St. Peter's CE Primary, Farnworth

'Learn, Sparkle & Shine.'

SCIENCE CURRICULUM: YEAR 6

2025-2026

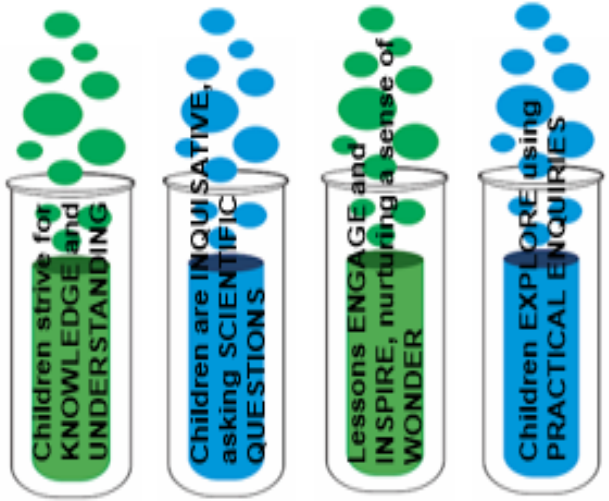
Psalm 111:2: "Great are the works of the Lord, studied by all who delight in them".

St Peter's C of E Primary School

Our Vision...

- Children at St Peter's **understand** what Science is, what it is for and why we do it. They acquire **knowledge capital.**
- They are **inquisitive**, and they are encouraged to **question** and **investigate.**
- They can explain the importance of science in the world. They have **aspiration** for the future.
- Children demonstrate an **enjoyment** of Science, being able to **talk** and **discuss** their thoughts, feelings and opinions using scientific **vocabulary**.
- The use of explicit **modelling** of concepts features prominently within **progressive** sequences of lessons.
- The children **engage** in science and **demonstrate working scientifically skills** through the **five strands of enquiry**.
- At St Peter's it is understood that **working scientifically** skills are taught alongside the **knowledge content** of the curriculum.

Science 'Learns, Sparkles and Shines' at St. Peter's when...



Proverbs 18:15: "An intelligent heart acquires knowledge, and the ear of the wise seeks knowledge".

Curriculum Overview:

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Unit of Study and Key objectives (Substantive Knowledge)	**BIOLOGY: Animals, Including Humans (Circulatory System)** • 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	**BIOLOGY: Living Things and Their Habitats (Classification)** • 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.	**BIOLOGY: Evolution** • Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. • 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		**PHYSICS: Light** • Recognise that light appears to travel in straight lines. • Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. • Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes. • Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.	**PHYSICS: Electricity** • 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

Definitions within Science:

Science: the systematic study of the structure and behaviour of the physical and natural world through observation, experimentation and the testing of theories against evidence obtained.

Physics: the science of matter, energy and their interactions.

Chemistry: the science of explaining the composition, structure and properties of substances and the transformations they undergo.

Biology: the science explaining living organisms and their vital processes.

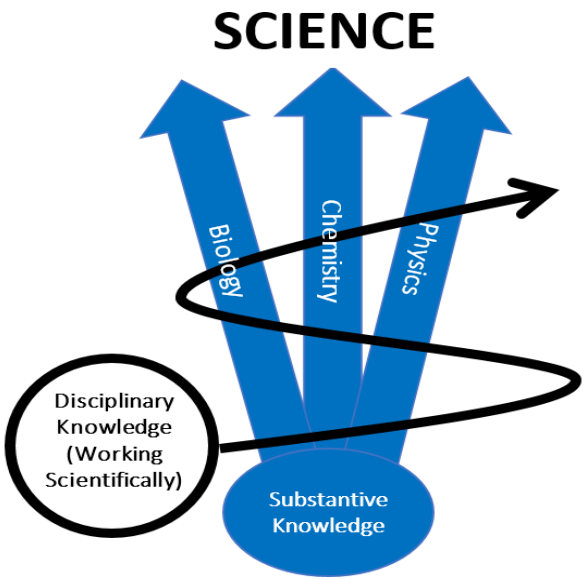
Geology*: the science that deals with the Earth's physical structure and substance, its history, and the processes that act on it.

Working Scientifically: the understanding of the nature, processes and methods of science. Includes the five strands of science enquiry: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing; and researching using secondary sources.

Scientific Enquiry: the processes of studying and investigating scientific ideas using the five strands of enquiry.

***Note: Geology is not identified as a separate strand of Science within the National Curriculum (2014). Geology is taught as part of the subject of Geography, but has significant Science overlap (Examples: the water cycle, rock formation etc.).**

Disciplinary Knowledge: Upper Key Stage 2



Working scientifically is an integral strand of scientific learning within the Primary Science national Curriculum (2014). It is integrated throughout the wider substantive knowledge strands of **Biology**, **Chemistry** and **Physics**, rather than being discrete and separate from them. The Curriculum at St. Peter's CE Primary School reflects this.

How we 'work scientifically':

Working Scientifically Objectives (Y5-6):

- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- Using test results to make predictions to set up further comparative and fair tests
- Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- Identifying scientific evidence that has been used to support or refute ideas or arguments.

The National Curriculum: Non-Statutory Guidance

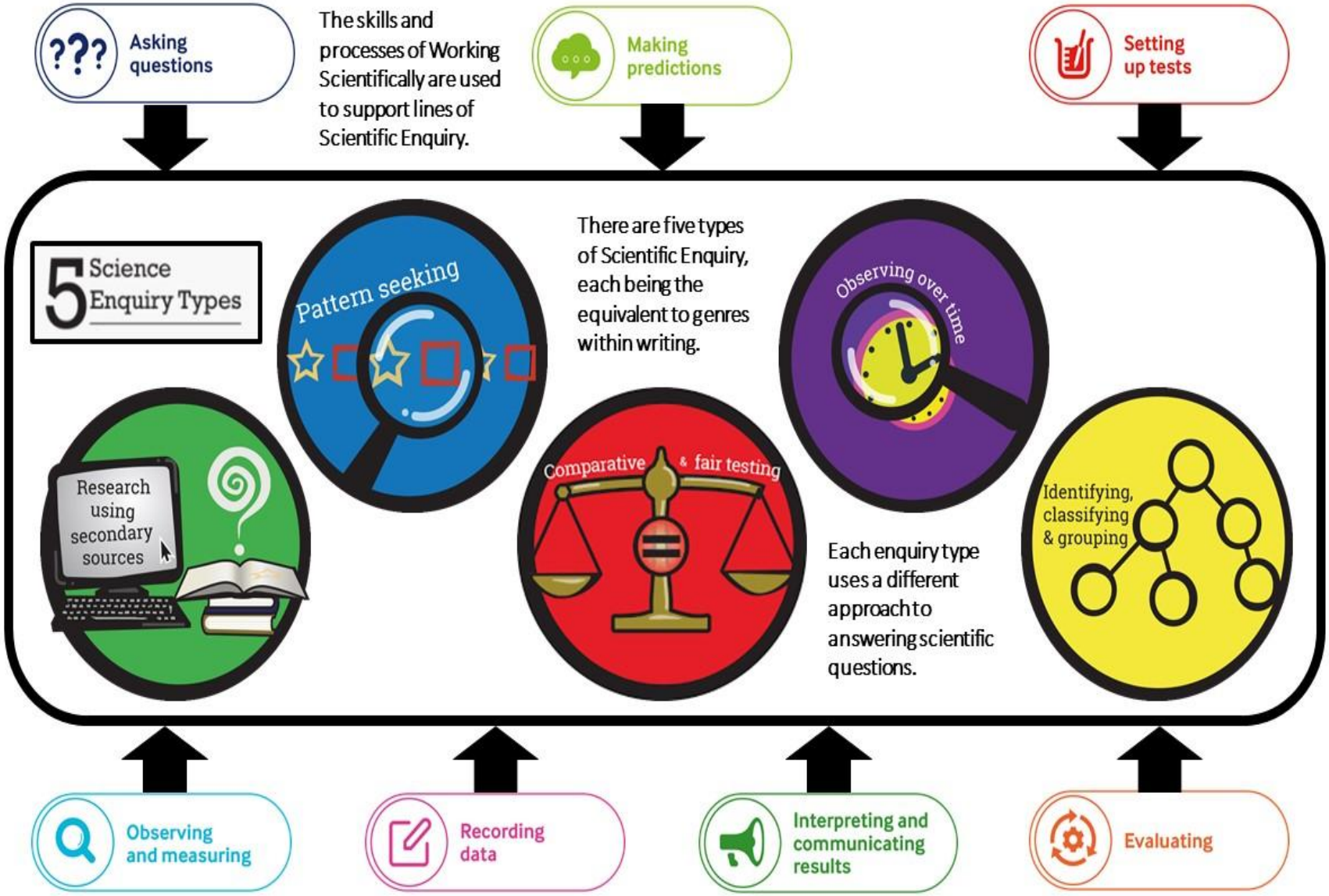
End of EYFS (YR)	Key Stage 1 (Y1/2)	Lower Key Stage 2 (Y3/4)	Upper Key Stage 2 (Y5/6)
Understanding the World **ELG: The natural World** Explore the natural world around them, making observations and drawing pictures of animals and plants. Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class. Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	The principal focus of science teaching in Key Stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly - constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos. 'Working scientifically' is described separately in the programme of study, but must **always** be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary at a level consistent with their increasing word reading and spelling knowledge at Key Stage 1.	The principal focus of science teaching in Lower Key Stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out. 'Working scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word reading and spelling knowledge.	The principal focus of science teaching in Upper Key Stage 2 is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this through exploring and talking about their ideas; asking their own questions about scientific phenomena; and analysing functions, relationships and interactions more systematically. At Upper Key Stage 2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fair tests and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use their scientific knowledge and understanding to explain their findings. 'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content. Pupils should read, spell and pronounce scientific vocabulary correctly.

Year 6 Working Scientifically Objectives Breakdown:

	Plan		Do		Record	Review		
Year 6	Asking questions	Plan an enquiry	Making observations	Take measurements/using equipment	Gathering and presenting Evidence	Drawing conclusions	Explaining Evidence	Evaluating outcomes
	Children independently ask scientific questions. This may be stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry.	Given a wide range of resources the children decide for themselves how to gather evidence to answer a scientific question. They choose a type of enquiry to carry out and justify their choice. They recognise how secondary sources can be used to answer questions that cannot be answered through practical work. Select from a range of practical resources to gather evidence to answer their questions. They carry out fair tests, recognising and controlling variables. They decide what observations or measurements to make over time and for how long. They look for patterns and relationships using a suitable sample.	Make systematic and careful observations.	The children select measuring equipment to give the most precise results e.g. ruler, tape measure or trundle wheel, force meter with a suitable scale. During an enquiry, they make decisions e.g. whether they need to: take repeat readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); or check further secondary sources (researching); in order to get accurate data (closer to the true value).	The children decide how to record and present evidence. They record observations e.g. using annotated photographs, videos, labelled diagrams, observational drawings, labelled scientific diagrams or writing. Record measurements e.g. using tables, tally charts, bar charts, line graphs and scatter graphs. They record classifications e.g. using tables, Venn diagrams, Carroll diagrams and classification keys. Children present the same data in different ways in order to help with answering the question.	Children answer their own and others' questions based on observations they have made, measurements they have taken or information they have gained from secondary sources. In their conclusions, children: identify causal relationships and patterns in the natural world from their evidence; identify results that do not fit the overall pattern; and explain their findings using their subject knowledge. (Also as part of explaining evidence).	When answering their own questions, they discuss whether other evidence e.g. from other groups, secondary sources and their scientific understanding, supports or refutes their answer. They talk about how their scientific ideas change due to new evidence that they have gathered. They talk about how new discoveries change scientific understanding. They communicate their findings to an audience using relevant scientific language and illustrations.	They evaluate, for example, the choice of method used, the control of variables, the precision and accuracy of measurements and the credibility of secondary sources used. They identify any limitations that reduce the trust they have in their data. Children use the scientific knowledge gained from enquiry work to make predictions they can investigate using comparative and fair tests.

Scientific Enquiry Types:

There are five types of scientific enquiry, which are used to support the scientific process. There should be a balance of enquiry types used within the Science Curriculum.



Key Vocabulary (Based on PLAN Documentation):

Year 6				
Biology: Animals, Including Humans	**Biology: Living Things and Their Habitats (Classification)**	**Biology: Evolution and Inheritance**	**Physics: Light**	**Physics: Electricity**
heart, pulse (rate), pumps, blood, blood vessels, transported, lungs, oxygen, drugs, carbon dioxide, nutrients, water, muscles, cycle, circulatory system, diet, exercise	vertebrates, fish, amphibians, reptiles, birds, mammals, invertebrates, spiders (arachnids), insects, snails, worms, flowering plants, non-flowering plants, living things, environment, animals, classify / classification key, micro-organisms, species, fungi, monera, bacteria, Protista, plant	evolution, offspring, sexual reproduction, variation, suited, adaptation, inheritance, environment, characteristics, species, habitat, fossils, natural selection, DNA, organism, climate	visible light rays, primary light source, secondary light source, dark/darkness, transparent, translucent, opaque, shiny surface, matt surface, shadow, reflect, straight lines, sunlight, dangerous, filters, refract, prism, spectrum	electricity, series circuit, complete circuit, cell/battery, circuit diagram, volts/voltage, bulb, switch, buzzer, motor, electrical symbols, electrical conductor, electrical insulator, socket, plug, fuses, component, current
Vocabulary from previous units of study (Linked)				
Year 5 Animals, Including Humans life-cycle, reproduce, sexual reproduction, sperm, egg, live young, puberty, adolescence, foetus, infant, child, adult	Year 5 Living Things and Their Habitats life-cycle, reproduce, sexual reproduction, sperm, egg, fertilises, live young, metamorphosis, plantlets, runners, asexual reproduction, bulbs, cuttings, pollination		Year 3 Light light, light source, dark/darkness, transparent, translucent, opaque, shiny surface, matt surface, shadow, reflect, mirror, sunlight, dangerous	Year 4 Electricity electricity, electrical appliance/device, mains, plug, electrical circuit, complete circuit, component, cell/battery, positive/negative, connect/connections, loose connection, short circuit, crocodile clip, bulb, switch, buzzer, electrical conductor, electrical insulator
Year 4 Animals, Including Humans (Digestion) digestive system, digestion, mouth, teeth, saliva, oesophagus, stomach, small intestine, pancreas,	Year 4 Living Things and Their Habitat classification key, environment, habitat, human impact, species, life process, seasonal change, hibernate, migration			

nutrients, large intestine, rectum, anus, prey, teeth, incisor, canine, molar, premolars, herbivore, carnivore, omnivore, producer, predator, food chain, organ, consumer	Vertebrate, Invertebrate, Warm-Blooded, Cold-Blooded, Flowering Plant, Non-Flowering Plant **Additional:** leaf arrangement, leaf edge, simple leaves, compound leaves, leaf veins **(only required if these features are used for identification purposes)**			
Year 3 Animals, Including Humans nutrition, nutrients, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, water, skeleton, bones, muscles, skull, ribs, spine, joints	**Year 2 Living Things and Their Habitats** living, non-living, dead, animal, habitat, food chain, prey, predator, carnivore, herbivore, omnivore, human, micro-habitat			
Year 2 Animals, Including Humans healthy, diet, exercise, nutrients, hygiene, vegetables, fruit, carbohydrates, meat, dairy, grow, sleep, off-spring				
Year 1 Animals, Including Humans mammal, fish, reptile, bird, amphibian, herbivore, carnivore, omnivore, nocturnal, human, pet, senses				

Mathematics within Science: Measuring, Recording and Representing Data

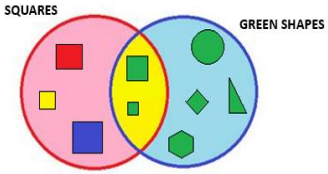
'… Scientific process is infused with maths; maths changes the look of science in a way that one cannot separate it from the other. So if maths is the language of science, then is science the reason for maths?' (Primary Science 124 Sept/Oct 2012)

Maths is an integral aspect of science as it is necessary in order to provide empirical evidence to support or refute scientific questions. Therefore, working scientifically and the scientific process requires children to be able to apply mathematical skills and concepts learned within the Primary Mathematics National Curriculum. Scientific investigation will require the use of measures (length, mass, volume, angles, time etc.) and subsequently, will require the representation of recorded data in the form of tables and charts/graphs. The type of graph required depends upon the type of data compiled: discrete or continuous numerical data. This in turn influences the choice of representation required (discrete: tally, bar, pie chart) or continuous (line, scatter graph). The selection of data representation should be in line with their age related expectations in Maths (Statistics).

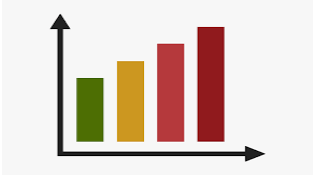
Discrete Data Representation

Favorite Pets		
Pet	Tally Marks	Number
	𝍸 𝍸	10
	𝍸	4
	𝍸 I	6

Tally Chart / Frequency Table: A method of recording the number of things seen using tally lines, with totals (frequencies) counted at the end of data collection.



Venn Diagram: A pictorial method for sorting and separating according to properties (usually non-numerical within



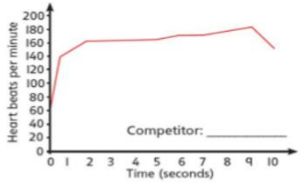
Bar Chart / Graph: Used to compare the numerical values of discrete data sets.

Pie Chart: Similar in function to bar graphs, looking at the frequencies of discrete data sets. These illustrate the proportion of values of the whole.

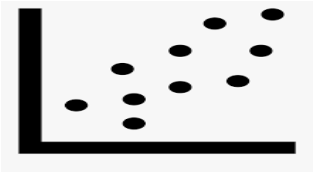
Continuous Data Representation

Water temperature (°C)	Time taken for sugar to dissolve (seconds)
20	55
30	41
40	27

Table: Boxes (rows and columns) where numerical data can be studied.



Line Graph: Used to plot continuous data that changes over time or distance.



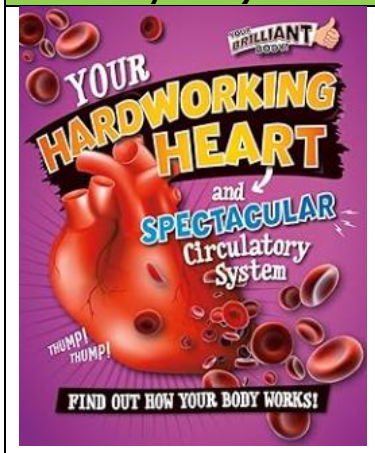
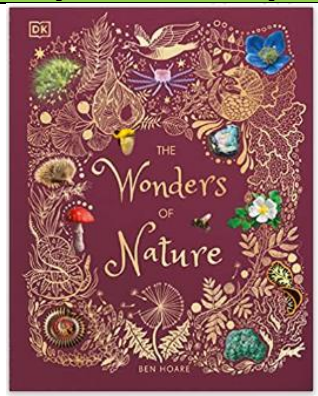
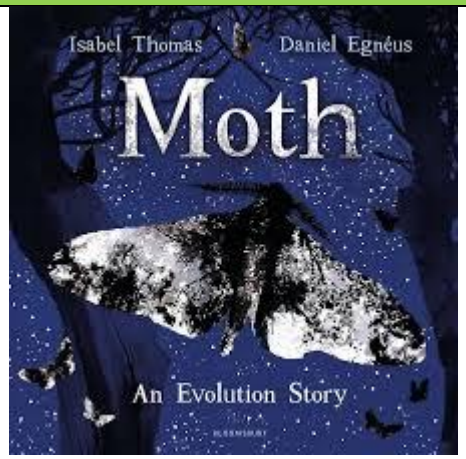
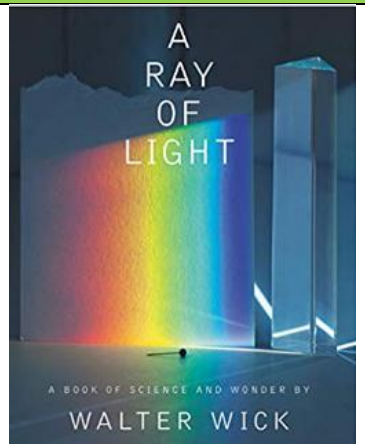
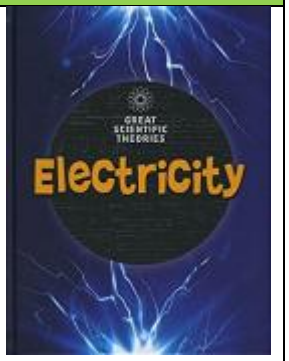
X / Y Scatter Graph: Use to find patterns and trends using two sets of numerical data in order to plot points.

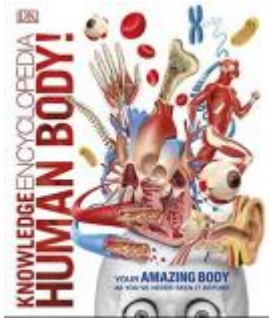
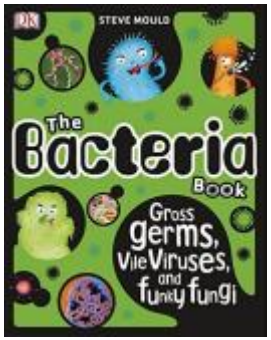
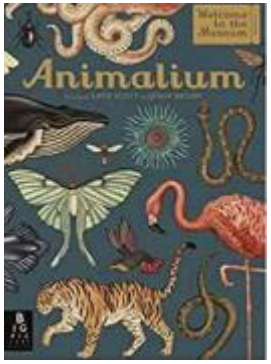
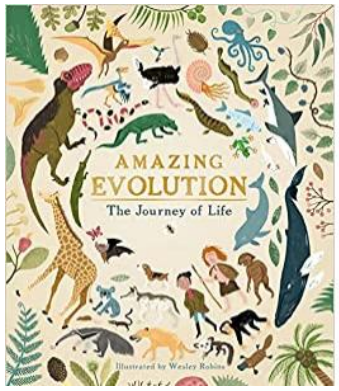
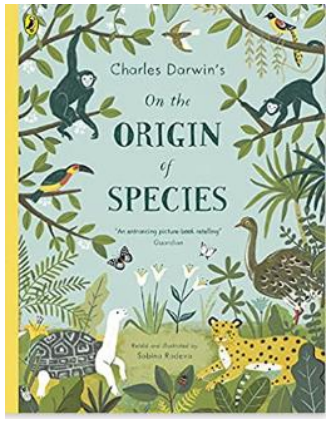
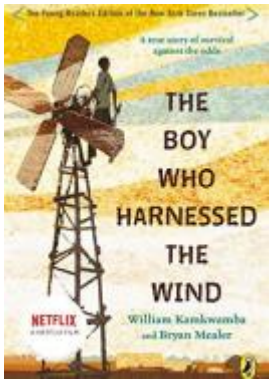
Reading within Science:

Reading is a vital delivery mechanism for the teaching and learning of Science. Consequently, it is fully integrated into the Science Curriculum, using key Reading skills / strands based upon 'Are You Really Reading?' (Identified on the unit overviews below). **Note:** the incorporation of reading within Science is to consolidate practicing those strands, whilst using them to deliver Science objectives. Therefore, the focus remains scientific.

All units of study have been allocated a key text (linked to the non-fiction reading spine – Science). These are as follow:

Key Texts:

Animals, Including Humans (Circulatory System)	Living Things and Their Habitats (Classification)	Evolution	Light	Electricity
				

 **Your Hardworking Heart and Spectacular Circulatory System (Paul Mason)** **Knowledge Encyclopaedia: Human Body! (DK)**	  **The Wonders of Nature (DK)** **The Bacteria Book: Gross Germs, Vile Viruses and Funky Fungi (Steve Mould)** **Animalium (Jenny Broom)**	  **Moth: An Evolution Story (Isabel Thomas)** **Amazing Evolution: The Journey of Life (Anna Claybourne)** **Charles Darwin's On The Origin of Species (Sabina Radeva)**	  **A Ray of Light (Walter Rick)** **Edison: The Mystery of the Missing Mouse Treasure (Torben Kuhlmann)** **Shadow (Lucy Christopher)**	 **Great Scientific Theories: Electricity (Louise Spilsbury)** **The Boy Who Harnessed the Wind (Young Readers' Edition) (William Kamkwamba)**

Science Capital – Key Scientist Studies:

Science capital is vital in broadening the children's wider understanding of Science and the role it plays within their wider lives. This includes understanding the contributions famous scientists have made in furthering knowledge and understanding in their respective disciplines. Whilst historically, there is a gender imbalance, where possible, the range of scientists linked to specific units of study better reflect modern attitudes towards Science and STEM. Linked scientist biographical studies are identified within the unit overviews below.

The **Upper KS2 Science Parents' Guide** contains additional information regarding what Science Capital is, why it is important for science education and provides lists of possible places to visit to enhance interest and understanding within the subject.

Unit of Study:	Animals, Including Humans (Circulatory System)	Living Things and Their Habitats (Classification)	Evolution	Light	Electricity
Linked Scientists:	**Other:** **William Harvey (1578-1657)** (Doctor who discovered the nature of blood circulation and the function of the heart as a pump)	**Biographical Study:** **Carl Linnaeus (1707-1778)** (Botanist and Zoologist; developed taxonomy for classifying organisms)	**Biographical Study:** **Charles Darwin (1809-1882)** (Natural historian, who developed the Theory of Evolution by natural selection) **Other:** **Alfred Russel Wallace (1823-1913)** (Natural historian who independently developed the Theory of Evolution)	**Other:** **Isaac Newton (1642-1726)**(English physicist and mathematician who discovered that a white light could be separated). **(Covered in Y5 – focus on light only)** **Ibn al-Haytham (Alhazen) (965-1040)** (Physicist and Mathematician who developed a theory that light travels in a straight line). **Ibn Sahl (940-1000)** (Mathematician who observed the paths of rays of light as they reflected off of mirrors)	**Other:** **Nikola Tesla (1856-1943)** (Engineer who helped develop AC current supply system) **Mildred S Dresselhaus (1930-2017)** (Research led to the development of rechargeable batteries in modern electronic appliances)

SCIENCE CURRICULUM GUIDANCE: YEAR 6

'Learn, Sparkle & Shine.'

Year Group: 6 **Term:** Autumn 1	**Unit of Study:** Animals, Including Humans (The Circulatory System)	**Science Branch:** Biology
Composite (The Big Idea): The body is made up of tissues and organs, which are linked together to do particular functions. The heart and lungs are such organs, which work together as part of the circulatory (cardiovascular) system, transporting oxygen, sugar and nutrients around our bodies.	**Context:** This unit builds upon the children's knowledge and understanding of the structure and functions of the human body. Previously, they will have identified the organs used for senses – example: eyes and ears (Y1). Pupils begin to understand wider aspects of growth and exercise within Y2, before looking in more detail at organs and organ systems starting in Y3 with skeletons (support, protection and movement) and muscles. Within Y3, they also look at balanced diets, which acts as a direct precursor to this unit of study. Once in Y4, pupils learn about the functions of the various organs of the digestive system, alongside learning about types of teeth and their structures. Y5 look more closely at the human life-cycle, with a focus on key changes within males and females during puberty. Children know what older people need to stay healthy and the difficulties they may face as a result of old age (Y5). This Year 6 unit builds on pupils' knowledge of the importance of a healthy lifestyle, including a balanced diet and the effects of sugar, the different food groups and their role in human development. New learning includes recognising the impact of diet, exercise, drugs and lifestyle on the way their bodies function. Year 6 pupils will identify and name and describe the functions of the main parts of the human circulatory system including the heart, lungs, blood and blood vessels. They understand that blood transports oxygen, water, sugars and nutrients around the body and remove waste products such as carbon dioxide from body tissues. This is the precursor to work studied in KS3 where pupils continue to study the human body as part of the discipline of biology.	

Prior Learning Requirements:	**Common Misconceptions (PLAN):**
• Know the names for the main parts of the body. • Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. • Identify and name a variety of common animals that are carnivores, herbivores and omnivores. • Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). • Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. • Animals, including humans, have offspring which grow into adults. • Know the basic needs of animals, including humans, for survival (water, food and air). • Humans and some other animals have skeletons and muscles for support, protection and movement. • Describe the changes as humans develop to old age. • The changes that happen as humans develop to old age. • The gestation period of different animals.	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

Biographical Study - Scientist:	**Key Vocabulary (Linked to PLAN) (Full list on Vocabulary progression document):**
Possible Mention: William Harvey (1578-1657) (Doctor who discovered the nature of blood circulation and the function of the heart as a pump)	• **exercise:** physical activity which causes an increased heart rate. • **diet:** the food and liquid (**water**) which is consumed by an animal in order to acquire **nutrients** for growth and repair. • **drugs:** medicine used to get rid of illnesses or infection, • **transported:** when blood and oxygen is carried around the body to ensure that the body is working effectively. • **circulatory System:** made up of the heart, blood vessels and blood. Carries oxygen, water and nutrients in a **cycle** around the body and removes unnecessary waste products such as carbon dioxide. • **heart:** an organ made of **muscle** that **pumps** blood through the circulatory system. You can feel your **heart rate** by pressing your fingers on you **pulse**. • **blood vessels:** a tubular structure carrying **blood** (a mixture of cells, platelets and plasma) through the tissues and organs; a vein, artery or capillary. • **capillaries:** any of the fine branching blood vessels that f orm a network. • Organs: a major, internal part of a living organism, each with its own specific and important use. • **lungs:** A pair of organs responsible for absorbing oxygen into the body and removing the waste gas, carbon dioxide out of the body.

NC Objectives (Substantive Knowledge):	**Working Scientifically (Disciplinary Knowledge):**
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.	Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph. Using test results to make predictions to set up further comparative and fair tests.

	Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations. Identifying scientific evidence that has been used to support or refute ideas or arguments. **Key enquiry types:** • Pattern Seeking (Is our heart rate always the same?) • Research Using Secondary Sources of Information (Effects of alcohol and drugs).

Maths Links:

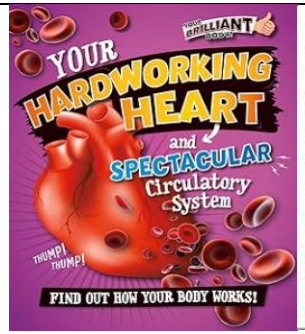
Data handling (continuous) – line graphs linked to pulse rate. Tabulation of results.
Measures (time) – use of stop-watches (conversion of minutes into seconds).

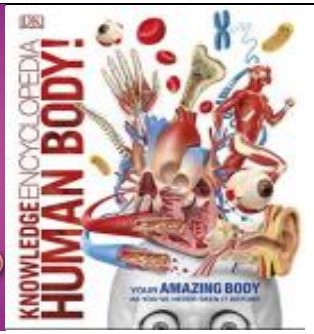
ATRR Reading Links:
Strand 1: The timeline (sequence of blood flow upon entering the heart / lungs).
Strand 2: The six-word summary / hashtag (functions of key organs and features of the circulatory system).
Strand 5: The most important Thing (linked to diet, exercise and drugs, both medicinal and illicit).

Linked Texts:

Your Hardworking Heart and Spectacular Circulatory System (Find out how your body works series) (Paul Mason)

Knowledge Encyclopaedia: Human Body (DK)





(Components) Lesson Sequence:

LC1: What is the heart and what does it do?
LC1b: Heart dissection (teacher modelled)
LC2: What are the features of the circulatory system?
LC3: What is blood?
LC4-5: Is our heart rate always the same? (Enquiry type: pattern seeking)
LC6: How does diet and exercise affect our health?
LC7: How do drugs and alcohol affect our health?

Prior Learning (Can you still?):

Lesson 1:
In Year 5, two of the units that you studied were:

- Earth and Space
- Reversible and irreversible changes in materials

For each of these units, discuss with your partners and write down three things that you learnt within each topic.

Lesson 2:
Label the parts of the heart.

Lesson 3:
Vocabulary to definition matching (current unit)

Lessons 4-5:

1) Name the four components of blood. (Red blood cells, white blood cells, plasma, platelets)
2) What do arteries do? (Carry blood away from the heart)
3) What does opaque mean? (Does not allow light to pass through it)
4) What is the Sun? (Star)

Lesson 6:
Write a short paragraph explaining how heart rate changes during exercise and why this happens.

Lesson 7:

1) How does exercise affect our heart rate? (Increases)
2) What do veins do? (Carry blood towards the heart)
3) What does friction mean? (A force where two surfaces rubbing past one another creating heat and slowing objects_
4) Name three electrical components. (Bulb, wire, cell (battery), motor, buzzer etc.)

Year Group: 6 **Term:** Autumn 2	**Unit of Study:** Living Things and Their Habitats (Classification)	**Science Branch:** Biology
Composite (The Big Idea): All living things can be grouped according to their characteristics. This means they share some features with other living things and therefore can be grouped together. Once they are grouped, they have been classified – this means they have joined a group.	**Context:** Throughout previous year groups, starting in Year 1, pupils have been exposed to a variety of living things, particularly plants and animals (native and nonindigenous, domesticated and wild) and how they are suited to living within their respective environments / habitats. They are aware of broad groups of living things, can identify living and non-living things and are aware of the seven characteristics of life and basic food chains (Y2 and Y4) and food webs (Y4). Throughout Years 1, 2, 4 and 5, pupils look at the characteristics of different animal groups (example: features of birds: wings, feathers, lay amniotic eggs, beaks etc.) and learn about the differences within their life cycles (Year 5). Within Year 4, pupils begin to use these characteristics to create branching identification keys for a range of plants and animals. In Year 6, pupils describe how living things are classified into broad groups according to common observable characteristics, which are based on similarities and differences. They learn about taxonomic hierarchy, with broad groups (Kingdoms) becoming increasingly smaller until reaching the level of individual species (Linnaean Classification System). Children are taught that all living things have a binomial name (genus & species) and that life is related through classification trees (links to Year 6 Evolution).	
Prior Learning Requirements: • Exposure to a variety of plants and animals in KS1, both domestic and nonindigenous. • Features of different types of living things (insects, birds, mammals etc.) (Covered within all year groups, with a focus on Year 5 life cycles). • Food chains (Year 2 and Year 4). • Food webs (Year 4) • Habitats and the animals found within them (Years 2 and 4).	**Common Misconceptions (PLAN):** Some children may think: • All micro-organisms are harmful. • Mushrooms are plants.	

• The differences in the life cycles of a mammal, an amphibian, an insect and birds. • The life processes of a range of plants and animals. • Classification keys (Year 4).	
Biographical Study - Scientist: **Carl Linnaeus (1707-1778)** Botanist and Zoologist; developed taxonomy for classifying organisms.	**Key Vocabulary (Linked to PLAN) (Full list on Vocabulary progression document):** • **classify:** to arrange or group something. • **characteristics:** a feature or quality belonging to something. • **environment:** the surroundings where a living things lives. • **classification key:** a set or questions to help identify the characteristics of living things. • **organism:** a living thing. • **micro-organism:** single-celled living things. • **species:** a particular type of living thing.

NC Objectives (Substantive Knowledge):	**Working Scientifically (Disciplinary Knowledge):**
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.	Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph. Using test results to make predictions to set up further comparative and fair tests. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations.

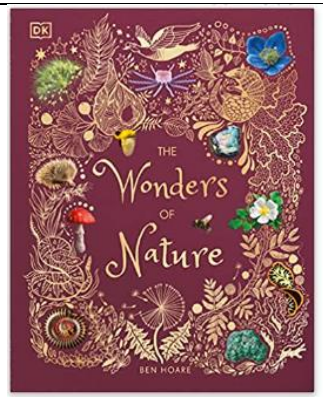
	Identifying scientific evidence that has been used to support or refute ideas or arguments. **Key enquiry types:** • Identifying, classifying and grouping. • Research Using Secondary Sources of Information. • Observations over time (bread mould).
Maths Links: • Charts and graphs (bar and pie charts) linked to the number of organisms within each category type within an ecosystem. • Venn and Carroll Diagrams (Sorting living things). • Tables to organise similarities and differences within species. • Fractions, Percentages and Ratio (linked to proportions of different types of living things found within a habitat of ecosystem). • Standard units of measure when comparing features of living things etc.	
ATRR Reading Links: Strand 1: Timeline Strand (linked to the life and work of Carl Linnaeus). Strand 2: Six-Word Summary describing living things. Strand 5: The Most Important Things – identifying key features of living things, which differentiate them from other species.	

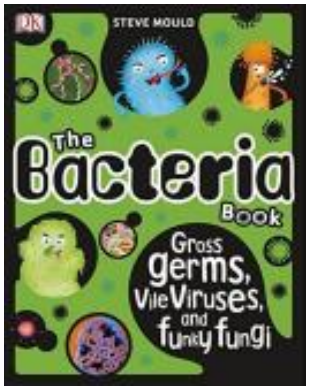
Linked Text:

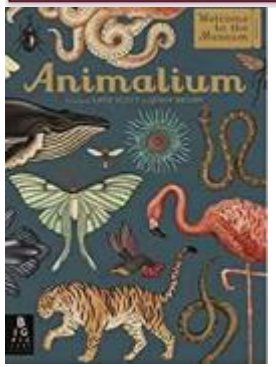
The Wonders of Nature (DK)

The Bacteria Book: Gross Germs, Vile Viruses and Funky Fungi (Steve Mould)

Animalium (Jenny Broom)







(Components) Lesson Sequence:

LC1: What is classification? (Recap of Y4 and sorting into groups using common characteristics).
LC2: What are classification keys?
LC3: What are characteristics? (Platypus links to NCR within Writing).
LC4: What is the Linnaean system of classification? (Key scientist study).
LC5: What are microorganisms and how do they affect the world in which we live? (Key investigation: mouldy bread over time).
LC6: What are the five types of micro-organism?

Prior Learning (Can you still?):

Lesson 1:

1) What are the four chambers of the heart called?
2) What do we call our heart rate when we are relaxed and doing very little?
3) How many days are there in a year? (Maths link).
4) Name the eight major planets which orbit the Sun.

Lesson 2:

Sorting activity – vertebrates / invertebrates (expand to Carroll Diagram if required).

Lesson 3:

Venn diagram sorting the following: lion, zebra, bald eagle, bat, great white shark, bumble bee)

Lesson 4:

1) What is the science of classifying living things? (taxonomy)
2) Which organ is responsible for oxygen entering our body and carbon dioxide leaving our body? (Lungs).
3) What causes a parachute to fall slowly? (Air resistance)
4) Name the four types of teeth found in a human mouth. (Molars, premolars, canine, incisors).

Lesson 5:

1) Identification keys always have two possible answers. What are they? (yes / no)
2) Name two ways in which exercise affects the human body. (increased heart rate, release of hormones – endorphins, increases cardiovascular rate, strengthens bones and muscles etc.)
3) When a caterpillar turns into an adult butterfly, what is the biological term for this? (metamorphosis)
4) What does the stomach contain? (Acid)

Lesson 6:

Create a 'yes/no' identification key for the following: cod (fish), gecko (reptile), octopus (cephalopod mollusc), ant (insect).

Year Group: 6 **Term:** Spring 1	**Unit of Study:** Evolution and Inheritance	**Science Branch:** Biology
Composite (The Big Idea): All living things genetically inherit their features from their parents. This mixing of DNA (deoxyribonucleic acid - the instructions for life) causes variation (differences) within populations of the same species. Individuals, whose characteristics and adaptations enable them to survive within their environments are able to reproduce, passing on their genetic traits to their offspring. This is called 'survival of the fittest', which causes a species to change over time. This process of change is called, 'evolution', a theory first developed by British naturalist, Charles Darwin.	**Context:** This unit in the cumulating unit linked to living things. Prior to this, children will have learnt to identify various plants and animals (Y1), broadening this knowledge in Y2, looking at many of the key features linked to each. Within Y4, children will have begun to sort plants and animals according to these characteristics, including the development of identification / classification keys. They will have also begun to explore how animals are suited to the environments in which they live. Earlier within the Y6 curriculum, pupils will have studied Classification, furthering their understanding of how living things are grouped from Kingdoms down to the individual species level (the Linnaean classification system). This provides them with an understanding that all life is linked through time and provides a taxonomic knowledge base onto which KS3 can build. This Evolution and Inheritance unit explores these characteristics, introducing the concept of variation within populations. The variation between adaptations, linked to environmental conditions, is what enables some organisms to out-compete and survive more easily, allowing them to pass on their genetic make-up to subsequent generations. This 'survival of the fittest' is what leads to evolution and speciation. Children also build upon prior knowledge of fossils (Y3), to explore how living things have evolved over long periods of time.	
Prior Learning Requirements: <u>Year 3:</u> Describe in simple terms how fossils are formed when things that have lived are trapped within rock. <u>Year 5:</u> Describe the life process of reproduction in some plants and animals.	**Common Misconceptions (PLAN):** 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	

<table>
<tr><td>Year 6:
Know that life in inter-related (Classification unit). Example: vertebrates (fish, amphibians, reptiles, mammals, birds).</td><td>• footballing skills, can be inherited cavemen and dinosaurs were alive at the same time.</td></tr>
<tr><td>Biographical Study - Scientist:

Charles Darwin (1809-1882)
English naturalist, geologist and scientist, who sailed to the Galapagos Islands on HMS Beagle. Whilst there, he developed his theories of natural selection and evolution.

Possible Mention: Alfred Russel Wallace (1823-1913) (Natural historian who independently developed the Theory of Evolution)</td><td>Key Vocabulary (Linked to PLAN):

• inhabit: the place where animals/plants occupy or live.
• habitat: the natural environment in which an animal lives.
• evolution: how animals and plants have changed or developed over time.
• adaptation: how an animal / plant has changed to become suited its surroundings over tie.
• fossil: the remains of a plant or an animal which has been preserved in some way.
• environment: a place in which a plant or animal can survive.
• DNA: the recipe stating how our bodies are made up.
• natural selection: Animals with the best adaptations survive to reproduce.
• organisms: living things, including plants, animals, fungi and bacteria.
• offspring: the young / baby of an animal.
• characteristics: the features of an animal / plant specific to an individual.
• climate: the weather conditions and temperature of a place.
• inheritance: the characteristics / features passed on from parent to offspring.
• sexual reproduction: male (sperm) and female (eggs) gametes fuse to create an embryo.
• variation: Differences in features within a species. Example: eye colour.
• species: A particular type of living thing.</td></tr>
<tr><td colspan="2">NC Objectives (Substantive Knowledge):

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.</td><td>Working Scientifically (Disciplinary Knowledge):

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.</td></tr>
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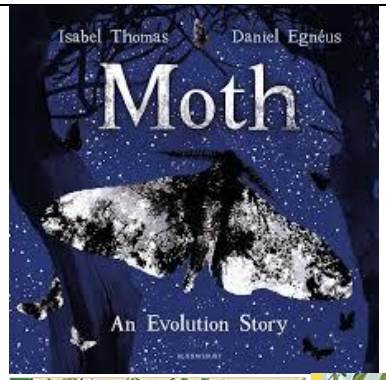
Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.	Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph. Using test results to make predictions to set up further comparative and fair tests. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations. Identifying scientific evidence that has been used to support or refute ideas or arguments. **Key enquiry types:** • Classifying and Sorting • Researching Secondary Sources of Information.
Maths Links: Data handling (discrete) – tally charts, bar charts and pie charts linked to different population characteristics (example: eye colour within a class / year group). Potentially link to ratio and proportion within localised populations. Measures (time) – dates, sequencing etc.	
AYRR Reading Links: Strand 1: Timeline (story of the peppered moth); Charles Darwin's voyage on board HMS Beagle Strand 4: Impression: Evidence (Charles Darwin; Robert Fitzroy) Strand 7: The 3/5 most important strand (linked to events in Charles Darwin's life / voyage).	

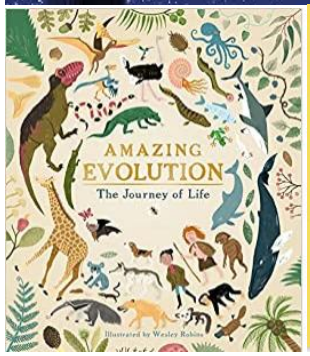
Linked Text:

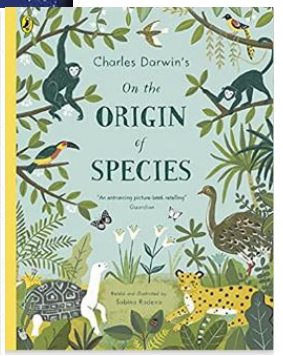
Moth: An Evolution Story (Isabel Thomas & Daniel Egneus)

Amazing Evolution: The Journey of Life (Anna Claybourne)

Charles Darwin's On The Origin of Species (Sabina Radeva)







(Components) Lesson Sequence:

LC1: Who was Charles Darwin? (Key scientist link and biography)
LC2: What do we inherit from our parents?
LC3-4: Why do animals differ?
LC5: What is natural selection and survival of the fittest?
LC6: How can fossils tell us about life in the past and how it has changed?

Prior Learning (Can you still?):

Lesson 1:

1) Name the five different types of vertebrates. (Birds, Amphibians, Reptiles, Mammals, Fish)
2) T _ _ _ _ _ _ _ is the science of classifying living things. (Taxonomy)
3) Name the main artery leaving the heart. (Aorta)
4) (Y3) Name a sedimentary rock? (Sandstone etc.)

Lesson 3-4:

1) Which islands did Charles Darwin visit whilst aboard HMS Beagle?
    A) Canary Islands
    B) Galapagos Islands
    C) Azores
    D) Bahamas
2) What is evolution? **(The change in a species over time)**
3) What do you measure to see how quickly the heart is beating? **(Pulse)**
4) (Y5) Tadpole to frog and caterpillar to butterfly are both examples of what lifecycle process? **(Metamorphosis)**

Lesson 5:

Create a classification key (Y/N) for the following creatures:

- Robin
- Goldfish
- Frog
- Cat
- Snake

Lesson 6:

1) Name three characteristics that a cactus needs in order to survive in an arid environment. (shallow, lateral roots; ability to store water; spikes to protect stored water; minimal leaf surface area and waxy cuticle to present evaporation etc.)
2) What is DNA? (instructions of life)
3) (Y4) What two types of teeth would a herbivore have? (Incisors / molars)
4) (Y3) How are sedimentary rocks formed? (Sediment / particles building up and compressed into stone over time).

Year Group: 6 **Term:** Spring 2	**Unit of Study:** Light	**Science Branch:** Physics
Composite (The Big Idea): Light travels in waves from primary and secondary sources in straight lines. These waves can be reflected off of surfaces or refracted within transparent objects causing them to change direction. Refraction also causes white light to separate into the colours of the rainbow. The light that can be seen with the human eye is called the 'visible spectrum'. And shadows are formed when light is blocked by opaque objects.	**Context:** Pupils will have general experiences of light and dark from their everyday lives, with learning beginning in EYFS. By the end of KS1, children will know when it is light or dark; will have experienced changing shadows as a part of continuous provision and general observations. They will know that it is lighter for longer in summer months and darker in winter months (Year 1: Seasons). Children will have also noticed that light can be blocked and that it can travel through materials such as glass and some plastics. They will also be aware of reflection, having seen in in the world around them. This unit is the second of two KS2 science units where pupils learn about light as part of the discipline of physics - the study of the processes that shape our world and how we use it. From Year 3, children will have a secure knowledge of the terms opaque, transparent and translucent; what plants need, including light, to grow well and how energy from light is the start of a food chain. Prior learning includes knowing that light from the sun can be dangerous and that there are ways to protect their eyes. Pupils also know we need light in order to see things and that darkness is the absence of light. This unit builds upon pupils' prior knowledge that light travels in straight lines from primary and secondary sources of light to our eyes. They also learn that shadows form when opaque objects block light rays. Year 6 learning builds upon this, looking at reflection in more detail, in particular, the relationship between the angles of incidence and reflection (maths link – protractors). It also explores the relationships between source distance and shadow shape / size. Pupils learn that whilst light travels in straight lines, it can be refracted (change direction) when it passes through different materials. They also learn that white light is composed of a spectrum of colours, which when refracted, creates a rainbow. This principle is explored more fully in KS3, through reflection, refraction and dispersal within physics. Pupils will also learn about how the eye functions, enabling us to see (Biology links to Animals, Including Humans).	

Prior Learning Requirements:	**Common Misconceptions (PLAN):**
• What a light source is (primary – makes own light; secondary – reflects the light from a primary source). • Shiny materials reflect light; they do not create it. • Understanding of the concept of light and dark. • Shadows are caused when certain materials block light. • Light travels in straight lines.	Some children may think: • We see objects because light travels from our eyes to the object.
Biographical Study - Scientist: **<u>Possible Mentions:</u>** **Isaac Newton (1642-1726)(**English physicist and mathematician who discovered that a white light could be separated). **Ibn al-Haytham (Alhazen) (965-1040)** (Physicist and Mathematician who developed a theory that light travels in a straight line). **Ibn Sahl (940-1000)**((Mathematician who observed the paths of rays of light as they reflected off of mirrors)	**Key Vocabulary (Linked to PLAN) (Full list on Vocabulary progression document):** • **transparent:** an object which allows light to pass through it. • **translucent:** an object which allows small amounts of light to pass through it. • **opaque:** an object which allows no light to pass through it. • **reflect:** light bouncing off an object's surface. • **light source:** an object which gives out light. **Primary** sources create light, whilst **secondary** sources reflect light. • **refract:** light changing direction within water, air or glass) when it enters at an angle. • **prism:** a glass or other transparent object in the shape of a prism, especially one that is triangular with refracting surfaces at an acute angle with each other. They separate white light into a spectrum of colours. • **shadow:** an absence of light formed when light is blocked by an opaque object. • **spectrum:** a band of colours that make up a rainbow (visible light): red, orange, yellow, green, blue, indigo and violet. • **visible light rays:** the part of the light spectrum which humans can see with their eyes. They travel in **straight lines**. • **dark/darkness:** an absence of light. • **shiny surface:** light easily reflects off of a material's surface. • **matt surface:** light does not reflect well off a material's surface. • **sunlight:** light created by the Sun. • **dangerous:** Sunlight is extremely bright and energetic. This can damage eyes if viewed directly. • **filters:** material layers used to block out some colours of light.

NC Objectives (Substantive Knowledge):	**Working Scientifically (Disciplinary Knowledge):**
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. Explain why shadows have the same shape as the objects that cast them.	Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph. Using test results to make predictions to set up further comparative and fair tests. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations. Identifying scientific evidence that has been used to support or refute ideas or arguments. **Key enquiry types:** • Pattern Seeking: changes in shadow shapes linked to source location • Fair Testing: changes in shadow shapes linked to source location

Maths Links:

- Measures – distances of sources from objects; size (height / length) of shadows.
- Area – area calculation of shadows (simple shapes – rectangles/ triangles).
- Calculation – Differences in length, area etc.

- Angles – measuring and drawing using a protractor (angles of incidence / refraction).
- Tables – presenting measured data.

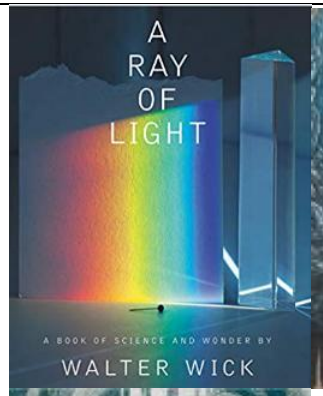
ATRR Reading Links:
Strand 1: Timeline – sequencing how the eye sees / detects light from sources.
Strand 2: Six-Word Summary (how light reflects or refracts).

Linked Text:

A Ray of Light (Walter Rick)

Edison: The Mystery of the Missing Mouse Treasure (Torben Kuhlmann)

Shadow (Lucy Christopher)



(Components) Lesson Sequence:

LC1: What do I already know about light? (Recap of key learning from Year 3). (Vocabulary exploration).
LC2: How does a light source help us to see? (Light travels in straight lines).
LC3: How does reflection cause light to change direction? (Maths links – angles)
LC4: **(OPTIONAL)** How can we see around corners?
LC5: How do our eyes work? (AYRR Strand 1).
LC6: How are shadows formed and how do they change? (Investigation – fair test and pattern seeking)
LC7: How can white light be split?

Prior Learning (Can you still?):

Lesson 1:

1) What is a fossil? (An imprint of a dead organism within sedimentary rocks).
2) How did fossils help prove evolution? (Fossils show us what living things looked like in the past, showing the changes that the species have undergone).
3) Write down key features of birds (Beaks wings, feathers, lay amniotic eggs, endotherms (warm-blooded) talons etc.).
4) What is the name of the blood vessels that carry blood away from the heart? (Arteries).

Lesson 2:

1) What do opaque, transparent and translucent mean? (cannot see through, can see through, partially see through)
2) What are primary and secondary sources of light? (Primary – creates light: sun, fire etc. Secondary – reflects light: moon, mirror.)
3) What was Charles Darwin famous for? (Theory of Evolution and Natural Selection).
4) How many chambers in the heart? Can you name them? (Four – right ventricle, left ventricle, right atrium, left atrium).

Lesson 3:

1) What is a shadow? (Absence of light / area where light is blocked)
2) How does light travel? (Straight lines)
3) What is a binomial name? (Two Latin words for genus and species).
4) What carries blood away from the heart? (Arteries)

Lesson 4:

1) What is an angle if incidence? (The angle that light strikes a reflective object relative to the normal)
2) What is an angle of reflection? (The angle that light reflects from a surface relative to the normal)
3) Name the four chambers of the heart. (Right / left ventricles, right/left atriums)
4) What carries blood towards the heart? (Veins)

Lesson 5:

1) Name two natural light sources. (Sun, fire etc.)
2) What is survival of the fittest? (The best adapted organisms survive to breed, passing on their genetics).
3) Why are the pulmonary artery and vein special? (Pulmonary artery takes deoxygenated blood to the lungs; the pulmonary vein takes oxygenated blood to the heart).
4) What is a thermal conductor? (Allows heat to travel through it).

Lesson 6:

1) What does the pupil do? (Lets light enter the eye)
2) What is the 'angle of incidence'? (The angle at which a ray of light strikes an object relative to the normal)
3) Name the four components of blood. (Plasma, red blood cells, white blood cells, platelets)
4) What is a thermal insulator? (Material which prevents heat from travelling through it)

Lesson 7:

1) What is strange about the image formed on the retina? (It is upside down)
2) Light always travels in _____ (straight lines).
3) What is a shadow? (An opaque object blocks light).
4) Which force slows an object down and generates heat when two surfaces rub against one another? (Friction).

<table>
<tr><td>Year Group: 6
Term: Summer 2</td><td>Unit of Study:
Electricity</td><td>Science Branch:
Physics</td></tr>
<tr><td>Composite (The Big Idea):

Electricity - the flow of electrons through conducting materials - can be used in circuits to power components such as buzzers, motors and bulbs. Varying the voltage of cells within circuits can affect the loudness, speed and brightness of these. All electrical components have standardised images, so that they are clearly recognised anywhere.</td><td colspan="2">Context:

This unit is the second of only two science units where pupils learn about electricity as part of the discipline of physics - the study of the processes that shape our world and how we use it. Pupils are able to identify common appliances that run on electricity (bulbs, motors, buzzers). They also have a secure knowledge of simple series electrical circuits including switches, which open and close, associating this with whether or not the appliances will work. Pupils will also be aware of some common electrical conductors and insulators and associate metals with being good conductors (pattern seeking).

During this Year 6 unit, pupils revise electrical safety and build upon their previous knowledge of electrical circuits as they use recognised, formal symbols when representing a simple circuit in a diagram. New learning includes associating the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. Pupils 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. Pupils also explore electricity generation linked to fossil fuels and renewable energy.</td></tr>
<tr><td>Prior Learning Requirements:

• 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</td><td colspan="2">Common Misconceptions (PLAN):

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>

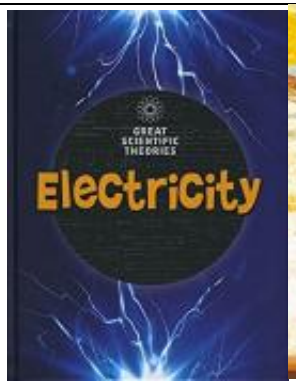
with whether or not a lamp lights in a simple series circuit. • Recognise some common conductors and insulators, and associate metals with being good conductors.	
Biographical Study - Scientist: **<u>Possible Mentions:</u>** **Nikola Tesla (1856-1943)** (Engineer who helped develop AC current supply system) **Mildred S Dresselhaus (1930-2017)** (Research led to the development of rechargeable batteries in modern electronic appliances)	**Key Vocabulary (Linked to PLAN) (Full list on Vocabulary progression document):** • **series circuit:** a circuit with a single pathway through which electrical current can flow. • **complete circuit:** no gaps between wires and components. • **electrical symbol:** standardised drawings which represent electrical components. • **cell/battery:** a device that stores energy until it is needed. A cell is a single unit. A battery is a collection of cells. • **current:** the flow of electrons measured in amps. • **component:** parts of a circuit, including **bulbs**, wires, **motors**, **switches**, **buzzers** etc. • **voltage:** the force ('electrical push') that makes the electric current move through the wires. This is measured in **volts**. • **buzzer**: An electronic component, which makes a noise when electricity passes through it. • **circuit diagram:** diagram showing the connected locations of circuit components as standardised symbols. • **electricity:** the flow of electrons through conducting materials such as metals. • **fuses:** wire designed to break if there is too much current and is used to protect the device. They are usually found within **plugs**, which are inserted into mains power sockets.

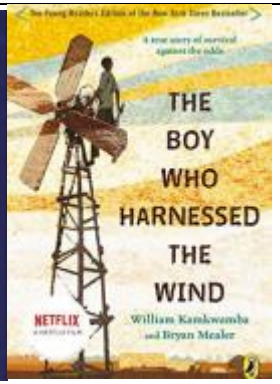
NC Objectives (Substantive Knowledge):	**Working Scientifically (Disciplinary Knowledge):**
Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Use recognised symbols when representing a simple circuit in a diagram.	Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graph. Using test results to make predictions to set up further comparative and fair tests. Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations. Identifying scientific evidence that has been used to support or refute ideas or arguments. **Key enquiry types:** Pattern Seeking and Fair Testing: Changing bulb brightness based on battery voltage and number of bulbs.
Maths Links: • Tabulation of data (measurements of light intensity using Lux). • Calculations of differences in brightness (Lux).	
ATRR Reading Links: Strand 2: Six-Word Summary. Strand 5: The 3/5 Most Important Things Strand (Electrical Safety)	

Linked Text:

Great Scientific Theories: Electricity (Louise Spilsbury)

The Boy Who Harnessed the Wind (Young Readers' Edition) (William Kamkwamba)





(Components) Lesson Sequence:

LC1: What are electrical hazards?
LC2: How is electricity produced?
LC3: What are electrical symbols?
LC4: What does a switch do? (Investigating and creating a variety of switches)
LC5: How does voltage affect bulb brightness? (Investigation – fair test and pattern seeking)

Prior Learning (Can you still?):

Lesson 1:
1) What is refraction? (Light changing direction as it passes through different mediums / materials)
2) What is a pulse rate? (How many times your heart beats per minute)
3) What is a thermal conductor? (Materials which allow heat to travel through them)
4) What process changes a gas into a liquid? (Condensation)

Lesson 2:
1) What is electricity? (It is the flow of electrons through a conducting materials)
2) How does exercise affect the heart? (It increases, allowing blood to carry oxygen to the body's organs)
3) What is a gestation period? (The time an animal is pregnant)
4) Name three electrical components. (Bulb, wire, motor, battery (cell), buzzer…)

Lesson 3:

1) Name three types of fossil fuel. (Oil, Gas, Coal)
2) What is an omnivore? (Animals that eat plants and meat)
3) Should footwear create more or less friction? Explain your answer in less than ten words. (Increase, as they provide grip to push you forwards)
4) When an object such as the Moon travels in an elliptical pattern around another object such as the Earth, we call it an **orbit**.

Lesson 4:

1) Draw the symbol for a bulb?

2) What is electricity? (The flow of electrons through a conducting material)
3) What property would make a good winter coat: thermal conductor or thermal insulator? (Thermal insulator)
4) Which of these would have the longest gestation period: Rat, Lion or an Elephant? (Elephant)

Lesson 5:

1) What is a pressure switch? (The contacts are pushed together to close the circuit)
2) If a switch is open then the appliance will be off.
3) Explain using material properties, why a frying pan is made out of metal, whilst its handle is plastic. (Metal conducts heat, allowing food to be cooked. Plastic is a thermal insulator, presenting hands being burnt)
4) What happen to sound the further away from the source you get? (It gets quieter, eventually reaching background noise levels)

Appendix 1: Year 6 Unit Specific Substantive Knowledge Overviews

Animals, Including Humans (Circulatory System):

Circulatory System

- Know the circulatory system is the system that circulates blood through the body.
- Know that this consists of the heart, blood vessels, blood, veins, arteries, capillaries, oxygen, lungs and ribcage.
- Know the location of the lungs and heart

Heart

- Know that the heart is a hollow muscular organ that pumps the blood through the circulatory system by regular contractions. There are four chambers with two atria and two ventricles.
- Know the following sequence that explains the function of the heart:
  - Deoxygenated blood flows into the heart from the body through the veins
  - This blood is pumped out to the lungs through the pulmonary artery
  - Blood is then oxygenated in the lungs
  - Blood returns to the heart through the pulmonary vein
  - The oxygenated blood is then pumped out of the heart through the aorta
  - The blood travels around the body delivering oxygen and nutrients to the organs.

Blood

- Describe the functions of red blood cells, white blood cells, platelets and plasma
- Show the percentage of each component by volume in a typical sample of blood.
- Know that oxygenated means 'to be enriched with oxygen'
- Know that deoxygenated means 'to be depleted of oxygen'
- Know that blood is red when oxygenated and deep purple or blue looking through skin when not.

Diet, exercise, drugs and lifestyle

- Know that diet can impact on lifestyle as fatty rich foods can clog arteries and veins, preventing blood from delivering what is needed.
- Know that exercise can improve the health of a person by removing fatty deposits from the body.
- Know that some exercises are called cardiovascular, and are designed to improve the fitness of the overall circulatory system by strengthening the organs and pulse rate.
- Know the impact of having little exercise and poor diet will have
- Know that taking certain drugs can cause permanent damage to the circulatory system (link to PSHE curriculum).

Living Things and Their Habitats (Classification)

- Know that plant taxonomy is the science that finds, identifies, describes, classifies, and names plants.

Classifying Organisms

- Know that there are millions of species of living things on our planet.
- Know that it would be difficult to describe and name each one individually.
- Know that while species can be very different from each other, many of them have similar features that allow us to put them into groups.
- Know that grouping things helps scientists identify gaps in their research and they get an idea of what to investigate next.

Modern Classification System

- Know that, in 1735 (in the eighteenth century), Carl Linnaeus started the modern system of organising species of organisms into certain groups and giving them scientific names.

Carl Linnaeus (1707 - 1778)

- Each species is given a name using Latin words, so that the same name can be used all over the world.
- Know that Latin is the language which the ancient Romans used to speak and is used frequently in science for classifying animals
- Know that the scientific name for modern human beings is 'homo sapiens'.
- Know that homo means ‘man’ and sapiens means ‘wise’.
- Know that homo is the genus name and sapiens is the species name. Putting different species into different groups according to their features is called classification.
- Know that a genus is a class of similar things, especially a group of animals or plants that includes several closely related species.

- Know that a species is a class of plants or animals whose members have the same main characteristics and are able to breed with each other.
- Know that plants can be classified into two groups - flowering and non-flowering.

- Know that non-flowering plants can be divided into two groups:
  - those that reproduce with dust-like particles called spores.
  - those that use seeds to reproduce

- Know the following plants by their appearance:

Flowering Plants	Non-flowering Plants
bluebell poppy rose dandelion daisy honeysuckle ivy snowdrop	ferns pine moss

- Know that mushrooms and fungi are not plants - they belong to a separate classification of living things called fungi.
- Revise the parts of a plant and their function: roots, stem, leaves, flower etc. (see Y2)

Life Cycle of a Plant

- Know that sexual reproduction in plants happens in a cycle-like pattern. Flowers come from seeds, and they create seeds too. All flowering plants go through the following life cycle:
- Germination is the process by which a plant begins to grow from a seed. Roots form under the soil. The stem, leaves and flower emerge above the soil.
- Pollen produced by a flower is carried by insects or blown by the wind to another flower. This process is called pollination.
- When the pollen reaches another flower, it travels to the ovary where it fertilises the ovules (egg cells) to make seeds. This process is called fertilisation.
- These seeds are scattered by animals or the wind. This process is called dispersal.
- Some of the seeds will grow into new plants.

- Know the parts of a flower related to reproduction - stamen (male) consists of the anther and filament.
- The carpel (female) consists of the stigma, style, ovule and ovary.

- Know how to label these on a diagram of a flower.

Evolution and Inheritance

- Know that characteristics are passed from parents to their offspring.
- Use the example of different breeds of dog (including what happens when Labradors are crossed with poodles).
- Know the term inheritance as 'the passing on of characteristics from parent to offspring' http://www.bbc.co.uk/timelines/zq8gcdm
- Know that variation in offspring over time can make animals more or less able to survive in particular environments e.g. the development of insulating fur on the arctic fox.

Charles Darwin

- Know that Darwin lived from 1809 - 1882 and is known for his theory of evolution Know that Darwin studied animals and plants (a biologist) and developed the idea of natural selection to explain how different species had evolved over time. Know that he explained his theory in his most famous book 'On The Origin of Species' Know that his theory was formulated whilst studying animals on the HMS Beagle voyage between 1831 and 1836 including the Galapagos islands.
- Know that in biology, an adaptation is defined as 'the process of change by which an organism or species becomes better suited to its environment.
- Know the case study of the peppered moths as described in Moth: An Evolution Story.
- Know that the theory of evolution states that evolution happens by natural selection through the following process:

The Process of Evolution

- More organisms are born than can survive.
- These individuals all have slight variations between them.
- Some of these variations are helpful and improve an organism's chance of survival. Those that survive pass their characteristics onto their offspring.
- Over time, these helpful variations are passed on to the next generation.
- This process takes thousands of years and can't be seen from one generation to the next.

Fossilisation (Links to Y3 Rocks and Fossils)

- Know that fossilisation is the process that forms fossils.
- Know that a fossil is 'the remains or impression of a prehistoric plant or animal embedded in rock and preserved in petrified form'
- Know that prehistoric means 'before written history'.
- Know that preserved means 'to keep something as it is'.
- Know that petrified means 'change into stone'
- Know how palaeontologists build up a picture of the past using incomplete evidence, most organisms die without leaving a fossil trace.
- Learn about stratigraphy, and that organisms found in lower layers of rock tend to have died earlier.
- Use diagrams showing a simplified cross-section of rock to date 3 different organisms, working out when they appeared, when they died out, and how long they lived for. Compare the organisms to each other and discuss which lived most recently.
- Use fossil evidence to guess how the animal may have looked when alive, showing this in a diagram.

Light

- Know that light travels in straight lines from its source.
- Know that some light sources are natural (stars, sun, fire, lightning, bioluminescence) and some are man-made (torch, light bulb, digital screen, laser pointer)
- Know that light either travels in a straight line directly from the source or by reflecting off a surface into our eye.
- Know how to draw arrows to show light entering the eye from a light source or reflection.

- Know that reflection is when light bounces off a surface, changing the direction of a ray of light.
- Know that all objects reflect light; smooth and shiny surfaces reflect all the rays of light at the same angle, rather than scattering the rays of light like rough or dull surfaces.
- Know that when rays of light reflect, they obey the law of reflection: The angle of incidence always equals the angle of reflection.
- Demonstrate with a laser pointer and mirror.
- Predict where the laser will point given a change in angle.

The Eye

- Know that the amount of light entering the eye is controlled by the pupil, which is surrounded by the iris – the coloured part of the eye.
- Know that the pupil dilates when it is darker to let more light into the eye.
- The pupil constricts when it is bright to reduce the amount light entering the eye

Shadows

- Know that a shadow is formed when light is blocked by an opaque object.
- Know that opaque means light cannot pass through, translucent means some light can pass through but it is difficult to see through and that transparent means light can pass easily through and it is easy to see through.
- Understand that as light travels in straight lines shadows have the same shape as the objects that cast them.
- Understand that if something casts a light or shadow somewhere, it causes it to appear there.

- Know that the further the light source from the opaque object the bigger the shadow. Know that the nearer the light source from the opaque object the smaller the shadow. Know that the shadow of an object can be moved by moving the light source.

- Know that a silhouette is different from a shadow because a silhouette is the solid dark shape that you see when someone or something has a bright light or pale background behind them.

Electricity

- Know that electricity is created by generators which can be powered by gas, coal, oil, wind or solar.
- Know that the electrical energy can be converted into other types of energy such as light, heat, movement or sound. Electricity is dangerous, so be careful when using electrical appliances.
- Know that metal is used in plugs to allow electricity to transfer from the wall socket, through the plug, and into a device such as a radio or TV.
- Know that some materials do not allow electricity to pass through them. These materials are known as electrical insulators.
- Know that plastic, wood, glass and rubber are good electrical insulators. That is why they are used to cover materials that carry electricity.
- Know that the plastic covering that surrounds wires is an electrical insulator. It stops you from getting an electrical shock.

Circuits

- Know that electricity can flow through the components in a complete electrical circuit. Know that a circuit always needs a power source, such as a battery, with wires connected to both the positive (+) and negative (-) ends.
- A battery is made from a collection of cells connected together.
- Know that when drawing circuit diagrams, rather than drawing detailed components; we use simple symbols to represent the different components.
- Know which symbols to use when drawing a circuit

- Know that a circuit can also contain other electrical components, such as bulbs, buzzers or motors, which allow electricity to pass through.
- Know that electricity will only travel around a circuit that is complete. That means it has no gaps. You can use a switch in a circuit to create a gap in a circuit. This can be used to switch it on and off.
- Know that when a switch is open (off), there is a gap in the circuit. Electricity cannot travel around the circuit. When a switch is closed (on), it makes the circuit complete. Electricity can travel around the circuit.
- Know that a circuit always has a battery (cell) but it can also contain other electrical components, such as bulbs, buzzers and motors.

- Know that electricity flows through a circuit, with the volt being the push that moves electrons along the wires.
- Know that the more volts there are in a circuit, the more power there is travelling through it.
- Understand that the higher the volts, the brighter a lamp and the louder a buzzer