

Science Progression Document

Year 6

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| **Topic 1: Physics**  **Electricity**  **Key Question: What is electricity?** | **Prior learning:**  Year 1: discusses properties of materials and uses.  Year 2: discusses properties of materials and explains suitability for different purposes.  Year 4: To know the components of a circuit and how electricity flows through a circuit.  **Future learning:**  KS3 – Children will study electricity in more depth, including; current and static electricity, parallel and series circuits. They will learn how current is measured and work out potential differences; calculate differences in resistance between conducting and insulating components (quantitative). | **Vocabulary:**  Appliance  Battery  Circuit  Components  Conductor  Electrical  Insulator  Mains power  Pylon  Renewable  energy  Non - renewable  energy | **Cross Curricular links:**  Geography- sustainability |
| **Children should know…** | **Key Questions:** | **Recap:** | **I am thinking like a scientist…** |
| How to construct and draw a variety of circuits using symbols to represent each component  • How to recognise if a circuit will work or not | How do you draw a circuit diagram? | What do you remember about electricity topic from Year 4? | Draw scientific diagrams to represent a circuit using symbols • Explain using scientific vocabulary why some circuits work and some don’t. |
| how the number and voltage of cells in a circuit links to the brightness of a  lamp or the volume of a buzzer | How does voltage in a circuit affect the brightness of a bulb? | Recap circuit symbols. | • Report and present findings from fair tests into voltage and output • Record results from an experiment using tables and graphs |
| reasons for variations in how components function, including the brightness of  bulbs, the loudness of buzzers and the on/off position of switches | How can I investigate variations in how components function? | Recap circuits which will work and not work and explain why. | • Plan, make predictions and carry out fair tests into the function of various components • Use scientific equipment to demonstrate how variation in the working of particular components can be changed. |
| Names of renewable and non-renewable forms of energy and their  corresponding advantages and disadvantages | What is renewable and non-renewable energy? | Symbols, number of batteries. | • Report and present findings from enquiries into renewable and non-renewable energy sources in oral and written forms such as displays and other presentations |
| the work of Nikola Tesla – inventor/electrical engineer | Who is Nikola Tesla? | Vocabulary recap, will these circuits work? | • Research the life and work of Nikola Tesla and present findings using IT |

**Misconceptions:**

When adding several components to a circuit, children may think that the bulb is the brightest or the first buzzer makes the most noise. This misconception often arises from the idea that electricity comes out of the battery so the first is the brightest and the last is the dimmest. In fact, all the bulbs would be the same level of brightness (the electricity is ‘shared’ between the components).

When making a circuit with different coloured wires, the children may ‘wrongly’ assume that the different coloured wires have different properties.

Children may think that the bigger the battery, the more electricity is contained in it and will make a bulb shine brighter. Although it is true to say a battery’s voltage does affect the brightness of a bulb, the size of the battery isn’t always related to the voltage e.g. a 1.5V battery can come in 4 different sizes.

**Key vocabulary to Explain (Pre-Teach):**

appliance – a device or piece of equipment that has been made to perform a specific task

battery – a small item used to power small appliances circuit – a route through which electricity flows

components – the parts of a circuit

conductor – allows electricity to flow through it electrical – something that uses electricity to work

insulator – doesn’t allow electricity to flow through it

mains power – electricity provided by power stations

pylon – a tower used for keeping electrical wires above the ground

renewable energy – energy from a source that is not depleted when used, such as wind or solar power

non-renewable energy – energy from a source that is depleted when used, such as coal, gas and oil

**Stretch and challenge:**

**Children could:**

* Children are presented with a diagram of a circuit and asked if it will work. They need to explain their thinking
* Children are presented with a circuit and asked to give two ways in which they could change the brightness of the bulb
* Children are given a table of results from an investigation; some of the values are missing. They are asked to estimate what the values might be and draw a line graph to display the data
* Children draw a bar graph or a line graph using the data they have collected in their investigation
* Children use their research skills to answer this question: How has non-renewable energy led to climate change?



1. How is night and day occur?
2. Describe what techniques we can use to separate a mixture?

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| **Topic 2: Physics**  **Light**  **Key Question: What is light?** | **Prior learning:**  Class F – Name different parts of the body and face  Year 1 – Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.  Year 3 - To understand how the eye works; To understand how light travels and forms shadows  **Future learning:**  KS3 – Children will learn that human sight is based on the ability to see red, blue and green light and that the colour of an object depends on the colours of light that it absorbs and  scatters. Light travels at 300 million metres per second in a vacuum and different colours of light have different frequencies. The path that light takes can be bent (refracted) and that  transparent materials can be shaped into lenses and prisms to alter the path of light by refraction (convex and concave lens).  The ray model can describe the formation of an image in a mirror and how objects appear different colours. | **Vocabulary:**  Dark  Reflect  Shadow  Opaque  Translucent  Transparent  Luminous  Scattering  Absorption  Refraction | **Cross Curricular links:**  Maths- Measurement  PSHE- Staying safe  Reflective clothing in dark |
| **Children should know…** | **Key Questions:** | **Recap:** | **I am thinking like a scientist…** |
| • that light travels as a wave, it does not bend while travelling. It follows the shortest path between the starting point and the endpoint, which is always a straight line. • Different light sources that are natural or man-made | How does light travel? | What do you know about light? | • Plan and conduct a test to investigate how light travels and explain/present the findings • Use labelled diagrams and models to explain scientific concepts |
| • A reflective object reflects light in all possible directions. The reflected light from the object reaches our eyes. Our brain receives the information from the eyes making us see the object. • Which materials are the best reflectors of light. | What materials make the best reflectors? | How does light travel? | • Plan enquiries to answer questions about how mirrors reflect light and record using straight line diagrams to indicate the direction of light. |
| • how the eye works. That Light enters the eye through the cornea. the pupil adjusts in response to the light, the lens focuses the light onto the retina, the light is focused onto the retina, the optic nerve transmits visual information to the brain. | How does the eye work? | Reflectors? | • Label the eye using scientific vocabulary and explain how we see |
| • that shadows are formed when an opaque object or material is placed in the path of rays of light. • That the shape of the shadow will be the same as the outline shape of the object and the size of the shadow is larger when the light source and object move closer to each other as more of the light is blocked. The further away from the light source an object is, the smaller the shadow will be | Why do shadows change during the day? | The eye | • Explain and demonstrate how a shadow is the same shape as the object that casts them • Investigate how a shadow changes throughout the day. Record the data using scientific diagrams and graphs. Present findings and draw conclusions. |
| • Why objects appear to be bent when in water (refraction) • The difference between reflection and refraction. | What is refraction? | Shadows/vocabulary | • Make observations and use scientific explain refractions and make comparisons with reflection |
| • that Sir Isaac Newton explained how a rainbow is formed (refraction) | What did Isaac Newton discover? | Refraction/How light travels | • Research the life and work of Isaac Newton and present using various methods |

**Key vocabulary to Explain (Pre-Teach):**

**dark** – the absence of light

**reflect** – a surface (or body) that throws back light without absorbing it

**shadow** – an area where direct light from a light source cannot reach due to obstruction by an object **opaque** – opaque materials do not let any light pass through them. They block the light. **translucent** – translucent materials let some light through, but scatter the light in all directions so that they cannot see clearly through them

**transparent** – transparent materials let light pass through them in straight lines so that you can see clearly through them

**luminous** – giving off light, bright or shining

**scattering** – when light is returned from a surface

**absorption** – when light strikes a surface and is retained within it.

**refraction** – the “bending” of light when it passes from one transparent material to another.

**Misconceptions:**

Children may think that the moon and other shiny/ reflective objects are light sources as they appear to shine however, they are not. The Moon reflects light from the Sun (it does not give off its own light) and cat’s eyes, mirrors, reflective material on clothing also only reflect light (they are not light sources).

Children may think that you see things because light comes out of your eyes. Misconceptions about shadows often centre around the position of the object, light source and shadow. The shadow always forms on the opposite side of the object from the light source; the shadow is a similar shape as the object and the base of the shadow always touches the object.

**Stretch and challenge:**

**Children could:**

* Discuss the advantages and disadvantages of only using one light source (a torch) in a school.
* Draw scientific diagrams to explain how we see objects; using arrows to show the direction the light rays travel in.
* Write an explanation of how we see things with our eyes.
* Draw conclusion about how shadows change throughout the day using scientific vocabulary
* After reading statements about why objects appear bent in water, decide who they agree or disagree with; using scientific language to justify their opinion.
* Write a quiz about light.



1. Can you describe ways in which seeds are dispersed? What is a life cycle? Describe one.
2. Water resistance and friction

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| **Topic 3: Biology**  **Animals including humans**  **Key Question: How do an animal’s living systems work together to maintain a healthy body?** | **Prior learning:**  Class F - Name different parts of the body and face  Class 1 – Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.  Class 2 – Show an understanding as to why exercise, balanced diet are important for humans.  Class 3 – Understand the importance of a nutritious, balanced diet; Understand the skeletal and muscular system of a human  Class 4 – Identify and name the parts of the human digestive system  Class 5 – Understand the process of reproduction in animals including humans  **Future learning:**  KS3 – Children will learn more about the importance of a healthy diet and how different foods are absorbed and used in the human body. They will learn more about gas exchange systems in the lungs of the human body. They will also look at the effects of recreational drugs including substance misuse. | **Vocabulary:**  Heart  Lungs  Blood  Vessels  Veins  Arteries  Heart rate  Oxygenated  Deoxygenated  Blood cells  Ventricle  Atrium | **Cross Curricular links:**  PSHE- the importance of a balanced diet and exercise for maintaining a healthy body |
| **Children should know…** | **Key Questions:** | **Recap:** | **I am thinking like a scientist…** |
| • that the main parts of the circulatory system are the lungs, heart, arteries and veins. • that the circulatory system is a continuous cycle, which transports nutrients, oxygen and water via the blood to all the parts of the body. | What is the circulatory system? | What do you know about the organs of your body and what they do? | • Create/label scientific diagrams to represent the main parts of the circulatory system • Explain how the circulatory system works |
| • The main parts of the heart (chamber, atrium, ventricle, aorta, valve, vein, artery) and can explain how the heart pumps blood around the body | How does the heart work? | Circulatory system | • Identify and name the main components of the heart in pictures and 3D models • Use scientific vocabulary to explain how the heart pumps blood around the body |
| • that a well-balanced diet provides all of the energy you need to keep active throughout the day • Which nutrients you need for growth and repair, helping you to stay strong and healthy and help to prevent illness. | Why do you need a balanced diet? | The Heart | • Explain the impacts of diet, exercise and lifestyle on the body • Plan and conduct a scientific enquiry into different food groups |
| • that all exercise is good for the body. That there are two main types of exercise: aerobic and strengthening. • that aerobic exercise increases your heartrate more than strengthening exercises. | Why do we need to exercise? | Balanced diet | • Plan, make predictions and carry out fair tests into the changes in heart rate after different types of aerobic exercise • Draw graphs to show the difference between heartrate and exercises |
| • that the misuse of drugs and alcohol can have an adverse effect on your body | Are all drugs bad for you? | Exercise | • Report and present findings from research and enquiries into the effects of drugs on the body using written and oral forms |
| • Marie Maynard Daly helped to discover the link between high cholesterol and clogged arteries, essential for our understanding of heart disease. | Who is Marie Maynard Daly? | Drugs | • Research the life and work of Marie Daly using IT, displays and presentations. |

**Misconceptions:**

Children may think that oxygenated blood is red whilst blood with no oxygen is blue. Children need to know that blood is never blue, but some scientific diagrams show it as blue so we can distinguish between the different types of blood.

Children may not realise that exercise is needed to keep the heart healthy and you should aim to complete at least 30 minutes of exercise a day that increases your heart rate.

**Key vocabulary to Explain (Pre-Teach):**

**heart** – a muscle that pumps blood around the body

**lungs** – spongy air filled organs that provide oxygen to the blood

**blood** – a liquid that carries oxygen, water and nutrients around the body

**veins** – carry deoxygenated blood to the heart

**arteries** – carry oxygenated blood away from the heart

**heart rate** – the number of times our heart beats per minute



1. Plant reproduction
2. Solids, Liquids and gases

**Stretch and challenge:**

**Children could:**

* make their own model of the human circulatory system
* research to see if all animals have the same circulatory system as humans
* make a working lung model using a plastic bottle and balloons
* investigate other activities to see which one makes the heart beat faster
* create a game about the transportation of water and nutrients
* make a non-fiction book to answer the key questions
* create a child friendly (or adult friendly) newsletter to explain “Health Heroes” and “Health Villains”

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| **Topic 4: Biology**  **Evolution**  **Key Question: What is evolution?** | **Prior learning:**  Year 2 – Show an understanding of how a specific habitat provides for the basic needs of things living there (plants and animals)  Year 3 - Rocks - Explain how fossils are formed.  Year 4 – Digestive system - Understand the functions of the organs in the human digestive system  Year 4 - Understand how changes to an environment could endanger living things  **Future learning:**  KS3 – Children will learn about inheritance, chromosomes, DNA and genes. They will learn that heredity is the process by which genetic information is transmitted from one generation to the next and that there are differences between species. They will also learn that there is variation between species and between individuals of the same species. This means some organisms compete more successfully, which can drive natural selection. Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction. | **Vocabulary:**  evolution  offspring  inheritance  variations  adaptation  environment  adaptive  traits  inherited  gene  species  natural  selection | **Cross Curricular links:**  Literacy- Biography on Charles Darwin? |
| **Children should know…** | **Key Questions:** | **Recap:** | **I am thinking like a scientist…** |
| • adaptation is how animals and plants are specialised to suit their environments. • how plants such as Cacti and Ash tree have adapted to their environments | What is adaptation? | Environments and animals found there | • Demonstrate an understanding, with specific examples, of how animals and plants has evolved over time • Identify characteristics that will make a plant suited to its environment |
| • how animals such as dolphins, toucans and coral have adapted to their environments | How do animals adapt to their environments? | What is adaptation? | • Use a wide range of secondary sources to find out how certain animals have adapted to their environments |
| • Evolution is the process of living things changing over time. • the process of advantageous adaptations being passed on to future generations is known as natural selection and links to evolution of a species (use peppered moths as an example) | What is evolution? | Animal adaptations | • Explain evolution is the process of living things changing over time • Make comparisons between the Galapagos island finches |
| • Inheritance is the process of parents passing on features to their offspring (recognising that offspring normally vary and are not identical to their parents) | What have I inherited from my parents? | Evolution | • Use scientific evidence and observations to explain and demonstrate the term inheritance |
| • a fossil is the preserved remains of a dead animal usually found within rocks and can tell us about what animals were like in the past. | What can fossils tell us? | Inherited characteristics/key vocab | • Identify scientific evidence about fossils that help support the theory of evolution |
| • To know about the key works of Charles Darwin with regards to his theory of evolution and work in the Galapagos Islands. | Who is Charles Darwin? | Fossils | • Research the life and work of Charles Darwin and present findings in various ways |

**Key vocabulary to Explain (Pre-Teach):**

**Adaptation:** When a plant or animal has changed in some way, usually over a long period of time, to be better suited to the environment in which they live.

**Environment:** the conditions that surround an organism.

**Evolution:** the process by which different kinds of living organisms are believed to have developed from earlier forms during the history of the Earth.

**Gene:** A unit of heredity which is transferred from a parent to offspring and is held to determine some characteristics of the offspring.

**Natural selection:** When the fittest, most adapted organisms survive and multiply whilst the least adapted die out.

**Inheritance:** the reception of genetic qualities by transmission from parent to offspring.

**Organism:** an individual animal, plant or single-celled life form.

**Species:** a group of similar organisms that are able to reproduce.

**Misconceptions:**

That evolution happens quickly and that individual species adapt rapidly to changes in their environment. This is not the case, evolution happens over time. Children think that if you believe in evolution then you can’t believe in God; however many evolution scientists also believe in God and have a religious background. Just because you believe in one, doesn't mean you can't believe in the other. Children may have heard that humans came from monkeys. Humans do belong to the same family as the great apes and the closest known living relative to Homo sapiens is the chimpanzee. However, this does not mean humans 'evolved from monkeys'. Humans share a common ape-like ancestor with old world monkeys and have very little connection to new world monkeys, which branched off the phylogenetic tree nearly 40 million years ago.

**Stretch and challenge:**

**Children could:**

* Consider what would happen if a cactus didn't have spines? Write a short explanation
* Complete a table matching the type of teeth an animal has to its diet. Explain how the shape of the teeth helps the animal feed
* Write 3 facts about the life of Charles Darwin, having previously read information about him
* Draw conclusions from their investigation
* Compare two different butterflies from a drawing provided. Consider the traits of the butterflies and predict what the offspring would look like
* Consider how fossils help us to understand evolution. Write an explanation



1. Reversible and irreversible changes
2. Gravity and air resistance

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| **Topic 5: Biology**  **Living things and their environment**  **Key Question: What is classification?** | **Prior learning:**  Year 1- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets) Identify and name a variety of common animals that are carnivores, herbivores and omnivores Year 2 - Classify things by living, dead or never lived. Year 3 - Compare and group rocks based on their appearance and physical appearance and physical properties, giving reasons. Group information according to common factors e.g. plants that grow in woodlands or plants that grow in gardens Year 4 - Identify the characteristics of living things. Recognise that living things can be grouped in a variety of ways. Use classification keys to help group, identify and name a variety of living things in their local and wider environment  **Future learning:**  KS3-Children will study cell structure and organisation and learn relationships within an ecosystem | **Vocabulary**  Classify  Vertebrate  Invertebrate  Exoskeleton  Vascular  Non-vascular  Taxonomy  Bacteria  Virus  Protozoa  Algae  Fungi  Carnivore  Herbivore  Omnivore | **Cross Curricular links:**  PSHE: Looking after the world we live in |
| **Children should know…** | **Key Questions:** | **Recap:** | **I am thinking like a scientist…** |
| How to sort animals into different groups using different criteria: omnivore/herbivore/carnivore or vertebrate/invertebrate or into one of the ten main animal groups (mammals, birds, fish, amphibians, reptiles, arachnids, annelids, crustaceans, insects and molluscs) | How are animals classified? | What are the seven life processes? | Use scientific criteria and definitions to sort a range of animals into various groups according to observable characteristics |
| how to use and create classification keys to identify living things by asking yes/no questions linked to its characteristics e.g. does it lay eggs? | What is a classification key? | What are the different animal groups? What is a carnivore/herbivore/omnivore? | Give reasons and explain the characteristics of different classification groups • Choose the most suitable questions to classify animals into more specific groups |
| • How to sort plants into groups according to their key characteristics | How can we classify plants? | Keys | • Use classification keys to group and identify a range of plants using scientific terminology correctly |
| • that micro-organisms are an organism of microscopic size, which may exist in its singlecelled form or as a colony of cells. • that the five main micro-organism groups are: bacteria, fungi, protozoa, viruses and algae | What are micro-organisms? | Plant classification | • Give examples and characteristics of the 5 main micro-organism groups and present results from enquiries in both written and oral form. |
| • that yeasts optimum growth conditions is moist, warm, and with nutrients that it can feed on | How does yeast grow? | Mic-organisms | • Observe and report what happens when yeast is given different environments to feed off. Draw conclusions. • Use scientific equipment such as measuring cylinders, funnels, and measuring equipment |
| • that Carl Linnaeus is a Swedish botanist that developed a classification system | Who is Carl Linnaeus? | What does yeast need to grow? | • Carry out research into the work of Carl Linneaus and present findings using IT |

**Stretch and challenge:**

**Children could:**

* Answer questions using the criteria used to sort animals that have been found in the garden.
* Children are given two opinions about which question to include in a classification key. They need to decide which question would be suitable and explain why.
* Children are given a classification key and asked to check if it is correct? They can use information books or the internet to check any facts that they are unsure of.
* Explain how yeast, when mixed with sugar and warm water, causes a balloon placed over the top to inflate.
* Use a classification key to determine the names of three different microorganisms.
* Children are asked to think about and explain why a standard system for classifying newly discovered species is important.



1. Earth in space
2. Water cycle

**Misconceptions:**

Some children may think that all microorganisms are harmful and make you ill. It is important to highlight that some microorganisms are useful and play an important part in decomposition. They may also think that microorganisms are all the same size; however, although all microbes cannot be seen with the naked eye, there is a huge variance in the size of microbes (e.g. in general, viruses are much smaller than bacteria). Children may think that mushrooms are a type of plant. They are not, they are classified as fungi.

**Key vocabulary to Explain (Pre-Teach):**

**classify** – to arrange a group of people or things in classes or categories according to shared qualities or characteristics

**vertebrate** – an animal that has a backbone

**invertebrate** – an animal without a backbone

**exoskeleton** – a rigid external covering for the body in some invertebrate animals

**vascular** – plants that use roots and stems to take in water and nutrients

**non-vascular** – plants that do not use roots and stems to take in water and nutrients

**taxonomy** – the scientific process of grouping or classifying living organisms

Also explain the terms; herbivore, carnivore, omnivore; the five main animal classification groups (mammals, birds, fish, reptiles and amphibians) and the five main microorganism groups (bacteria, viruses, protozoa, algae and fungi).

