



## Horbury Bridge Academy Science Overview

### Curriculum Drivers

At Horbury Bridge Academy we want all of our children to gain the experiences they need to thrive in today's ever changing global landscape. As a small school serving a local community, it is important for us to not only focus on our area and what makes us unique, but also to provide experiences for pupils beyond those available within our community in order for us to support them in becoming global citizens of the future. In order to achieve this, we have three core drivers that run through our curriculum and alongside our Christian vision. These drivers are used to shape the choices we make when planning and delivering learning experiences for our pupils.

Our vision:

***“Living by Our Christian Values: Together in Faith, Hope and Love”***

Our drivers:

1. **Diversity**
2. **Sustainability**
3. **Enrichment**

### Science Principles

Pupils should:

- know that science is a subject that helps us understand the world around us.
- understand that science revolves around asking questions and know that we can't always find the answers.
- know that scientists carry out enquiries to try and find out the answers to their questions.
- know that science can be used to predict how things behave, explain what is happening and figure out why.
- understand that scientific theory has changed over time and that it will continue to change in the future.

- know the key knowledge identified in each unit, so that they have a firm knowledge base to continue studying.

Our science curriculum is mapped across the year groups in three forms: **substantive knowledge, disciplinary knowledge and vocabulary.**

1. Substantive knowledge includes scientific concepts. This is based on the knowledge specified in the National Curriculum.
2. Disciplinary knowledge relates to how scientists work scientifically to construct their understanding of scientific concepts. Our aim is for pupils to learn more, do more and remember more.
3. We teach vocabulary explicitly alongside the substantive and disciplinary concepts.

## Scientific Concepts

To further support the children to know more and remember more, we return to key substantive and disciplinary concepts as we learn about different areas of science. This supports children to make links and comparisons in their learning. We have identified substantive and disciplinary concepts that are:

Substantive Concepts		Disciplinary Concepts
<b>Biology</b>	Plants Living things and their habitats Animals, including humans Evolution and inheritance	Ask scientific questions Plan scientific enquiries Carry out scientific enquiries Select and use scientific equipment Make observations Make reasoned predictions Take accurate measurements Collect data Use scientific language Report findings Draw conclusions and make improvements
<b>Chemistry</b>	Properties and changes of materials	
<b>Physics</b>	Light Forces Sound Electricity Earth and Space Seasonal Changes Rocks	

## Early Years Foundation Stage

Across Foundation Stage, scientific knowledge and Working Scientifically skills are explicitly taught as foundations for the KS1 National Curriculum. The focus is primarily to develop the Scientific skills within this document, using the science 'topics' as the vehicles of delivery. Where appropriate, the core concepts are also interwoven into the delivery of the unit of work.

The science topics allow children to develop knowledge and skills in order for them to reach the requirements of the 'The Natural World' Early Learning Goal.

**Past and Present ELG - Children at the expected level of development will:**

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

<b>EYFS Science Themes</b>	<b>Links to KS1 Science</b>
<b>Exploring Autumn, Winter, Spring and Summer</b>	<b>Seasonal Change</b>
<b>Space - use of equipment, change of cooking ingredients</b>	<b>Study of a non-European contrasting place - Materials</b>
<b>Africa - What happens to our rubbish?</b>	<b>Study of a non-European contrasting place - Materials</b>
<b>Minibeasts</b>	<b>Hot and cold places - Animals (habitats, food chains)</b>
<b>Around the world - Compare materials</b>	<b>Study of a non-European contrasting place - Materials</b>
<b>Dinosaurs - Classification</b>	<b>Beyond living memory - Animals</b>
<b>Looking after our planet - Planting seeds</b>	<b>Seaside study - Plants</b>
<b>Farm animals</b>	<b>Beyond living memory - Animals</b>
<b>People who help us - lifecycles</b>	<b>Beyond living memory - Animals</b>
<b>People who help us - plants</b>	<b>Knowing our locality - Plants</b>

**Substantive Knowledge Overview**

Biology	Physics	Chemistry
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	Animals including humans	Seasonal Changes	Plants	Living things and their habitats	Evolution and inheritance	Forces and Magnets	Sound	Light	Electricity	Earth and Space	Rocks	Properties and changes of materials
EYFS	✓	✓	✓	✓		✓				✓		✓
KS1	✓	✓	✓	✓								✓
LKS2	✓		✓	✓		✓	✓	✓	✓		✓	✓
UKS2	✓			✓	✓	✓		✓	✓	✓		✓

### Termly Teaching Overview

	Cycle A				Cycle B			
	Autumn Term		Spring Term	Summer Term	Autumn Term		Spring Term	Summer Term
KS1	Seasonal Change		Seasonal Change Living things and their habitats	Seasonal Change Plants (structure)	Animals, including humans		Materials	Plants (growth)
LKS2	Electricity	Rocks Forces	Animals, including humans	Properties and changes of materials	Light	Sound	Animals, including humans	Plants Living things and their habitats
UKS2	Forces	Light	Properties and changes of materials	Animals, including humans Living things and their habitats	Earth and space	Evolution and inheritance	Animals, including humans	Electricity

# Key Stage 1

Class 1   Year 1/2   Cycle A			
Term	Autumn	Spring	Summer
Theme	Why are there so many leaves on the floor?	Would a dinosaur make a good pet?	Which plants and birds would we find in Coxley Woods?
Substantive Concept	Seasonal Change	Living things and their habitats <i>Seasonal Change</i>	Plants <i>Seasonal Change</i>
NC Coverage	<ul style="list-style-type: none"> <li>observe changes across the 4 seasons</li> <li>observe and describe weather associated with the seasons and how day length varies</li> </ul>	<ul style="list-style-type: none"> <li>Explore and compare the difference between things that are living, dead and things that have never been alive.</li> <li>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.</li> <li>Identify and name a variety of plants and animals in their habitat, including their habitats.</li> <li>Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different types of food.</li> </ul>	<ul style="list-style-type: none"> <li>Identify and name a variety of common, wild and garden plants, including deciduous and evergreen trees.</li> <li>Identify and describe the basic structure of a variety of common flowering plants.</li> <li>Identify and name the roots, trunk, branches and leaves of trees.</li> </ul>

<b>Substantive Knowledge (Concepts)</b>	<ul style="list-style-type: none"> <li>● know the four seasons of the year</li> <li>● know the features of each season and the changes between them</li> <li>● know the weather associated with each season and how the temperature changes throughout the year</li> <li>● know the number of daylight hour changes throughout the year.</li> <li>● Know that materials have different properties that make them suitable for a purpose (<i>materials</i>)</li> </ul>	<ul style="list-style-type: none"> <li>● Some things are living, some were once living but now dead and some things never lived.</li> <li>● There is variation between living things.</li> <li>● Different animals and plants live in different places.</li> <li>● Living things are adapted to survive in different habitats.</li> <li>● Environmental change can affect plants and animals that live there</li> <li>● Food chains can be used to show us what an animal eats.</li> </ul>	<ul style="list-style-type: none"> <li>● We need plants to survive (to clean air, to eat)</li> <li>● We can eat different parts of plants and some are poisonous</li> <li>● Name wild and garden plants, trees (deciduous and evergreen) and vegetables growing in the locality.</li> <li>● Name parts of plants (petal, stem, leaf, root, trunk, branches)</li> </ul>
<b>Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)</b>	<ul style="list-style-type: none"> <li>● observe closely</li> <li>● compare, sort and group things</li> <li>● use simple scientific language</li> <li>● ask simple questions</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>● Observation over time</li> <li>● Identifying, classifying and grouping</li> <li>● Pattern seeking</li> </ul>	<ul style="list-style-type: none"> <li>● Ask questions</li> <li>● Know that questions can be answered with different enquiries.</li> <li>● Record learning in different ways</li> <li>● Talk about what I think will happen and what I have found out</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>● Identifying, classifying and grouping</li> <li>● Pattern seeking</li> <li>● Research using secondary sources</li> </ul>	<ul style="list-style-type: none"> <li>● Perform simple texts to answer questions</li> <li>● Use simple equipment</li> <li>● Take simple measurements using non-standard units</li> <li>● Use simple scientific language</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>● Identifying, classifying and grouping</li> <li>● Research using secondary sources</li> <li>● Comparative and fair testings</li> </ul>
<b>Vocabulary</b>	<p>Revisit: Change, seasons, weather, spring, summer, autumn, winter, sunny, windy, snowy</p> <p>New: daylight saving, temperature, hibernation, migration, overcast,</p>	<p>Revisit: food, seashore, woodland, ocean, desert, damp, shade</p> <p>New: Living, dead, never alive, habitats, micro-habitats, food chain, leaf litter, shelter, conditions,, rainforest,</p>	<p>Revisit: roots, petal, stem, leaf, branches</p> <p>New: survive, poisonous, deciduous, evergreen, flowering, common, variety</p>

	Disciplinary: Predict, enquiry, sort, observe, identify, compare, describe, label, name	Disciplinary: Question, enquiry, record, describe, explain, sort, name, identity	Disciplinary: compare, record, predict, measure, diagram, name, identify
Focus Scientist	<b>Laura Tobin</b> - Meteorologist	<b>Steve Backshall</b> - Wildlife presenter, naturalist	<b>Agnes Arber</b> - plant anatomist

Class 1   Year 1/2   Cycle B				
Term	Autumn		Spring	Summer
Theme	How are animals different from each other?	How can I stay healthy?	What materials do we use in our school?	How can I grow a healthy plant?
Substantive Concept	Animals including humans		Materials	Plants
NC Coverage	<ul style="list-style-type: none"> <li>Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals.</li> <li>Identify and name a variety of common animals that are carnivores, herbivores and omnivores</li> </ul>	<ul style="list-style-type: none"> <li>Find out and describe the basic needs of animals, including humans, for survival (water, food and air)</li> <li>Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.</li> <li>Know that animals, including humans have offspring which grow in to adults</li> <li>Know the basic stages in a life cycle for</li> </ul>	<ul style="list-style-type: none"> <li>Distinguish between and object and the material from which it is made.</li> <li>Identify and name a variety of everyday materials, including wood, metal, plastic, glass, water and rock,</li> <li>Describe the simple physical properties of a variety of everyday materials.</li> <li>Compare and group together a variety of everyday materials</li> </ul>	<ul style="list-style-type: none"> <li>Observe and describe how seeds and bulbs grow into mature plants</li> <li>Find out and describe how plants need water, light and warmth to grow and stay healthy</li> </ul>

		animals including humans	<p>based on their simple properties</p> <ul style="list-style-type: none"> <li>Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.</li> <li>Find out how shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.</li> </ul>	
Substantive Knowledge (Concepts)	<ul style="list-style-type: none"> <li>There are many different animals with different characteristics.</li> <li>Know the difference between carnivore, omnivore and herbivore.</li> <li>Animals have senses to help individuals survive. When animals sense things they are able to respond.</li> <li>Know which body part is related to each of the five senses</li> </ul>	<ul style="list-style-type: none"> <li>Animals need food, water and air to survive.</li> <li>Animals need a variety of food to help them grow, repair their bodies, be active and stay healthy</li> <li>Animals move in order to survive and different animals move in different ways to help them survive.</li> <li>Exercise keeps animal's bodies in</li> </ul>	<ul style="list-style-type: none"> <li>There are many different materials with describeable and measurable properties</li> <li>Materials that have similar properties are grouped into metals, rocks, fabrics, wood, plastic and ceramics (including glass).</li> <li>The properties of a material determine whether they are suitable for a purpose.</li> </ul>	<ul style="list-style-type: none"> <li>Plants grow from seeds/bulbs starting with germination</li> <li>Plants need light, water and warmth to grow and survive</li> <li>Flowers make seeds to make more plants</li> </ul>

		<p>good condition and increases survival chances.</p> <ul style="list-style-type: none"> <li>• All animals eventually die.</li> <li>• Animals reproduce when they reach maturity.</li> <li>• Animals grow until maturity and then do not grow any larger.</li> <li>• all animals have a life cycle with the same basic stages</li> </ul>	<ul style="list-style-type: none"> <li>• Materials can be changed by physical force</li> </ul>	
Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)	<ul style="list-style-type: none"> <li>• Compare sort and group things</li> <li>• record learning in different ways</li> <li>• talk about what they think will happen or what they have found out</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Identifying, classifying and grouping</li> <li>• Research using secondary sources</li> </ul>	<ul style="list-style-type: none"> <li>• record learning in different ways</li> <li>• talk about what they think will happen or what they have found out</li> <li>• Use simple scientific language</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Identifying, classifying and grouping</li> <li>• Research using secondary sources</li> <li>• Observation over time</li> </ul>	<ul style="list-style-type: none"> <li>• Use simple equipment</li> <li>• Ask simple questions</li> <li>• Know that questions can be answered in different ways</li> <li>• Use simple scientific language</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Identifying, classifying and grouping</li> <li>• Comparative and fair testing</li> <li>• Pattern seeking</li> </ul>	<ul style="list-style-type: none"> <li>• I can make simple measurements using non-standard units</li> <li>• I perform simple texts to answer questions</li> <li>• I observe closely</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Observation over time</li> <li>• Comparative and fair testing</li> <li>• Pattern seeking</li> </ul>
Vocabulary	Revisit: head, neck, ear, mouth, shoulder, hand, fingers, leg, foot, thumb, eye, nose, knee, toes, teeth, elbow	Revisit: Food, water, healthy, active, grow, move, life cycle	Revisit: rock, paper, cardboard, wood, metal, plastic, glass, brick, rubber, twisting, squashing, bending, stretching,	Revisit: warmth, bulbs, seeds, roots, stem, flower, seeds, petals, light, water, air

	New: Amphibians, birds, fish, mammals, reptiles, carnivores, herbivore, omnivore, sight, hearing, touch, taste, smell,	New: Survival, Air, Food, Adult, Baby, Offspring, Exercise, Hygiene, repair, reproduce, maturity	New: waterproof/not waterproof, absorbent, opaque, flexible, brittle, waterproof, fabric, material, properties	New: Germinate, temperature, healthy, survive
	Disciplinary: Compare, record, diagram, label, predict, compare, identify, research	Disciplinary: Compare, record, diagram, label, predict, compare, identify, research, watch, observe, change, notice	Disciplinary: Compare, identify, notice, pattern, equipment, question, appropriate, best, worst	Disciplinary: Observe, compare, change, measure, record, notice
Focus Scientist	<b>Jane Goodall</b> - Chimpanzee expert	<b>Mary Seacole</b> - battlefield nurse	<b>Charles Macintosh</b> - Materials chemist (invented the waterproof coat)	<b>Beatrix Potter</b> - author & botanist

## Lower Key Stage 2

Class 2   Year 3/4   Cycle A				
Term	Autumn		Spring	Summer
Theme	Where does electricity come from and how does it work?	What do rocks tell us about the day the Earth was formed?	How do our bodies work?	Where does snow come from?
Substantive Concept	Electricity	Rocks and Forces	Animals, including humans	Properties and changes of materials
NC Coverage	<ul style="list-style-type: none"> <li>Identify common appliances that run on electricity.</li> <li>Construct a simple series electrical circuit,</li> </ul>	<ul style="list-style-type: none"> <li>Compare and group together different kinds of rocks based on their appearance and simple physical properties</li> </ul>	<ul style="list-style-type: none"> <li>Identify that animals, including humans, need the right types and amounts of nutrition, and they cannot make their own food; they get</li> </ul>	<ul style="list-style-type: none"> <li>Compare and group materials together, according to whether they are solids, liquids or gases.</li> </ul>

	<p>identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.</p> <ul style="list-style-type: none"> <li>• Identify whether a lamp will light in a simple series circuit, based on whether the lamp is part of a complete loop with a battery.</li> <li>• Recognise that a switch opens and closes the circuit and associate this with whether a lamp lights in a simple series circuit. Recognise some common conductors and insulators, and associate metals with being good conductors.</li> <li>• Know the difference between a conductor and an insulator, giving examples of each.</li> <li>• Safety when using electricity</li> </ul>	<ul style="list-style-type: none"> <li>• Describe in simple terms how fossils are formed when things that have lived are trapped within rock</li> <li>• Recognise that soils are made from rocks and organic matter</li> <li>• Compare how things move on different surfaces.</li> <li>• Know how a simple pulley works and use making lifting an object simpler</li> <li>• Notice that some forces need contact between two objects, but magnetic forces can act at a distance.</li> <li>• Observe how magnets attract and repel each other and attract some materials and not others.</li> <li>• Compare and group together a variety of everyday materials based on whether they are attracted to a magnet and identify some magnetic materials.</li> <li>• Describe magnets as having two poles.</li> </ul>	<p>their nutrition from what they eat.</p> <ul style="list-style-type: none"> <li>• Know how nutrients, water and oxygen are transported within animals and humans.</li> <li>• Identify that humans and some other animals have muscles for support, protections and movement.</li> </ul>	<ul style="list-style-type: none"> <li>• Observe that some materials change state when heated or cooled, and measure and research the temperature at which this happens in degrees Celsius. •</li> <li>• Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.</li> </ul>
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		<ul style="list-style-type: none"> <li>● Predict whether two magnets will attract or repel each other, depending on which poles are facing.</li> </ul>		
<b>Substantive Knowledge (Concepts)</b>	<ul style="list-style-type: none"> <li>● Identify and name appliances that require electricity (mains or battery) to function.</li> <li>● Know how to construct a series circuit.</li> <li>● Identify and name the components in a series circuit (cells, wires, buzzers, bulbs and switches).</li> <li>● A complete circuit is needed for electricity to flow and components to work.</li> <li>● Know the function of a switch.</li> <li>● Some materials allow electricity to flow easily, these are called conductors</li> <li>● Some materials don't allow electricity to flow, these are called insulators.</li> </ul>	<ul style="list-style-type: none"> <li>● There are different types of rocks and soils</li> <li>● The property of soils is affected by the: type of rock; size of rock pieces; amount of organic matter in it</li> <li>● Fossils were formed millions of years ago</li> <li>● Fossils provide evidence that living things have changed over time.</li> <li>● All forces are a push or a pull</li> <li>● Pushes and pulls require contact between 2 objects</li> <li>● Some forces work without any contact or from a distance</li> <li>● Magnets have 2 poles, they can attract and they can repel</li> <li>● magnets attract metals that contain iron</li> <li>● Magnetic materials will be attracted to the magnet</li> </ul>	<ul style="list-style-type: none"> <li>● Different animals are adapted to eat different food</li> <li>● Understand the Eatwell plate and know how it helps us to eat healthily</li> <li>● Many animals have skeletons to support their bodies and protect the vital organs</li> <li>● Muscles are connected to bones and move them when they contract</li> <li>● Movable joints connect bones</li> </ul>	<ul style="list-style-type: none"> <li>● Solids, liquids and gases are described by observable properties.</li> <li>● Materials can be divided into solids, liquids and gases.</li> <li>● Heating causes solids to melt into liquids and liquids evaporate into gases.</li> <li>● Cooling causes gases to condense into liquids and liquids to freeze into solids.</li> <li>● The temperature at which given substances change state are always the same.</li> <li>● Water freezes at 0 degrees celsius and boils at 100 degrees celsius.</li> <li>● Know and explain the stages of the water cycle</li> </ul>

		<ul style="list-style-type: none"> <li>Things move differently on different surfaces depending on what materials they are made from.</li> </ul>		
Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)	<ul style="list-style-type: none"> <li>Set up simple enquiries</li> <li>Make sensible predictions</li> <li>Answer questions using simple scientific evidence</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>Comparative and fair testing</li> <li>Identifying, classifying and grouping</li> <li>Pattern seeking</li> </ul>	<ul style="list-style-type: none"> <li>Explain what I have found by speaking and writing</li> <li>Ask relevant questions</li> <li>Gather, classify and record findings in different ways</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>Identifying, classifying and grouping</li> <li>Research using secondary sources</li> <li>Pattern seeking</li> </ul>	<ul style="list-style-type: none"> <li>Present data using diagrams, tables, keys and charts</li> <li>Use relevant scientific language</li> <li>Answer questions using simple scientific evidence</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>Identifying, classifying and grouping</li> <li>Research using secondary sources</li> <li>Comparative and fair testing</li> </ul>	<ul style="list-style-type: none"> <li>I can measure in standard units</li> <li>I make careful observations</li> <li>I can use a range of equipment accurately</li> <li>I can suggest improvements</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>Comparative a fair testing</li> <li>Identifying, classifying and grouping</li> <li>Observing over time</li> </ul>
Vocabulary	Revisit: Electricity, battery, switch,	Revisit: Soil, rock, fossil.  push, pull, surface.	Revisit: Healthy, survival	Revisit: Temperature, melt, freeze, water, ice,
	New: Circuit, electrical appliance, cell, electrical component, conductor, insulator, mains, wires, crocodile clips, battery holder, motor, buzzer	New: igneous, metamorphic, sedimentary, anthropic, permeable, impermeable, organic matter, top soil, subsoil, base rock  magnet, magnetic, magnetic field, attract, repel, poles,	New: Nutrients, nutrition, carbohydrates, protein, fats, vitamins, minerals, water, fibre, skeleton, bones, joints, vertebrates, invertebrates, muscles, contract, relax,	New: Solid, liquid, gas, particles, state, materials, properties, matter, process, dissolve, condensation, evaporation, water vapour, energy, precipitation, collection

		north, south, magnetic force, compass, Force,		
	Disciplinary: Comparison/ compare, variable, recognise, fair, identify, plan, constant, decide	Disciplinary: Comparison/ compare, identify, similarity difference, diagram, research, source, table	Disciplinary: Present, data, diagram, evidence, primary sources, secondary sources, compare, variable, fair, keep the same/ constant, conclude	Disciplinary: Observe, identify, classify, variable, constant, recognise, enquire, conclude, improve, evaluate, measure, units
Focus Scientist	<b>Thomas Edison</b> - Invented the first working light bulb	<b>Mary Anning</b> - Discovery of fossils		<b>Joseph Priestly: Chemist</b> Discovered oxygen, carbon dioxide invented the rubber, invented fizzy drinks

Class 2   Year 3/4   Cycle B				
Term	Autumn		Spring	Summer
Theme	Why is my shadow following me?	Why can I hear that noise?	What happens to the food we eat?	Which wild animals and plants thrive in our local environment?
Substantive Concept	Light	Sound	Animals, including humans	Plants Living things and their habitats
NC Coverage	<ul style="list-style-type: none"> <li>Recognise that they need light in order to see things and that dark is the absence of light.</li> <li>Notice that light is reflected from surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>Know how sound is made associating some of them with vibrating.</li> <li>Know what happens to a sound as it travels from its source to our ears.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the simple functions of the basic parts of the digestive system in humans.</li> <li>Identify the different types of teeth in</li> </ul>	<ul style="list-style-type: none"> <li>Identify and describe the functions of different parts of the flowering plant: roots, stem/trunk/leaves and flowers</li> </ul>

	<ul style="list-style-type: none"> <li>● Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.</li> <li>● Recognise that shadows are formed when the light from a light source is blocked by a solid object.</li> <li>● Find patterns in the way that the sizes of shadows change</li> </ul>	<ul style="list-style-type: none"> <li>● Know the correlation between the volume of a sound and the strength of the vibrations that produced it.</li> <li>● Know how sound travels from a source to our ears.</li> <li>● Know the correlation between pitch and the object</li> </ul>	<p>humans and their simple functions.</p> <ul style="list-style-type: none"> <li>● Construct and interpret a variety of food chains, identifying producers, predators and prey</li> </ul>	<ul style="list-style-type: none"> <li>● Explore the part flowers play in a flowering plants life cycle, including pollination, seed formation and seed dispersal</li> <li>● Explain the requirements of plants for life and growth (air, light, water, nutrients from soil, room to grow) and how they vary between plants</li> <li>● Know the way in which water is transported between plants</li> <li>● Recognise that living things can be grouped in a variety of ways.</li> <li>● Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.</li> <li>● Recognise that environments can change and that this can sometimes pose danger to living things.</li> </ul>
<p>Substantive Knowledge <b>(Concepts)</b></p>	<ul style="list-style-type: none"> <li>● There must be light for us to see. Without light, it is dark.</li> </ul>	<ul style="list-style-type: none"> <li>● Sound travels from its source in all different directions and we hear</li> </ul>	<ul style="list-style-type: none"> <li>● Animals have teeth to help them eat</li> <li>● Different types of teeth do different jobs</li> </ul>	<ul style="list-style-type: none"> <li>● Plants are producers, they make their own food.</li> </ul>

	<ul style="list-style-type: none"> <li>• Beams of light bounce off some materials. This is called reflection.</li> <li>• Transparent objects let light through and opaque objects don't let light through.</li> <li>• Light comes from a source.</li> <li>• Shadows are formed when an opaque object blocks the light.</li> <li>• The closer a shadow is to a light source the bigger it is.</li> </ul>	<p>it when it travels to our ears.</p> <ul style="list-style-type: none"> <li>• Changing the shape, size and material of an object will change the sound it makes</li> <li>• Sound is produced when an object vibrates</li> <li>• Bigger vibrations make louder sounds and smaller vibrations make quieter sounds.</li> <li>• Faster vibrations make a higher pitched sound (higher frequency)</li> </ul>	<ul style="list-style-type: none"> <li>• Food is broken down by the teeth and further by the stomach and intestines where nutrients go in to the blood.</li> <li>• Name the different parts of the digestive system and explain what they do</li> <li>• Nutrients produced by plants move from primary to secondary consumers in a food chain.</li> </ul>	<ul style="list-style-type: none"> <li>• Their leaves absorb sunlight and carbon dioxide</li> <li>• Plants have roots, which provide support and draw water from the soil</li> <li>• Flowering plants have specific adaptations which help it to carry out pollination, fertilisation and seed production</li> <li>• Seed dispersal improves a plants chances of successful reproduction</li> <li>• Seeds/bulbs require the right conditions to germinate and grow.</li> <li>• Seeds contain enough food for the plant's initial growth</li>   <li>• Living things can be divided into groups based upon their characteristics</li> <li>• Environmental change affects different habitats differently</li> <li>• Different organisms are affected differently by</li> </ul>
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				<p>environmental change</p> <ul style="list-style-type: none"> <li>• Different food chains occur in different habitats</li> <li>• Human activity significantly affects the environment</li> </ul>
<p>Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)</p>	<ul style="list-style-type: none"> <li>• Ask relevant questions</li> <li>• Make sensible predictions</li> <li>• Answer questions using simple scientific evidence</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Observation over time</li> <li>• Pattern seeking</li> </ul>	<ul style="list-style-type: none"> <li>• Use a range of equipment accurately</li> <li>• Measure in standard units</li> <li>• Set up simple enquiries</li> <li>• Gather, classify and record findings in different ways</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Pattern seeking</li> <li>• Comparative and fair testing</li> </ul>	<ul style="list-style-type: none"> <li>• Use relevant scientific language</li> <li>• Present data using diagrams, tables, keys and charts</li> <li>• Explain what they have found using speaking and writing</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Identifying, classifying and grouping</li> <li>• Research using secondary sources</li> </ul>	<ul style="list-style-type: none"> <li>• Measure in standard units</li> <li>• Make careful observations</li> <li>• Present data using diagrams, tables, keys and charts</li> <li>• suggest improvements</li> </ul> <p><i>Enquiry types</i></p> <ul style="list-style-type: none"> <li>• Comparative and fair testing</li> <li>• Observation over time</li> <li>• Research using secondary sources</li> <li>• Identifying, classifying and grouping</li> </ul>
Vocabulary	Revisit dark, sun,	Revisit ear	Revisit tongue, mouth, teeth, tooth, stomach, Herbivore, Carnivore, omnivore, food chain	Revisit: Air, light, soil, water, flowers, growth, flowering, nonflowering, plants, animals, vertebrates, fish, amphibians, reptiles, mammals, invertebrates

	New: light source, reflect, ray, mirror, bounce, visible, beam, glare, travel, straight, opaque, shadow, block, transparent, translucent.	New: Amplitude, volume, quiet, loud, pitch, high, low, particles, instruments, wave.	New: Digestive system, oesophagus, gallbladder, small intestine, pancreas, large intestine, liver, canine, incisor, molar, premolar, producer, consumer.	New: seedling, absorb, carbon dioxide, fertilisation, reproduction, energy, pollination, dispersal, transportation, nutrients,  environment, danger, deforestation, extinction, endangered, human impact, nature reserves, deforestation.
	Disciplinary: Observe, pattern, identify, predict, explain, reason, evidence	Disciplinary: Decibels, datalogger, equipment, range, enquiry, classify, record, graph, compare, variable, constant, pattern	Disciplinary: Identify, sources, diagram, label, key, construct, interpret, variety, similarities, differences	Disciplinary: Compare, variable, constant, measure, observe, research, sources, identify, classify, classification, classification key,
Focus Scientist	<b>Patricia Bath</b> - ophthalmologist and inventor	<b>Gailileo Galeli</b> - Frequency and pitch of sound waves	<b>Ivan Pavlov</b> - Digestive system mechanism	<b>George Washington Carver</b> - born into slavery, farming and agriculture

## Upper Key Stage 2

Class 3   Year 5/6   Cycle A				
Term	Autumn		Spring	Summer
Theme	How and why do objects move?	How can we see the world around us?	Is all change irreversible?	What happens when animals get older?

Substantive Concept	Forces	Light	Properties and changes of materials	Animals including humans Living things and their habitats
NC Coverage	<ul style="list-style-type: none"> <li>● Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object and the impact of gravity on our lives.</li> <li>● Identify the effects of air resistance, water resistance and friction, which act between moving surfaces.</li> <li>● Recognise that some mechanisms, including levers, pulleys, and gears, allow a smaller force to have a greater effect.</li> </ul>	<ul style="list-style-type: none"> <li>● Recognise that light appears to travel in straight lines.</li> <li>● 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.</li> <li>● 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.</li> <li>● Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.</li> <li>● Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.</li> </ul>	<ul style="list-style-type: none"> <li>● condensation in the water cycle and associate the rate of evaporation with temperature.</li> <li>● Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution.</li> <li>● Use knowledge of solids, liquids, and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.</li> <li>● Compare and group together everyday materials based on their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.</li> <li>● comparative and fair tests, for the uses of everyday materials, including wood, metals and plastic.</li> </ul>	<ul style="list-style-type: none"> <li>● Describe the changes as humans develop to old age.</li> <li>● Know the life cycle of different living things, e.g. Mammal, amphibian, insect bird.</li> <li>● Know the process of reproduction in plants.</li> <li>● Know the process of reproduction in animals.</li> <li>● Classify living things into broad groups according to observable characteristics and based on similarities and differences.</li> <li>● Give reasons for classifying plants and animals based on specific characteristics.</li> </ul>

			<ul style="list-style-type: none"> <li>• Demonstrate that dissolving, mixing and changes of state are reversible changes.</li> <li>• Explain that some changes result in the formation of new materials, and this kind of change is usually not reversible, including changes associated with burning and the action of acid on bicarbonate of soda</li> </ul>	
<p>Substantive Knowledge (Concepts)</p>	<ul style="list-style-type: none"> <li>• Know that gravity is a force that acts between and object and the Earth's core</li> <li>• Air resistance and water resistance are forces against motion caused by objects having to move air and water out of their way.</li> <li>• Friction is a force against motion caused by two surfaces rubbing against each other.</li> <li>• An object will move when forces are not balanced.</li> </ul>	<ul style="list-style-type: none"> <li>• Know that light is a wave that appears to travel in straight lines.</li> <li>• Use the idea that light travels in straight lines to explain how we see.</li> <li>• Know that light reflects off all objects (unless they are black) but we do not always see the beam as non shiny surfaces scatter the light.</li> <li>• Know that shadows have the same shape as the objects that cast them.</li> <li>• Know how simple optical instruments work e.g magnifying</li> </ul>	<ul style="list-style-type: none"> <li>• When two or more substances are mixed and remain present the mixture can be separated.</li> <li>• dissolving, mixing and changes of state are reversible changes.</li> <li>• Some changes can be reversed, and some cannot.</li> <li>• Materials change state by heating and cooling.</li> <li>• Mixtures can be separated in the following ways: Filtration &amp; sieving,</li> </ul>	<ul style="list-style-type: none"> <li>• Different animals mature at different rates and live to different ages</li> <li>• Puberty is something we all go through and it prepares our bodies for being adults and reproduction</li> <li>• Some organisms reproduce sexually where offspring inherit information from both parents</li> <li>• Some organisms reproduce asexually by making a copy of a single parent</li> </ul>

	<ul style="list-style-type: none"> <li>Some objects require large forces to make them move; gears, pulley and levers can reduce the force needed to make things move</li> </ul>	<p>glass, microscope, binoculars.</p>	<p>Magnets, Evaporation, Floating</p> <ul style="list-style-type: none"> <li>All matter (including gas) has mass.</li> <li>Sometimes mixed substances react to make a new substance. These changes are usually irreversible.</li> <li>Heating can sometimes cause materials to change permanently. When this happens, a new substance is made. These changes are not reversible.</li> <li>Indicators that something new has been made are: The properties of the material are different (colour, state, texture, hardness, smell, temperature)</li> <li>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)</li> </ul>	<ul style="list-style-type: none"> <li>Different types of organism have different life cycles</li> </ul>
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<p>Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)</p>	<ul style="list-style-type: none"> <li>Use relevant scientific language to support or refute ideas</li> <li>Select and use a range of scientific equipment accurately</li> <li>Use results to draw conclusions and suggest improvements</li> <li>Plan enquiries to answer questions</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Identifying, classifying and grouping</li> <li>Observation over time</li> <li>Comparative and fair testing</li> </ul>	<ul style="list-style-type: none"> <li>Select and use a range of scientific equipment accurately</li> <li>Measure with precision, taking repeat readings if needed</li> <li>Decide how to record learning</li> <li>Decide how to present data using diagrams, tables, keys and graphs</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Pattern seeking</li> <li>Research using secondary sources</li> </ul>	<ul style="list-style-type: none"> <li>Make sensible predictions based in scientific reasoning</li> <li>Use results to make predictions and set up further enquiries</li> <li>Ask different kinds of questions</li> <li>Decide what observations and measurements to make</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Comparative and fair testing</li> <li>Observation over time</li> </ul>	<ul style="list-style-type: none"> <li>Report findings using speaking, writing, displays and presentations</li> <li>Decide how to record learning</li> <li>Use relevant scientific language and illustrations to support or refute ideas</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Identifying, classifying and grouping</li> <li>Observing over time</li> <li>Pattern seeking</li> </ul>
<p>Vocabulary</p>	<p>Revisit: force, push, pull,</p>	<p>Revisit: Light source, dark, reflect, mirror, visible, shadow, sun, block, beam, ray, bounce, glare, travel, straight, opaque, transparent, translucent.</p>	<p>Revisit: Solid, liquid, gas, materials, properties, matter, melt, freeze, water, ice, temperature, process, condensation, evaporation, water vapour, energy, precipitation, collection, Dissolving, Mixing Material, conductor, mixture, flexible, magnetic, hard.</p>	<p>Revisit: Baby, Toddler, Teenager, Elderly, Growth, male, female, young, offspring, mammal, amphibian, insect, bird, plant, vertebrates, invertebrate</p>
	<p>New: Air resistance, Water resistance, Friction, Gravity, Newton, Gears, Pulleys, opposing, motion, streamline, brake, mechanism, lever, cog, machine, effort, load, fulcrum.</p>	<p>New: Absorb, emitted, scattered refraction</p>	<p>New: insoluble, suspension, chemical, physical, irreversible, solution, solute, reversible, insulator, transparent, permeable, soluble, property,</p>	<p>New: Development, Puberty, Hormone, Physical, Emotional, Foetus, Embryo, Womb, Gestation, reproduction, sexual, asexual, variation</p>

	Disciplinary: Pattern, conclude, identify, observe, evaluate, improve, efficiency, repeat, support, refute, plan, enquire.	Disciplinary: Measure, precision, data logger, range, lumens, accurate, repeat reading, anomaly, pattern, table, diagram, label, explain.	Disciplinary: Measure, thermometer, weigh, separate, compare, observe, time, variable, constant, observe, identify, analyse, evaluate, predict, hypothesis	Disciplinary: Identify, classify, observe, support, refute, present, illustration, categorise
Focus Scientist	<b>Isaac Newton</b> - Laws of gravity	<b>Ibn al-Haytham (Alhazen)</b> - Light and our eyes		<b>Carl Linnaeus</b> - Plant and animals classification

Class 3   Year 5/6   Cycle B				
Term	Autumn		Spring	Summer
Theme	Sun, moon and earth: what is moving and how do we know?	What is evolution and how do scientists know about it?	How do our choices affect how our bodies work?	Can we vary the effects of electricity?
Substantive Concept	Earth and space	Evolution and inheritance	Animals including humans	Electricity
NC Coverage	<ul style="list-style-type: none"> <li>Describe the movement of the Earth, and other planets, relative to the Sun in the solar system</li> <li>Describe the movement of the Moon relative to the Earth</li> <li>Describe the Sun, Earth and Moon as approximately spherical bodies</li> </ul>	<ul style="list-style-type: none"> <li>Know about evolution and can explain what it is.</li> <li>Know how fossils can be used to find out about the past.</li> <li>Recognise that living things produce offspring of the same kind, but normally offspring vary and are</li> </ul>	<ul style="list-style-type: none"> <li>Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.</li> <li>Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.</li> </ul>	<ul style="list-style-type: none"> <li>Associate the brightness of a lamp of the volume of a buzzer with the number and voltage of cells used in the circuit</li> <li>Compare and give reasons for variations in how components function, including the brightness of bulbs, the</li> </ul>

	<ul style="list-style-type: none"> <li>Describe the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.</li> </ul>	<p>not identical to their parents</p> <ul style="list-style-type: none"> <li>Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago</li> </ul>	<ul style="list-style-type: none"> <li>Describe the ways in which nutrients and water are transported within animals, including humans.</li> </ul>	<p>loudness of buzzers and the on/off position of the switches.</p> <ul style="list-style-type: none"> <li>Use recognised symbols when representing a simple circuit diagram.</li> </ul>
<p><b>Substantive Knowledge (Concepts)</b></p>	<ul style="list-style-type: none"> <li>Stars, planets and moons has so much mass they attract other things, including each other, due to a force called Gravity.</li> <li>Objects with a smaller mass orbit objects with a larger mass</li> <li>Objects like planets, moons and stars spin.</li> <li>The sun, moon and planets are roughly spherical</li> <li>Planets in our solar system have day and night because when they rotate only half of the planet faces the sun.</li> </ul>	<ul style="list-style-type: none"> <li>Life cycles have evolved to help organisms survive to adulthood</li> <li>Over time, the characteristics that are most suited to the environment become increasingly common</li> <li>Organisms best suited to their environment are more likely to survive long enough to reproduce.</li> <li>Variation exists between a population.</li> <li>Competition exists for resources and mates</li> </ul>	<ul style="list-style-type: none"> <li>The heart pumps blood around the body</li> <li>Oxygen is breathed into the lungs where it is absorbed by the blood</li> <li>Muscles need oxygen to release energy from food to do work</li> <li>Know that blood vessels carry blood around the body</li> <li>Nutrients are absorbed into the bloodstream by the small intestine</li> <li>The heart pumps blood around the body so that oxygen, water and nutrients can get to where they are needed</li> </ul>	<ul style="list-style-type: none"> <li>Batteries are a store of energy. This energy pushes electricity around a circuit. When the battery is empty, it stops pushing. The voltage is the 'push'.</li> <li>The higher the voltage of a battery, the brighter a bulb will be and the louder a buzzer will be.</li> <li>The more components in a circuit, the less powerful they will be.</li> </ul>

	<ul style="list-style-type: none"> <li>Historically, scientists thought that the Earth was at the centre of our solar system instead of the sun - scientific theory changes when we discover more.</li> </ul>			
Disciplinary Knowledge (Working Scientifically and 5 Enquiry Types)	<ul style="list-style-type: none"> <li>Ask different kinds of relevant questions</li> <li>Use relevant scientific language and illustration to support or refute ideas</li> <li>Decide how to record learning</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Research using secondary sources</li> <li>Pattern Seeking</li> <li>Observation over time</li> </ul>	<ul style="list-style-type: none"> <li>Use results to draw conclusions and suggest improvements</li> <li>Report findings using speaking, writing, displays and presentations</li> <li>Use relevant scientific language and illustration to support or refute ideas</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Research using secondary sources</li> <li>Observation over time</li> <li>Identifying, classifying and grouping</li> </ul>	<ul style="list-style-type: none"> <li>Measure with precision taking repeat readings if necessary</li> <li>Plan enquiries to answer questions</li> <li>Decide how to present data using diagrams, tables, keys and graphs</li> <li>Make sensible predictions using scientific reasoning</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Comparative and fair testing</li> <li>Pattern seeking</li> <li>Observation over time</li> </ul>	<ul style="list-style-type: none"> <li>Measure with precision taking repeat readings if necessary</li> <li>Decide what observations and measurements to make</li> <li>Select and use scientific equipment accurately</li> <li>Use results to make predictions and set up further enquiries</li> </ul> <p><i>Enquiry Types</i></p> <ul style="list-style-type: none"> <li>Comparative and fair testing</li> <li>Pattern seeking</li> </ul>
Vocabulary	<p>Revisit: Earth, Sun, Moon, Day, Night, star, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune,</p>	<p>Revisit: Fossils,</p>	<p>Revisit: heart, lungs, blood, digestive, nutrients, water, oxygen, exercise, muscles</p>	<p>Revisit: Circuit, electrical appliance, cell, electrical component, conductor, insulator, mains, wires, crocodile clips, battery holder, motor, buzzer</p>
	<p>New: Axis, Rotation, Phases of the Moon, constellation, waxing,</p>	<p>New: Adaptation, Evolution, Characteristics, Reproduction,</p>	<p>New:alcohol, drugs, tobacco, Oxygenated, Deoxygenated, Valve, Respiration Circulatory system, blood vessels, artery,</p>	<p>New: electrons, electric current, voltage</p>

	waning, crescent, gibbous. planets, solar system, rotate, orbit, axis, spherical, geocentric, heliocentric.	Genetics, Variation, Inherited, Environmental, Mutation, Competition, Survival of the Fittest,	vein, transport, gas exchange,	
	Disciplinary: Evaluate, relevant, illustration, support, refute, explain, correlation, observe, interpret, support, improve	Disciplinary: Evidence, conclude, suggest, report, present, explain, relevant, support, refute, research, sources, identify, classification, improve,	Disciplinary: Precision, repeat readings, average, mean, plan, enquiry, data, diagrams, tables, graphs, record, present, observe, compare, variable, constant, hypothesis	Disciplinary: measure, lumen, datalogger, repeat reading, reliable, data, diagram, graph, predict, evaluate, support, conclude, explain
<b>Focus Scientist</b>	<b>Helen Sharman:</b> First British astronaut  <b>Katherine Johnson</b> - NASA mathematician	<b>Charles Darwin</b> - Theory of Evolution by Natural selection		<b>Olga D. González-Sanabria</b> - Invented a special type of battery that is used to power the ISS

Primary substantive concept	KS3 substantive knowledge
Plants	<ul style="list-style-type: none"> <li>Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.</li> </ul>
Living things and their habitats	<ul style="list-style-type: none"> <li>Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive</li> </ul>

	<p>systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta.</p> <ul style="list-style-type: none"> <li>● Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.</li> <li>● Differences between species.</li> </ul>
Animals, including humans	<ul style="list-style-type: none"> <li>● Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta.</li> <li>● The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases.</li> <li>● The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.</li> <li>● The structure and functions of the gas exchange system in humans, including adaptations to function.</li> <li>● The mechanism of breathing to move air in and out of the lungs.</li> <li>● The impact of exercise, asthma and smoking on the human gas exchange system</li> </ul>
Evolution and inheritance	<ul style="list-style-type: none"> <li>● Heredity as the process by which genetic information is transmitted from one generation to the next.</li> <li>● A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model.</li> <li>● The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection.</li> <li>● Changes in the environment may leave individuals within a species,</li> </ul>

	<p>and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction.</p>
Seasonal changes	<ul style="list-style-type: none"> <li>• The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.</li> </ul>
Properties and changes of materials	<ul style="list-style-type: none"> <li>• Chemical reactions as the rearrangement of atoms.</li> <li>• Representing chemical reactions using formulae and using equations.</li> <li>• Combustion, thermal decomposition, oxidation and displacement reactions.</li> <li>• Defining acids and alkalis in terms of neutralisation reactions.</li> <li>• The pH scale for measuring acidity/alkalinity; and indicators.</li> </ul>
Rocks	<ul style="list-style-type: none"> <li>• The composition of the Earth.</li> <li>• The structure of the Earth.</li> <li>• The rock cycle and the formation of igneous, sedimentary and metamorphic rocks.</li> </ul>
Light	<ul style="list-style-type: none"> <li>• The similarities and differences between light waves and waves in matter.</li> <li>• Light waves travelling through a vacuum; speed of light.</li> <li>• The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface.</li> <li>• Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye.</li> <li>• Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in</li> </ul>

	<p>cameras.</p> <ul style="list-style-type: none"> <li>• Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.</li> </ul>
<p>Forces</p>	<ul style="list-style-type: none"> <li>• Magnetic fields by plotting with compass, representation by field lines.</li> <li>• Earth's magnetism, compass and navigation.</li> <li>• Forces as pushes or pulls, arising from the interaction between two objects.</li> <li>• Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces.</li> <li>• Moment as the turning effect of a force.</li> <li>• Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water.</li> <li>• Forces measured in Newtons, measurements of stretch or compression as force is changed.</li> </ul>
<p>Sound</p>	<ul style="list-style-type: none"> <li>• Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition.</li> <li>• Frequencies of sound waves, measured in Hertz (Hz); echoes, reflection and absorption of sound.</li> <li>• Sound needs a medium to travel, the speed of sound in air, in water, in solids.</li> <li>• Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal.</li> <li>• Auditory range of humans and animals.</li> <li>• Pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound.</li> <li>• Waves transferring information for conversion to electrical signals</li> </ul>

	by microphone.
Electricity	<ul style="list-style-type: none"> <li>• Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge.</li> <li>• Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current.</li> <li>• Differences in resistance between conducting and insulating components (quantitative).</li> <li>• Static electricity</li> </ul>
Earth and space	<ul style="list-style-type: none"> <li>• Gravity force, weight = mass x gravitational field strength (g), on Earth <math>g=10 \text{ N/kg}</math>, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only).</li> <li>• Our Sun as a star, other stars in our galaxy, other galaxies.</li> <li>• The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.</li> <li>• The light year as a unit of astronomical distance.</li> </ul>