Science Curriculum

Curriculum Intent for Science

Science embodies the acquisition of knowledge and understanding of the natural world and beyond through the process of rigorous testing, observation and experimentation, which constantly challenge and build upon prior discoveries. This process results in technological advancements through the application of Science within engineering, which in turn has a profound impact on the world around us. Consequently, we believe that it is our duty to further develop this Science capital through the study of a diverse range of scientists, noting how these key individuals contributed to their fields.

Our **'Science Curriculum'** challenges us to develop children who understand what Science is, what it is for and its relevance in the world around us. We aim to nurture and develop their inquisitive nature in order to advance their knowledge using scientific vocabulary in order to discuss and confidently question the world around them, as they explore new concepts using a practical, 'hands-on' approach through scientific enquiry. Overall, we strive to expose the children to have a deeper understanding of the world, widening their opportunities for science capital and fostering a life-long love of Science and STEM.

At Masefield, Science is taught as a discrete subject in order that the development of knowledge, vocabulary and scientific enquiry skills are taught both meaningfully and explicitly. Naturally, links are made to other areas of the curriculum, especially English, Mathematics, Design Technology and Computing, but this does not dilute the quality and entitlement of high quality Science teaching.

The school's long-term plan for Science follows the Key Stage 1 and Key Stage 2 National Curriculum (2014) and sets out the content of teaching within in each year group. This is supported by the school's Science progression document which demonstrates learning outcomes and expectations for Biology, Chemistry, Physics and Working Scientifically within each Science stand and subsequent units of work. Short term planning details how this content is developed over a series of lessons within the unit of work. The organisation of the Science curriculum provides structured opportunities for pupils to:

- Develop and use key scientific vocabulary within their correct contexts.
- Explore concepts and dispel common misconceptions through the use of investigation.
- Explore the world around them, developing their understanding of key physical and biological processes.
- Approach Science through practical scientific enquiry, through the process of enquire, explore, record and explain.
- Opportunities for working scientifically are provided, using a combination of observation over time, pattern seeking, identifying, classifying and grouping, comparative and fair testing and research using secondary sources of information.
- Devise their own lines of enquiry, which can be planned and subsequently implemented.
- Understand the essential role of Mathematics as a quantifiable source of evidence for scientific understanding.

- Understand the role of Science in the wider world, including its cultural impact on our everyday lives.
- Develop their Science capital through their understanding of the work of scientists and naturalists, from a range of times and cultures, understanding how their discoveries contribute to the cumulative nature of scientific understanding. This is covered through year-group unit linked scientists and Masefield's four House Teams.

Teaching and Learning Science

In addition to the conscious structure and design of the Science curriculum, great consideration has been paid to the design of the implementation of the curriculum in the classroom. Teaching delivery will vary according to the activities being undertaken, but will follow the principles set out in the Teaching, Learning and Implementation policy and will include class, group and individual instruction and guidance, exposition and demonstration, and the use of questioning and discussion. The following resources and approaches are adopted across all year groups in order to ensure effective delivery of the intended curriculum.

The teaching of scientific knowledge and working scientifically are, where possible, taught in unison, rather than as separate entities, within the majority of Science lessons.

The school's vocabulary progression document (Science) provides a clear focus for the development and exploration of key words, working in conjunction with knowledge organisers, classroom displays of key vocabulary and the use of varied concept and vocabulary exploration activities.

For consistency of approach, the use of Lancashire Planning Posters (physical and electronic) are used to support the teaching of planning practical investigations, guiding pupils to generate focussed scientific enquiry questions.

All year groups undertake a biographical study of a famous scientist linked to specific, identified units of work outlined in the Science long-term plan.

National Curriculum

The national curriculum for science aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics.
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them.
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

End of EYFS	Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Understanding the World **ELG: The natural World** Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	The principal focus of science teaching in Key Stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly - constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be	The principal focus of science teaching in Lower Key Stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out.	The principal focus of science teaching in Upper Key Stage 2 is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this through exploring and talking about their ideas; asking their own questions about scientific phenomena; and analysing functions, relationships and interactions more systematically. At Upper Key Stage 2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests

	some use of appropriate secondary sources, such as books, photographs and videos. 'Working scientifically' is described separately in the programme of study, but must **always** be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary at a level consistent with their increasing word reading and spelling knowledge at Key Stage 1.	'Working scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word reading and spelling knowledge.	and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use their scientific knowledge and understanding to explain their findings. 'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read, spell and pronounce scientific vocabulary correctly.

Scientific Enquiry

Working Scientifically

Asking questions
Asking questions that can be answered using a scientific enquiry.

Making predictions
Using prior knowledge to suggest what will happen in an enquiry.

Setting up tests
Deciding on the method and equipment to use to carry out an enquiry.

Observing and measuring
Using senses and measuring equipment to make observations about the enquiry.

Recording data
Using tables, drawings and other means to note observations and measurements.

Interpreting and communicating results
Using information from the data to say what you found out.

Evaluating
Reflecting on the success of the enquiry approach and identifying further questions for enquiry.

Overview of Science Content

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 1	**Physics: Seasonal Changes (Throughout the year)**	**Chemistry: Everyday Materials**		**Biology: Animals, Including Humans**	**Biology: Plants**	
	Scientific Enquiry: Observing over Time Pattern Seeking **Is the weather the same every day?**	Scientific Enquiry: Comparative & Fair Testing **Are all materials the same?**		Scientific Enquiry: Pattern Seeking **Are all animals totally different?**	Scientific Enquiry: Research using secondary sources **What parts is a plant made of?**	
	Key Scientist Robert Fitzroy			Biography: Key Scientist Steve Irwin		
	Y1 Seasonal Changes LBQ Assessment	**Y1 Everyday Materials LBQ Assessment**		**Y1 Animals, Including Humans LBQ Assessment**	**Y1 Plants LBQ Assessment**	
Year 2	**Biology: Living Things & their Habitats**	**Chemistry: Uses of everyday materials**	**Biology: Animals, Including Humans**		**Biology: Plants**	
	Scientific Enquiry: Identifying, classifying & grouping **Is everything on Earth alive?**	Scientific Enquiry: Identifying, classifying & grouping Comparative & Fair Testing **What materials could be used to make a good raincoat?**	Scientific Enquiry: Pattern Seeking **Do all animals start off small?**		Scientific Enquiry: Observing over Time **Do plants grow the same amount every day?**	
		Biography: Key Scientist John Boyd Dunlop	Key Scientist Joan Beauchamp Procter			
	Y1 Living Things and Their Habitats LBQ Assessment	**Y1 Materials LBQ Assessment**	**Y1 Animals, Including Humans LBQ Assessment**		**Y2 Plants LBQ Assessment**	
Year 3	**Chemistry: Rocks**	**Physics: Light**	**Physics: Forces and Magnets**	**Biology: Animals, Including Humans**	**Biology: Plants**	
	Scientific Enquiry: Identifying, classifying & grouping	Scientific Enquiry: Observing over Time **Why do shadows change during the day?**	Scientific Enquiry: Identifying, classifying & grouping	Scientific Enquiry: Research using secondary sources	Scientific Enquiry: Observing over Time Comparative & Fair Testing	

	Are all rocks made in the same way?		**Are all metals attracted to magnets?**	**How does our body move and stand up?**	**Do all plants need exactly the same things?**	
	Biography: Key Scientist Mary Anning		Key Scientist Michael Faraday		Key Scientist Beatrix Potter	
	LBQ Vocabulary: **10626**	LBQ Vocabulary: **11262**	LBQ Vocabulary: **11040**	LBQ Vocabulary: **10711** LBQ Vocabulary: **10596**	LBQ Vocabulary: **10565** LBQ Vocabulary: **10512**	
	10669: Fossil Formation **10927**: Rock properties and uses	**11262**: Light and Dark **11253**: Shadows	**10894**: Forces **11256**: Magnets	**10560**: Different Animal Diets **10605**: Skeletons, Muscles and Joints **11498**: Food and Diet: Food Groups	**11258**: What Plants Need to Grow **10500**: Life Cycle of a Flowering Plant	
Year 4	**Physics: Sound**	**Physics: Electricity**	**Chemistry: States of Matter**	**Biology: Living Things and Their Habitats**	**Biology: Animals, Including Humans**	
	Scientific Enquiry: Pattern Seeking **How do instruments make different sounds?**	Scientific Enquiry: Identifying, classifying & grouping Comparative & Fair Testing **Does Electricity flow easily through all objects?**	Scientific Enquiry: Observing over Time Comparative & Fair Testing **Does ice always melt at the same speed?**	Scientific Enquiry: Identifying, classifying & grouping **Are some animals more alike than others?**	Scientific Enquiry: Comparative & Fair Testing Research using secondary sources **Digestion investigation**	
		Key Scientist Benjamin Franklin		Biography: Key Scientist David Attenborough		
	N/A	LBQ Vocabulary: **11034**	LBQ Vocabulary: **10629**	LBQ Vocabulary: **10499** LBQ Vocabulary: **10550** LBQ Vocabulary: **10607**	LBQ Vocabulary: **10451**	
	11251: Sound **11272**: Changing the Volume of a Sound **11257**: Changing the Pitch of a Sound	**10893**: Electrical Circuits	**10638**: Processes of Changing State **10642**: Properties of Solids, Liquids and Gases **11250**: The Water Cycle	**10548**: Parts of a Food Chain **10496**: Classification Keys and Grouping Organisms **10608**: Environmental Changes in Habitats	**10452**: The Human Digestive System **10455**: Types and Functions of Teeth	
Year 5	**Physics: Forces**	**Physics: Earth and Space**	**Biology: Living Things and Their Habitat**	**Chemistry: Properties and Changes of Materials**	**Biology: Animals including humans**	
	Scientific Enquiry: Comparative & Fair Testing **How do parachutes work?**	Scientific Enquiry: Observing over Time **What shape is the moon and does it change?**	Scientific Enquiry: Research using secondary sources **If life has existed for billions of years, why are there still people alive today?**	Scientific Enquiry: Pattern Seeking **Is it possible to separate materials?**	Scientific Enquiry:	
	Biography: Key Scientist Galileo Galilei Isaac Newton	Key Scientist Galileo Galilei		Key Scientist Marie Curie		

	N/A	LBQ Vocabulary: **10653**	LBQ Vocabulary: **10577** LBQ Vocabulary: **10492**	LBQ Vocabulary: **10888**	N/A	
	11255: Friction **10171**: Gravity and the Difference Between Mass and Weight	**10652**: Earth, Sun and Moon **11261**: Our Solar System **10654**: Relative Movement of the Moon and Earth	**10570**: Comparing Life Cycle of Different Animals **11259**: Parts of a Flower **10557**: Plant Reproduction	**10666:** Irreversible Changes (Levels 1-2 Q1-13) **10662:** Separating Solutions (Levels 1-2 Q1-16) **10698:** Dissolving (Q1-19) **10661**: Reversible changes (Level 1 Q1-8)	**10575**: Life Cycle of a Human	
Year 6	**Biology: Animals, Including Humans**	**Physics: Electricity**	**Biology: Evolution and Inheritance**		**Physics: Light**	**Biology: Living Things and Their Habitats**
	Scientific Enquiry: Pattern Seeking **Is our heart rate always the same?**	Scientific Enquiry: Pattern Seeking **Is it possible to change how bright a bulb is?**	Scientific Enquiry: Identifying, classifying & grouping **Why do species of animals look different?**		Scientific Enquiry: Pattern Seeking **Why can I hear round corners but not see round corners?**	Scientific Enquiry: Observing over Time Comparative & Fair Testing **What makes bread rise?**
			Biography: Key Scientist Charles Darwin Jane Goodall			Key Scientist Carl Linnaeus
	LBQ Vocabulary: **10630**	LBQ Vocabulary: **10891**	LBQ Vocabulary: **10627**		LBQ Vocabulary: **11254**	LBQ Vocabulary: **10551**
	11263: The human circulatory system **11264**: The heart and the blood	**11045**: Cells and Circuits	**10648**: Evolution		**11214**: How Light Travels and How We See	**10480**: Grouping Organisms: Plants, Animals and Microorganisms

THIS IS A WEBSITE SAMPLE – PLEASE CONTACT MR DONE FOR ALL UNITS IN ALL YEAR GROUPS

EYFS - Understanding of the World	
3 & 4 Year Olds	• Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • Talk about what they see, using a wide vocabulary. • Plant seeds and care for growing plants. • Understand the key features of the life cycle of a plant and an animal. • Begin to understand the need to respect and care for the natural environment and all living things. • Explore and talk about different forces they can feel • Talk about the differences between materials and changes they notice.
Reception	• Explore the natural world around them. • Describe what they see, hear and feel whilst outside. • Recognise some environments that are different from the one in which they live. • Understand the effect of changing seasons on the natural world around them.
Early Learning Goals	• Explore the natural world around them, making observations and drawing pictures of animals and plants; • Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class; • Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.

Term: Scientist Study:	Y1 – Autumn then throughout the year. **Robert Fitzroy** (1805-1865) English captain of HMS Beagle, the ship on which Charles Darwin travelled to the Galapagos Islands. He was a meteorologist, using his knowledge of weather helped him to establish the Met Office.	Key Text(s):	 
Unit Title:	**Physics: Seasonal Changes** <u>Context for study:</u> This unit follows on from work in Reception where pupils study the names of the 4 seasons and look at changes to trees and plants during this time as each season occurs. In year 1 they begin to learn more about the 4 seasons, including the months that fall into each season and the weather patterns they follow. They will learn about the changes to the earth's light patterns through the seasons and how the seasons affect animals and plants. This unit comes before work studied in year 2 about what plants need to grow well and when plants grow best. They review work studied in year 1 about common plants and how seasons affect deciduous and evergreen plants.		

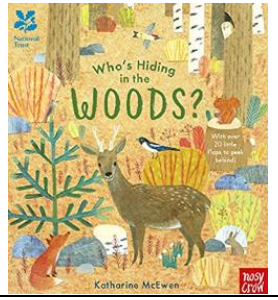
Prior Knowledge Requirements	**Key Vocabulary for the Unit:**
• The difference between hot and cold weather • Played in snow eg made footprints, snowballs or in puddles • Listened to stories at Christmas time set in winter and stories about a sunny day. • Explored and handled wet and dry materials eg ice • The names of the 4 seasons • The weather changes with the season • Some trees and plants change with the seasons	**Season:** Different times of the year, where weather patterns change along with temperature. The seasons are spring, summer, autumn and winter. **Spring:** The time of year between March and May. There is usually lots of signs of new growth in Spring. **Summer:** The hottest season in the UK. It happens between June and August. **Autumn:** Leaves fall off of trees, the days become shorter and in begins to get colder and wetter. **Winter: T**he coldest season in the UK. Usually have snow in this season. Occurs between December and February. **Day:** The time where sunlight can be seen. **Night:** Between sunrise and sunset, where it is dark. **Weather:** Weather is what the sky and the air outside are like, such as cold and cloudy.

Composite – The Big Idea	**Components – Sequence of Learning**
Each year, the UK has four different seasons. Each season has different weather patterns and temperatures, which affect the lives of plants and animals in different ways.	1. Retrieval of previous learning – see above Introduce and explore knowledge organiser Teach new Vocabulary (inc LBQ vocab QS where appropriate) 2. Order seasons with months of year

Common Misconceptions	3. Seasonal events and changes 4. Explain how much daylight in each season 5. Plants through the seasons 6. Type of weather for each season 7. **Is the weather the same every day?** 8. LBQ Question Set
Some children may think: • it always snows in winter • it is always sunny in the summer • there are only flowers in spring and summer • it rains most in the winter	

NC Objectives	**Knowledge Content**	**Working Scientifically**
Observe changes across the four seasons. *Observe and describe weather associated with the seasons and how day length varies.* *Working Scientifically:* *Gathering and recording data to help in answering questions.*	Know that there are 4 seasons - Autumn, Winter, Spring and Summer. Know that the seasons occur in a cycle and that they consist of months of the year. Know how the environment changes in each season. Autumn - Leaves change colour and fall from deciduous trees, harvest time, some birds migrate (e.g. swallows) Winter - Some animals including hedgehogs and tortoises hibernate throughout Winter (identify these animals) water freezes to ice. Many plants stop growing. Spring - Flowers begin to grow, associated with rebirth and growth, some baby animals are born (e.g. lambing season), Summer - Flowers and trees are in bloom. (Time-lapse video of seasons - https://vimeo.com/2639782) Know that the length of daylight varies with Winter having the shortest daylight hours and Summer having the longest. Know that the Earth orbits the Sun with one orbit constituting a year of 365 days Know the weather patterns associated with each season - Autumn - Temperatures start to drop from Summer, overcast Winter - Coldest time of year, snow, frosty in the morning, sleet, blizzard, hail Spring - Temperatures start to warm up Summer - Hottest time of the year, sunshine, generally dry weather but may be thunderstorms	Scientific Enquiry: Observing over Time Pattern Seeking **Is the weather the same every day?** *Chn keep a weather diary across a period of time and compare this to a pre-made one for a different period of the year, drawing conclusions.* Know how to gather information on rainfall and temperature at each season. Know that a thermometer is used to measure temperature. Know how to read a thermometer to find out the temperature outside. Know that we measure temperature in degrees Celsius which is abbreviated to °C.

		Know that when the temperature falls below 0°C then water turns to ice. Know that the temperature on earth is affected by the sun.

Term: Scientist Study:	Y2- Autumn 1 N/A	Key Text(s):	 
Unit Title:	**Biology: Living Things and their Habitats** **Context for study:** Prior to this unit pupils will have already started to study habitats by looking at minibeasts in Reception. In year 2 pupils will learn about the food chains of animals in varying habitats and will look at microhabitats and the animals that live there. They will also learn how to determine if something is alive, was once alive or never lived, using the acronym MRS NERG. This unit comes before work in Year 3 studying the animals native to sea, river and canals and the features that help them to live there. In year 4 pupils will continue learning about habitats by grouping animals into categories, such as vertebrates/invertebrates, before moving onto work in year 5, studying adaptation and eco-systems.		

Prior Knowledge Requirements	**Key Vocabulary for the Unit:**
• Which things are living, dead and things which have never been alive • The names of some common plants and types of trees • Some animals are suitable to be kept as pets but others are not • All animals need water, air and food to survive • Animals can be grouped into vertebrates and invertebrates • Animals can be grouped into carnivores, herbivores and omnivores • Animals, including humans, have offspring which grow into adults	**Living:** Something that is alive and not dead. **Non-Living:** Things that have never been alive. **Dead:** Were once alive but not anymore. **Animal:** Creatures which must eat other living things. These include, birds, mammals, reptiles, spiders, insects, amphibians, worms and fish. **Habitat:** The home or environment of a living thing. For example: a woodland could be the environment for a badger. **Food Chain:** This shows us what different living tings eat and in what order. **Prey:** Animals which are eaten by predators. **Predator:** Animals which hunt and eat other animals. **Carnivore:** Animals which eat only meat. **Herbivore:** Animals which only eat plants. **Omnivore:** Animals which eat both plants and animals. **Human:** People. Humans are mammals. **Micro-Habitat:** A small area of the larger habitat. For example: A rotting log can be a micro-habitat within a woodland.

• Different vegetation belts and biomes around the world	

Composite – The Big Idea All living things live in habitats, places which give them everything that they need in order to survive (food, drink, shelter etc.). All living things must feed. Some create their own food (plants), whilst others eat each other (predators eat prey) in food chains. **Common Misconceptions** Some children may think: • an animal's habitat is like its 'home' • plants and seeds are not alive as they cannot be seen to move • fire is living • arrows in a food chain mean 'eats'.	**Components – Sequence of Learning** 1. Retrieval of previous learning – see above Introduce and explore knowledge organiser Teach new Vocabulary (inc LBQ vocab QS where appropriate) **2. Is everything on Earth alive?** 3. MRS GREN 4. Explain how some animals are adapted to their habitats 5. Identify and name some plants and animals in the local area 6. Create and describe a food chain. 7. LBQ Question Set

NC Objectives	**Knowledge Content**	**Working Scientifically**
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 microhabitats.*	To know which items, including those made from a variety of materials, fit into each category and place them in a table under the headings living (tree, person, animal, fish, grass) dead (paper, bunch of flowers, cotton shirt, wooden table) never been alive (plastic chair, pen, window, stone, metal) Understand that a flame is not alive and that a deciduous tree is not dead in Winter. Know that living things move, grow, consume nutrients and reproduce; that dead things used to do these things but no longer do; and that things that never lived have never done these things. Know the acronym MRS NERG (Movement, Respiratory, Sensitivity, Nutrition, Excretion, Reproduction and Growth) to teach about how to organise objects into each category. Know the meaning of these terms from this table:	Scientific Enquiry: Identifying, classifying & grouping **Is everything on Earth alive?** *Chn sort pictures and specimens into alive, dead, and never alive. (Include misconceptions like the sun and the sea.)* Use questions to sort different animals based on their characteristics and habitat.

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. *Working scientifically:* *Observing closely, using simple equipment.* *Identifying and classifying.* *Using their observations and ideas to suggest answers to questions.*		

M	Movement	All living things move, even plants.
R	Respiration	Getting energy from food.
S	Sensitivity	Detecting changes in the surroundings.
G	Growth	All living things grow.
R	Reproduction	Making more living things
E	Excretion	Getting rid of waste.
N	Nutrition	Taking in and using food.

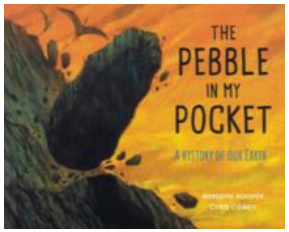
Know that a species of animal or plant that is extinct no longer has any living members in the world. e.g. dinosaurs, dodo.

Know that all creatures need air, food, shelter and water to survive
1. Sea/underwater - A fish breathes through gills, has fins to swim, swim bladders for buoyancy, eat water insects and other sea creatures (shrimp)
2. Woodland - A fox/badger, breathes through lungs, has fur for warmth, lives in a den underground, eats creatures found in the habitat (frogs, worms, berries, mice)
3. Birds - breathe through lungs, have wings to fly to warmer places (migrate) or out of danger, eat worms and slugs found on the ground.

Know that animals and plants survive in a habitat because of each other and that different plants and animals live in different places because of their needs.
Link to food chains for how they depend on each other to survive.

Pupils should look at some habitats and microhabitats in the local area and record their findings.
Recognise and name these larger habitats - ocean, tropical rainforest, desert, woodland, and polar ice.
Know the names of plants in these habitats such as cactus, tumbleweed (desert), orchid, coffee plant (rainforest) dandelion, moss, clover, grass, shrub, conifer (woodland/grassland).
Know the names of the following minibeasts - caterpillar, spider, woodlouse, beetle, worm, slug, water boatman, pond skater and observe where they live.
Know that an insect has 6 legs.

	Know that a spider has 8 legs and is an arachnid. Know that a worm and a slug are not insects. Understand the term microhabitat: a small habitat specific to minibeasts within larger habitats. A woodland has many microhabitats - under a log or rock, a leaf pile, under a bush or a pond. Know the terms omnivore, carnivore and herbivore to describe the eating habits of animals in the food chain. Know that the arrows on a food chain show the direction that the energy travels. Use the terms Producer, Consumer, Prey, Predator to describe a food chain and use the terminology to organise and create food chains. Know the following food chains: 1. Sunlight, Clover, Snail, Songbird and Falcon 2. Sunlight, Ash Tree, Greenfly, Frog, Snake 3. Sunlight, Lettuce, Slug, Frog, Fox	

Term: Scientist Study:	Y3- Autumn 1 **Mary Anning** (1799-1847) English fossil collector and palaeontologist who showed fossils to be impressions of extinct creatures (usually dinosaurs). She found the first complete ichthyosaur skeleton.	Key Text(s):	 
Unit Title:	**Chemistry: Rocks** **Context for study:** This unit is the third of five science units where pupils study materials as part of the discipline of chemistry - the identification of the properties a substance is made from. It is also the study of forces as part of the discipline of physics – the study of the processes that shape our world and how we use it. Pupils have a secure knowledge of the properties of materials and can identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for different uses. Previous learning includes comparing how things move on different surfaces. Pupils know that squashing, bending, twisting and stretching can change the shapes of some solid objects. Pupils have studied the work of John Dunlop. This year 3 unit builds on pupils' knowledge of properties of materials as pupils learn about rocks and soils. New learning includes comparing and grouping together different kinds of rocks on the basis of their appearance and simple physical properties. Pupils describe how fossils are formed when things that have lived are trapped within rock and recognise that soils are made from rocks and organic matter. The knowledge acquired of rocks and soils during this unit will help pupils understand the significance of the life and works of palaeontologist Mary Anning. Later in the year, during a separate Year 3 forces unit, pupils further develop their knowledge as they 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. This unit is the precursor to work studied in Year 4 as pupils study materials in terms of solids, liquids and gases. Year 5 pupils learn about dissolving, mixing and changes of state, and reversible and irreversible changes. Pupils also build on previous knowledge of magnetic and non-magnetic metals.		

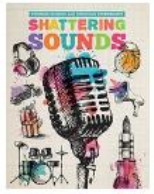
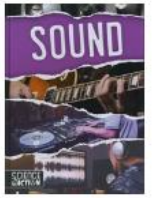
Prior Knowledge Requirements	**Key Vocabulary for the Unit:**
• What materials some objects are made from • How to give simple descriptions of materials • Which materials are made/ natural • The properties of common materials • How the shape of solids can be changed by squashing, bending, twisting and stretching	**Rock/Stone:** A hard material formed out of minerals in the Earth's crust. There are three types of rocks: sedimentary, igneous and metamorphic. **Layers**: A thickness of material which sits upon other materials beneath it. **Organic Matter**: Organic matter is matter that has come from a recently living organism. It is capable of decaying. **Permeable** (Absorbs Water): Allows water to soak into it. **Impermeable** (Waterproof): Water cannot soak into the material, instead, it simple runs off of the surface. **Soil**: Soil consists of a mix of organic material (decayed plants and animals) and broken bits of rocks and minerals. **Fossil**: A fossil is the preserved remains or traces of a dead organism. **Sedimentary Rocks**: Sedimentary rocks are made when sand, mud and pebbles get laid down in layers. **Igneous Rocks:** Igneous rock is formed when magma cools and solidifies, it may do this above or below the Earth's surface. **Metamorphic Rocks**: When a rock experiences heat and pressure, it becomes a metamorphic rock. All metamorphic rocks start as another type of rock. **Magma**: Hot, liquid rock found within the Earth's mantle. When magma comes to the surface of the crust, it is called lava.

Composite – The Big Idea	**Components – Sequence of Learning**
Rocks are formed in the Earth's crust and they have different properties. Soils are formed from the breakdown of rocks and decaying organic matter. Fossils are formed when dead animals are trapped within rocks. **Common Misconceptions** Some children may think: • rocks are all hard in nature • rock-like, man-made substances such as concrete or brick are rocks	1. Retrieval of previous learning – see above Introduce and explore knowledge organiser Teach new Vocabulary (inc LBQ vocab QS where appropriate) 2. Observe and describe the properties of rocks 3. **Are all rocks made in the same way?** 4. Match rocks to their properties and suggest uses for them 5. Explain how fossils are formed 6. Investigate what soils are made from 7. Information Text and LBQ Question Set

• materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural' • certain found artefacts, like old bits of pottery or coins, are fossils • a fossil is an actual piece of the extinct animal or plant • soil and compost are the same thing.	

NC Objectives	**Knowledge Content**	**Working Scientifically**
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.* *Working scientifically:* *Asking relevant questions and using different types of scientific enquiries to answer them.* *Setting up simple practical enquiries, comparative and fair tests.* *Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.*	Know the three natural types of rocks: igneous, sedimentary and metamorphic. Know that the Earth has a solid crust made up of tectonic plates with molten rock beneath. Igneous rocks are formed from the heat of lava or magma. They have large crystals. e.g. Granite and basalt Sedimentary rocks are formed from sediment (small pieces of rock and earth that settle at the bottom of a liquid i.e. water) being compressed by the weight of the liquid above and cementing over time. They are made of small grains. e.g. Limestone (chalk), coal and sandstone. Metamorphic rocks are formerly igneous or sedimentary rocks that have been changed at a chemical level due to intense heat from magma. e.g. Marble and slate. Fossils Know that a fossil is the hard remains of a prehistoric animal or plant that are found inside a rock Know that fossils are comprised of body fossils (animal bones) and chemical fossils (that contain carbon and prove life once existed such as imprints in the ground and leave trace fossils behind) and understand how fossils are formed. Know that fossils are only found in sedimentary rock and go through the same process of compression and cementation in the ground over long periods of time. Know that it is very rare for living things to become fossilised. Usually after most animals die their bodies just rot away and nothing is left behind. However, under certain special conditions, a fossil can form. Know the sequence of fossil formation as: 1. Animal dies and is buried by sediment 2. Soft parts of the animal decay or decompose 3. More sediment builds up around the animal and is compressed to form rock 4. Bones start to be dissolved by water underground	<u>Scientific Enquiry:</u> Identifying, classifying & grouping **Are all rocks made in the same way?** *Using criteria, chn sort rock samples (and pictures) into the three types.* Know how to use a magnifying glass to identify features of the rock types. Identify if the rocks have grains or crystals. Know how to test a range of rocks for: Density (use comparative weight of similar sized rocks) Permeability/impermeability (waterproof - pour a small amount of water and observe it is absorbed or runs off) Strength (hard or soft - use a coin or similar object to

Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions. *Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.* *Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.* *Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.* *Identifying differences, similarities or changes related to simple scientific ideas and processes.* *Using straightforward scientific evidence to answer questions or to support their findings.*	5. Minerals in the water then turn to rock Mary Anning Know that Mary Anning is famous for finding many important fossils. Know that she was born in 1799 in Lyme Regis, Dorset which is near the coast. Know that 200 million years ago Dorset was beneath the sea. Know that her fossils helped us to understand more about prehistoric animals. Know the term palaeontology means 'a person who studies fossils' Know the term dinosaur comes from the Greek word deinos (terrible) and sauros (lizard) which, put together, makes 'terrible lizard.' Know that dinosaurs are actually reptiles not lizards. Learn about the discovery of the ichthyosaur skull and a complete plesiosaur and how this changed the view of the prehistoric (pre-written history) natural world. Know that previously people did not believe in dinosaurs as real, as there was no evidence. It also helped people realise the world was much older than previously thought. Video clips: https://www.bbc.com/ideas/videos/the-girl-who-helped-discoverdinosaurs/p06bfr1s https://www.bbc.co.uk/programmes/p015gn8 Soil Know that soil is a mixture of air, water, broken down rock matter and other organic material (dead or living animal tissue) Know the names of common soil types: sand, clay and silt. Know that sandy soil is dry and gritty, and does not hold onto water. Silty soil is richer in nutrients and smoother to the touch. It has smaller particles (a tiny piece of matter) and it can retain water for longer but will eventually start to lose this. Clay soil has the smallest particles and so absorbs more water. It is silky when wet but smooth and solid when dry. It contains the most nutrients as they cannot escape in water. Know that topsoil is dark in color and high in organic matter Know that subsoil usually appears to be lighter in colour and has a sticky texture Know that bedrock is the solid rock in the ground which supports all the soil above it.	scratch the rock and observe whether particles are easily dislodged). To decide which rock group the rock belongs to based on the properties.

Term: Scientist Study:	Y4- Autumn 1 N/A	Key Text(s):	 
Unit Title:	**Physics: Sound** **Context for study:** This is a stand-alone unit where pupils learn about sound as part of the discipline of physics - the study of the processes that shape our world and how we use it. It is important to assume that all pupils have very little prior knowledge in this unit. During teaching, extra attention must be given to explicitly teaching the precise meaning of subject specific vocabulary as pupils may be unfamiliar with this. This unit does not link directly with any future science teaching so it is important that knowledge is secured during the unit. In Year 4, pupils identify how sounds are made and recognise that vibrations from sounds travel through a medium to the ear. Learning includes the anatomy of the ear and how whales communicate via Whale Song. The knowledge of sound acquired in this unit will help pupils find patterns between the pitch of a sound and features of the object that produced it. It also helps pupils find patterns between the volume of a sound and the strength of the vibrations that produced it. Pupils will know that sounds get fainter as the distance from the sound source increases.		

Prior Knowledge Requirements	**Key Vocabulary for the Unit:**
• Hearing is one of our 5 senses. • We use our ears to hear. • Sounds vary – loud, quiet, high pitch, low pitch. • Sounds can be combined using musical instruments. • From Music, pupils will be aware of pitch, tempo and pulse.	**Sound:** Noise created from the vibrations of mediums such as air and water. **Source:** The place where the sound wave is first created. **Vibrate / Vibration:** Vibrations backwards and forwards movements caused when a medium such as air wobbles in the form of sound waves. **Pitch (High / Low):** A high sound has a high pitch and a low sound has a low pitch. A tight drum skin gives a higher pitched sound than a loose drum skin. **Volume:** How loud or quiet something is. **Faint:** Very low volume sounds that are difficult to detect. **Loud:** Very noisy sounds that are easy to detect. **Insulation:** Protecting something by surrounding it with material that reduces or prevents the transmission of sound. **Ear:** An organ of the body designed to detect sound waves. **Sound Wave:** The continuous vibrations of a medium moving away from the source.

	Frequency: Frequency is measured as the number of wave cycles that occur in one second. More waves means a higher frequency. This is linked to pitch.

Composite – The Big Idea	**Components – Sequence of Learning**
Sound is created from a source and travels outwards in the form of a sound wave in all directions. Sound waves are caused by vibrating molecules in either solids, liquids or gases. Bigger sound waves create louder sounds and longer wave lengths create lower frequencies (pitches). Sounds are detected by the ears of animals. **Common Misconceptions** Some children may think: • sound is only heard by the listener • sound only travels in one direction from the source • sound can't travel through solids and liquids • high sounds are load and low sounds are quiet.	1. Retrieval of previous learning – see above Introduce and explore knowledge organiser Teach new Vocabulary (inc LBQ vocab QS where appropriate) 2. Explain how sounds are made 3. Describe how sounds waves travel through the ear 4. Explore how the pitch of sound changes 5. Explain the volume of a sound can change 6. How do instruments make different sounds? 7. Investigate the relationship between distance and volume. 8. Information Text and LBQ Question Set

NC Objectives	**Knowledge Content**	**Working Scientifically**
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*	Know sounds are made when something vibrates. Know that vibrate means to shake with repeated small quick movements. Metal vibrates when it is struck, vocal chords inside our throat vibrate when we speak. This causes the air around the source of the sound to vibrate. The vibration travels through the air to our ear in a wave. Sound waves can travel through solids (such as metal, stone and wood), liquids (such as water) and gases (such as air). Know that sound travels in longitudinal waves as each particle pushes the particles next to it. Know that where there is no gas, there is no sound. Sound cannot travel through space as there is no air. This is called a vacuum. Anatomy of the ear Know the structure/ anatomy of the human ear. Know that the ear consists of the outer ear and inner ear.	Scientific Enquiry: Pattern Seeking **How do instruments make different sounds?** *Chn to play a guitar or flute with different notes to show how different vibrations make notes of different pitch.*

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.* *Working scientifically:* *. Asking relevant questions and using different types of scientific enquiries to answer them.* *Setting up simple practical enquiries, comparative and fair tests.* *Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.* *Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.* *Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.* *Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.* *Using results to draw simple conclusions, make predictions for new values, suggest*	Know that the eardrum is a thin piece of stretched skin inside the ear which vibrates. These vibrations then travel through a sequence of small bones (the smallest bones in the human body). These bones connect to the cochlea. The cochlea looks like a snail shell (the word 'cochlea' means snail in Ancient Greek). Small hairs in the cochlea convert the vibrations into nerve impulses which send information to the brain for processing. Pitch Know that pitch is how high or low a sound is. Know that the following words would be used to describe low and high pitch sound. |	
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Low Pitch	squeak, squeal,
High Pitch	rumble, grunt, boom | Know that pitch and volume are different - volume is how loud or quiet a sound is. Know that there are high pitches and low pitches. A short string gives a higher-pitched sound than a long string when they are plucked. A tight drum skin gives a higher-pitched sound than a loose drum skin. Volume Know that the volume of a sound is how loud or quiet a sound is. Know that the stronger the vibrations the louder the sound. The weaker the vibrations the quieter the sound. Know that as sounds travel the vibrations become weaker, because they run out of energy. This means that the volume of the sound will decrease the further away a sound is from an ear to hear it.	Demonstrate that sound can travel through gas and liquid. Scratch a desk and listen to the sound through the air and then place your ear on the desk and listen again. Know that the sound is louder when it travels through the desk.

improvements and raise further questions.		

Term: Scientist Study:	Y5- Autumn 1 **Galileo Galilei (1564-1642)** A scientist from Italy who discovered that when you drop two objects of similar shape and size but of different mass they will fall at the same rate.	Key Text(s):	 
Unit Title:	**Physics: Forces** **Context for study:** This unit is the first of three science units where pupils study forces as part of the discipline of physics - the study of the processes that shape our world and how we use it. Pupils have a secure knowledge of resistance and friction, are able to compare how things move on different surfaces and know that applying forces to objects can change their shape. In Year 5, pupils revise and build upon previous learning on magnetism. They know some forces need contact between two objects, but magnetic forces can act at a distance. Pupils know magnets have two poles and that they attract or repel each other. Pupils further develop their knowledge of magnetic and non-magnetic materials with thermal and electrical conductivity. New learning in this unit includes knowing that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. Pupils study the effects of air resistance, water resistance and friction that act between moving surfaces. By the end of the unit, pupils will know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. The knowledge acquired in this unit will help pupils as they learn more about materials and their properties.		

Prior Knowledge Requirements	**Key Vocabulary for the Unit:**
• Forces are pushes and pulls • These forces change the motion of an object. They will make it start to move or speed up, slow it down or even make it stop. • Friction is a force that holds back the motion of an object • Some surfaces create more friction than others which means that objects move across them slower • On a ramp, the force that causes the object to move downwards is gravity	**Force:** The strength of a physical action or movement measured in Newtons (N). **Gravity:** Gravity is a force which tries to pull two objects toward each other. **Air Resistance:** Air resistance is a type of friction between air and another material. For example, when an aeroplane flies through the air or a parachute falls to Earth. **Water Resistance:** If you go swimming, there is friction between your skin and the water particles. **Simple Machines:** Devices that change the direction or magnitude of forces. These include **gears**, **levers** and **pulleys**. They are often combined together to form **mechanisms**. **Friction:** Friction is a force between two surfaces that are sliding, or trying to slide, across each other. **Levers:** A lever can be described as a long rigid body with a fulcrum along its length. **Pulleys:** Pulley is a simple machine and comprises of a wheel on a fixed axle, with a groove along the edges to guide a rope or cable. **Gears:** Gears are wheels with teeth that slot together. When one gear is turned the other one turns as well.

Composite – The Big Idea

Forces can move objects, change their direction of travel and their shape. Forces are pushes and pulls and can be contact forces such as friction or non-contact forces such as gravity. Friction, air and water resistance can slow the movement of objects. Simple machines such as gears, levers and pulleys can transform the direction and strength of forces. Forces are measured in Newtons (N).

Common Misconceptions

Some children may think:

- the heavier the object the faster it falls, because it has more gravity acting on it
- forces always act in pairs which are equal and opposite
- smooth surfaces have no friction
- objects always travel better on smooth surfaces
- a moving object has a force which is pushing it forwards and it stops when the pushing force wears out
- a non-moving object has no forces acting on it
- heavy objects sink and light objects float.

Components – Sequence of Learning

1. Retrieval of previous learning – see above
   Introduce and explore knowledge organiser
   Teach new Vocabulary (inc LBQ vocab QS where appropriate)
2. Explain why objects fall to Earth
3. Explain and describe the effects of friction on different materials.
4. **How do parachutes work?**
5. Explain how a lever works.
6. Explain how gears and pulleys work.
7. Information texts and LBQ Question Set

NC Objectives	**Knowledge Content**	**Working Scientifically**
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*	Gravity Know that the force that pulls things to the ground on Earth (and other planets) is called gravity. Know that gravity acts as a pull force making unsupported objects fall towards Earth. Know that gravity pulls towards earth wherever you are on Earth. Know that gravity holds Earth and the other planets in their orbits around the Sun.	Scientific Enquiry: Comparative & Fair Testing **How do parachutes work?** *Chn to create parachutes, changing a variable to try to isolate what is needed for*

friction, that act between moving surfaces *Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.* *Working scientifically:* *Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.* *Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.* *Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph.* *Using test results to make predictions to set up further comparative and fair tests.* *Reporting and presenting 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.* *Identifying scientific evidence that has been used to support or refute ideas or arguments.*	Friction, Air Resistance and Water Resistance Know that friction occurs when objects move through water or air. Air resistance is a type of friction between air and another material (this is sometimes called drag). Know that as an object moves, air resistance slows it down. The faster the object's motion, the greater the air resistance exerted against it. Air resistance affects all moving objects. For example, when an aeroplane flies through the air, air particles hit the aeroplane making it more difficult for it to move through the air. Isaac Newton To know that Sir Isaac Newton (1642 - 1726) was an English mathematician and scientist. He is known as one of the most influential scientists of all time. He developed Newton's law of universal gravitation. Know that he is said to have 'discovered' the concept of gravity when sitting under a tree and an apple fell to the ground near him. There is a common myth that the apple landed on his head which is generally considered to be untrue. Newton also discovered that white light was made from a range of colours (review previous work on rainbows and the colour spectrum). Know that he is buried in Westminster Abbey with other famous people Charles Dickens, Charles Darwin, Queen Elizabeth I and most recently Professor Stephen Hawking Galileo Galilei To know that Galileo Galilei (1564 - 1642) was a scientist from Italy. He discovered that when you drop two objects of similar shape and size but of different mass they will fall at the same rate. This went against the common sense idea at the time from Aristotle who believed that heavier objects fell faster. He is said to have dropped objects from the Leaning Tower of Pisa to demonstrate this. Most scientists and historians believe this was a 'thought experiment' and did not actually happen. A thought experiment is when you imagine the outcome of an experiment rather than carry it out directly. Know that water resistance acts in the same way that air resistance does. If you go swimming, there is friction between your skin and the water particles. This is known as water resistance. When something is in water, there are two forces acting on it. Its weight and the force of the water pushing up, the upthrust. If the weight is equal to or less than the upthrust, it floats. Things that float are 'buoyant'. Know that 'buoyancy' is the ability of an object to float in liquid or the air. Know that a buoy is a floating object that is used to show ships and boats where they can go and to warn them of danger.	*an effective parachute (e.g. changing parachute material, size, shape, etc)* Observe the fall of sycamore seeds. Demonstrate how a paper helicopter can act as a model of a sycamore seed. Know how air pushes the blades of the paper helicopter as it falls and causes it to rotate. Conduct an experiment to test parachutes and measure air resistance with designs that are different sizes. Use graphs to map the results.

	Know that if the weight of an object is greater than the upthrust, it sinks. Know how to use arrows on diagrams to show the forces at work in given situations e.g. submarine in water, parachute falling, car moving on the road. Levers, Pulleys and Gears Know that levers, pulleys and gears are mechanisms that allow a small force to have a greater effect. Know that a lever is a simple mechanism used to move or lift objects. Know how to label a diagram showing a lever, load, effort and a fulcrum or pivot. Know that the nearer the fulcrum/pivot to the load then the less effort is needed. Know that a seesaw works because the fulcrum is in the middle. Consider what would happen if a seesaw had the fulcrum closer to one end. Gears Know that gears are toothed wheels that lock together and turn each other. Know that gears are often different sizes. A number of gears connected together are called a gear train. Small gears rotate faster than large ones and need less effort to move. Know that gears on a bike enable us to go faster than we could normally move without using up a lot of energy. For further information - https://www.dkfindout.com/uk/science/simple-machines/gears/ Watch examples of gears - https://www.youtube.com/watch?v=D_i3PJIYtuY Pulley Know that a pulley is a device consisting of a wheel over which a rope or chain is pulled in order to lift heavy objects. Know that when someone raises a flag up a flagpole a pulley system is used.	

Term:	Y6- Autumn 1	Key Text(s):	
Scientist Study:	N/A		

Unit Title: Biology: Animals including Humans

Context for study:

This is the final unit of eight science units where pupils study animals, including humans, as part of the discipline of biology - the study of living organisms. Pupils have a secure knowledge of life cycles and what animals, including humans, need to survive. Pupils know that humans and some other animals have skeletons and muscles for support, protection and movement. Pupils know the functions of the basic parts of the digestive system and the functions of different types of teeth in humans. Previous learning includes the changes a human goes through as they develop across their lifetime. In SRE sessions, pupils learned how babies grow and develop, and about puberty. Pupils know what older people need to stay healthy and the difficulties they may face as a result of old age. This Year 6 unit builds on pupils' knowledge of the importance of a healthy lifestyle, including a balanced diet and the effects of sugar, the different food groups and their role in human development. New learning includes recognising the impact of diet, exercise, drugs and lifestyle on the way their bodies function. In Year 6, pupils identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. Pupils also describe the ways in which nutrients and water are transported within animals, including humans. This is the precursor to work studied in KS3 when pupils continue to study the human body as part of the discipline of biology.

Prior Knowledge Requirements

- Know the names for the main parts of the body.
- 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.

Key Vocabulary for the Unit:

Heart: Organ which pumps blood around the body.
Pulse (rate): Your heart has to push so much blood through your body that you can feel a little thump in your arteries each time the heart beats
Pumps: Regular contracting (squeezing) and relaxing, which pushes the blood at high pressure.
Blood: A body fluid which contains platelets, red and while blood cells within plasma. Red blood cells carry oxygen. White blood cells are art of the body's immune system.
Blood Vessels: Blood vessels are a series of tubes inside your body. They move blood to and from your heart.
Lungs: Organs designed to take oxygen from the air and deliver it into the blood stream. They also remove carbon dioxide from the blood and back into the air.
Oxygen: A gas required by living things.
Drugs: A drug is a chemical that is not food and that affects your body. Some drugs are given to people by doctors to make them healthy.
Carbon Dioxide: A waste gas created through breathing (respiration).
Nutrients: Vitamins and minerals needed to keep people healthy.

• Animals, including humans, have offspring which grow into adults. • Know the basic needs of animals, including humans, for survival (water, food and air). • Humans and some other animals have skeletons and muscles for support, protection and movement. • Describe the changes as humans develop to old age. • The changes that happen as humans develop to old age • The gestation period of different animals	**Muscles:** Tissues which are connected to other parts of the body (usually bones) which contract and relax, allowing us to move. **Circulatory System:** Also called the cardiovascular system, delivers nutrients and oxygen to all cells in the body.
Composite – The Big Idea The body is made up of tissues and organs, which are linked together to do particular functions. The heart and lungs are such organs, which work together as part of the circulatory (cardiovascular) system, transporting oxygen, sugar and nutrients around our bodies. **Common Misconceptions** Some children may think: • your heart is on the left side of your chest • the heart makes blood • the blood travels in one loop from the heart to the lungs and around the body • when we exercise, our heart beats faster to work the muscles more • some blood in our bodies is blue and some blood is red • we just eat food for energy • all fat is bad for you	**Components – Sequence of Learning** 1. Retrieval of previous learning – see above Introduce and explore knowledge organiser Teach new Vocabulary (inc LBQ vocab QS where appropriate) 2. Identify the main parts of the human circulatory system and explain their functions. 3. Explain how the human heart works. 4. Describe the functions of blood and blood vessels. **5. Is our heart rate always the same?** 6. Explain how diet and exercise affect health. 7. LBQ Question Set and information text.

NC Objectives	Knowledge Content	Working Scientifically
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.* *Working scientifically:* *Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.* *Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.* *Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph.* *Using test results to make predictions to set up further comparative and fair tests.* *Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and*	Circulatory System Know the circulatory system is the system that circulates blood through the body. Know that this consists of the heart, blood vessels, blood, veins, arteries, capillaries, oxygen, lungs and ribcage. Know the location of the lungs and heart Heart Know that the heart is a hollow muscular organ that pumps the blood through the circulatory system by regular contractions. There are four chambers with two atria and two ventricles. Know the following sequence that explains the function of the heart: 1. Deoxygenated blood flows into the heart from the body through the veins 2. This blood is pumped out to the lungs through the pulmonary artery 3. Blood is then oxygenated in the lungs 4. Blood returns to the heart through the pulmonary vein 5. The oxygenated blood is then pumped out of the heart through the aorta 6. The blood travels around the body delivering oxygen and nutrients to the organs. Know that oxygenated means 'to be enriched with oxygen' Know that deoxygenated means 'to be depleted of oxygen' Know that blood is red when oxygenated and deep purple or blue looking through skin when not. Blood Describe the functions of red blood cells, white blood cells, platelets and plasma Show the percentage of each component by volume in a typical sample of blood. Diet, exercise, drugs and lifestyle Know that diet can impact on lifestyle as fatty rich foods can clog arteries and veins, preventing blood from delivering what is needed. Know that exercise can improve the health of a person by removing fatty deposits from the body. Know that some exercises are called cardiovascular, and are designed to improve the fitness of the overall circulatory system by strengthening the organs and pulse rate. Know the impact of having little exercise and poor diet will have Know that taking certain drugs can cause permanent damage to the circulatory system	Scientific Enquiry: Pattern Seeking **Is our heart rate always the same?** *Chn to investigate the effect of exercise on heart rate and how long it takes for their pulse to return to the resting rate after exercising for a minute.* Take measurements of pulse rate before and after a range of exercises. Make predictions as to what will happen if measurements are taken at regular intervals. Repeat over time and record results in a line graph.

written forms such as displays and other presentations. *Identifying scientific evidence that has been used to support or refute ideas or arguments.*	(link to PSHE curriculum)	

Fair Tests:

Year 3	Year 4	Year 5	Year 6
BIOLOGY: PLANTS	**BIOLOGY: LIVING THINGS & THEIR HABITATS**	**CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS**	**BIOLOGY: CLASSIFICATION**
How does the length of the carnation stem affect how long it takes for the food colouring to dye the petals?	Does the amount of light affect how many woodlice move around?	How does the level of salt affect how quickly brine shrimp hatch?	How does the temperature affect how much gas is produced by yeast?
BIOLOGY: ANIMALS, INCLUDING HUMANS	**CHEMISTRY: CHANGING STATES OF MATTER**	**BIOLOGY: ANIMALS, INCLUDING HUMANS**	**BIOLOGY: ANIMALS, INCLUDING HUMANS**
How does the angle that your elbow/knee is bent affect the circumference of your upper arm/thigh?	How does the mass of a block of ice affect how long it takes to melt?	How does age affect a human's reaction time?	How does the length of time we exercise for affect our heart rate?
CHEMISTRY: ROCKS	**CHEMISTRY: CHANGING STATES OF MATTER**	**CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS**	**BIOLOGY: ANIMALS, INCLUDING HUMANS**
How does adding different amounts of sand to soil affect how quickly water drains through it?	How does the surface area of a container of water affect how long it takes to evaporate?	How does the temperature of tea affect how long it takes for a sugar cube to dissolve?	Can exercising regularly affect your lung capacity?
PHYSICS: LIGHT	**PHYSICS: SOUND**	**PHYSICS: FORCES**	**PHYSICS: LIGHT**
How does the number of layers of transparent plastic affect how much light can pass through?	How does the volume of a drum change as you move further away from it?	How does the angle of launch affect how far a paper rocket will go?	How does the angle that a light ray hits a plane mirror affect the angle at which it reflects off the surface?
PHYSICS: FORCES & MAGNETS	**PHYSICS: ELECTRICITY**	**PHYSICS: FORCES**	**PHYSICS: ELECTRICITY**
How does the mass of an object affect how much force is needed to make it move?	How does the thickness of a conducting material affect how bright the lamp is?	How does the surface area of a container affect the time it takes to sink?	How does the voltage of the batteries in a circuit affect the brightness of the lamp?
PHYSICS: LIGHT	**PHYSICS: SOUND**	**PHYSICS: FORCES**	**PHYSICS: ELECTRICITY**
How does the distance between the shadow puppet and the screen affect the size of the shadow?	How does the length of a guitar string/tuning fork affect the pitch of the sound?	How does the surface area of a parachute affect the time it takes to fall to the ground?	How does the voltage of the batteries in a circuit affect the volume of the buzzer?

Comparative Tests:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
BIOLOGY: PLANTS Which type of compost grows the tallest sunflower?	**BIOLOGY: PLANTS** Do cress seeds grow quicker inside or outside?	**BIOLOGY: PLANTS** Which conditions help seeds germinate faster?	**BIOLOGY: LIVING THINGS & THEIR HABITATS** How does the average temperature of the pond water change in each season?	**PHYSICS: FORCES** Which seed shape takes the longest time to fall?	**BIOLOGY: CLASSIFICATION** Which is the most common invertebrate on our school playing field?
BIOLOGY: PLANTS Which tree has the biggest leaves?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** Do amphibians have more in common with reptiles or fish?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** How does the skull circumference of a girl compare with that of a boy?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** In our class, are omnivores taller than vegetarians?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** Who grows the fastest, girls or boys?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** Which type of exercise has the greatest effect on our heart rate?
BIOLOGY: ANIMALS, INCLUDING HUMANS Is our sense of smell better when we can't see?	**BIOLOGY: ANIMALS, INCLUDING HUMANS** Do bananas make us run faster?	**CHEMISTRY: ROCKS** Which soil absorbs the most water?	**CHEMISTRY: CHANGING STATES OF MATTER** Does seawater evaporate quicker than fresh water?	**CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS** Which type of sugar dissolves the fastest?	**BIOLOGY: EVOLUTION & INHERITANCE** What is the most common eye colour in our class?
PHYSICS: SEASONAL CHANGES In which season does it rain the most?	**BIOLOGY: LIVING THINGS & THEIR HABITATS** Is there the same level of light in the evergreen wood compared with the deciduous wood?	**PHYSICS: LIGHT** Which pair of sunglasses will be best at protecting our eyes?	**PHYSICS: SOUND** Which material is best to use for muffling sound in ear defenders?	**PHYSICS: EARTH & SPACE** How does the length of daylight hours change in each season?	**PHYSICS: LIGHT** Which material is most reflective?
CHEMISTRY: EVERYDAY MATERIALS Which materials are the most flexible?	**CHEMISTRY: USES OF EVERYDAY MATERIALS** Which shapes make the strongest paper bridge?	**PHYSICS: FORCES & MAGNETS** Which magnet is strongest?	**PHYSICS: SOUND** Are two ears better than one?	**PHYSICS: FORCES** Which shoe is the most slippy?	**PHYSICS: ELECTRICITY** Which make of battery lasts the longest?
CHEMISTRY: EVERYDAY MATERIALS Which materials are the most absorbent?	**CHEMISTRY: USES OF EVERYDAY MATERIALS** Which material would be best for the roof of the little pig's house?	**PHYSICS: FORCES & MAGNETS** Which surface is best to stop you slipping?	**PHYSICS: ELECTRICITY** Which metal is the best conductor of electricity?	**PHYSICS: FORCES** Which shape parachute takes the longest to fall?	**PHYSICS: ELECTRICITY** Which type of fruit makes the best fruity battery?

Observations Over Time:

Year 1

BIOLOGY: PLANTS

How does a daffodil bulb change over the year?

BIOLOGY: PLANTS

How does my sunflower change each week?

PHYSICS: SEASONAL CHANGE

How does the oak tree change over the year?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How does my height change over the year?

CHEMISTRY: EVERYDAY MATERIALS

What happens to materials over time if we bury them in the ground?

CHEMISTRY: EVERYDAY MATERIALS

What happens to shaving foam over time?

PHYSICS: SEASONAL CHANGE

How does the colour of a UV bead change over the day?

Year 2

BIOLOGY: PLANTS

What happens to my bean after I have planted it?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How does a tadpole change over time?

BIOLOGY: LIVING THINGS & THEIR HABITATS

How does the school pond change over the year?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How much food and drink do I have over a week?

CHEMISTRY: USES OF EVERYDAY MATERIALS

How long do bubble bath bubbles last for?

CHEMISTRY: USES OF EVERYDAY MATERIALS

What will happen to our snowman?

CHEMISTRY: USES OF EVERYDAY MATERIALS

Would a paper boat float forever?

Year 3

BIOLOGY: PLANTS

What happens to celery when it is left in a glass of coloured water?

BIOLOGY: PLANTS

How do flowers in a vase change over time?

CHEMISTRY: ROCKS

How does tumbling change a rock over time?

CHEMISTRY: ROCKS

What happens when water keeps dripping on a sandcastle?

PHYSICS: FORCES & MAGNETS

If we magnetise a pin, how long does it stay magnetised for?

PHYSICS: LIGHT

When is our classroom darkest?

PHYSICS: LIGHT

Is the Sun the same brightness all day?

Year 4

BIOLOGY: LIVING THINGS & THEIR HABITATS

How does the variety of invertebrates on the school field change over the year?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How does an egg shell change when it is left in cola?

CHEMISTRY: CHANGING STATES OF MATTER

Which material is best for keeping our hot chocolate warm?

CHEMISTRY: CHANGING STATES OF MATTER

How does the level of water in a glass change when left on the windowsill?

CHEMISTRY: CHANGING STATES OF MATTER

How does the mass of an ice cube change over time?

PHYSICS: ELECTRICITY

How long does a battery light a torch for?

PHYSICS: SOUND

When is our classroom the quietest?

Year 5

BIOLOGY: LIVING THINGS & THEIR HABITATS

How do brine shrimp change over their lifetime?

BIOLOGY: LIVING THINGS & THEIR HABITATS

How does a bean change as it germinates?

BIOLOGY: LIVING THINGS & THEIR HABITATS

How does our compost heap change over time?

CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS

How does a container of salt water change over time?

CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS

How does a sugar cube change as it is put in a glass of water?

CHEMISTRY: PROPERTIES & CHANGES OF MATERIALS

How does a nail in salt water change over time?

PHYSICS: FORCES

How long does a pendulum swing for before it stops?

Year 6

BIOLOGY: CLASSIFICATION

What happens to a piece of bread if you leave it on the windowsill for two weeks?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How does my heart rate change over the day?

BIOLOGY: EVOLUTION & INHERITANCE

How do different animal embryos change?

BIOLOGY: ANIMALS, INCLUDING HUMANS

How much exercise do I do in a week?

PHYSICS: ELECTRICITY

Does the temperature of a light bulb go up the longer it is on?

PHYSICS: ELECTRICITY

How would you group electrical components and appliances based on what electricity makes them do?

PHYSICS: LIGHT

How does my shadow change over the day?

Pattern Seeking:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
PHYSICS: SEASONAL CHANGES Do trees with bigger leaves lose their leaves first in autumn?	BIOLOGY: PLANTS Do bigger seeds grow into bigger plants?	BIOLOGY: PLANTS What colour flowers do pollinating insects prefer?	BIOLOGY: LIVING THINGS & THEIR HABITATS How has the use of insecticides affected bee population?	BIOLOGY: LIVING THINGS & THEIR HABITATS Is there a relationship between a mammal's size and its gestation period?	BIOLOGY: CLASSIFICATION Do all flowers have the same number of petals?
BIOLOGY: PLANTS Is there a pattern in where we find moss growing in the school grounds?	BIOLOGY: LIVING THINGS & THEIR HABITATS What conditions do woodlice prefer to live in?	BIOLOGY: ANIMALS, INCLUDING HUMANS Do male humans have larger skulls that female humans?	BIOLOGY: ANIMALS, INCLUDING HUMANS Are foods that are high in energy always high in sugar?	BIOLOGY: ANIMALS, INCLUDING HUMANS Are the oldest children in our school the tallest?	BIOLOGY: ANIMALS, INCLUDING HUMANS Is there a pattern between what we eat for breakfast and how fast we can run?
BIOLOGY: ANIMALS, INCLUDING HUMANS Do you get better at smelling as you get older?	BIOLOGY: ANIMALS, INCLUDING HUMANS Which age group of children wash their hands the most in a day?	CHEMISTRY: ROCKS Is there a pattern in where we find volcanos on planet Earth?	CHEMISTRY: CHANGES IN STATES OF MATTER Is there a pattern in how long it takes different sized ice lollies to melt?	PHYSICS: FORCES Do all stretchy materials stretch in the same way?	BIOLOGY: EVOLUTION & INHERITANCE Is there a pattern between the size and shape of a bird's beak and the food it will eat?
PHYSICS: SEASONAL CHANGES Does the wind always blow the same way?	BIOLOGY: LIVING THINGS & THEIR HABITATS Which habitat do worms prefer – where can we find the most worms?	BIOLOGY: ANIMALS, INCLUDING HUMANS Are you more likely to have bad eye sight and to wear glasses if you are older?	PHYSICS: SOUND Is there a link between how loud it is in school and the time of day? If there is a pattern, is it the same in every area of the school?	PHYSICS: EARTH & SPACE Is there a pattern between the size of a planet and the time it takes to travel around the Sun?	PHYSICS: LIGHT Is there a pattern to how bright it is in school over the day? And, if there is a pattern, is it the same in every classroom?
CHEMISTRY: EVERYDAY MATERIALS Is there a pattern in the types of materials that are used to make objects in a school?	PHYSICS: FORCES & MAGNETS Do magnetic materials always conduct electricity?	PHYSICS: FORCES & MAGNETS Does the size and shape of a magnet affect how strong it is?	PHYSICS: ELECTRICITY Which room has the most electrical sockets in a house?	PHYSICS: FORCES Do all objects fall through water in the same way?	PHYSICS: ELECTRICITY Does the temperature of a light bulb go up the longer it is on?

Research:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
BIOLOGY: PLANTS What are the most common British plants and where can we find them?	BIOLOGY: PLANTS How does a cactus survive in a desert with no water?	BIOLOGY: PLANTS What are all the different ways that seeds disperse?	BIOLOGY: LIVING THINGS & THEIR HABITATS Why are people cutting down the rainforests and what effect does that have?	BIOLOGY: LIVING THINGS & THEIR HABITATS What are the differences between the life cycle of an insect and a mammal?	BIOLOGY: CLASSIFICATION What do different types of microorganisms do? Are they always harmful?
BIOLOGY: ANIMALS, INCLUDING HUMANS How are the animals in Australia different to the ones that we find in Britain?	BIOLOGY: ANIMALS, INCLUDING HUMANS What do you need to do to look after a pet dog/cat/lizard and keep it healthy?	CHEMISTRY: ANIMALS, INCLUDING HUMANS Why do different types of vitamins keep us healthy and which foods can we find them in?	BIOLOGY: ANIMALS, INCLUDING HUMANS How do dentists fix broken teeth?	BIOLOGY: ANIMALS, INCLUDING HUMANS Why do people get grey/white hair when they get older?	BIOLOGY: ANIMALS, INCLUDING HUMANS How have our ideas about disease and medicine changed over time?
BIOLOGY: ANIMALS, INCLUDING HUMANS Do all animals have the same senses as humans?	BIOLOGY: LIVING THINGS & THEIR HABITATS What food do you need in a healthy diet and why?	CHEMISTRY: ROCKS Who was Mary Anning and what did she discover?	BIOLOGY: LIVING THINGS & THEIR HABITATS What are hurricanes, and why do they happen?	BIOLOGY: LIVING THINGS & THEIR HABITATS What are microplastics and why are they harming the planet?	BIOLOGY: EVOLUTION & INHERITANCE What happened when Charles Darwin visited the Galapagos islands?
PHYSICS: SEASONAL CHANGES Are there plants that are in flower in every season? What are they?	PHYSICS: LIVING THINGS & THEIR HABITATS How does the habitat of the Arctic compare with the habitat of the rainforest?	PHYSICS: LIGHT How does the Sun make light?	PHYSICS: ELECTRICITY How has electricity changed the way we live?	PHYSICS: EARTH & SPACE How have our ideas about the solar system changed over time?	BIOLOGY: EVOLUTION & INHERITANCE Why do some people need to wear glasses to see clearly?
CHEMISTRY: EVERYDAY MATERIALS How are bricks made?	CHEMISTRY: USES OF EVERYDAY MATERIALS How have the materials we use changed over time?	PHYSICS: FORCES & MAGNETS How have our ideas about forces changed over time?	PHYSICS: ELECTRICITY How does a light bulb work?	PHYSICS: EARTH & SPACE What unusual objects did Jocelyn Bell Burnell discover?	PHYSICS: ELECTRICITY How has our understanding of electricity changed over time?
CHEMISTRY: EVERYDAY MATERIALS Which materials can be recycled?	CHEMISTRY: USES OF EVERYDAY MATERIALS How are plastics made?	PHYSICS: FORCES & MAGNETS How does a compass work?	PHYSICS: SOUND Do all animals have the same hearing range?	PHYSICS: FORCES How do submarines sink if they are full of air?	PHYSICS: LIGHT How do astronomers know what stars are made of?

Identifying and Classifying:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
How can we sort the leaves that we collected on our walk?	How can we identify the trees that we observed on our tree hunt?	How many different ways can you group our seed collection?	What are the names for all the organs involved in the digestive system?	Can you identify all the stages in the human life cycle?	How would you make a classification key for vertebrates/invertebrates or microorganisms?
How can we organise all the zoo animals?	Which offspring belongs to which animal?	How do the skeletons of different animals compare?	How can we organise teeth into groups?	Compare this collection of animals based on similarities and differences in their lifecycle	Which organs of the body make up the circulation system, and where are they found?
What are the names for all the parts of our bodies?	How would you group these plants and animals based on what habitat you would find them in?	Can you use the identification key to find out the name of each of the rocks in your collection?	Can you group these materials and objects into solids, liquids, and gases?	Can you group these materials based on whether they are transparent or not?	Compare the skeletons of apes, humans, and Neanderthals – how are they similar, and how are they different?
How would you group these things based on which season you are most likely to see them in?	How would you group things to show which are living, dead, or have never been alive?	How would you organise these light sources into natural and artificial sources?	Can we use the classification keys to identify all the animals that we caught pond dipping?	How could you organise all the objects in the solar system into groups?	Can you classify these observations into evidence for the idea of evolution, and evidence against?
We need to choose a material to make an umbrella. Which materials are waterproof?	Which materials are shiny and which are dull?	How can we group the food that we eat?	How would you group these electrical devices based on where the electricity comes from?	Can you label and name all the forces acting on the objects in each of these situations?	Can you identify all the colours of light that make white light when mixed together? What colours do you get if you mix different colours of light together?
Which materials will float and which will sink?	Which materials will let electricity go through them, and which will not?	Which materials are magnetic?	How would you sort these objects/materials based on their temperature?	Can you observe and identify all the phases in the cycle of the Moon?	How would you group electrical components and appliances based on what electricity makes them do?