Springcroft Primary School

Year 6
Science Programme of Study

Inc. Core-Standard Coverage of Enquiry Types and Scientific Skills:

Enquiry Types	
Research Using Secondary Sources	✓✓✓
Observing Over Time	✓✓✓
Pattern Seeking	✓✓
Identifying, Classifying and Grouping	✓✓✓✓✓
Comparative and Fair Testing	✓✓✓

Working Scientifically	
Conducting Secondary Research	✓✓
Asking Questions	✓✓
Making Predictions and Hypothesising	✓✓✓
Setting up Investigations	✓✓✓
Observing and Measuring	✓✓
Recording Data	✓✓
Interpreting and Communicating Results	✓✓✓✓
Evaluating and Questioning Further	✓

Aims

'The National Curriculum for Science' aims to ensure that all pupils:

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

Scientific Knowledge and Conceptual Understanding:

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content.

Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The Nature, Processes and Methods of Science:

'Working Scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources. Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working Scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

Year 6 – Science Programme of Study - ***Timelines of Learning (The Bigger Picture)***

Unit	Prior Learning…	What I will learn now…	What I don't need to learn yet…
Living Things and their Habitats	**Pupils should have been taught to:** • Recognise that living things can be grouped in a variety of ways. (4-Living Things and their Habitats) • Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (4-Living Things and their Habitats) • Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (5-Living Things and their Habitats) • Describe the life process of reproduction in some plants and animals. (5-Living Things and their Habitats)	**Pupils should be taught to:** • Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. (6-Living Things and their Habitats) • Give reasons for classifying plants and animals based on specific characteristics. (6-Living Things and their Habitats)	**Pupils in Key Stage 3 will be taught about:** • Differences between species.
Evolution and Inheritance	**Pupils should have been taught to:** • 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. (2-Living things and their habitats) • Describe in simple terms how fossils are formed when things that have lived are trapped within rock. (3-Rocks) • Recognise that environments can change and that this can sometimes pose dangers to living things. (4-Living things and their Habitats)	**Pupils should be taught to:** • Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. (6-Evolution and inheritance) • Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. (6-Evolution and inheritance) • Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. (6-Evolution and inheritance)	**Pupils in Key Stage 3 will be taught about:** • Heredity as the process by which genetic information is transmitted from one generation to the next. • 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. • The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection. • Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction.
Electricity	**Pupils should have been taught to:** • Identify common appliances that run on electricity (4-Electricity) • Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. (4-Electricity) • 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. (4-Electricity) • Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. (4-Electricity) • Recognise some common conductors and insulators, and associate metals with being good conductors. (4-Electricity)	**Pupils should be taught to:** • Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. (6-Electricity) • Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. (6-Electricity) • Use recognised symbols when representing a simple circuit in a diagram. (6-Electricity)	**Pupils in Key Stage 3 will be taught about:** • Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge. • Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current. • Differences in resistance between conducting and insulating components (quantitative). • Static electricity.
Animals inc. Humans	**Pupils should have been taught to:** • Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. (2-Animals, including Humans) • Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. (3-Animals, including Humans) • Describe the simple functions of the basic parts of the digestive system in humans. (4-Animals, including Humans) • Identify the different types of teeth in humans and their simple functions. (4-Animals, including Humans)	**Pupils should be taught to:** • Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. (6-Animals, including Humans) • Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. (6-Animals, including Humans) • Describe the ways in which nutrients and water are transported within animals, including humans. (6-Animals, including Humans)	**In Key Stage 3 pupils will be taught about:** • The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases. • The effects of recreational drugs (including substance misuse) on behaviour, health and life processes. • The structure and functions of the gas exchange system in humans, including adaptations to function. • The mechanism of breathing to move air in and out of the lungs. • The impact of exercise, asthma and smoking on the human gas exchange system.

Light	**Pupils should have been taught to:** • Recognise that they need light in order to see things and that dark is the absence of light. (3-Light) • Notice that light is reflected from surfaces. (3-Light) • Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (3-Light) • Recognise that shadows are formed when the light from a light source is blocked by a solid object. (3-Light) • Find patterns in the way that the size of shadows change. (3-Light)	**Pupils should be taught to:** • Recognise that light appears to travel in straight lines. (6-Light) • 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. (6-Light) • 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. (6-Light) • Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. (6-Light)	**Pupils in Key Stage 3 will be taught about:** • The similarities and differences between light waves and waves in matter. • Light waves travelling through a vacuum; speed of light • The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface. • 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. • Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras. • Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.

Year 5 – Science Programme of Study - *Timelines of Learning* ***(Working Scientifically)***

	Plan		**Do**			**Review**		
Stages	Recognise the best type of enquiry to answer a question	Choose equipment, select tests, use secondary sources to decide how to obtain accurate observations and measurements	Obtain observations and measurements using equipment and/or secondary sources	Record observations and measurements	Present observations and measurements	Draw conclusions and make explanations	Evaluate the data collected	Evaluate the process used (including next steps)
Prior learning… **End of Year 5**	I ask relevant questions (containing scientific knowledge and understanding) and with help I recognise which type of enquiry is best to answer a question.	I decide what observations and measurements to make (controlling variables with help where necessary) and what equipment to use to make my measurements and observations.	I use a range of equipment independently. The series of observations and measurements I take are adequate for the task. I use information sources provided to find things out. I identify possible risks to myself and others.	I gather and record non-complex results (data and observations) using e.g., tables and scientific diagrams.	I present the results (data and observations) in a range of formats e.g., bar and line graphs, simple scatter graphs, keys and frequency charts.	I draw conclusions from my data and observations. I begin to use basic scientific evidence to support or refute the ideas or arguments for my conclusion.	I look at my results and decide if any observations or measurements are unsuitable.	I use what I have found out to suggest improvements to my work, giving reasons for these suggestions. I can set up further questions to investigate.
What I will learn now… **End of Year 6**	I ask relevant questions (containing scientific knowledge and understanding). I recognise which type of enquiry is best to answer a question.	I can plan different types of science enquiries to answer questions. I recognise and control variables where necessary. I decide what observations and measurements to make and what equipment to use (giving reasons) to make my measurements and observations.	I take measurements, using a range of scientific equipment with increasing accuracy and precision. I take repeat readings when appropriate. I use relevant information sources to find things out. I identify possible risks to myself and others.	I record data and results of increasing complexity using e.g., scientific diagrams and labels and tables. I choose a method to suit the results, e.g., a two-column table.	I present the data and results in suitable formats using e.g., line graphs, bar graphs, scatter graphs and classification keys.	From my data and observations, I draw valid conclusions (i.e., consistent with the evidence) including causal relationships. I identify scientific evidence to support or refute the ideas or arguments for my conclusion.	I look at my results and decide if any observations or measurements are unsuitable and need to be carried out again. I offer simple explanations for differences in results.	I use my test results to make predictions to set up further enquiries e.g., comparative and fair tests and suggest how my working methods could be improved, with reasons.
What I don't need to learn yet… **End of KS3**	Understand that scientific methods and theories develop as scientists modify earlier explanations to take account of new evidence and ideas, together with the importance of publishing results and peer review Evaluate risks Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience	Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.	I take measurements using a range of methods for different investigations.	I make and record observations and measurements using a range of methods for different investigations.	Present observations and data using appropriate methods, including tables and graphs. Apply mathematical concepts and calculate results.	Present reasoned explanations, including explaining data in relation to predictions and hypotheses	Evaluate data, showing awareness of potential sources of random and systematic error.	Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions and set up further investigations. Identify further questions arising from my results

KEY: **NAVY BLUE – EYFS Framework (pre-2021) or National Curriculum - <u>statutory</u>**
RED – Non-statutory to support progression

Year 6 – Science Programme of Study – *Yearly Overview* ***(Knowledge and Understanding)***

	Autumn 1	Autumn 2	Spring 1	Spring 2 and Summer 1	Summer 2
Year 6	**Living Things and their Habitats**	**Evolution and Inheritance**	**Electricity**	**Animals inc. Humans**	**Light**
	Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. Give reasons for classifying plants and animals based on specific characteristics. ***Cross Curricular Links:*** ***Maths*** *- Find out about the significance of the work of Carl Linnaeus who developed the binomial system for classification. Children to sort and group living things using Venn / Carroll diagrams and create classification keys.* ***Geography –*** *Learn about micro-organisms, plants and animals around the world. For example, children may consider how to locate and classify species living in the Serengeti or Arctic Circle, etc.*	Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. ***Cross Curricular Links:*** ***Maths*** *- Investigate and compare the measurements of different parts of the pupils' bodies and the ratios between two body parts.* ***History*** *- Create a timeline about living things that inhabited the earth. Work out which species survived the longest etc.* ***English –*** *Write an information text about a specific fossil, providing information about how it was once a living thing that inhabited the Earth millions of years ago.*	Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Use recognised symbols when representing a simple circuit in a diagram.	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. ***Cross Curricular Links:*** ***Maths*** *- Interpret graphs containing information about the effects of tobacco, alcohol and other drugs on weight gain, blood pressure etc.* ***Maths –*** *Draw a line graph to show how a person's pulse rate changes over time when consuming a piece of chocolate*	Recognise that light appears to travel in straight lines. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes. Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. ***Cross Curricular Links:*** ***Maths*** *– Measure the angle of incidence and angle of reflection.*

Exemplification *of 'Scientific Enquiry Types' and 'Working Scientifically'*

5 Enquiry Types

Research Using Secondary Sources
Where the answer is found or developed using secondary sources. This is usually where it is impossible or unsafe for pupils to fully answer with first-hand enquiries, or where confirmation of the conclusions drawn during first-hand enquires is sought. This enquiry skill helps pupils to evaluate sources, distinguish between fact and opinion and recognise conflicting evidence and bias.

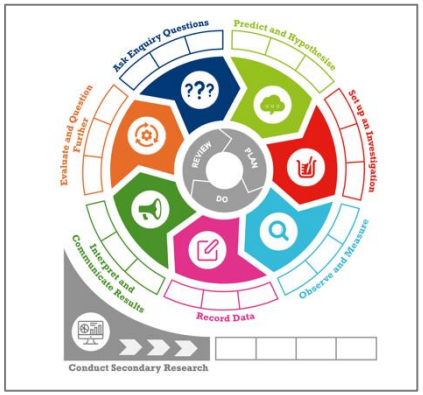
Observing Over Time
Pupils identify and measure events and changes in living things, materials and physical process or events. These observations may take place over time spans of minutes or hours (e.g., puddles evaporating) up to several weeks or months (e.g., rearing young chicks).

Pattern Seeking
Pupils observe, measure and record events and systems when carrying out pattern seeking enquires. They also collect and interpret data from secondary sources. They make observations and conduct surveys where the variables can't easily be controlled for practical or ethical reasons.

Identifying, Classifying and Grouping
Pupils make sense of how the world is organised. Identification is the process of using differences to name something and classification is organising things into groups. Opportunities to identify arise when pupils recognise not all birds are the same for example and can identify and name them. They can then use observable and behavioural similarities to group them and add new things.

Comparative and Fair Testing
Helps pupils explore relationship between variables. Comparative tests children compare one event with another. E.g., does the red car go faster than the green car? A fair test identifies the causal relationship between two variable. E.g., does the height of the ramp affect how quickly the toy car rolls down the ramp and everything else remains the same?

Definitions adapted from 'It's not fair - or is it?' (Turner, Keogh, Lawrence & Naylor, 2011)
Enquiry Symbols - © University of Manchester
Working Scientifically Symbols - © - Primary Science Teaching Trust



The **Working Scientifically Wheel** may be used in lessons to draw attention to the focused 'working scientifically' skill being covered.

Colouring or dating a section for each focused skill provides an opportunity to check that all of the skills are covered across the year, and also track children's progress in relation to the identified skills.

Working Scientifically – Processes of Science

Asking Questions
Asking questions that can be answered using a scientific enquiry. E.g., how does the road surface affect the speed at which a car travels?

Making Predictions and Hypothesising
Using prior knowledge (inc. that developed through secondary research) to suggest what will happen in a scientific enquiry. E.g., I think that a smoother road surface will allow a car to travel faster.

Setting up an Investigation
Deciding on the method and equipment to use to carry out an enquiry. E.g., children may use a timing ramp, different surface coverings and a data logger to test how the road surface affects the speed at which a car travels.

Observing and Measuring
Using measuring equipment and the senses to make observations or take measurements relating to the enquiry. E.g., the car took 1.5 seconds to travel between point A and point B on a smooth surface.

Recording Data
Using tables, drawing and other means to note observations and measurements. E.g., children record the results of their investigation using a two-way table.

Interpreting and Communicating Results
Using information from the recorded data to say what you found out and presenting this in an appropriate form. E.g., children draw and explain a bar chart showing how the time taken for a car to travel between points A and B changes depending on the surface covering.

Evaluating and Questioning Further
Reflecting on the success of the enquiry approach and identifying further questions for enquiry. E.g., children may ask how the angle of the ramp may also affect the speed at which the car travels between points A and B.

Year 6 – Core Investigations– ***Coverage of 'Working Scientifically' and 'Scientific Enquiry'***

	Living Things and their Habitats	Evolution and Inheritance	Electricity	Light	Animals inc. Humans
Year 6	**NC OBJ** - Describe how living things are classified into broad groups according to common observable characteristics and based on similarities… ***including micro-organisms*** *[see more].* **Enquiry Type:** *Observing Over Time* **Working Scientifically Skill:** *Set Up Investigations* **(1) Investigation Overview:** ***OWN PLANS – Growing Mould*** Children set up an investigation to observe the growth of mould on white bread (having been touched by clean and dirty hands).	**NC OBJ** - Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. **Enquiry Type:** *Identifying, Classifying and Grouping* **Working Scientifically Skill:** *Interpret & Communicate Results* **(1) Investigation Overview:** ***OWN Planning - Who's the Dad? Mr Men*** Children select Mr Men and Little Miss mother and father figures, before creating images of what their offspring would look like.	**NC OBJ** - Compare and give reasons for variations in how components function, including the brightness of… *[see more].* **Enquiry Type:** *Identify, Classify and Group* **Working Sci. Skill:** *Interp. & Com. Results* **(1) Investigation Overview:** ***Ogden – What Electricity Makes It Do*** Children consider how appliances may be grouped based on what electricity makes them do. Present results using Carroll diagrams.	**NC OBJ** - Recognise that light appears to travel in straight lines. **Enquiry Type:** *Identify, Classify and Group* **Working Sci. Skill:** *Predict & Hypothesise* **(1) Investigation Overview:** ***OWN PLANS - Laser Light*** Use a laser and mirrors to show / identify light travelling in straight lines. Children to predict what happens when a laser is shone at 1, 2, 3 mirrors, etc.	**NC OBJ** - Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. **Enquiry Type:** *Observing Over Time* **Working Scientifically Skill:** *Predict & Hypothesise* **(1) Investigation Overview:** ***Ogden Trust – Cardiovascular Scientists*** Children make predictions about the how their heart rate changes throughout the day. Children then plan and carry out an investigation to test their hypothesis, using a data logger to measure their heartrate throughout the day.
	NC OBJ - Describe how living things are classified into broad groups according to common observable characteristics and based on similarities… *[see more].* **Enquiry Type:** *Identifying, Classifying and Grouping* **Working Scientifically Skill:** *Asking Questions* **(2) Investigation Overview:** ***TAPS Focussed Assessment – Outdoor Keys*** Children produce their own classification keys for different types of leaves, including a range of questions based on similarities and differences between common observable characteristics.	**NC OBJ** - Identify how animals and plants are adapted to suit their environment in diff. ways & that adaptation may lead to evolution. **Enquiry Type:** *Research Using Sec. Sources* **Working Scientifically Skill:** *Conduct Sec. Research* **(2) Investigation Overview:** ***Ogden Trust – Darwin and the Galapagos Islands*** Children conduct secondary research to identify what Charles Darwin discovered when he visited the Galapagos islands. Consider ways in which this information may be presented effectively.	**NC OBJ** - Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells… *[see more].* **Enquiry Type:** *Comparative / Fair Testing* **Working Sci. Skill:** *Asking Questions* **(2) Investigation Overview:** ***OWN PLAN – Volume of a Buzzer*** Children ask Q's to help them investigate if the volume of a buzzer increases as cells are added to a circuit. Measure using a data logger and record results accurately.	**NC OBJ** - Use the idea that light travels in straight lines to explain that objects are seen because they give out… *[see more].* **Enquiry Type:** *Comparative / Fair Testing* **Working Sci. Skill:** *Asking Questions* **(2) Investigation Overview:** ***TAPS Focussed Assessment – Light Questions*** Children raise questions about light. Then sort these into groups for how they could be answered e.g. research, direct observation, testing, we may never know...	**NC OBJ** - Describe the ways in which nutrients and water are transported within animals, including humans. **Enquiry Type:** *Research Using Sec. Sources* **Working Scientifically Skill:** *Interpret & Communicate Results* **(2) Investigation Overview:** ***ASE PLAN – Circulatory System Drama*** Children work in groups and each research a part of the circulatory/digestive system before acting out how each part works to keep us alive, recognising that blood collects nutrients from the digestive system, etc.
	NC OBJ - Give reasons for classifying plants and animals based on specific characteristics. **Enquiry Type:** *Research Using Sec. Sources* **Working Scientifically Skill:** *Interpret & Communicate Results* **(3) Investigation Overview:** ***TAPS Focussed Assessment – Invertebrate Research*** After input on classification, give children. different invertebrates to research (annelids, molluscs, insects, etc.). Groups must give examples and describe features which make an invertebrate a member of its classification group and report and present information about an invertebrate classification group.	**NC OBJ** - Identify how animals and plants are adapted to suit their environment in diff. ways & that adaptation may lead to evolution. **Enquiry Type:** *Pattern Seeking* **Working Scientifically Skill:** *Set Up Investigations* **(3) Investigation Overview:** ***Ogden Trust – Bird's and their Beaks*** Children research the foods that different species of birds eat. Then set up and conduct an investigation to identify if there is a pattern between the size and/or shape of a bird's beak and the types of food it will eat.	**NC OBJ** - Compare and give reasons for variations in how components function, including the brightness of… *[see more].* **Enquiry Type:** *Comparative / Fair Testing* **Working Sci. Skill:** *Recording Data* **(3) Investigation Overview:** ***TAPS Focussed Assess. – Bulb Brightness*** Children investigate how to change the brightness of a bulb in a circuit. Identify variables and carry out investigation – measuring brightness using a data logger and record results accurately	**NC OBJ** - Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects… *[see more].* **Enquiry Type:** *Observe Over Time* **Working Sci. Skill:** *Predict & Hypothesise* **(3) Investigation Overview:** ***Ogden Trust. – How My Shadow Changes*** Children make predicts about and investigate how the shape (but not just the length) of their shadows change throughout the day.	**NC OBJ** - Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. **Enquiry Type:** *Comparative / Fair Testing* **Working Scientifically Skill:** *Set Up Investigations* **(3) Investigation Overview:** ***Ogden Trust –Most Important Meal of the Day*** Children ask q's to investigate the relationship between what we eat and how fast we run. Set up an investigation to test diet and performance - consider portion size, when / what we eat, etc. and investigate.
	NC OBJ - Give reasons for classifying plants and animals based on specific characteristics. **Enquiry Type:** *Identifying, Classifying and Grouping* **Working Scientifically Skill:** *Recording Data* **(4) Investigation Overview:** ***OWN PLANS- Classify Like Linnaeus*** Survey plants and animals in the school grounds, collecting samples/photos of animals/plants. Use the identified plants and animals to test the Linnaean classification system – can children classify the plants / animals that they have found?	**NC OBJ** - Recognise that living things have changed over time and that fossils provide information about living things … *[see more].* **Enquiry Type:** *Identifying, Classifying and Grouping* **Working Scientifically Skill:** *Evaluate / Q. Further* **(4) Investigation Overview:** ***TAPS Focussed Assessment – Fossil Habitats*** Children use fossils (photos, real or resin) and their own research to identify information about things that have lived in the past. Discuss which artefacts provide the strongest evidence, etc.		**NC OBJ** - Explain that we see things because light travels from light sources to our eyes or from light… *[see more].* **Enquiry Type:** *Research - Sec. Sources* **Working Sci. Skill:** *Conduct Research* **(4) Investigation Overview:** ***Ogden Trust – Why Wear Glasses?*** Children use sec. sources to research why people wear glasses and how these work in relation to the idea that we see things by light travelling to / from our eyes.	

Year 6 – Science Knowledge Builder– ***Small Steps and Suggested Lesson-Level Overview***

Small Steps Overview – Living Things and their Habitats (Y6)

(1)	*Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals.*
(2)	*Give reasons for classifying plants and animals based on specific characteristics.*
(3)	***Providing further depth and breadth of understanding***

NOTE – SOME STEPS WILL TAKE MORE THAN 60 MINUTES

Pupils will know…		***Key Vocab (MUST be introduced)***	
All knowledge (inc. key vocab) linked to prior learning (see page 3 for linked objectives)			
that there are very small organisms, called microorganisms, which can be harmful. ***(3)***	***Step 1***	*organism, microorganism, microscope*	
that microorganisms are very tiny living things that can only be seen using a microscope. ***(3)***			
that microorganisms can be found in and on our bodies, in the air, in water and on objects around us. ***(3)***	***Step 2***	***Consolidate vocabulary (re)introduced at Step 1***	
that microorganisms feed and grow. ***(3)***			
that microorganisms bring about decay (inc. food decay). ***(3)***	***Step 3***	*decay*	← ***Core Investigation 1***
that food needs to be handled and stored with care to control the presence of microorganisms. ***(3)***			
that decay caused by microorganisms can be beneficial. ***(3)***	***Step 4***		
that microorganisms are useful in food production. ***(3)***			
that yeast is a microorganism. ***(3)***			
that diseases can be passed on by microorganisms. ***(3)***	***Step 5***	*disease, illness*	
that microorganisms often cause many common illnesses. ***(3)***			
that scientists, called taxonomists, sort and group living things according to their similarities and differences. ***(1)***	***Step 6***	*taxonomist, taxonomy*	
that characteristics are special qualities or appearances that make an individual or group of things different to others. ***(1)***			
that broad groupings, such as micro-organisms, plants and animals can be subdivided.	***Step 7***	*classification, classify, vertebrates, invertebrates, insects, spiders, snails, worms, fish, amphibians, reptiles, birds and mammals*	← ***Core Investigation 2***
that animals may be classified as classified broadly as invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals). ***(1)***			← ***Core Investigation 3***
that in 1735, Swedish Scientist Carl Linnaeus first published a system for classifying all living things. ***(1)***	***Step 8***	*Carl Linnaeus, taxonomic system*	
that an adapted version of this system is still used today: The Linnaeus System. ***(1)***			
that the current taxonomic system now has eight levels in its hierarchy. ***(1)***			
that from lowest to highest, the eight level in the current taxonomic system are: species, genus, family, order, class, phylum, kingdom, domain. ***(2)***	***Step 9***	*species, genus, family, order, class, phylum, kingdom, domain*	
that the number of living things in each level gets smaller until the one animal is left in its species level. ***(2)***			
that a 'domain' is the broadest level of the taxonomic system – it includes bacteria, archaea and eukaryotes. ***(2)***	***Step 10***	*bacteria, archaea and eukaryotes, animals, plants, fungi, protists, prokaryotes*	
that all plants and animals are eukaryotes. ***(2)***			
that the next division of the classification system is that of kingdoms: animals, plants, fungi, protists, prokaryotes. ***(2)***			
that Living things can then be classified by: phylum; class; order; family; genus; species. ***(2)***			← ***Core Investigation 4***

****Vocabulary may already have been introduced but must be covered in the given context***

Year 6 – Science Lesson Objectives

Living Things and their Habitats (Y6)

To describe and investigate helpful and harmful microorganisms.
To identify the characteristics of different types of microorganisms.
1. To set up an investigation to observe the growth of mould. (Clean and dirty hands on bread)
To find out about the significance of the work of Carl Linnaeus.
To ask questions to produce our own classification keys.
To give reasons for classifying animals based on their similarities and differences. (microorganisms, plants and animals)
To report and present information about an invertebrate classification group.
To identify and classify plants and animals found in my local habitat.
To explain the classification of organisms found in my local habitat.
To research unfamiliar animals and plants and decide where they belong in the classification system.
Assessment – Children create their own creature and explain which classification group it would belong to and why.

Black - Learning objective Red – Suggested Activities or useful information. Purple – Core investigations

Year 6 – Science Knowledge Builder– ***Small Steps and Suggested Lesson-Level Overview***

Small Steps Overview – Evolution and Inheritance (Y6)

(1)	*Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.*
(2)	*Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.*
(3)	*Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.*
(4)	***Providing further depth and breadth of understanding***

NOTE – SOME STEPS WILL TAKE MORE THAN 60 MINUTES

Pupils will know…		***Key Vocab (MUST be introduced)***	
All knowledge (inc. key vocab) linked to prior learning (see page 3 for linked objectives)			
that there are similarities and differences between animals inc. humans. ***(2)***	***Step 1***	*similarity, difference, variation*	
that living things produce offspring of the same kind. ***(2)***	***Step 2***	*inherit, inherited traits, characteristics, offspring, parent, reproduce, generation*	← ***Core Investigation 1***
that offspring normally vary and are not identical to their parents. ***(2)***			
that some characteristics are passed from parents to their offspring – these are called inherited traits. ***(2)***			
that genetics is the study of what offspring inherit from their parents. ***(2)***	***Step 3***	*genetics, gene*	
that genes contain the code that decides which traits a living thing will have. ***(2)***			
that a dominant gene hides the effect of a recessive gene. E.g., a dominant gene may result in brown eye colour. ***(2)***	***Step 4***	*dominant gene, recessive gene*	
that a recessive gene can be masked by a dominant gene. E.g., to have blue eyes, you must have the gene for this from both parents. ***(2)***			
that differences within a species can also be caused by mutations. ***(4)***	***Step 5***	*DNA, mutation*	
that mutations are random changes which are not inherited from the parents. ***(4)***			
that a single mutation can have a large effect, but this is unlikely. ***(4)***	***Step 6***	*evolution*	
that living things have changed over time and this is called evolution. ***(3)***			
that evolutionary change may occur as a result of the accumulation of many mutations with small effects. ***(4)***			
that evolution also occurs when there is competition to survive (natural selection). ***(3)***	***Step 7***	*competition, natural selection, Charles Darwin, survival*	← ***Core Investigation 2***
the theory of evolution by natural selection was proposed by Charles Darwin. ***(3)***			
that variation in offspring over time can make animals more or less able to survive in particular environments. ***(3)***	***Step 8***	*adaptation, adaptive traits, ancestor*	← ***Core Investigation 3***
that some animals change by developing characteristics that suit their environment and help them to survive - these are called adaptive traits. ***(3)***			
that adaptation can lead to evolution if the environment changes. ***(3)***	***Step 9***		
that when living things do not adequately adapt to their environment, they may become extinct. ***(4)***	***Step 10***	*extinct, maladaptation*	
that living things and extinct animals provide evidence of natural selection and evolution. ***(3)***			
that fossils are the remains of living things which inhabited the world millions of years ago. ***(1)***	***Step 11***	*palaeontology, fossil, sedimentary rock, species*	
that fossils are found in sedimentary rocks. ***(1)***			
that fossils can show the evolution of species over time and provide information about species that were once living. ***(1)***			← ***Core Investigation 4***

****Vocabulary may already have been introduced but must be covered in the given context***

Year 6 – Science Lesson Objectives

Evolution and Inheritance (Y6)

To explain the scientific concept of inheritance.
To demonstrate understanding of the scientific meaning of adaptation.
To identify the key ideas of the theory of evolution.
To understand how human beings have evolved.
To explain how human intervention affects evolution.
To explain how adaptations can result in both advantages and disadvantages. (more or less able to survive in particular environments)
To identify evidence for evolution from fossil records.
1. To identify information about things that have lived in the past and identify the evidence to support this.
2. To learn how characteristics can vary. (Mr Men)
3. To research what Charles Darwin discovered when he visited the Galapagos islands.
4. To identify if there is a pattern between the size and/or shape of a bird's beak and the types of food it will eat.
Assessment - Explain the advantages and disadvantages of specific adaptations, such as being on two feet rather than four, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers.

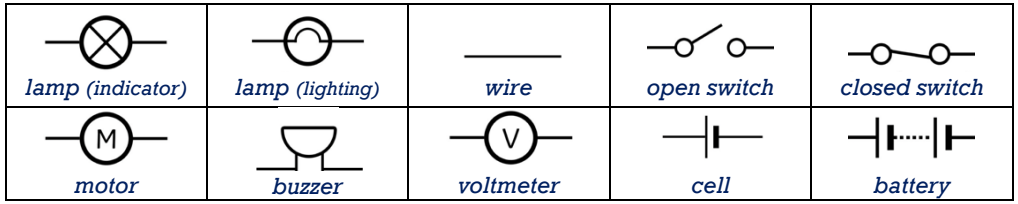
Black - Learning objective Red – Suggested Activities or useful information. Purple – Core investigations

Year 6 – Science Knowledge Builder– ***Small Steps and Suggested Lesson-Level Overview***

Small Steps Overview – Electricity (Y6)

(1)	*Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.*
(2)	*Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches.*
(3)	*Use recognised symbols when representing a simple circuit in a diagram.*
(4)	***Providing further depth and breadth of understanding***

NOTE – SOME STEPS WILL TAKE MORE THAN 60 MINUTES

Pupils will know…		***Key Vocab (MUST be introduced)***	
that there are conventional symbols for components in electrical circuits (pupils will know each of the following symbols). ***(3)***  	***Step 1***	*lamp (indicator), lamp (lighting), wire, open switch, closed switch, motor, buzzer, voltmeter, cell, battery, circuit symbol, circuit diagram*	
that there are two circuit symbols for a lamp: one for a lamp used to provide illumination and another for a lamp used as an indicator. ***(3)***			
that circuit diagrams, using these symbols, can be understood by anyone who knows the symbols and can be used for constructing and interpreting circuits. ***(3)***			
that conventional symbols can be used to draw diagrams of circuits. ***(3)***	***Step 2***	*component, appliance, series circuit*	
that a simple loop with all components connected in line (in series) is called a 'series circuit'. ***(4)***			
that a switch can be used to make or break a circuit to turn things on or off (using either batteries or mains). ***(2)***	***Step 3***	*battery, mains*	← ***Core Investigation 1***
that the number of components in a circuit can affect how they function. ***(2)***	***Step 4***	***Consolidate vocab introduced from Steps 1-3.***	
that the arrangement of components in a circuit can affect how they function. ***(2)***			
that the brightness of a bulb, the speed of a motor or the volume of a buzzer can be changed in a circuit by changing the number or size (in volts) of the batteries used. ***(1)***	***Step 5***	*brightness, speed, volume, volt(s/age)*	← ***Core Investigation 2***
that increasing the number or size (in volts) of batteries in a series circuit increases the number of volts in the circuit. ***(1)***			
that increasing the number of volts in a circuit will increase the brightness of a bulb, the speed of a motor or the volume of a buzzer. ***(1)***			
that the brightness of a bulb, the speed of a motor or the volume of a buzzer can be changed in a circuit by adjusting the number of bulbs, motors or buzzers. ***(2)***	***Step 6***	*resistance*	← ***Core Investigation 3***
that increasing the number of bulbs, motors or buzzers in a series circuit increases the resistance and therefore reduces the brightness of the bulbs, the speed of the motors or the volume of the buzzers. ***(2)***			
that the brightness of a bulb, the speed of a motor or the volume of a buzzer can be changed in a series circuit by adjusting the length and thickness of wires in the circuit. ***(2)***	***Step 7***	***Consolidate vocab introduced from Steps 1-6.***	
that increasing the length of wires in a series circuit increases the resistance and therefore reduces the brightness of the bulbs, the speed of the motors or the volume of the buzzers. ***(2)***			
that in a complete circuit, the component and battery should be matched, e.g., a 1.5-volt bulb should be matched to a 1.5-volt battery. ***(4)***	***Step 8***		
that bulbs and motors are designed to be used with batteries of a particular voltage and that if the voltage is exceeded the device may burn out. ***(4)***			
that care needs to be taken when components in a circuit are changed to ensure that bulbs/motors/buzzers do not burn out. ***(4)***	***Step 9***		

****Vocabulary may already have been introduced but must be covered in the given context***

Year 6 – Science Lesson Objectives

Electricity (Y6)

To should construct simple series circuits. (series circuits, not parallel circuits)
To represent a simple circuit in a diagram using recognised symbols.
To understand variations in how components function.
To systematically identify the effect of changing one component at a time in a circuit.
To explain the importance of the major discoveries in electricity.
To observe and explain the effects of differing volts in a circuit.
1. To present results using Carroll diagrams. (how appliances may be grouped based on what electricity makes them do)
2. To define a scientific question to test. (investigate if the volume of a buzzer increases as cells are added to a circuit).
3. To investigate how they can change the brightness of the bulb choosing from the available equipment. (TAPS – Bulb brightness).
Assessment - To use salt dough as a conductor in a circuit (TAPS -conductive dough)

Black - Learning objective Red – Suggested Activities or useful information. Purple – Core investigations

Year 6 – Science Knowledge Builder– ***Small Steps and Suggested Lesson-Level Overview***

Small Steps Overview – Animals inc. Humans (Y6)

(1)	*Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.*
(2)	*Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.*
(3)	*Describe the ways in which nutrients and water are transported within animals, including humans.*
(4)	***Providing further depth and breadth of understanding***

NOTE – SOME STEPS WILL TAKE MORE THAN 60 MINUTES

Pupils will know…		***Key Vocab (MUST be introduced)***	
That the human circulatory system is made up of 3 main parts: the heart, the blood vessels and the blood. ***(1)***	***Step 1***	*heart, blood, blood vessel*	
That the heart, blood vessels and blood have specific functions. ***(1)***			
That the heart constantly pumps blood around the body. ***(1)***	***Step 2***	*tissue, vein, artery(ies), capillary(ies), pulse*	← ***Core Investigation 1***
That a person's heart rate can be measured by their pulse. ***(1/2)***			
That blood vessels are tube-like structures that carry blood through tissues and organs. ***(1)***			
That veins, arteries and capillaries are the three main types of blood vessels. ***(1)***			
That blood transports oxygen to different parts of the body. ***(1)***	***Step 3***	*oxygenated, deoxygenated,*	
That blood can be either oxygenated or deoxygenated. ***(1)***			
That oxygenated blood has more oxygen, and it becomes oxygenated in the lungs. ***(1)***			
That ***most*** *arteries carry oxygenated blood away from the heart.* ***(1)***			
That deoxygenated blood has less oxygen, as the oxygen has already been transferred to the rest of the body. ***(1)***			
That ***most*** *veins carry deoxygenated blood towards the heart.* ***(1)***			
The blood also carries nutrients such as vitamins, minerals, sugars, fats and proteins around the body, as well as water. ***(3)***	***Step 4***	*nutrients, vitamin, mineral, sugar, fat, protein, water, digestion, absorbed, small intestine, energy*	← ***Core Investigation 2***
That digested nutrients are absorbed into the blood through capillaries in the small intestine. ***(3)***			
That nutrients come from what we eat. ***(3)***			← ***Core Investigation 3***
That certain foods give us more energy than others. ***(3)***			
That a healthy diet involves consuming certain quantities of a range of nutrients. ***(2)***	***Step 5***	*healthy, unhealthy, overweight, body mass index, moderation, balanced diet*	
That the consumption of 'unhealthy' foods should be done in moderation. ***(2)***			
That the consumption of too many 'unhealthy' foods can cause weight gain, and lead to us being overweight. ***(2)***			
That the consumption of drugs has an effect on your body (consider the difference between 'drugs' and 'medication'). ***(2)***	***Step 6***	*drug, medication, chemical*	
That medicines are prescribed by a healthcare professional to help us stay healthy, but they can harm us if they are not used properly. ***(2)***			
That drugs/medicines contain natural or man-made chemicals and it is these chemicals that affect a person's body. ***(2)***			
That alcohol is a type of drug produced from grain, fruit or vegetables in a process called fermentation. ***(4)***	***Step 7***	*alcohol, tobacco, nicotine, addiction*	
That nicotine is a type of drug found in tobacco, and is therefore found in cigarettes. ***(2)***			
That smoking can cause irreversible and long-term damage to your health through its effects on the body. ***(2)***			
That drugs can be addictive. ***(2)***			
That waste products are transported to the organs that remove them from the blood and then eliminate them from the body. ***(4)***	***Step 8***	*liver, kidney, toxin*	
That regular exercise can help us to maintain a healthy lifestyle. ***(2)***	***Step 9***	*exercise, healthy lifestyle*	
That a child should complete at least 60 minutes of exercise each day. ***(2)***			
That regular exercise: ***(2)*** • *Improves circulation and increases the amount of oxygen around the body* • *Releases chemicals in the brain which help us to feel calm and relaxed* • *Strengthens muscles, inc. the heart muscle.*			

****Vocabulary may already have been introduced but must be covered in the given context***

Year 6 – Science Lesson Objectives

Animals inc. Humans (Y6)

To know the three main parts of the circulatory system and describe their functions. (heart, blood vessels and blood)
To be able to describe the importance of exercise and how it affects the heart.
To be able to explain how diet and exercise affect the body.
To be able to recognise the impact of drugs and alcohol on the way bodies function.
To describe the ways in which nutrients and water are transported within animals
1. To make predictions about the how our heart rate changes throughout the day.
2. To report and present information about a part of the circulatory/digestive system.
3. Set up an investigation to test diet and performance.
Assessment -

Black - Learning objective Red – Suggested Activities or useful information. Purple – Core investigations

Year 6 – Science Knowledge Builder– ***Small Steps and Suggested Lesson-Level Overview***

Small Steps Overview – Light (Y6)

(1)	*Recognise that light appears to travel in straight lines.*
(2)	*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.*
(3)	*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.*
(4)	*Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.*
(5)	***Providing further depth and breadth of understanding***

NOTE – SOME STEPS WILL TAKE MORE THAN 60 MINUTES

Pupils will know…		***Key Vocab (MUST be introduced) ****	
All knowledge (inc. key vocab) linked to prior learning (see page 3 for linked objectives)			***← Core Investigation 1***
That light is a form of energy that travels in waves from a source. (3)	***Step 1***	*Light, energy, waves, source, travel*	
Unlike water or sound, light waves do not need a medium to travel through. (5)			
That a light source is an object that makes its own light. (5)	***Step 2***	*Light source*	
That light travels out from sources in straight lines. ***(1)***	***Step 3***	*beam, ray*	
That the straight lines in which light travels are called rays or beams of light. ***(1)***			
That we need light to be able to see things. ***(3)***	***Step 4***	*reflected*	***← Core Investigation 2***
That when we see things, light travels from a source [to an object (it is then reflected) and finally] to our eye. ***(3)***			
That shiny surfaces reflect light better than dull surfaces. ***(2)***			
That the direction of a beam or ray of light travelling from a light source can be indicated by a straight line with an arrow. ***(1)***	***Step 5***	*incident ray, reflected ray*	
That the ray of light that has been reflected off a surface is called the reflected ray. ***(1)***			
That the ray of light travelling from a source to a surface is called the incident ray. ***(1)***			
That a transparent object is something that lets light pass through it easily, meaning you can easily see through it. ***(4)***	***Step 6***	*transparent, translucent, opaque*	
That a translucent object is something that lets some light pass through it, but diffuses the light so that you cannot see though it clearly. ***(4)***			
That an opaque object is something that does not let any light pass through it, and therefore you cannot see through it at all. ***(4)***			
That when light is blocked by an object, a shadow is formed. ***(4)***	***Step 7***	*shadow*	
That transparent, translucent and opaque objects may form a shadow. ***(4)***			
That transparent or translucent objects may cause a shadow to appear faint, fuzzy or coloured. ***(4)***			
That because light travels in straight lines, shadows that form have the same shape as the object that cast them. ***(4)***	***Step 8***	*angle, elongated, shortened*	***← Core Investigation 3***
That shadows can be elongated or shortened depending on the angle of the light source. ***(4)***			
That a shadow is larger when the object is closer to the light source, because it blocks more of the light. ***(4)***			
That a shadow is smaller when the object is further way from the light source, because it blocks less of the light. ***(4)***			
That shadows are different from reflections – and a reflection is formed when a ray of light changes direction on hitting a surface. ***(5)***	***Step 9***	*reflection*	
That light which is visible to the human eye is made up of a colour spectrum. ***(5)***	***Step 10***	*visible light, spectrum, prism*	
That visible light can be separated into the colours of the spectrum using a prism. ***(5)***			
That a prism is a solid 3D shape with flat sides and two ends of equal shape and size. ***(5)***			
That refraction is when light changes direction as it passes from one medium to another (i.e., from air into water). ***(5)***	***Step 11***	*refraction*	***← Core Investigation 4***
That glasses use refraction to manipulate rays of light so they reach the retina of a person's eye. ***(5)***			

****Vocabulary may already have been introduced but must be covered in the given context***

Year 6 – Science Lesson Objectives

Light (Y6)

To explain that light travels in straight lines from light sources to our eyes, and from light sources to objects and then to our eyes.
To understand how mirrors reflect light, and how they can help us see objects. (creating a periscope and explaining how it works).
To investigate how refraction changes the direction in which light travels.
To investigate how a prism changes a ray of light. (creating colour wheels)
1. To make predictions about how light travels.
2. To identify a range of investigable questions and understand how they could go about answering them.
3. To make predictions about how the shape of their shadows change throughout the day.
4. To research why people wear glasses and how these work.
Assessment -

Black - Learning objective Red – Suggested Activities or useful information. Purple – Core investigations

Year 6 - Possible Misconceptions

<table>
<tr><td rowspan="4">Year 6</td><td>Living Things and their Habitats</td><td>Light</td><td rowspan="4">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
all dairy is good for you
protein is good for you, so you can eat as much as you want
foods only contain fat if you can see it
all drugs are bad for you.</td></tr>
<tr><td>Some children may think:
all micro-organisms are harmful
mushrooms are plants.</td><td>Some children may think:
we see objects because light travels from our eyes to the object.</td></tr>
<tr><td>Evolution and Inheritance</td><td>Electricity</td></tr>
<tr><td>Some children may think:
adaptation occurs during an animal's lifetime: giraffes' necks stretch during their lifetime to reach higher leaves and animals living in cold environments grow thick fur during their life
offspring most resemble their parents of the same sex, so that sons look like fathers
all characteristics, including those that are due to actions during the parent's life such as dyed hair or footballing skills, can be inherited
cavemen and dinosaurs were alive at the same time.</td><td>Some children may think:
larger-sized batteries make bulbs brighter
a complete circuit uses up electricity components in a circuit that are closer to the battery get more electricity.</td></tr>
</table>

Useful Resources and Websites

Name	Link / Location
• Primary Science Teaching Trust (website)	https://pstt.org.uk
• Teacher Assessment in Primary Science (TAPS)	https://pstt.org.uk/resources/curriculum-materials/assessment
• STEM	https://www.stem.org.uk/primary-science
• Explorify	https://explorify.uk
• ReachOut CPD	https://www.reachoutcpd.com