. Explore the requirements of plants for growth. Investigate the way water is transported within plants. Explore the life cycle of plants. Explore the part that flowers play	To ensure coverage over the 2-year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations
Main Investigation	What is the Earth made from?	Why do we have a skeleton?	How is sound produced?	How can I identify materials based on their properties?	How do plants make their food?	What are mixtures and how can they be separated?

Year 3/4 Cycle B

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y4	Y4	Y3	Y4	Y3	
Aspect	Biology	Biology	Physics	Physics	Physics	Working scientifically
Theme	Living things	Animals including humans	Forces and magnets	Electricity	Light	Coverage
Coverage	Classification of living things	Food chains Digestive system and teeth	Friction Magnets Grouping	Conductors and insulators Simple switches	Light and dark Reflections Sun safety Shadows	Generating own enquiry
Key Knowledge	Recognise that living things can be grouped in a variety of ways. Explore and use classification keys to ID and name variety of living things in local/wider environment. Changes in environment can pose dangers to living things.	Construct and interpret variety of food chains, identifying predator and prey. Describe the simple functions of basic parts of human digestive system. Identify different types of teeth and their functions. .	Compare how things move on different surfaces. Recognise some forces need contact but others, such as magnets can act at a distance. Observe and predict whether magnets will attract or repel. Describe magnets as having two poles.	Identify and name common appliances that require electricity. Construct a simple series electrical circuit naming its basic parts – cells, wires, bulbs, switches and buzzers. Identify whether or not a lamp will light in a simple series circuit. Recognise a switch opens and closes a circuit. Recognise some common conductors and insulators.	Recognise that we need light to see things and dark is the absence of light. Notice that light is reflected from surfaces. Recognise that light from the Sun can be dangerous and that there are ways to protect eyes Recognise that shadows are formed when the light from a light source is blocked by an opaque object.	To ensure coverage over the 2-year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations

					Find patterns in the way that shadows change.	
Main Investigation	What is classification?	How does the body get nutrients from food into the bloodstream?	What is a magnet?	What are electric circuits and how do they work?	Why can you see your reflection in a mirror but not the floor?	

Year 4/5 Cycle A

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y5	Y4	Y4	Y5	Y4	
Aspect	Chemistry	Physics/ Chemistry	Physics	Physics	Physics	Working scientifically
Theme	Materials	Materials	Sound	Earth and Space	Materials	Coverage
Coverage	Dissolving Reversible/irreversible changes – filtering/sieving/ evaporation	Comparing/grouping Uses of materials	Sound vibrations Pitch and volume	Movement of Earth/moon/sun Gravity	Changing state Water cycle Classification of materials Conductors and insulators	Generating own enquiry
Key Knowledge	Know that some materials dissolve to form a solution, describe how to recover. Decide how mixtures might be separated – filtering, sieving and evaporating. Demonstrate reversible changes – dissolving, mixing, changes of state. Recognise and explain irreversible changes	Compare/group materials based on their properties - hardness, solubility, transparency, conductivity, response to magnets. Give evidence based reasons for uses of everyday materials	Identify how sounds are made – associating some with something vibrating. Recognise that vibrations made from sounds travel through a medium to the ear. Find patterns between the pitch/volume of a sound and features of the object that produced it. Recognise that sounds get fainter as distance from sound source increases.	Describe movement of Earth/planets relative to the Sun. Describe movement of the Moon relative to Earth. Describe the Sun, Earth, Moon as approx. spherical bodies. Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky.	Compare and group materials – solids, liquids, gases. Observe changes of state – hot and cold- Measuring temperature at which changes happen. Identify part played by evaporation and condensation in water cycle. Recognise common conductors and insulators	To ensure coverage over the 2 year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations
Main Investigation	What are mixtures and how can they be separated?	What materials could we use to build a school?	How is sound produced?	What is Earth's address in space?	How are new substances made?	How do plants reproduce?

Year 4/5 Cycle B

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y4	Y5	Y4	Y5	Y5	
Aspect	Biology	Biology	Physics	Biology	Physics	Working scientifically
Theme	Living things	Animals, including humans	Electricity	Animals, Including Humans	Forces	Coverage
Coverage	Classification of living things	Digestive system and teeth	Conductors and insulators Simple switches	Human changes Life cycles- mammal/amphibian/insect/bird Reproduction	Gravity Air/Water resistance Levers/Pulleys/Gears	Generating own enquiry
Key Knowledge	Recognise that living things can be grouped in a variety of ways. Explore and use classification keys to ID and name variety of living things in local/wider environment. Changes in environment can pose dangers to living things. Construct and interpret variety of food chains, identifying predator and prey.	Describe the simple functions of basic parts of human digestive system. Identify different types of teeth and their functions. Identify that animals need the right amount of nutrition from the food they eat. .	Identify and name common appliances that require electricity. Construct a simple series electrical circuit naming its basic parts – cells, wires, bulbs, switches and buzzers. Identify whether or not a lamp will light in a simple series circuit. Recognise a switch opens and closes a circuit. Recognise some common conductors and insulators.	Describe changes in humans as they age. Describe the differences in life cycles of a mammal, amphibian, insect and bird. Describe the life process of reproduction in some plants/animals.	Explain that unsupported objects fall towards Earth. Identify effects of air-resistance, water resistance and friction. Investigate how levers, pulleys and gears can change the effect of forces.	To ensure coverage over the 2-year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations
Main Investigation	What is classification?	How does the body get nutrients from food into the bloodstream?	How can electrical circuits be controlled?	Do all animals start life as an egg?	How and why do things move?	

Y5/6 –Cycle A

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y6	Y6	Y5	Y6	Y5	
Aspect	Biology	Biology	Physics	Physics	Chemistry	Working scientifically
Theme	Animals including humans	Living Things and their Habitat	Earth and Space	Light	Materials	Coverage
Coverage	The circulatory system Water/nutrient transportation	Classifying living things Identifying features Creating own classification keys	Movement of Earth/moon/sun Gravity	Light sources Reflection Shadows	Dissolving Reversible/irreversible changes – filtering/sieving/evaporation	Generating own enquiry
Key Knowledge	Identify and name main parts of circulatory system. Recognise impact of diet, exercise, drugs and lifestyle. Describe ways nutrients/water transported.	Describe how living things are classified Use classification keys to identify and sort living things Give reasons for classifying animals and plants	Describe movement of Earth/planets relative to Sun. Describe movement of Moon relative to Earth. Describe the Sun, Earth, Moon as approx. spherical bodies.	Recognise that light travels in straight lines Recognise that objects are seen because they give out, or reflect light. Explain that we see things because light travels from light sources to our eyes or from the light source to objects and then to our eyes.	Know that some materials dissolve to form a solution, describe how to recover. Decide how mixtures might be separated – filtering, sieving and evaporating. Demonstrate reversible changes –dissolving, mixing, changes of state. Recognise and explain irreversible changes	To ensure coverage over the 2-year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations

				Recognise and explain why shadows have same shape as object		
Main Investigation	How do nutrients get to where they are needed in the body?Is it important to pump your own?	What is a mammal?	What is Earth's address in space?	Why does my shadow change length?	How are new substances made?	Possible inquiry – If we were to move to another planet, what would we need in order to live well?

Y5/6 –Cycle B

Term	Aut 1	Aut 2	Spr 1	Spr 2	Sum 1	Sum 2
	Y5	y6	Y5	Y6	Y5	
Aspect	Chemistry	Physics	Biology	Biology	Physics	Working scientifically
Theme	Materials	Electricity	Life cycles	Evolution and Inheritance	Forces	Coverage
Coverage	Comparing/grouping Uses of materials	Circuits/switches Buzzers/bulbs Batteries	Human changes Life cycles-mammal/amphibian/insect/bird Reproduction	Fossils Adaptation to environment – Plants and animals Identical and non-identical offspring	Gravity Air/Water resistance Levers/Pulleys/Gears	Generating own enquiry
Key Knowledge	Compare/group materials based on their properties - hardness, solubility, transparency, conductivity, response to magnets. Give evidence based reasons for uses of everyday materials.	Recognise the brightness of light/volume of buzzer is linked to voltage. Give reasons for variation of components – buzzers/lights/switches Represent circuit using recognised symbols	Describe changes in humans as they age. Describe the differences in life cycles of a mammal, amphibian, insect and bird. Describe life process of reproduction in some plants/animals.	Recognise that living things have changed over time and fossils can provide information. Recognise that living things produce offspring of the same kind, but they don't always look alike.	Explain that unsupported objects fall towards Earth. Identify effects of air-resistance, water resistance and friction. Investigate how levers, pulleys and gears can change the effect of forces.	To ensure coverage over the 2-year cycle. Use progression document in front of books to highlight any potential gaps. Children to generate own enquiries, plan, conduct and evaluate own investigations
Main Investigation	What materials could we use to make a school?	How can electrical circuits be controlled?	Do all animals start life as an egg?	What is evolution and how do we know it happened?	How and why do things move?	

Skills Progression

	OBSERVATION AND CONCLUSION	ENQUIRY, PREDICTION, TESTING	DATA COLLECTION	RECORDING	VOCABULARY
R	• Make simple observations	• Enjoy finding out about things	• Join in – e.g. leaf collections	• Draw what interests them	

Year 1	• Make observations • Talk simply about what they see. • Answer simple questions about what they see • Describe simple features with simple vocabulary–parts of the body, a tree • Observe closely using simple equipment to help them – e.g. magnifying glass	• Perform simple tests using simple equipment – e.g. a timer • Talk about some reasons why things might happen, or why something has happened • Understand basic safety rules when testing out their ideas	• Recognise that scientific ideas are more than guesses, and based on evidence • Collect data when asked – e.g. a weather station • Count data sets – trees in a field Sort data within given criteria – tall trees, wet days, blue eyes • Remember and recall information • Underline important facts	• Record what they have seen or done in different ways, including drawing and labelled diagrams • Record some information onto a pre prepared chart • Label objects according to simple criteria • Record things they have seen or done from memory	Properties Metal Rock Fabric Wood Plastic Ceramic Purpose organisms growth energy fish amphibians mammals birds Reptiles herbivore omnivore carnivore

Year 2	• Answer questions using evidence • Ask questions about what they see • Make relevant observations • Give simple reasons and explanations for what they have seen • Identify simple parts of what they see – e.g. petal, leg •	• Find things out, with help and suggestions • Begin to make predictions about what might happen • Understand key factors that Make a fair test • Use simple apparatus effectively and safely	• Gather and record data to help in answering questions and understand why this is important • Use tallies to count in surveys • Use books to find information	• Begin to use cause and effect in their explanations, and some scientific vocabulary • Use simple tables and charts • Identify, classify and use bulleted lists • Make sketches of their observations • Use line graphs to present their findings	**m**aturity reproduce die offspring life cycle food chain (from 'Animal survival' y1) producer consumer changed Physical force absorb crumbly property Drag Pull

					Suitable Strongest Flexible motion pushing pulling slow down speed up direction flowering reproduction (reproduce from ‘Animal life cycles’ yr 2) germinate (germination from ‘Plants’ yr1) generations

Year 3	OBSERVATION AND CONCLUSION	ENQUIRY, PREDICTION, TESTING	DATA COLLECTION	RECORDING	VOCABULARY

	• Choose what observations to make • Know that questions can be answered in different ways • Compare what happened to what might have happened and give simple explanations • Make a precise series of observations and measurements • Classify simple features –flower, tree • Examine closely and question what is seen	• Identify features of a fair test and carry out a fair test with help • Think of questions to ask during testing • Decide on approaches to answer questions and suggest own ideas • Select suitable equipment • Suggest improvements in their work • Predict before testing • Begin to repeat observations and measurements	• Use books and other sources of information • Begin to suggest ways to collect data • Recognise the importance of data collection • Make suggestions about how to collect data • Use graphs to find and interpret patterns	• Record and label sketches and diagrams, sometimes with notes • Use technology to record results • Begin to plot points for simple graphs • Record systematically • Record a series of observations in different ways	magnet force attraction repulsion metal non-contact force pole vertebrates invertebrates skeleton exoskeleton vital organs support mass muscles connect contract State

Year 4	• Make systematic and careful observations and comparisons • Compare observations over time • Categorise observations • Begin to make theories • Provide explanations using scientific language • Use precise scientific language • Ask relevant questions	• Decide on the best approaches for enquiry • Make predictions based on scientific knowledge • Describe or show how to vary a factor and keep others the same • Repeat tests and explain difference • Review work and check predictions • Suggest improvements giving reasons	• Recognise the importance of the evidence collected • Compare and identify data patterns • Select from a range of sources • Question others about their work • Know the work of some scientists • Count and measure quantities accurately • Use sources of information to analyse	• Use a range of scientific conventions • Understand and begin to use both quantitative and qualitative data • Record and present data in a variety of ways – tables, bar charts, line graphs • Order results scientifically	Substance Mixture Dissolving Solution Meat Dairy Protein Grains Root vegetable Carbohydrates Fat Insulation Fruits Minerals Vitamins Fibre Healthy Digestion Pollination Seed (from yr 1 'Plants') Stamen

					Stigma Ovaries Petals Dispersal Germination (from yr 1 'Plants') Electricity Batteries Electricity Device Wires Circuit Conductor Insulator Classification Classification key Vertebrates (from yr 3 'Animal skeletons and movement) Invertebrates (from yr 3 'Animals, skeletons and movement') Food chain (from yr 1 'Animal Survival') Nutrients (from yr 3 'Plant food production')

					Organism (from yr 1 'Animal Survival') Mammal (from yr 1 'Animal Survival') Amphibian (from yr 1 Animal Survival') Insect Bird (from yr 1 'Animal Survival') Environmental change Sound Pitch Volume Vibration Ear drum Frequency Amplitude

Year 5	• Begin to relate conclusions to patterns, previous knowledge and observational evidence • Make judgements and conclusions about what has been seen, and support these with known facts • Justify their own theories through observation	• Offer explanations for differences • Modify tests for accuracy • Plan different types of scientific enquiries to answer questions • Recognise and control variables • Make practical suggestions about working methods and improvements • Use results to draw simple conclusions, make predictions for new values, suggest improvements • Develop further observations and experiments from results	• Gather and classify data in a variety of ways • Distinguish and discriminate between different elements of data	• Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables • Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	Million Billion Evolution Extinct Fossil Palaeontologist Organism Microorganism Bacteria Microscope Solar System Planets Orbit Star Moon

	and conclusion • Use straightforward scientific evidence to answer questions or support findings.				Rotating Day Year Galaxy Universe Asteroid Comet Gravity Mass Matter Mass React Irreversible Water resistance Air resistance

					Friction undulations Interlock Gears Pulley Lever Oxygen Sugar Lungs Muscles Circulation Heart

Year 6	• Evaluate the results of observations Combine observations to give new hypotheses • Look for and understand poor data Identify differences, similarities or changes related to simple scientific ideas and processes	• Use a range of scientific enquiry to answer questions • Use test results to make predictions and to set up further comparative and fair tests	• Identify scientific evidence that has been used to support or refute ideas or arguments. • Take accurate measurements using a range of equipment, including thermometers, with increasing accuracy and precision • Repeat readings when appropriate	• Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results	Shadow Opaque Transparent Translucent Reflection Pupil Evolution Natural selection Population Variation Competition Adapted Offspring Inheritance Charles Darwin

					Lamarck Jean-Baptise HMS Beagle Current Voltage Volts Conductor Resistance Resistor

Substantive Knowledge Progression

PHYSICS Forces		
	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1		

Year 2	**<u>Year 2- Pushes and pulls</u>** **Knowledge Block 1** ● Objects can move (be in **Motion**) in various ways-roll, slide and bounce **Knowledge Block 2** ● The **pushing** or **pulling** of an object can affect its motion. ● Pushing or pulling can do three things, **slow down, speed up or change the direction** of an object. **Knowledge Block 3** ● The larger the push/pull the bigger the effect on motion	***<u>Year 3 Forces and Magnets</u>*** ***Pupils should be taught to:*** ● *compare how things move on different surfaces* ● *notice that some forces need contact between two objects* .
Year 3	**<u>Magnets</u>** **Knowledge Block 1- What magnets do** ● Magnets exert **attractive forces** on some **metals** **Knowledge Block 2- Magnets don't need to touch** ● Magnetic forces work through other materials including air, so magnets don't need to be touching to **exert** their force. It is called a **non-contact force** **Knowledge Block 3- Magnets attract and repel** ● Each end of a magnet is called a **pole**, opposite poles are called north and south. ● Magnets exert **attractive** forces on each other when the poles facing each other are north and south (opposites). ● Magnets exert **repulsive** forces on each other when the poles facing each other are the same. **Knowledge Block 4- what affects magnetic strength** The strength of magnetic forces is affected by: ● The strength of the magnet. ● The distance between the magnet and the object. ● The material the object is made from.	***<u>Year 3 Forces and Magnets</u>*** ***Pupils should be taught to:*** ● *compare how things move on different surfaces* ● *notice that some forces need contact between two objects, but magnetic forces can act at a distance* ● *observe how magnets attract or repel each other and attract some materials and not others* ● *compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials* ● *describe magnets as having two poles* ● *predict whether two magnets will attract or repel each other, depending on which poles are facing.*

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 4		

Year 5	**Forces that oppose motion** **Knowledge Block 1: Water and air resistance.** ● When objects move through air and water, they have to push it out of the way. The water and air push back with forces called **water resistance** and **air resistance**. The harder it is to push the material out of the way the greater the resistance. ● Gases weigh less than liquids and so water resistance is greater than air resistance. **Knowledge Block 2: Friction** ● **Friction** is a **force against motion** caused by two surfaces **rubbing** against each other. It occurs because no surfaces are perfectly smooth; they have bumps and **undulations** that can **interlock** when placed on top of each other. ● To move one **interlocking** surface over another, one of three things must happen: ● The surfaces must rise slightly ● The bumps on the surface must bend ● The bumps on the surface must break ● All of these actions require a force, this is what causes friction **Knowledge Block 3: Managing Forces** ● Some objects require large forces to make them move; **gears**, **pulley** and **levers** can reduce the force needed to make things move. ● The use of levers can reduce the force needed to move things. The object you are lifting is called the **load**, and the force you apply to the arm to make the object move is called the **effort**. ● The use of pulleys can reduce the force needed to move things (These are particularly complex ideas. It might be better to teach them through a design technology project where children make toys using cogs, pulleys and lever)	***Year 5 Forces and Magnets*** ***Pupils should be taught to:*** ● *explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object* ● *identify the effects of air resistance, water resistance and friction, that act between moving surfaces* ● *recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.*
Year 6		

PHYSICS
Energy Pathways

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1		
Year 2		
Year 3	**<u>Light</u>** **Knowledge Block 1- Light and sight** • There must be light for us to see. • Light comes from a **source**. • We need light to see things, even **shiny** things. • Light from the sun can be dangerous and that there are ways to protect their eyes **Knowledge Block 2- What light does when it hits materials** • If an object is **transparent** light will go through it and we will be able to see through it. • If an object is **opaque,** it will block the light and no light will get through. This is what forms shadows. • The closer to the light source an object is, the bigger the shadow will be. This is because the object blocks more of the light. • The further away from the light source an object is, the smaller the shadow will be. This is because the object blocks less of the light. • If an object is perfectly **reflective,** light will bounce back off it and we will see reflections of objects. • If the material is **translucent,** it will allow light through, but we won't be able to see through it.	***<u>Year 3 Light</u>*** ***Pupils should be taught to:*** • *recognise that they need light in order to see things and that dark is the absence of light* • *notice that light is reflected from surfaces* • *recognise that light from the sun can be dangerous and that there are ways to protect their eyes* • *recognise that shadows are formed when the light from a light source is blocked by an opaque object* • *find patterns in the way that the size of shadows change.*

Year 4	**Sound** **Knowledge Block 1: Describing Sound** ● Sounds can be produced in a variety of ways. ● Sounds have the properties of **pitch** and **volume.** ● When a sound is produced it spreads out from its source in all directions **Knowledge Block 2: How sound is made and travels** ● Sound is caused by **vibration** (objects move rapidly back and forth or up and down) ● When objects vibrate it makes the objects in contact with it also vibrate. This includes the air. ● The vibration travels through the air and makes other objects it is in contact with vibrate including your **ear drum**. **Knowledge Block 3: Pitch and Volume changes** ● Pitch and volume are caused by how the material vibrates ● The pitch of a sound is caused by how fast an object vibrates. This is called the **frequency** of vibration. Higher the frequency, higher the pitch ● Smaller objects or tighter strings tend to vibrate with a higher frequency ● The volume of sound is caused by how big each vibration is. This is called the **amplitude** of vibration. The bigger the amplitude the higher the volume. ● Sounds get fainter as the distance from the sound source increases.	***Year 4 Sound*** ***Pupils should be taught to:*** ● *identify how sounds are made, associating some of them with something vibrating* ● *recognise that vibrations from sounds travel through a medium to the ear* ● *find patterns between the pitch of a sound and features of the object that produced it* ● *find patterns between the volume of a sound and the strength of the vibrations that produced it* ● *recognise that sounds get fainter as the distance from the sound source increases.*

Year 5	**Substantive Knowledge from Learning Journeys**	*National Curriculum Statutory Requirement*

Year 6	**How light behaves** **Knowledge Block 1: How light travels** ● When light is emitted from a light source, it travels in straight lines until it hits an object. This can be represented by an arrow. ● **Shadows** form when light hits an **opaque** object. The area behind the object is in darkness because light can only travel in straight lines. ● Shadows have the same shape as the objects that cast them. **Knowledge Block 2: How light behaves when it hits objects** ● When light hits a **transparent** object, it goes through it in a straight line so we can see a clear image through it. ● When light hits a **translucent** material, it goes through it but is scattered, this means light can pass through, but we can't see an image through it. ● When light hits a mirrored surface, it reflects off it in straight lines, so we can see an image in the reflective material. ● Sometimes when light hits a material it **reflects** off it in many different directions (it is scattered). In this case light will be reflected but no image will be seen in the material. ● Shiny surfaces are better reflectors and rough surfaces scatter light more. Opaque objects don't allow any light to pass through them **Knowledge Block 3: How we see** ● Animals see objects when light is reflected off the object and enters the eye through the **pupil**. ● The pupil changes its size to allow enough, but not too much light into the eye. ● Too much light damages the eye and too little results in poor quality images.	***Year 6 Light*** ***Pupils should be taught to:*** ● *recognise that light appears to travel in straight lines* ● *use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye* ● *explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes* *use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.*

PHYSICS Electricity		
	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1		
Year 2		
Year 3		

Year 4	**Electricity** **Knowledge Block 1- Electricity as a power source** ● Lots of **devices** are powered by **electricity** ● Electricity comes from a source There are two main sources- **batteries and mains** **Knowledge Block 2- What batteries do** ● A battery pushes electricity to the device. ● To be able to push electricity the battery must be connected to the device using **wires** ● This is called a **circuit** **Knowledge Block 3- Making devices work harder** ● If there are more batteries added to a circuit this provides a bigger push on the electricity ● This will make the device work harder e.g., brighter bulbs, faster spinning motor, louder buzzer **Knowledge Block 3- Insulators and conductors** ● Some materials will allow electricity to flow through them- **Conductors** ● Metals such as silver, gold and copper are good conductors. Water is also a conductor of electricity. ● Other materials will not allow electricity to flow through them- **Insulators** ● Plastic, wood, glass and rubber are good electrical insulators. That is why they are used to cover materials that carry electricity. ● A switch opens and closes a circuit	***Year 4 Electricity*** ***Pupils should be taught to:*** ● *identify common appliances that run on electricity* ● *construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers* ● *identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery* ● *recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit* ● *recognise some common conductors and insulators, and associate metals with being good conductors.*

Year 5	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 6	**Controlling electrical circuits** **Knowledge Block 1: Pushing electrical current** ● Current is the flow of electricity around a circuit. ● The power supply in a circuit pushes the current round the circuit ● The voltage of the power supply is a measure of this push ● Voltage is measure in volts ● Batteries have a limited store of energy and when this is gone, they can no longer push the current **Knowledge Block 2: Electrical current** ● Current is the flow of electricity through a **conductor** ● When current passes through a device it makes it work ● Increasing the voltage (the number of cells in the battery) increases the current. The larger the flow of current, the harder the device works **Knowledge Block 3: Electrical resistance** ● All parts of a circuit offer **resistance** to electrical current including the wires. ● Resistance is the slowing down of electrical current ● The more devices added into a circuit the greater the resistance ● This means less current flows around the circuit	***Year 6 Electricity*** ***Pupils should be taught to:*** ● *associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit* ● *compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches* ● *use recognised symbols when representing a simple circuit in a diagram.*

PHYSICS
Earth & Space

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1	**Year 1- Seasons** **Knowledge Block 1- Surviving the changing seasons** ● There are four seasons, **Spring, summer, autumn** and **winter** ● Each season is about three months long ● In Spring, young animals like lambs and chicks are born, the flowers bloom and the weather starts to become warmer. ● In autumn, the leaves fall off the trees and the amount of time we have in the day becomes less. ● Winter has the shortest amount of time during the day and the weather is at its coldest. ● In summer the trees are full of green leaves and the weather is at its warmest. ● Animals and plants have adapted ways of surviving the changing seasons ● These include **hibernating**, storing food, fattening up, **migration**, loss of leaves ● Trees can be either **evergreen** or **deciduous**. ● **Evergreen** trees keep their green leaves all year round. ● **Deciduous** trees lose their leaves every autumn. (THIS SUBSTANTIVE KNOWLEDGE APPEARS IN THE PROGRESSION WITHIN THE BIOLOGY- VARIATION AND EVOLUTION)	***Year 1 Seasonal Changes*** ***Pupils should be taught to:*** ● *observe changes across the four seasons* ● *observe and describe weather associated with the seasons and how day length varies* ***Year 1 Plants*** ***Pupils should be taught to:*** ● *identify and name a variety of common wild and garden plants, including deciduous and evergreen trees*
Year 2		
Year 3		
Year 4		

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

Year 5	**Space and Gravity** **Knowledge Block 1: Our Solar system** ● A **Solar system** is a collection of **planets**, which **orbit** (a curved path) a **star**. ● There are huge number of stars in space and therefore a huge number of solar systems ● Our solar system consists of 8 planets, many of those planets have **moons** which orbit around them. ● Earth's moon is not a planet but is a satellite which orbits Earth. It is around a quarter of the size of Earth. ● As the Moon orbits the Earth, the Sun lights up different parts of it, making it seem as if the Moon is changing shape. We call these the phases of the moon. ● The Moon doesn't emit (give off) light itself, the 'moonlight' we see is actually the Sun's light reflected off the lunar surface. ● Our solar system can be represented with a model (see diagram), but it isn't possible to draw it to scale. ● The planets and moons are **rotating** (spinning) ● The time it takes one planet to rotate is called a **day**. On Earth this is 24 hours ● The time it takes a planet to complete one orbit around its star is called a **year**. On Earth this is 356.25 days ● The solar system is with a massive collection of stars called the **galaxy** (called the Milky way) ● The Milky way is one of billions of galaxies in the **Universe**. **Knowledge Block 2: What else is in the solar system?** ● Stars are huge balls of gas that produce vast amounts of light and heat. ● **Asteroids** are lumps of rock that orbit a star (there are millions in between Mars and Jupiter) ● **Comets** are objects that are made of Ice, which melts when they get closer to the sun leaving a tail. **Knowledge Block 3: Gravity and its effects** ● **Gravity** is force of attraction between two objects with **mass** (a quantity of matter) ● The bigger the mass the bigger force it exerts ● Gravity works over distance but gets weaker as distance increases ● Stars, planets, moons have a very large amount of mass. They exert a gravitational attraction on each other ● Differences in gravity result in smaller mass objects orbiting around lager mass objects, e.g., planets around stars and moons around planets	***Year 6 Earth and space*** ***Pupils should be taught to:*** ● *describe the movement of the Earth, and other planets, relative to the Sun in the solar system* ● *describe the movement of the Moon relative to the Earth* ● *describe the Sun, Earth and Moon as approximately spherical bodies* ● *use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.*
Year 6		

CHEMISTRY
Materials

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1	**Describing Materials** **Knowledge Block 1- The big idea about materials** • There are many different materials that have different observable **properties** • Materials that have similar properties are grouped into **metals, rocks, fabrics, wood, plastic and ceramics** (including glass).	***Year 1 Everyday Materials*** ***Pupils should be taught to:*** • *distinguish between an object and the material from which it is made* • *identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock* • *describe the simple physical properties of a variety of everyday materials* • *compare and group together a variety of everyday materials on the basis of their simple physical properties.*
Year 2	**Changing Materials** **Knowledge Block 1- How materials can change** • The properties of a material determine whether they are **suitable** for a **purpose**. • Materials can be **changed** by **physical force** (twisting, bending, squashing and stretching). (The purpose of the activities within this learning journey is for children to understand why we choose certain materials to do certain jobs. Children will plan how to test materials (wood, metal, plastic, glass, brick, paper, rock, cardboard))	***Year 2 Uses of everyday materials*** ***Pupils should be taught to:*** • *identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses* • *find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching*

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

Year 3	**Solids, liquids and gases** **Knowledge Block 1- Properties of solids, liquids and gases** ● Materials can be divided into solids, liquids and gases. ● **Solids** hold their shape unless forced to change. ● **Liquids** flow easily but stay in their container because of **gravity**. The more **viscous** a liquid the less runny it is. ● **Gases** move everywhere and are not held in containers by **gravity**. **Knowledge Block 2- Changing state** ● **Heating** causes solids to **melt** into liquids and liquids to **evaporate** to gases. ● **Cooling** causes gases to **condense** to liquids and liquids to **freeze** to solids. **Knowledge Block 3- Melting, freezing, boiling and condensation temperatures** ● Different substances change **state** at different temperatures but the temperatures at which given substances changes state is always the same. **Knowledge Block 4- All about the water cycle** ● The temperature at which a substance **melts** from a solid to a liquid is the same at which it **freezes** from a liquid to a solid. ● The temperature at which a substance **boils** from a liquid to a gas is the same at which it **condenses** from a gas to a liquid. ● Liquids **evaporate** slowly, even below their boiling temperatures. ● The water cycle is the process by which water is continuously transferred between the surface of the earth and the atmosphere. ● Liquid water evaporates into water vapor, condenses to form clouds, and precipitates back to earth in the form of rain and snow.	***Year 4 States of matter*** ***Pupils should be taught to:*** ● *compare and group materials together, according to whether they are solids, liquids or gases* ● *observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)* ● *identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.*

Year 3	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
	Rocks and soils **Knowledge Block 1- The different types of rocks** ● A **rock** is a solid material made up of **minerals** forming part of the surface of the Earth ● Rocks are exposed on the surface at cliffs, hills and mountains but are also under the surface. ● Some rocks, called **ores** contain metals ● Some rocks are made of **grains** squashed together and can contain the remains of long-dead organisms, called **fossils**. This type of rock is called **sedimentary** rock, an example would be **limestone**, **sandstone** or **mudstone** ● Some rocks are made of **crystals** that are locked tightly together. These are called **igneous** and **metamorphic** rocks; an example of igneous rock is **granite,** and an example of metamorphic rock is **slate** **Knowledge Block 2- The properties of rocks** ● These three types of rocks all have different properties to each other, including **porosity**, **hardness**, reaction to chemicals ● The properties of the rock depend on how the rock was formed, e.g. Some igneous rocks form from lava from volcanoes and cool very quickly leading to very small crystals **Knowledge Block 3- The structure of soils** ● **Soil** is made up of small broken-down pieces of rock. ● Soil contains a range of different size rock pieces, e.g., sand grains or stones. ● Soil also contains **humus** (rotted plant material) ● Soil made of very fine rock is called **silt** or **clay**.	***Year 3 Rocks*** ***Pupils should be taught to:*** ● *compare and group together different kinds of rocks on the basis of their appearance and simple physical properties* ● *describe in simple terms how fossils are formed when things that have lived are trapped within rock* ● *recognise that soils are made from rocks and organic matter.*

Year 4	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
	Mixtures and separating them **Knowledge Block 1- What mixtures are** ● A **substance** is an object with the same properties throughout. ● A **mixture** is when more than one substance is present in the same container **Knowledge Block 2- What dissolving is** ● When a substance is added to a liquid the substance can disappear- this is called **dissolving** ● A mixture of a substance that has dissolved in a liquid is called a **solution** ● Not every substance can dissolve in water **Knowledge Block 3- Separating mixtures** ● Mixtures can be separated if the substances have different properties ● This is because the substances in the mixture are still present and are unchanged ● There are different techniques for separating mixtures. - Filtration requires the substances be one that does not dissolve in a liquid to work. - Sieving requires the substances to be of different sizes to work - Magnets requires the substances to be some magnetic materials and some non-magnet materials to work. - Evaporation requires a solid substance dissolved in water and the solid has a higher boiling point in water to work. - Floating requires some substances to float and some substances to sink to work.	***Year 5 Properties and changes of materials*** ***Pupils should be taught to:*** ● *compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets* ● *know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution* ● *use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating*

Year 5	**<u>Making new substances</u>** **Knowledge Block 1: Reversible and irreversible changes** ● All matter, including gas, has **mass**. ● Sometimes, mixed substances **react** to make a new substance. These changes are usually **irreversible**. ● Heating can sometimes cause materials to change permanently. When this happens, a new substance is made. These changes are not reversible. ● Indicators that something new has been made are the properties of the material are different (colour, state, texture, hardness, smell, temperature) ● If it is not possible to get the material back easily it is likely that it is not there anymore and something new has been made (irreversible change)	***<u>Year 5 Properties and changes of materials</u>*** ***Pupils should be taught to:*** ● *give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic* ● *demonstrate that dissolving, mixing and changes of state are reversible changes* ● *explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.*
Year 6		

BIOLOGY
Plants

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
Year 1	**Plants** **Knowledge Block 1- Where do plants come from** • A **seed** contains a miniature plant that can develop into a fully grown plant. • A **bulb** has underground vertical shoots which already has modified **leaves** • Seeds and bulbs need water to grow but most do not need light (**germination**) • Seeds and bulbs have food stores inside them to help the plant start to grow. **Knowledge Block 2- Plant survival** • To survive plants, need to get water, light, and avoid being eaten **Knowledge Block 3- How plants get what they need to survive** • A seed produces **roots** to allow water to get into the plant. • A seed produces **shoots** to produce leaves to collect the sunlight. • A basic plant structure can include leaves, flowers (blossom), petals, fruit, roots, bulb, seed, trunk, branches, stem	***Year 1 Plants*** ***Notes and guidance (non-statutory)*** *Pupils should use the local environment throughout the year to explore and answer questions about plants growing in their habitat. Where possible, they should observe the growth of flowers and vegetables that they have planted.* *They should become familiar with common names of flowers, examples of deciduous and evergreen trees, and plant structures (including leaves, flowers (blossom), petals, fruit, roots, **bulb, seed**, trunk, branches, stem).* ***From Year 2*** *Note: Seeds and bulbs need water to grow but most do not need light; seeds and bulbs have a store of food inside them.*
Year 2	**New Plants** **Knowledge Block 1- What flowers are for** • All **flowering plants** make seeds (**reproduction**) that can grow (**germinate**) into new plants • Plants need water, light and a suitable temperature to grow and stay healthy **Knowledge Block 2- What happens after a plant has produced seeds** • Some plants die after it has produced its seed and sometimes the plant lives for many **generations** producing seeds each year	***Year 2 Plants*** ***Pupils should be taught to:*** • *observe and describe how seeds and bulbs grow into mature plants* • *find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.*

Year 3	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

	Plants and their food production
	
	Knowledge Block 1- Plants don't go to McDonalds
	● Plants do not eat food so have to make their own.
	● This food provides then with energy, and materials to grow
	● To make the food (sugar) plants need water from the ground, **carbon dioxide** from the air and light from the sun.
	  ○ The water is taken up through the **roots** from the **soil**
	  ○ The carbon dioxide is taken in through the **leaves**
	● As well as food, plants also make **oxygen** which is given out back into the air through the leaves
		Year 3 Plants
		
		Pupils should be taught to:
		● *identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers*
		● *explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant*
		● *investigate the way in which water is transported within plants*

Year 4	**<u>Plant reproduction</u>** **Knowledge Block 1- The reproductive parts of a flowering plant** ● Flowering plants **reproduce** by the process of **pollination** ● Pollination leads to the formation of a **seed** which can grow into a new plant ● Flowering plants have evolved specific parts to carry out pollination and seed growth ● Those parts are **stamen** where pollen is produced, **stigma** where pollen is collected, and the **ovaries** which contains the eggs that become a seed when the pollen travels down the stigma and meets the egg ● Flowers have **petals** also are a range of colours, patterns, and smells to attract insects **Knowledge Block 2- All flowers are similar but different** ● Plants and flowers look different because they pollinate in different ways. ● There are two types of pollination Insect and wind ● Insect pollinated flowers are usually bright coloured and strong scents ● Wind pollinated flowers have less colourful petals and much less scent **Knowledge Block 3- Seed dispersal** ● Plants have evolved many different ways to **disperse** their seeds ● Seed dispersal increases the chances of seeds **germinating** and growing into a mature plant **Knowledge Block 4- What a seed does** ● A seed contains a miniature, undeveloped version of the plant ● They contain a food store for the first stage of growth (until the plant can make its own food) ● They are surrounded with a protective coat.	***<u>Year 3 Plants</u>*** ***Pupils should be taught to:*** ● *explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.*
Year 5		

Year 6		

BIOLOGY **Animals (including humans)**		
	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

Year 1	**Animal Survival** **Knowledge Block 1- Feeding for survival** ● Animals are groups of **organisms** that need to consume food to survive. ● Food provides **energy** and the building blocks of **growth**. ● There are many different groups of animals including **fish, amphibians, reptiles, birds and mammals**. They have different structures, and they eat different types of foods. ● The structure of a variety of common animals varies **Mammals** have hair/fur and give birth to live young, **fish** can breathe underwater using gills, **birds** have feathers, beaks and wings. Females lay eggs. Most birds can fly, **reptiles** are air breathing and have scaly skin and lays eggs, and **amphibians** have smooth slimy skin and live on land and in water. ● Some eat other animals (**carnivores**), and others only eat vegetables (**herbivores**), and some like to eat both plants and meat (**omnivores**) ● Common animals that are **carnivores** include lions, cats, sharks and snakes ● Common animals that are **herbivores** include cows, horses, sheep, elephants and deer ● Common animals that are **omnivores** include humans, bears, monkeys and seagulls **Knowledge Block 2- Moving for survival** ● Animals must move to get their food ● They will move in different ways to get their food ● Animals that eat other animals are called **predators** ● Animals that are eaten by other animals are called **prey** ● Animals feeding relationships can be illustrated in a **food chain** **Knowledge Block 3- Sensing for survival** ● The five sense organs are the **eyes** (for seeing), **nose** (for smelling), **ears** (for hearing), **tongue** (for tasting), and **skin** (for touching or feeling). ● Animals have senses to help them survive ● Animals have developed a range of ways to find prey or avoid being eaten	***Year 1 Animals, including humans*** ***Pupils should be taught to:*** ● *identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals* ● *identify and name a variety of common animals that are carnivores, herbivores and omnivores* ● *describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets)* ● *identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.* ***Year 2 Animals, including humans*** ***Pupils should be taught to:*** ● *find out about and describe the basic needs of animals, including humans, for survival (water, food and air)*

Year 2	**Substantive Knowledge from Learning Journeys**	*National Curriculum Statutory Requirement*
	Animal Life Cycles **Knowledge Block 1- Animal timelines** ● Things that are **living**, move, feed, grow, **reproduce** and use their senses ● Animals grow until they reach **maturity** and then don't grow any larger ● Animals **reproduce** when they reach maturity (adulthood) ● All animals eventually, **die** ● Different animals live to different ages ● Different animals reach different sizes before they are able to reproduce ● Different animals reproduce at different ages ● Animals, including humans, have **offspring** which grow into adults ● Exercise, eating the right amounts of different types of food and **hygiene** are important to maintain good **health** and **wellbeing** **Knowledge Block 2- How animals get their food** ● **Habitats** are places where animals and plants live (from Year 1) ● Animals live in habitats in which they are suited. ● Different kinds of animals and plants depend on each other within **habitat**. ● Animals get their food from plants and other animals. This can be shown in a **food chain**. ● A food chain begins with a **producer**. This is often a green plant because plants can make their own food. ● A living this that eats other plants is called a **consumer**.	***Year 2 Living things and their habitats*** ***Pupils should be taught to:*** ● *explore and compare the differences between things that are living, dead, and things that have never been alive* ● *identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other* ● *identify and name a variety of plants and animals in their habitats, including micro-habitats* ● *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.* ***Year 2 Animals, including humans*** ***Pupils should be taught to:*** ● *notice that animals, including humans, have offspring which grow into adults* ● *describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.*

Year 3	**Animals, skeletons and movement** **Knowledge Block 1- Skeletons protect vital organs** ● All **vertebrates** have internal **skeletons** that protect **vital organs**. ● **Invertebrates** have **exoskeletons** that protect **vital organs**. **Knowledge Block 2- Skeletons support weight** ● Skeletons support the weight of land animals. ● Stronger bones can **support** a greater **mass.** **Knowledge Block 3- Skeletons support movement** ● Bones are **connected** (but can move relative to each other) at joints. ● **Muscles** connect to bones and move them when they **contract**. ● Stronger bones can **anchor** stronger muscles.	***Year 3 Animals, including humans*** ***Pupils should be taught to:*** ● *identify that humans and some other animals have skeletons and muscles for support, protection and movement.*

Year 4	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
	Digestion **Knowledge Block 1- Food groups** ○ Animals need a variety of foods to help them grow and survive. The main food groups are: ● **Meat**, **dairy** and pulses provide **protein** for muscles. ● **Grains** and **root vegetables** provide **carbohydrates** for energy. ● **Fat** for **insulation** and energy. ● **Fruit** and **vegetables** for **minerals, vitamins and fibre**. These are essential to keep our bodies working well and protect us from illnesses. **Knowledge Block 2- Variation in animals' diet** ● Different animals require different foods to survive. ● Animals get their food from plants and other animals. This can be shown in a **food chain**. (From Year 2) ● A food chain begins with a **producer**. This is often a green plant because plants can make their own food. (From Year 2) ● A living this that eats other plants is called a **consumer**. (From Year 2) ● Humans require a balanced diet to remain **healthy** but healthy diets vary depending upon the type of activity that humans do. ● Humans have 2 sets of teeth in their lifetimes ● Humans have three main types of teeth- incisors, canines and molars. ● Incisors help to bite off and chew pieces of food. ● Canines are used for tearing and ripping food. ● Molars help to crush and grind food. **Knowledge Block 3- How humans digest food** ● The **nutrients** in food have to get to every part of the body. The **blood** transports them. ● The role of **digestion** is to get the nutrients in food to dissolve in the blood, if it doesn't dissolve it can't enter the blood and be transported.	***Year 3 Animals, including humans*** ***Pupils should be taught to:*** ● *identify that animal, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat* ***Year 4 Animals, including humans*** ***Pupils should be taught to:*** ● *describe the simple functions of the basic parts of the digestive system in humans* ● *identify the different types of teeth in humans and their simple functions* ● *construct and interpret a variety of food chains, identifying producers, predators and prey.*

Year 5	**Substantive Knowledge from Learning Journeys**	*National Curriculum Statutory Requirement*
	Circulation **Knowledge Block 1: Getting oxygen into the blood** ● All animals need **oxygen** to survive. ● Air is breathed into the **lungs** where the oxygen in the air is passed into the blood. ● Every part of animals' bodies need oxygen, especially **muscles**. ● Muscles need a supply of oxygen and **sugar (glucose)** to make them work, they are supplied by the blood. **Knowledge Block 2: The blood circulation model** ● The heart is a vital organ pumps blood through the blood vessels. ● Blood Vessels are the tubes that blood flows through. ● The blood **circulates** around the body in a way that ensures all muscles in the body get a supply of oxygen and sugar. ● The **heart** pumps blood to every muscle in the body. The circulatory route must allow the blood to collect oxygen from the lungs, sugar from the intestines and visit muscles. ● The blood then returns to the heart where it is pumped again. ● Exercise helps the heart to work more efficiently. ● Eating a healthy diet helps to keep the blood vessels from getting blocked. ● Avoiding smoking and alcohol puts less stress on the whole system and keeps it healthier.	***Year 6 Animals, including humans*** ***Pupils should be taught to:*** ● *identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood* ● *recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function* ● *describe the ways in which nutrients and water are transported within animals, including humans.*

	Year 5 Animals, including humans ● *describe the changes as humans develop to old age.* ***Relationships Education, Relationships and Sex Education (RSE) and Health Education*** *66. The content set out in this guidance covers everything that primary schools should teach about relationships and health, including puberty. The national curriculum for science also includes subject content in related areas, such as the main external body parts, the* ***human body as it grows from birth to old age*** *(including puberty) and reproduction in some plants and animals. It will be for primary schools to determine whether they need to cover any additional content on sex education to meet the needs of their pupils. Many primary schools already choose to teach some aspects of sex education and will continue to do so, although it is not a requirement.* *104. Relationships Education, RSE and Health Education complement several national curriculum subjects. Where schools are teaching the national curriculum, they should look for opportunities to draw links between the subjects and integrate teaching where appropriate. There continues to be no right of withdrawal from any part of the national curriculum.*	
Year 6		

BIOLOGY
Variation and Evolution

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

Year 1	**Habitats** **Knowledge Block 1- Adapted to survive** ● There is variation in all living things ● Animals and plants live in a variety of different places called habitats ● Animals and plants have adapted to survive in different habitats ● Wild plants such as ferns, daisies, nettles and dandelions grow randomly. ● Garden plants such as roses, tulips, poppies, daffodils are planted intentionally. **Knowledge Block 2- Plants adaptations for survival** ● Plants have specific adaptations for survival ● To survive they need to get water, light, and avoid being eaten **Year 1- Seasons** **Knowledge Block 1- Surviving the changing seasons** ● There are four seasons, **Spring, summer, autumn** and **winter** ● Each season is about three months long ● In Spring, young animals like lambs and chicks are born, the flowers bloom and the weather starts to become warmer. ● In autumn, the leaves fall off the trees and the amount of time we have in the day becomes less. ● Winter has the shortest amount of time during the day and the weather is at its coldest. ● In summer the trees are full of green leaves and the weather is at its warmest. (THIS SUBSTANTIVE KNOWLEDGE APPEARS IN THE PROGRESSION WITHIN THE PHYSICS- EARTH AND SPACE) ● Animals and plants have adapted ways of surviving the changing seasons ● These include **hibernating**, storing food, fattening up, **migration**, loss of leaves ● Trees can be either **evergreen** or **deciduous**. ● **Evergreen** trees keep their green leaves all year round. ● **Deciduous** trees lose their leaves every autumn.	***Year 1 Plants*** ***Pupils should be taught to:*** ● *identify and describe the basic structure of a variety of common flowering plants, including trees.* ***Year 1 Seasonal Changes*** ***Pupils should be taught to:*** ● *observe changes across the four seasons* ● *observe and describe weather associated with the seasons and how day length varies* ***Year 1 Plants*** ***Pupils should be taught to:*** ● *identify and name a variety of common wild and garden plants, including deciduous and evergreen trees*

Year 2		

Year 3	**Substantive Knowledge from Learning Journeys**	*National Curriculum Statutory Requirement*

Year 4	**Living things** **Knowledge Block 1- Classifying living things** ● Living things can be divided into groups based upon their characteristics ● **Classification keys** help group, identify and name living things ● Animals can be classified as **vertebrates** (having a spine) or **invertebrates** (lacking a spine) ● In any habitat there are **food chains** and webs where **nutrients** are passed from one **organism** to another when it is eaten ● If the population of one organism in the chain or web is affected, it has a knock-on effect to all the others **Knowledge Block 2- Life cycles** ● Mammals, amphibians, insects and birds have different life cycles. ● Lifecycles vary in time depending on the species of animal- it can be as short as just a few weeks for insects, to up to 200 years for sea urchins. Larger animals often have longer life cycles but not always. ● All animal life cycles begin with growth and development followed by reproduction. ● Some animals undergo a complete **metamorphosis** as they grow. Metamorphosis is a process where animals undergo an abrupt and obvious change in the structure of their body and their behaviour. ● Some animals are eusocial. This means they live in colonies (groups) with one animal or group producing young and the others working to care for them. **Knowledge Block 2- Environmental change** ● **Environmental change** affects different habitats differently ● Human activity significantly affects the environment ● Different organisms are affected differently by environmental change	***Year 4 Living things and their habitats*** ***Pupils should be taught to:*** ● *recognise that living things can be grouped in a variety of ways* ● *explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment* ● *recognise that environments can change and that this can sometimes pose dangers to living things.* ***Year 5 Living things and their habitats*** ***Pupils should be taught to:*** ● *describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird* ● *describe the life process of reproduction in some plants and animals.*

	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*

Year 5

Fossils, geological time and classification

Knowledge Block 1- What is evolution and how do we know it happened?

- The Earth is very old. Around 4.2 **billion** years. We know this from dating rocks
- Life first appeared on Earth around 3.8 billion years ago.
- Life was, at first, very simple but over **millions** and millions of years life became more complex through the process of **evolution**

Knowledge Block 2- Evidence for evolution

- There are many sources of evidence for evolution
- **Fossils** are one of the main sources of evidence for evolution. They show when new organisms appear and when they go **extinct**.
- Due to the nature of fossil formation and discovery, fossils only provide an incomplete record of evolution.
- Scientists use fossils along with other pieces of evidence *(DNA, Embryology, comparative anatomy, artificial selection)* to work out how organisms have evolved
- Fossils form when dead organisms are rapidly buried or leave an imprint and are turned to stone over a long period of time. If they survive in the Earth, they then have to be found by a **palaeontologist** who will study them.

Knowledge Block 3: Classification of life

- All living (and **extinct**) **organisms** are classified into groups based upon their physical features.
- This includes animals, plants, fungi, and **microorganisms** like **bacteria**.
- Within each of these broad groups, organisms are classified into small subgroups. Animals- invertebrates, mammals, birds, amphibians, reptiles and fish, Plants- flowering plants, ferns, conifers, moss.
- Bacteria are a group of organisms that are not visible to the naked eye but are very abundant and have distinct physical features we can only see under powerful **microscopes**.

Year 5 Evolution and inheritance

Pupils should be taught to:

- *recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago*

Year 6 Living things and their habitats

Pupils should be taught to:

- *describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals*
- *give reasons for classifying plants and animals based on specific characteristics.*

Year 6	Substantive Knowledge from Learning Journeys	*National Curriculum Statutory Requirement*
	Classification and Evolution **Knowledge Block 1: Natural selection** • **Evolution** is the change of physical form in a population over a long-time span • **Natural selection** is the process which controls that change. • In any **population** there is **variation** and **competition** for resources (food, water, mates). • Within that variation, organisms that have features which make them better **adapted** at securing food, water, and mates, are more likely to survive and produce **offspring** which have **inherited** those same successful features. Those that are not well adapted will eventually go **extinct**. • Over a long enough timeline all organisms in a population will have those successful features. • This is known as the *Theory of Evolution by Natural Selection* and was developed by **Charles Darwin** in 1859 **Knowledge Block 2: How Charles Darwin discovered the process of Evolution by Natural selection** ● Before Darwin, **Lamarck's** Idea of acquired characteristics was proposed. (Giraffes stretch their necks in life, which made their children have longer necks). ● Darwin as a young man travelled around the world on the **HMS Beagle**. On this 5-year voyage he saw lots of things and recorded down lots of evidence which allowed him to work out how organisms change over time by a different mechanism of Natural selection	***Year 5 Evolution and inheritance*** ***Pupils should be taught to:*** ● *recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents* ● *identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution*