

Bluecoat Primary Academy Science Progression Document 2020

**Bluecoat Primary Academy Science Intent Statement**

At Bluecoat Primary Academy we believe a high-quality science education provides the foundations for understanding the world, by promoting experiences of exploring and investigating scientific phenomena in a range of contexts leading to a development of natural curiosity. Children will be encouraged to build their knowledge and understanding through asking questions, taking risks, experimenting, reflecting, making and learning from mistakes; whereby they acquire and apply core skills equipping them for an ever-changing diverse world.

**Science Progression Document Guide**

Key Ideas: provides an overview of the key ideas and procedural knowledge pupils should know by the end of the year.

Working scientifically: specifies the understanding of the nature, processes and methods of science for each year group and should be taught continuously encouraging pupils to use features of scientific enquiry 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

Vocabulary: The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. Pupils should be encouraged to use this during lessons and refer back to in retrieval lessons.

Types of Working Scientifically:

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| **Identifying and Classifying** | **Comparative testing** | **Fair tests** | **Pattern seeking** | **Research** | **Ideas over time** |
| Increased focus on measuring and using data to answer ‘Big Questions’.Continue to build on their observational skills, becoming more independent in identifying, through the use of increasingly complex tools, as well as developing higher order skills in reasoning and justification when explaining how they have chosen to group things. Design simple tests to help them classify materials, as well as independently using a range of secondary sources to support them in identifying a range of living things. | Use an increasingly wide range of equipment to make measurements.Learn what it means to measure accurately and check for reliability.Learn to independently plan how to record and analyse the data, using tables, pictograms, and bar charts to compare the measurements they make.Use bar charts to draw conclusions about what they have found out to be the answer to their ‘Big Question’.Evaluate the procedure they used and the quality of their data, suggesting ways they could improve their test. | Plan their own tests to collect data. Through fair testing learn to understand the different types of variables:* The dependent variable that they will change in their test,
* The independent variable that they are going to measure so that they can find out how the dependent variable affects it,
* The control variables which the children will need to keep the same so that they don’t affect the results.

Measure and record data that can be displayed in a scatter or line graph. Use their data to draw conclusions that identify a relationship. Become more systematic in how they approach fair tests more independently. Written conclusions to become more focussed on scientific explanations. Focus on their skills in evaluating their enquiries. | Decide what they should measure and observe.Choose equipment that are appropriate to collect data.Use a data logger to collect accurate data.Using data analysis techniques to spot patterns.Use data and graphs to support their explanations. Use their findings to form and justify their own predictions, then propose further investigations to test predictions. | Reading for information and note-taking.Learn to interpret information they find and critically consider its relevance.Use a range of secondary sources, including books, websites and video.Listen to professionals/experts to get information, ask questions/ interviews or send letters/emails.Create questionnaires and interviews to collect data.Evaluate the quality of information they have found and how well it has enabled them to draw conclusions and answer their ‘Big Question’. | Explore and talk about their own and other people’s scientific ideas.Begin to recognise how scientific ideas change and develop over time.Use a range of secondary sources of informationDevelop their use of scientific language.Explain ideas using their scientific knowledge and understanding.Evaluate the significance, strengths and weaknesses of different scientists’ ideas. |

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| **Living Things and Their Habitats** |
| **National curriculum objectives:*** describe how [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) are classified into broad groups according to common observable characteristics and based on similarities and differences, including [micro-organisms](http://primaryscienceonline.org.uk/glossary-of-terms/micro-organisms/), [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) and [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/)
* give reasons for classifying [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) and [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) based on specific characteristics

***Pupils should*** build on their learning about grouping [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) in year 4 by looking at the classification system in more detail. They should be introduced to the idea that broad groupings, such as [micro-organisms](http://primaryscienceonline.org.uk/glossary-of-terms/micro-organisms/), [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) and [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) can be subdivided. Through direct observations where possible, they should classify [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) into commonly found [invertebrates](http://primaryscienceonline.org.uk/glossary-of-terms/invertebrates/) (such as insects, spiders, snails, worms) and [vertebrates](http://primaryscienceonline.org.uk/glossary-of-terms/vertebrates/) ([fish](http://primaryscienceonline.org.uk/glossary-of-terms/fish/), [amphibians](http://primaryscienceonline.org.uk/glossary-of-terms/amphibians/), [reptiles](http://primaryscienceonline.org.uk/glossary-of-terms/reptiles/), [birds](http://primaryscienceonline.org.uk/glossary-of-terms/birds/) and [mammals](http://primaryscienceonline.org.uk/glossary-of-terms/mammals/)). They should discuss reasons why [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) are placed in one group and not another. Pupils might find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification.***Pupils might work scientifically by:*** using classification systems and keys to identify some [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) and [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) in the immediate [environment](http://primaryscienceonline.org.uk/glossary-of-terms/environment/). They could research unfamiliar [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) and [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) from a broad range of other [habitats](http://primaryscienceonline.org.uk/glossary-of-terms/habitat/) and decide where they belong in the classification system. | **Key ideas:**1. Variation exists within a population (and between offspring of some plants)
2. Organisms best suited to their environment are more likely to survive long enough to reproduce.
3. Organisms are best adapted to reproduce are more likely to do so.
4. Organisms reproduce and offspring have similar characteristic patterns.
5. Competition exists for resources and mates.
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| **Prior Learning** |  | **Vocabulary** |
| **In Year 5:**-describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird -describe the life process of reproduction in some plants and animals.  | Animals can be classified in different ways, the classification of living things is complex and based upon genetic similarities. It is therefore a useful tool to work out evolutionary patterns. (do not focus on detailed classification() Important classifications are plants and animals – vertebrates, invertebrates and mammals, birds, reptiles, amphibians and insects. | Variations exists within these classifications. Children need to develop a rich understanding of variation through studying their environment and then asking questions about environments and organisms that they may have never seen before. It is essential that pupils are encouraged to notice and explore variation in depth. (organisms of the same and different species, between offspring from the same parents (plants and animals) – between offspring and their parents and between different habitats). | Animals adapt to fit their habitat. Those that adapted best survived.Children can be shown artistic impressions of how horses, giraffes, elephants, humans or other animals have thought to have changed over time, and be encouraged to describe changes and think about how these changes occurred and over what time scales. Fossils of extinct animals so that they can consider if an animal is alive today that has similarities to it.  | Classification, Vertebrates, Invertebrates, Micro-organisms, Amphibians, Reptiles, Mammals, Insects, variation, organisms, populations, characteristics, environment, flowering, non-flowering, plants, animals, human impact, nature reserves, deforestation, classify, bacteria  |
| **Common Misconceptions:** | **Some children may think:**• all micro-organisms are harmful• mushrooms are plants. |
| **Working scientifically opportunities:**  Revisit KS1 skills: focus on asking questions about the similarities and differences between things. Go outside to explore the world around them at all times of the year. |
| **Identifying and Classifying** | Classify a range of animals and plants in different areas of school. – consider a longitudinal study where these areas are monitored over time for change. |  |  |  |
| **Comparative testing** |  |  |  |
| **Fair tests** |  |  | What happens if you put a house plant outside? Observe and study the impact on the plant. Make predictions for how it could have adapted and what could have been done to protect it. |
| **Pattern seeking** |  | Do all flowers have the same amount of petals? |  |
| **Research** | Look at the work of palaeontologists such as Mary Anning and about how Alfred Wallace and Charles Darwin developed their ideas on evolution.What do different types of micro-organisms do? |
| **Ideas over time** | Explore the work of Carl Linneaus and how his work is used today. |
| **In KS3:*** cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
* the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts
* the similarities and differences between plant and animal cells
* the role of diffusion in the movement of materials in and between cells
* the structural adaptations of some unicellular organisms
* the hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms
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| **Evolution and Inheritance** |
| **National curriculum objectives:*** recognise that [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) have changed over time and that [fossils](http://primaryscienceonline.org.uk/glossary-of-terms/fossils/) provide information about [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) that inhabited the Earth millions of years ago
* recognise that [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) produce offspring of the same kind, but normally offspring vary and are not identical to their parents
* identify how [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) and [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) are adapted to suit their [environment](http://primaryscienceonline.org.uk/glossary-of-terms/environment/) in different ways and that [adaptation](http://primaryscienceonline.org.uk/glossary-of-terms/adaptation/) may lead to [evolution](http://primaryscienceonline.org.uk/glossary-of-terms/evolution/)

 Building on what they learned about [fossils](http://primaryscienceonline.org.uk/glossary-of-terms/fossils/) in the topic on [rocks](http://primaryscienceonline.org.uk/glossary-of-terms/rocks/) in year 3, pupils should find out more about how [living things](http://primaryscienceonline.org.uk/glossary-of-terms/living-things/) on earth have changed over time. They should be introduced to the idea that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, labradors are crossed with poodles. They should also appreciate that variation in offspring over time can make [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) more or less able to survive in particular environments, for example, by exploring how giraffes’ necks got longer, or the development of insulating fur on the arctic fox. Pupils might find out about the work of palaeontologists such as [Mary Anning and about how Charles Darwin and Alfred Wallace](http://primaryscienceonline.org.uk/famous-scientists/) developed their ideas on [evolution](http://primaryscienceonline.org.uk/glossary-of-terms/evolution/).Note: at this stage, pupils are not expected to understand how genes and chromosomes work. | **Key ideas:**1. Lifecycles have evolved to help organisms survive to adulthood.
2. Overtime the characteristics that are most suited to the environment become increasingly common.

These are duplicated from Living Things and Their Habitat:1. Organisms best suited to their environment are more likely to survive long enough to reproduce.
2. Organisms are best adapted to reproduce are more likely to do so.
3. Organisms reproduce and offspring have similar characteristic patterns.

Competition exists for resources and mates. |
| **Prior Learning** | **Evolution and Natural Selection** | **Vocabulary** |
| • Identify that most living things live in habitats to which they are suited anddescribe how different habitats provide for the basic needs of differentkinds of animals and plants, and how they depend on each other. (Y2 -Living things and their habitats)• Notice that animals, including humans, have offspring which grow intoadults. (Y2 - Animals, including humans)• Explore the part that flowers play in the life cycle of flowering plants,including pollination, seed formation and seed dispersal. (Y3 - Plants)• Describe in simple terms how fossils are formed when things that havelived are trapped within rock. (Y3 - Rocks)• Recognise that environments can change and that this can sometimespose dangers to living things. (Y4 - Living things and their habitats)• Describe the life process of reproduction in some plants and animals.(Living things and their habitats - Y5) | Over the last many millions of years there are many examples of organisms becoming extinct and others evolving into new organisms over generations. | The way fossils form and are found mean the fossil record is an incomplete record of all evolution. Scientists have had to piece together evidence to work out how organisms evolve. | Darwin’s theory of natural selection explains how evolution occurs.Some organisms reproduce sexually where offspring inherit information from both parents, others reproduce asexually by making a copy of a single parent. A sexual reproduction results in little variation in a population that makes evolution less likely.All living thing have similar stages of life. | Fossils, adaption, evolution, characteristics, reproduction, genetics. |
| **Common Misconceptions:** | **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 environmentsgrow 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. |
| **Working scientifically opportunities:**  Revisit KS1 skills: focus on asking questions about the similarities and differences between things. Go outside to explore the world around them at all times of the year. |
| **Identifying and Classifying** |  |  |  |  |
| **Comparative testing** |  |  | Create a family tree based upon similarities and differences – Little Miss and Mr Men/ SimpsonsThey could do this linked to their own families – look at what traits have been inherited or not e.g. ears, dimples, eye shape, mouth, abilities to do things like hand clasp, double joints. |
| **Fair tests** |  |  |  |
| **Pattern seeking** |  |  | Is there a pattern between the size of a bird’s beak and the food they eat? |
| **Research** | Construct a timeline – the last 1 billion years add key events eg: when life first appeared, plants dinosaurs and when extinction occurred.Children given organisms to research how they evolved and put information on the timeline. |  | Children provided with a simple Darwinian and Lamarckian explanation for evolution – keep it anonymous – children try to work out which is the better argument – could try and use these theories to link to prior learning around why giraffes evolved to have longer necks.Use secondary sources to find out about how the population of peppered moths changed during the industrial revolution. |
| **Ideas over time** | Fossil evidence suggests that mammoths lived from 400,000 to 10,000 years ago :-what happened to them? Did they become extinct?Did they evolve into modern day elephants?Are they still here?Consider what scientists would have to do to find out which of these is most likely. |
| **In KS3:*** 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
* differences between species
* the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation
* the variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection
* changes in the environment which 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
* the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material
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| **Animals Including Humans** |
| **National curriculum objectives:*** identify and name the main parts of the human [circulatory system](http://primaryscienceonline.org.uk/glossary-of-terms/circulatotory-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](http://primaryscienceonline.org.uk/glossary-of-terms/animals/), including humans

*Pupils should* build on their learning from years 3 and 4 about the main body parts and internal organs (skeletal, muscular and [digestive system](http://primaryscienceonline.org.uk/glossary-of-terms/digestive-system/)) to explore and answer questions that help them to understand how the [circulatory system](http://primaryscienceonline.org.uk/glossary-of-terms/circulatotory-system/) enables the body to function.Pupils should learn how to keep their bodies healthy and how their bodies might be damaged – including how some drugs and other substances can be harmful to the [human body](http://primaryscienceonline.org.uk/glossary-of-terms/human-body/).*Pupils might work scientifically by:*exploring the work of scientists and scientific research about the relationship between diet, exercise, drugs, lifestyle and health. | **Key ideas:**1. The heart pumps blood around the body.
2. Oxygen is breathed into the lungs where it is absorbed by the blood.
3. Muscles need oxygen to release energy from food to do work. (oxygen is taken into the blood in the lungs; the heart pumps the blood through blood vessels to the muscles; the muscles take oxygen and nutrients from the blood.)
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| **Prior Learning** |  | **Vocabulary** |
| **In Year 5:**-describe the differences in the [life cycles](http://primaryscienceonline.org.uk/glossary-of-terms/life-cycles/) of a mammal, an amphibian, an insect and a bird-describe the life process of reproduction in some [plants](http://primaryscienceonline.org.uk/glossary-of-terms/plants/) and [animals](http://primaryscienceonline.org.uk/glossary-of-terms/animals/) | All animals need oxygen to survive. Air is breathed into the lungs where the oxygen in the air is passed into the blood. Every part of animals bodies need oxygen, especially muscles.Muscles need a supply of oxygen and sugar to make them work, they are supplied this by the blood. | The blood circulates around the body in a way that ensures all muscles in the body get a supply of oxygen and sugar.The heart pumps blood to every muscle in the body. The circulatory route must allow the blood to collect oxygen from the lungs, sugar from the intestines and visit muscles. | Oxygenated, deoxygenated, valve, exercise, respiration, circulatory system, heart, lungs, blood vessels, blood, artery, vein, pulmonary, alveoli, capillary, digestive, transport, gas exchange, villi, nutrients, water, oxygen, alcohol, drugs, tobacco |
| **Common Misconceptions:** | **Some children may think:**• your heart is on the left side of your chest• the heart makes blood• the blood travels in one loop from the heart to the lungs and around the body• when we exercise, our heart beats faster to work the muscles more• some blood in our bodies is blue and some blood is red• we just eat food for energy• all fat is bad for you• 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. |
| **Working scientifically opportunities:**  Revisit KS1 skills: focus on asking questions about the similarities and differences between things. Go outside to explore the world around them at all times of the year. |
| **Identifying and Classifying** |  | Which organs of the body make up the circulatory system, and where are they found? |  |
| **Comparative testing** | How does the size of a person affect their lung capacity? | Which type of exercise has the greatest effect on our heart rate? |
| **Fair tests** | Candles need oxygen to burn. How is the time a candle burns for affected by the amount of times I have breathed in and out the air that it burns in? | How does the length of time we exercise for affect our heart rate?Can exercising regularly affect your lung capacity? |
| **Pattern seeking** |  | Is there a pattern between what we eat for breakfast and how fast we run? |
| **Research** | How have our ideas about disease and medicine changed over time? – Link to the here and now Covid 19 |
| **Ideas over time** | What ideas did Edward Jenner have about small pox and how did he test them? |
| **In KS3:**• The consequences of imbalances in the diet, including obesity, starvationand deficiency diseases. (KS3)• The effects of recreational drugs (including substance misuse) onbehaviour, health and life processes. (KS3)• The structure and functions of the gas exchange system in humans,including adaptations to function. (KS3)• The mechanism of breathing to move air in and out of the lungs. (KS3)• The impact of exercise, asthma and smoking on the human gas exchangesystem. (KS3) |

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| **Light and how it travels** |
| **National curriculum objectives:*** recognise that [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) appears to travel in straight lines
* use the idea that [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) travels in straight lines to explain that objects are seen because they give out or reflect [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) into the eye
* explain that we see things because [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) travels from [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) sources to our eyes or from [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) sources to objects and then to our eyes
* use the idea that [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) travels in straight lines to explain why [shadows](http://primaryscienceonline.org.uk/glossary-of-terms/shadows/) have the same shape as the objects that cast them

***Pupils should*** build on the work on [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) in year 3, exploring the way that [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) behaves, including [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) sources, reflection and [shadows](http://primaryscienceonline.org.uk/glossary-of-terms/shadows/). They should talk about what happens and make predictions.***Pupils might work scientifically by:*** deciding where to place rear-view mirrors on cars; designing and making a periscope and using the idea that [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) appears to travel in straight lines to explain how it works. They might investigate the relationship between [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) sources, objects and [shadows](http://primaryscienceonline.org.uk/glossary-of-terms/shadows/) by using shadow puppets. They could extend their experience of [light](http://primaryscienceonline.org.uk/glossary-of-terms/light/) by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water, and coloured filters (they do not need to explain why these phenomena occur). | **Key ideas:**1. Animals see light sources when light travels from the source into their eyes.
2. Animals see objects when light is reflected off that object and enters their eyes.
3. Light reflects off all objects (unless they are black). Non shiny surfaces scatter the light so we don’t see the beam.
4. Light travels in straight lines.
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| **Prior Learning** | **How light behaves and how we see** | **Vocabulary** |
| **In Year 3 :**Recognise that they need light in order to see things and that dark is the absence of light.• Notice that light is reflected from surfaces. • Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. • Recognise that shadows are formed when the light from a light source is blocked by an opaque object. • Find patterns in the way that the size of shadows change. | When light is emitted from a light source it travels in straight lines until it hits an object. This can be represented by an arrow.Shadows form when light hits an opaque object, the area behind is in darkness because light can only travel in straight lines. | When light hits a transparent object it goes through it in a straight line so we can see a clear image through it.When light hits a translucent material it goes through it nut is scattered, this means light can pass through but we can’t see an image through it.When light hits a mirrored surface it reflects off it in straight lines, so we can see an image in the reflective material.Some times when light hits a material it reflects off it in many directions (it is scattered). In this case light will be reflected but no image will be seen in the material.Shiny surfaces are better reflectors and rough surfaces scatter light more. Opaque objects don’t allow any light to pass through them. | Animals see objects when light is reflected off the object and enters the eye through the pupil. The pupil changes its size to allow enough, but not too much light into the eye. Too much light damages the eye and too little results in poor quality images. | Refraction, Reflection, Light, Spectrum, Rainbow, Colour, Light source, dark, ray, mirror, reflect, beam, sun, glare, travel, straight, opaque, shadow, block, transparent, translucent, absorb, emitted, scattered,  |
| **Common Misconceptions:** | **Some children may think:*** **We see objects because light travels from our eyes to the object.**
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| **Working scientifically opportunities:**  Revisit KS1 skills: focus on asking questions about the similarities and differences between things. Go outside to explore the world around them at all times of the year. |
| **Identifying and Classifying** |  |  |  |  |
| **Comparative testing** |  | Which material is most reflective? | How does the eye adapt to different light conditions?Predict how nocturnal animals are adapted to living in low light conditions; check predictions through research. |
| **Fair tests** | Draw on knowledge from y3/4.How does the size of an object affect the size of the shadow?How does the distance between the light and the object affect the size of the shadow?How does the distance between the object and the screen affect the size of the shadow? | How does the amount aluminium foil is scrunched affect how much light is scattered? |  |
| **Pattern seeking** | Is there a pattern to how bright it is over the school day? Is it the same in every calssrom? |  |  |
| **Research** |  |  |  |
| **Ideas over time** | How do astronomers know what stars are made of? |
| **In KS3:**• The similarities and differences between light waves and waves in matter.(KS3)• Light waves travelling through a vacuum; speed of light. (KS3)• The transmission of light through materials: absorption, diffuse scatteringand specular reflection at a surface. (KS3)• Use of ray model to explain imaging in mirrors, the pinhole camera, therefraction of light and action of convex lens in focusing (qualitative); thehuman eye. (KS3)• Light transferring energy from source to absorber leading to chemical andelectrical effects; photo-sensitive material in the retina and in cameras.(KS3)• Colours and the different frequencies of light, white light and prisms(qualitative only); differential colour effects in absorption and diffusereflection. (KS3) |

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| **Electricity** |
| **National curriculum objectives:*** associate the brightness of a lamp or the [volume](http://primaryscienceonline.org.uk/glossary-of-terms/volume/) of a buzzer with the number and [voltage](http://primaryscienceonline.org.uk/glossary-of-terms/voltage/) of cells used in the circuit
* compare and give reasons for variations in how [components](http://primaryscienceonline.org.uk/glossary-of-terms/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 (see [circuits](http://primaryscienceonline.org.uk/glossary-of-terms/circuits/))

Building on their work in year 4, pupils should construct simple series [circuits](http://primaryscienceonline.org.uk/glossary-of-terms/circuits/), to help them to answer questions about what happens when they try different [components](http://primaryscienceonline.org.uk/glossary-of-terms/components/), for example, switches, bulbs, buzzers and motors. They should learn how to represent a simple circuit in a diagram using recognised symbols.Note: pupils are expected to learn only about series [circuits](http://primaryscienceonline.org.uk/glossary-of-terms/circuits/), not parallel [circuits](http://primaryscienceonline.org.uk/glossary-of-terms/circuits/). Pupils should be taught to take the necessary precautions for working safely with [electricity](http://primaryscienceonline.org.uk/glossary-of-terms/electricity/).*Pupils might work scientifically by:*systematically identifying the effect of changing one component at a time in a circuit; designing and making a set of traffic lights, a burglar alarm or some other useful circuit. | **Key ideas:**1. Batteries are a store of energy. This energy pushes electricity round the circuit. When the battery’s energy is gone it stops pushing. Voltage measure the ‘push’.
2. The greater the current flowing through a device the harder it works.
3. Current is how much electricity is flowing round a circuit.
4. When current flows through wires heat is released. The greater the current, the more heat is released.
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| **Prior Learning** | **Controlling electrical circuits** | **Vocabulary** |
| **In Year 4:**• Identify common appliances that run on electricity. • Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers• Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery• Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • Recognise some common conductors and insulators, and associate metals with being good conductors. | The power supply pushes the current round the circuit. The voltage of the power supply is a measure of this push. Batteries have a limited store of energy, when it is gone they no longer push the current.When current goes through a device it makes it work, the greater the current the harder the device works. | When any device is placed in the circuit it makes it harder for current to flow (resistance). The more devices the greater the resistance and the lower the current.As current goes through a conductor it heats it up. The greater the current flowing the greater the heating effect. This can be useful in electrical heaters but can be hazardous and cause fires. | Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor,switch, voltageN.B.Children do not need to understand what voltage is, but will use volts and voltage to describe different batteries. The words “cells” and batteries” are now used interchangeably. |
| **Common Misconceptions:** | **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. |
| **Working scientifically opportunities:**  Revisit KS1 skills: focus on asking questions about the similarities and differences between things. Go outside to explore the world around them at all times of the year. |
| **Identifying and Classifying** | How would you group electrical appliances based on what electricity makes them do? |  |  |
| **Comparative testing** | Design a circuit that will allow us to quickly compare how well different batteries push current.  |  |
| **Fair tests** | * How does the voltage of a battery affect how much current is pushed?
* How does the number of batteries used affect the current that flows?
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| **Pattern seeking** | Does the temperature of a light bulb go up the longer it is on? | Does the length of a wire affect how bright a bulb is?* Does this affect how hot it becomes when it conducts?
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| **Research** | How has our understanding of electricity changed over time?Look at inventions after Edison and the inventors who introduced them – a timeline and then research eg: Nikola Tesla, electric power systems. David Crosthwait, heating systems and refrigeration |
| **Ideas over time** | When was solar power discovered? How has it developed? |
| **In KS3:**• Electric current, measured in amperes, in circuits, series and parallelcircuits, currents add where branches meet and current as flow of charge.(KS3)• Potential difference, measured in volts, battery and bulb ratings;resistance, measured in ohms, as the ratio of potential difference (p.d.) tocurrent. (KS3)• Differences in resistance between conducting and insulating components(quantitative). (KS3)• Static electricity. (KS3) |