Brookvale Primary School
Science Curriculum
Sequences of Learning

Subject Sequence of Learning

Year 1

Year 1
Autumn 1: My Body and Senses

Unit Intent:
In this unit, children will learn about the basic parts of the human body and explore their five senses whilst developing early 'working scientifically' skills.

Core Knowledge Outcomes:

- Identify, name, draw and label the basic parts of the human body.
- Say which part of the body is associated with each sense
- Sight - in order to see objects we need light, so the opposite is true: without light (pure darkness) we cannot see things. Light is reflected off objects. The brain then makes sense of the signals sent from the eye to tell us what we can see.
- Taste - Humans have taste buds. When we eat, the food rubs against the taste buds which send messages to the brain to tell us what the taste is. There are five tastes: sweet, sour, bitter, salty and umami (savoury, e.g. fish, mushrooms, yeast). Sight and smell also play an important part in taste. If we remove smell, the taste changes
- Touch - When we touch something, the nerves in our skin send messages to our brain which tells us whether something is hot or cold and what it feels like, such as sharp or sticky. We also sense pressure – something pushing against our skin.
- Hearing - Sound is made when something moves or vibrates. Just as with light having a source, there are sources of sound. If you hit a drum, the part you hit (the skin) vibrates. This in turn vibrates (shakes) the air next to the drum, until all the air in your ear is also vibrated

Working Scientifically Outcomes:

- Observe closely, using simple equipment.
- Identify and classify.
- Gather and record data to help in answering questions

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What is a skeleton and can we name the different parts of the body?
KQ2: Which body part do we associate with sense of smell and how can we measure the strength of smell?
KQ3: Do my other senses affect my sense of taste?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Which part of our body is associated with sight and how do eyes in animals differ from humans?
KQ5: What parts of our body do we associate with the sense of touch?
KQ6: How does the shape of our ear help us to locate the source of a sound?
End of Unit Assessment: Rising Stars

Year 1
Autumn 2: Celebrations: Light, Sound & Plants

Unit Intent:
In this unit, children will learn about different materials and their uses, the beginnings of light and shadows and which parts of a plant are linked to food whilst developing early 'working scientifically' skills.

Core Knowledge Outcomes:

- Say which part of the body is associated with each sense.
- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock.
- Describe the simple physical properties of a variety of everyday materials.
- Identify and describe the basic structure of a variety of common plants, including trees.
- Shadows- children are not required to know that light travels in straight lines, even though it is an important and helpful idea. Because of this, when it hits an object, e.g. a child, light cannot get through, so the area behind is less well-lit and a shadow is formed. The shadow is the same shape as the object (the child) blocking the light.

Working Scientifically Outcomes:

- Observe closely, using simple equipment.
- Identify and classify.
- Perform simple tests.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What does darkness look like?
KQ2: How can we create a shadow?
KQ3: What sounds do different materials make?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Which material is the best to make a drum?
KQ5: Which part of a plant does food come from?
KQ6: Which parts of a plant do we eat?
End of Unit Assessment: Rising Stars

Year 1
Spring 1: Polar Regions

Unit Intent:
In this unit, children will plan an expedition to the polar regions, learning about properties of different materials, and a range of living things in the polar regions.

Core Knowledge Outcomes:

- Identify and name a variety of animals including fish, amphibians, reptiles, birds and mammals.
- Identify and name common animals that are carnivores, herbivores and omnivores.
- Describe and compare the structure of a variety of common animals.
- Describe the simple properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple properties.
- Keeping warm- A good insulator is air and many of the materials used in clothing, particularly coats, trap air in the material as does wearing layers of clothing. Polar explorers need clothing that will keep the body warm (especially their fingers and toes), that is light and comfortable and that allows the wearer to move around easily.
- Camouflage- Animals use camouflage to hide themselves from predators so they are not eaten, and also to hide from their prey so they cannot be seen by the animal they want to eat. Animals can camouflage themselves using colour, the shape of their body or behaviour. For example, a polar bear is white and therefore camouflaged against the snow.
- The BAS- The British Antarctic Survey (www.bas.ac.uk) provides excellent information about living and working in Antarctica. The site explains that generally the food is the same as that eaten at home, but fresh food is limited so most is frozen, dried or tinned. People working there either eat at the Research Station or take food with them on expeditions. They are limited to what they can carry, so most food is dried so that only water is needed to create a meal.

Working Scientifically Outcomes:

- Ask simple questions and recognise that they can be answered in different ways.
- Perform simple tests.
- Identify and classify.
- Use their observations and ideas to suggest answers to questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What would we need to go on an adventure?
KQ2: How would you test gloves to find out which were best for a polar explorer to wear?
KQ3: Am I a herbivore, carnivore or omnivore?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How do animals adapt to their surroundings?
KQ5: How can we use a hand lens to help us observe changes?
KQ6: What changes can we observe?
End of Unit Assessment: Rising Stars

Year 1
Spring 2: Plants and Animals

Unit Intent:

In this unit, children explore their local environment (school grounds or local park) to find out about the plants and animals that live in their locality. Children will learn to name and identify common wild and garden plants, including trees, so they are familiar with common names and able to use these in Year 2 and beyond. This topic can also be linked to activities in the Seasonal changes.

Core Knowledge Outcomes:

- Plants
  - Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. Identify and describe the basic structure of a variety of common flowering plants, including trees.
- Animals (including humans)
  - 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).

Working Scientifically Outcomes:

- Ask simple questions and recognise that they can be answered in different ways.
- Observe closely, using simple equipment.
- Perform simple tests.
- Identify and classify.
- Use their observations and ideas to suggest answers to questions. Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Which plants and animals live here?
KQ2: What are the differences between deciduous and evergreen trees?
KQ3: How are leaves similar and different?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How can we record data on a tally chart?
KQ5: How can we encourage more birds to visit our local environment?
KQ6: Which group does the animal belong to?
End of Unit Assessment: Rising Stars

Year 1
Summer 1: On Safari

Unit Intent:

In this unit, children will learn about and explore invertebrates and other plants and animals in the local area.

Core Knowledge Outcomes:

- Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.
- 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).
- 'Invertebrates' is the correct scientific word. Particularly since it helps them to learn that a vertebrate has a backbone (goldfish, robin, dog, cat, human) and invertebrates do not have a backbone. This is a basic classification that children will need to use as they move through the primary

years. Remember that invertebrates is the collective name for animals without vertebrae and insects are a subset of that group: they have three parts to the body, six legs and usually two pairs of wings.

Working Scientifically Outcomes:

- Ask simple questions and recognise that they can be answered in different ways.
- Observe closely, using simple equipment.
- Perform simple tests.
- Identify and classify.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Minibeast, bug or invertebrate?
KQ2: Where do invertebrates live?
KQ3: How can I use a hand lens to look closer at an invertebrate?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Is a snail an insect?
KQ5: What do we know about invertebrates?
End of Unit Assessment: Rising Stars

Year 1
Summer 2: Holidays

Unit Intent:

In this unit, children will plan what they need to pack for a holiday, and explore the different animals they might encounter at the seaside and the human impact on the environment.

Core Knowledge Outcomes

- 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 or omnivores.
- Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).
- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials including wood, plastic, glass, metal, water and rock.
- Describe the simple physical properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.

Working Scientifically Outcomes

- Ask simple questions and recognise that they can be answered in different ways.
- Observe closely, using simple equipment.
- Perform simple tests.
- Identify and classify.

- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How do we keep safe in the sun?
KQ2: How can we keep our water cool on a hot day?
KQ3: What materials are best to make sunglasses?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How can I classify marine and seashore animals?
KQ5: Why do some animals have shells?
KQ6: Why is litter not a good thing at the beach and in the sea?
End of Unit Assessment: Rising Stars

Year 1
Throughout the year: Seasonal Changes

Unit Intent:
In this unit, children will learn about seasonal changes.

Core Knowledge Outcomes

- Observe how the world changes across the four seasons (Autumn, Winter, Spring, Summer)
- Describe some physical changes in the environment across the four seasons (e.g. leaves falling, buds on trees, flowers develop, fruits form)
- Demonstrate knowledge of a wider range of weather associated with each season e.g. winds/ showers/storms/frost/drought)
- Demonstrate an understanding of how the length of day varies across the four seasons

Working Scientifically Outcomes

- Observe closely, using simple equipment.
- Identify and classify.
- Gather and record data to help in answering questions

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What seasonal changes are associated September and October?
KQ2: What seasonal changes are associated November and December?
KQ3: What seasonal changes are associated January and February?
KQ4: What seasonal changes are associated March and April?
KQ5: What seasonal changes are associated May and June?
KQ6: What seasonal changes are associated July and August?

Year 2

Year 2 Autumn 1: Healthy Me
Unit Intent: In this unit, children will explore the importance of exercise, diet and good hygiene, building on the Who am I? topic from Year 1.
Core Knowledge Outcomes • Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. • Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. • Children need to be helped to make healthy eating choices. We can do this by teaching children that eating too much sugar, fat and salt can affect out health. • Children need a balanced diet, so that, when they get older they don't have problems with joints and hearts etc. Many foods have a lot of sugar in them, however it must be hard for children to understand how much sugar they can eat a day. You could show or give children sugar cubes, then show a snack such as a bowl of ice cream and sauce and put eight sugar cubes next to it, or eight teaspoons of sugar; and an apple, with no sugar cubes. • Hands on and visual clues such as this will help children to understand how much sugar is in their food, and help them make decisions. One sugar cube = one teaspoon of sugar, = approximately four grams.
Working Scientifically Outcomes • Observe closely. • Perform simple tests. To Identify and classify. • Use observations and ideas to suggest answers to questions. • Gather and record data in answering questions.
Sequence of Learning (Key Questions/Key Assessment) **KQ1:** How do we keep fit? **KQ2:** How does exercise help me? **KQ3:** How can we keep ourselves safe when we exercise? **Mid-Unit Assessment -** Low-stakes quiz to inform T & L **KQ4:** Why is food so important for humans? **KQ5:** Which snacks are the healthiest for us to eat? **KQ6:** How can we stop the spread of germs? **End of Unit Assessment:** Rising Stars

Year 2
Autumn 2: Materials

Unit Intent:
In this unit, children will explore the properties and uses of everyday materials, set in the context of meeting, talking to and feeding the Materials Monster.

Core Knowledge Outcomes

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Working Scientifically Outcomes

- Observe closely.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: In what ways can we sort materials?
KQ2: What are the properties of different materials?
KQ3: Why do we use different materials for different purposes?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Would we make a teapot out of chocolate? Why?
KQ5: What happens when we squash different materials?
KQ6: Can we find the most suitable material for a purpose?
End of Unit Assessment: Rising Stars

Year 2
Spring 1: Materials and their Properties

Unit Intent:
In this unit, children explore how the shapes of objects can be changed by squashing, bending, twisting and stretching. In doing this they raise questions, perform simple tests, and gather and record data.

Core Knowledge Outcomes:

- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Working Scientifically Outcomes:

- Observe closely.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How can we use our bodies to change shapes by twisting and squashing?
KQ2: Do we use a push or pull force when stretching and squashing?
KQ3: What happens when you squash, bend, stretch and twist a balloon?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Which sock is the stretchiest?
KQ5: How easy is it to stretch and squash to make a model character?
KQ6: How can we make objects travel through the air by squashing materials?
End of Unit Assessment: Rising Stars

Year 2
Spring 2: Our Local Environment - Microhabitats

Unit Intent:

This topic brings together study of living things, habitats and growing plants and is strongly focussed on outdoor learning and investigations.

Core Knowledge Outcomes:

- Explore and compare the differences between things that are living, dead, and things that have never been alive.
- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.
- Identify and name a variety of plants and animals in their habitats, including micro-habitats.
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.
- Living things- Our environments are full of things that are living, dead and things that have never been alive. In order for something to be classified as alive, there are certain things that it needs to do. At Year 2 this must be communicated in simple terms, as it can be a difficult concept to grasp. Basically, living things are able to move, breathe, grow, reproduce (in humans, babies), get rid of waste (in humans, 'wee' and 'poo') and eat. They also need to be able to know when something changes, e.g. gets colder, warmer (sensitivity). These ideas are more difficult to understand with plants, because we cannot see them move, breathe, get rid of waste or make their own food. It is much easier for children to recognise these things in themselves, their pets and animals in the locality.
- Food chains- Simple rules for food chains are:
    - A food chain tells us who eats who.
    - Food chains do this by using arrows.
    - The arrows means 'is eaten by', so (below) the plant is eaten by an animal, which is eaten by another animal.

Working Scientifically Outcomes:

- Ask simple questions and recognise that they can be answered in different ways.
- Observe closely, using simple equipment.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What does it mean to be alive, dead and never been alive?
KQ2: How can we define a habitat?
KQ3: Which animals live in which habitats and micro-habitats?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What does a plant or animal need in a habitat to survive?
KQ5: What is a food chain?
KQ6: Where do we fit into a food chain?
End of Unit Assessment: Rising Stars

Year 2
Summer 1: Young Gardeners

Unit Intent:

This topic brings together study of living things and habitats and is strongly focussed on outdoor learning and investigations.

Core Knowledge Outcomes:

- Observe and describe how seeds and bulbs grow into mature plants.
- Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.

Working Scientifically Outcomes:

- Ask simple questions and recognise that they can be answered in different ways.
- Observe closely, using simple equipment.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What is growing in our school grounds?
KQ2: What shall we grow?

KQ3: What do seeds need for germination?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What do plants need to grow?
KQ5: What are the best conditions for a flower to grow?
KQ6: What are the best conditions for a flower to grow?
End of Unit Assessment: Rising Stars

Year 2
Summer 2- Animals - Survival

Unit Intent:
This topic explores food, including making healthy food choices, and cooking various different foods

Core Knowledge Outcomes:

- Find out about and describe the basic needs of humans for survival (water, food and air).
- Describe the importance for humans of eating the right amounts of different types of food, and hygiene.
- Observe and describe how seeds and bulbs grow into mature plants.
- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.

Working Scientifically Outcomes:

- Observe closely.
- Perform simple tests.
- Identify and classify.
- Use observations and ideas to suggest answers to questions.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What do humans need to survive?
KQ2: What is a balanced diet?
KQ3: How can we make sure that we eat healthily?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What does it mean to have a healthy, balanced diet?
KQ5: How can we keep our food fresh?
End of Unit Assessment: Rising Stars

Year 2
Throughout the year: Seasonal Changes

Unit Intent:

In this unit, children will learn about seasonal changes.

Core Knowledge Outcomes:

- Observe how the world changes across the four seasons (Autumn, Winter, Spring, Summer)
- Describe some physical changes in the environment across the four seasons (e.g. leaves falling, buds on trees, flowers develop, fruits form)
- Demonstrate knowledge of a wider range of weather associated with each season e.g. winds/ showers/storms/frost/drought)
- Demonstrate an understanding of how the length of day varies across the four seasons

Working Scientifically Outcomes:

- Observe closely, using simple equipment.
- Identify and classify.
- Gather and record data to help in answering questions

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What seasonal changes are associated September and October?
KQ2: What seasonal changes are associated November and December?
KQ3: What seasonal changes are associated January and February?
KQ4: What seasonal changes are associated March and April?
KQ5: What seasonal changes are associated May and June?
KQ6: What seasonal changes are associated July and August?

Year 3

Year 3
Autumn 1: Rocks, Soils and Fossils

Unit Intent:

In this topic children work scientifically on a variety of quick investigations and longer tasks to learn about rocks. This topic covers the properties and uses of rocks, the rock family, soils and finally fossils.

Core Knowledge Outcomes:

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock.
- Recognise that soils are made from rocks and organic matter.
- The Earth can be divided into three main layers: the core, mantle and crust. Rock is a natural material that is found in the Earth's crust. The Earth is at least 4800 million years old and the oldest rock is about 4000 million years old. The age of a rock can be judged by radioactive decay and nearby fossil types. Younger rocks are usually on top of older ones.

- Rocks- There are three main types of rock formation: sedimentary, igneous and metamorphic.
    - Sedimentary rocks are formed when sediment / rock is deposited from air, ice, wind or water (where the sediments are suspended in the water). These build up in layers. This is called sedimentation; hence the name. As the layers build up, water is squeezed out and the sediments are 'cemented' together. Chalk, shale, limestone and sandstone are all examples of sedimentary rock. Sedimentary rock contains fossils.
    - Igneous rocks begin as molten magma (liquid rock) from inside the Earth. As the magma moves towards the surface it cools; the faster it cools the smaller the crystals (e.g. if it flows into water). Obsidian, which looks glassy, is an example of this. If the lava cools slowly the crystals are larger, e.g. granite. Igneous rocks do not contain fossils because the heat would have melted them.
    - Metamorphic rocks are rocks that have been changed by heat or pressure; the word morph means change. The rocks are heated (but not melted like igneous) or changed during great earth movements where rocks are squeezed and put under enormous pressure. Both sedimentary and igneous rocks can be changed in this way and that is why metamorphic rocks usually do not contain fossils.
- Different rocks can be identified by their properties, e.g. colour, texture, hardness and permeability. The study of rocks is geology and people studying rocks are called geologists.
- Rocks come in different sizes and there are lots of everyday words used for them, e.g. boulder, stones, pebbles, gravel and sand. Rocks can be weathered by the effect of: temperature, e.g. freezing and thawing; wind blowing tiny grains of rock (sand) against rock wearing it away; rain and waves.
- Many rocks have different uses such as slate for roofs, marble as floor tiles, chalk in schools, toothpaste and polish and granite for buildings, paving stones and bridges.
- Minerals from rocks are found in breakfast cereals (iron and zinc), bread (limestone), ice creams and cheese (gypsum). Salt is dissolved from rocks and even water contains minerals from rocks.
- Soils- Soil is formed by weathering, which breaks the rocks into small particles of rock / mineral that are then mixed with dead and decaying plants and animals (humus) as well as water and air.
- Soil helps to support plant life by providing plants with nutrients, water and air. It keeps plant roots in the ground.
- The characteristics of the soil depend on the rock it is formed from. There are different kinds of soil, e.g. clay, sandy soil, loam. Clay soil has very small particles which can hold water. It is sticky to the touch when wet, but smooth when dry. Sandy soil has the largest particles. It feels dry and gritty and water drains through it quickly. Loam is a soil that is a mix of different soils and it is high in humus (decaying plants and animals) so it is popular with gardeners. Different plants grow better in different types of soil.
- Fossils- Fossils are the prehistoric remains of plants or animals that have been preserved, usually by being buried under layers of mud or sand which are then changed into sedimentary rock. Fossils can also be made when animals and plants are frozen in ice or become stuck in tree resin that hardens to form amber.
- A palaeontologist studies fossils and palaeontology is the study of fossils. By studying fossils palaeontologists can learn a lot about the environment in which the plant or animal lived and their relationships with other living things. They can also see how living things have evolved, which is why children return to fossils in Year 6.

CHILDREN'S MISCONCEPTIONS:

- that all rocks are large, heavy and jagged.
- that rocks are made of one substance: in fact, some rocks contain crystals and are made of more than one mineral.
- that concrete is a rock.
- that fossils are actual animals and plants.
- that only bones can be fossils.
- that humans can make rocks: in fact, rocks are naturally occurring.
- that rocks form when pebbles stick together: in fact, pebbles are fragments of rock.

- that all sedimentary rocks form under water: in fact, they can be formed on land, e.g. desert sandstone.

Working Scientifically Outcomes

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Are all rocks the same?
KQ2: Permeable or impermeable?
KQ3: What are sedimentary, igneous and metamorphic rocks?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What is soil?
KQ5: Are all soils the same?
KQ6: What is a fossil?
KQ7: How are fossils formed?
End of Unit Assessment: Rising Stars

Year 3
Autumn 2: Food and our bodies

Unit Intent:

In this unit, children work scientifically on a variety of quick challenges and longer tasks to learn about food and their bodies. This topic looks at where animals get food from and why it is important, and skeletons, muscles and joints.

Core Knowledge Outcomes:

- Identify that animals, including humans, need the right types and amount of nutrition and that they cannot make their own food: they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.
- **Nutrition-** The basic needs of all humans and other animals are food, water, oxygen and shelter. Unlike plants, which make their own food by photosynthesis, animals (including humans) cannot make their own food. Instead, they have to get their food by eating plants or other animals.
- Humans need to eat regularly and eat different kinds of food to stay healthy. The food that humans eat can be divided up into different groups. There are various ways of doing this, but we recommend you use the following groups:
    - Fruit and vegetables are a good source of vitamins and minerals and fibre that helps people to go to the toilet. They are also low in fat and calories.

- Starchy foods, e.g. bread, rice, potatoes, pasta and cereals should make up just over a third of the food we eat. They are a good source of energy, fibre, calcium, iron and B vitamins. Where possible, people should eat wholegrain bread, rice and pasta.
- Dairy food, e.g. milk, cheese and yoghurt, is a good source of protein and calcium. Our bodies need protein to work properly and to help the body repair itself. Calcium helps to keep our bones and teeth strong.
- Meat, fish, eggs, beans, pulses and nuts help the body to grow. They are rich in protein for healthy bones, zinc for hair, nails and eyes and fish is good for keeping the heart healthy.
- Fat and sugar are needed in small amounts. Fats are important as they provide the body with energy and help the skin and brain. They help the body to absorb different vitamins such as A, K and D. At the same time, fats act as insulation to help keep humans warm. Sugar is a source of energy but it should not make up more than around 5% of calorie intake because excess sugar can lead to tooth decay, type 2 diabetes and other health issues.
- Water is essential to life; without water humans and other animals would die. In humans, the body needs water to work; blood needs water. We need water to digest our food and remove waste in urine. Thirst is a sign that the body is dehydrated so we need to keep hydrated and drink water, milk and eat fruit and vegetables but avoid sugary drinks.

- **Skeletons-** The skeleton is a strong, rigid structure inside the body made of bone. Bone is living tissue made from bone cells, collagen and minerals such as calcium phosphate. The bones of our skeleton provide us with a strong structure supporting and protecting the rest of the body.
- The ribs form a protective structure around the heart and lungs; the skull protects the brain.
- Inside bone is a spongy tissue called bone marrow, which is where red blood cells are made. Bone needs a blood supply, just like every other tissue in the body. Bones are joined together by strong elastic groups of fibres known as ligaments.
- Cartilage is the elastic, slippery protein covering the ends of bones at joints, allowing them to move freely. Noses and ears are made from cartilage and some fish, such as sharks, have whole skeletons made of it.
- We are born with around 300 bones, but as we get older some of these fuse together into large bones. So, by the time we are adults, we only have 206 bones.
- Some creatures such as crabs, lobsters and insects have a tough external skeleton, or exoskeleton. However, this is often made from a protein called chitin.
- **Muscles and joints**-Joints are the places where bones meet. They allow the skeleton to move and allow humans and other animals to grow. There are various types of joint, each allowing different types of movement:
  - Sliding joints like the ankle and wrist allow for limited rotation at the joint.
  - Fixed joints are fixed and do not allow movement, such as the joints between the various bones in the skull.
  - Ball and socket joints have a rounded end that fits into a cup-like cavity on another bone, e.g. hip and shoulder joints.
  - The elbow and knee are simple hinge joints, allowing basic movement in a single plane, e.g. backwards and forwards.
- Bones are moved using muscles. These muscles are attached to bones by tendons – strong, inelastic strips of tissue. Muscles can contract and get shorter; this pulls on the tendon and makes the bone move. They work in pairs; one muscle contracts and pulls in one direction, then another contracts and pulls back while the original muscle relaxes. Muscles do not always attach to bone; some do things such as move the eyes. The heart is a ball of muscle, a muscular organ, which pumps blood around the body.
- The smallest muscle in the human body is the stapedius; it is a tiny muscle that is less than 2 mm long located in the middle ear. The largest and strongest is the gluteus maximus, which children will enjoy learning about because it is the buttocks / bottom.

CHILDREN'S MISCONCEPTIONS

- that we only eat food to give us energy: in fact, food does much more, including providing the vitamins and nutrients we need to keep our bodies healthy.
- that all fats are bad for us: we need a certain amount of fat in our diet for many different reasons including building cells, helping nerves carry messages, protecting our organs and heat insulation to keep us warm.
- that bone is not living and cannot grow: in fact, it is made from living cells. That is why bone can heal itself if it is broken or fractured.

- that only arms and legs have muscles.
- that muscles are not found all over the body.
- that muscles can push: in fact, they can only pull, but our bodies can push things because of the way the muscles pull on different bones.

Working Scientifically Outcomes:

- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar graphs and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What do humans and other animals need to survive?
KQ2: Which food groups do I eat?
KQ3: What would happen if we didn't have a skeleton**?**
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How does our skeleton protect our vital organs?
KQ5: Why is your heart the hardest working muscle in your body?
KQ6: How does the arm muscle work?
End of Unit Assessment: Rising Stars

Year 3
Spring 1: Light and Shadows

Unit Intent:

In this unit, children will work scientifically on a variety of quick challenges and longer tasks to learn about the wonders of light, including reflections and shadows.

Core Knowledge Outcomes:

- Recognise that we need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the Sun can be dangerous and that there are ways to protect the eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the sizes of shadows change.
- We need light to see. The Sun, fire, electric light and torches are all sources of light. The Moon is not a source of light because it reflects sunlight. Darkness is the absence of light, but few children experience 'darkness' because of street lighting, night lights, etc.
- We see objects that are not the light source because the light source hits them, is reflected off and then travels to our eyes. Often the light has bounced (been reflected) off several objects before it enters our eyes. Different materials reflect light by different amounts. Dull materials scatter light and do not reflect very well. Shiny objects, such as mirrors, reflect light extremely well. When light strikes a mirror, it is reflected at the same angle as it hits the mirror: we call these two angles the angle of incidence and reflection.

- Scientists use the shorthand of straight lines to represent how light travels. This unit provides the opportunity for children to draw diagrams of how light is reflected off surfaces. In Year 3 it will suffice to just draw straight lines. High attainers can add one arrow to the centre of each line to show the direction of travel (which is a feature of Year 6 work).
- Shadows are formed when some rays of light continue to travel in straight lines, while other rays are stopped by an object. Objects that do not let light through them are called opaque: these objects make dark shadows.
- Objects that let a little light through, such as bathroom windows, are called translucent objects and they form shadows that are not as dark.
- Objects that let all or nearly all light through, such as water or clear plastic film, are called transparent. They can make a very faint shadow because they might block a little light, or no shadow at all if they let all the light through.
- **Mirrors-** We see objects because light rays enter our eyes after bouncing off the objects. This bouncing of light off objects is known as reflection. Objects that have a rough surface do not reflect light well; they scatter it and we cannot see ourselves in them. Objects that are very smooth and shiny reflect light well and we can see images, reflections. Most mirrors are made from a smooth piece of glass with a silvery coating at the back of it.
- There are different kinds of mirrors: if you look into a plane mirror the image is the same size as the object and the same way up. A concave mirror has a surface that bulges inwards and the image can make a person look smaller and upside down. A convex mirror has a surface that bulges out and the image is usually the right way up but larger.

CHILDREN'S MISCONCEPTIONS

- that light is only found when a light is switched on.
- that they can see things because light comes out of their eyes and hits an object.
- that shadows are not related to the object that causes them: in fact, every shadow must be cast by an object.
- that shadows are the reflections of objects: in fact, they are caused when light is blocked.
- that shadows are dark light: in fact, they form because of the absence of light. No light is dark.
- that only mirrors make reflections: in fact, you can see your reflection in many shiny materials.
- that all reflections in mirrors are exactly like the object: in fact, concave and convex mirrors distort images, making them look bigger or smaller.
- that the image in a mirror is on the surface: in fact, the mirror simply reflects light into your eyes.

Working Scientifically Outcomes:

- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment including thermometers and data loggers.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What causes darkness?
KQ2: How do mirrors work?
KQ3: What happens to a shape when we change the position of a mirror?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How do mirrors reflect objects?
KQ5: Which material is best for making shadows?
KQ6: How can we change the size of a shadow?

End of Unit Assessment: Rising Stars

Year 3
Spring 2: How Does a Garden Grow?

Unit Intent:

In this unit, children will work scientifically on a variety of quick challenges and longer tasks to learn about plants. They learn about the different parts of plants, what plants need to live, water transportation in plants and pollination.

Core Knowledge Outcomes:

- Identify and describe the functions of different parts of flowering plants: roots, stem / trunk, leaves and flowers.
- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant.
- Investigate the way in which water is transported within plants.
- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
- The main parts of a flowering plant are: roots, stem, leaves, flower.
- The roots of a plant anchor it into the soil. They absorb water and any dissolved nutrients. These are then transported to the rest of the plant via bundles of tubes inside the stem called vascular bundles.
- The stem is the main support structure of the plant, allowing it to stay upright and providing a frame for the leaves. In many plants the stem is also a place where nutrients can be stored.
- For plants to grow healthy they need a number of things, such as:
    - water
    - light
    - air
    - sufficient space
    - a supply of minerals and other nutrients.
- Plants do not need soil to grow, as long as they get a suitable supply of minerals and nutrients. In fact, in many modern commercial greenhouses plants are grown in a nutrient-rich liquid instead of soil. This growing technique is called hydroponics.
- It is important to be aware that there's a difference between what seeds need to germinate and what plants need to grow. Seeds just need warmth and water to germinate, they do not need light. They initially grow using the food stores within the seed. If they do not get any light before these stores are used up, then they can die.
- The leaves are where the plant makes its food. They take in carbon dioxide from the air and water from rain, converting them into oxygen and a sugar called glucose. Leaves also get energy from the Sun, capturing it using a green chemical known as chlorophyll. This whole process is called photosynthesis.
- Water moves upward to the top of the plant through long, thin tubes running up from the roots through the stems and leaves called xylem. Water moves up the xylem through a process called capillary action. Capillary action is the name of the process when liquids, like water, move up through a solid, like a hollow tube or spongy material. At this stage children do not need to know terms such as xylem or capillary action. When discussing how water is transported in a plant use the word moves and avoid suggesting the plant sucks up water (as a human sucks up water from a straw).

- Flowers are the reproductive organs of the plant. They produce pollen and eggs, which then produce seeds that the plant then disperses (spreads away from the plant) so new plants can grow.
- **Plant reproduction**- Flowering plants reproduce sexually. Most flowers have both male and female parts. The male parts produce the pollen and the female parts produce the ova (eggs). Both the pollen and eggs contain half the genetic information necessary to make a new plant, in the same way that sperm and eggs do in animals.
- Plants cannot pollinate their own flowers; instead, they need to get their pollen to the flowers of their own plant or of another plant. Often this is carried by insects, but plants can also disperse their pollen into the wind. When pollen lands on the stigma of another flower, it joins with the egg and their DNA combines. The egg is now fertilised. This will happen many times with all the eggs in the ovary.
- Each egg develops into a seed and, as this happens, the flower will change and lose its petals. The ovary swells up and turns into a structure known as a fruit. In some plants the fruit is attractive to animals who then eat it, carrying the seeds inside their body until they go to the toilet elsewhere where the seeds can then grow. Other seeds are dispersed on the wind, via water or other methods.
- Remember: Stamen = 'men' = male. Stigma = 'mama' = female.

CHILDREN'S MISCONCEPTIONS

- that plants get their food through their roots: in fact, they take in water and some minerals through the roots, but make their food in their leaves.
- that trees are not plants: they are.
- that mushrooms are plants: they are not; they are fungi.
- that plants get their food from the soil: plants make their own food, but the roots help them get water, minerals and nutrients that help them grow.
- that seeds need light to germinate: this is not true as, they just need water and warmth. There's enough food stored inside the seed to provide the energy it needs to produce a shoot and roots.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What do all plants have in common?
KQ2: How can water get all the way up to the top of a tall tree?
KQ3: What do I want to know about plants?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Why do you need to water your plants in the garden during the summer, but not over the winter?
KQ5: Why is pollination so important to gardeners and farmers?

KQ6: The number of bees is falling. Why might this affect all of us?
End of Unit Assessment: Rising Stars

Year 3
Summer 1: Forces and Magnets

Unit Intent:

This topic looks at magnets and their uses, and what makes magnetic poles special, along with the idea that some forces such as magnetic force can act without contact – unlike pushes and pulls, which require direct contact.

Core Knowledge Outcomes:

- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials.
- Describe magnets as having two poles. Predict whether two magnets will attract or repel each other, depending on which poles are facing.
- A magnet is a material or object that produces a magnetic field. This magnetic field is invisible but produces a force that pulls on only a few other metals, most notably iron, and attracts or repels other magnets. The name points to the very earliest discovery of magnetic materials in Ancient Greece: the word 'magnet' in Greek meant 'stone from Magnesia'. These lodestones were naturally magnetised pieces of iron ore that attracted other pieces of iron.
- Magnets produce a magnetic force. The area around the magnet where the force can be detected is called a magnetic field. A magnetic field is strongest at the ends of a bar magnet, which are called poles. Horseshoe magnets also have poles at the two ends. Circular magnets have the poles at the top and the bottom.
- Magnets have north poles and south poles. The north and south poles of bar magnets always attract each other. Two north or south poles always repel. This is summed up in the rule 'like poles repel, unlike poles attract'. So, when two magnets are close, they create pushing or pulling forces on one another. These forces are strongest at the ends of the magnets.
- The idea that magnets have poles comes from the observation that, if a bar magnet is allowed to swing on a pivot, it always comes to rest facing the same direction at a particular point on the Earth. This is because the magnet is affected by the Earth's magnetic field.
- The Earth acts as if it is a large bar magnet with a north and south pole. It is not a bar magnet, it just acts as if it were. So, one end of a bar magnet is attracted to the Earth's North magnetic pole. In fact, this end of the magnet is a north-seeking pole and is called its north pole: it is actually a south pole because opposite poles attract. Confusing but true.
- Earth's North and South magnetic poles are not at the same point as the geographical poles. They are some way off. To complicate matters further, the poles constantly move.
- Iron is magnetic, so any metal with iron in it will be attracted to a magnet. Most other metals, like aluminium, copper or gold, are not magnetic. Magnets can only be made out of the metals iron, cobalt and nickel. The ones used in schools are called permanent magnets and retain their magnetism for a very long time if carefully looked after.
- Permanent magnets come in many different shapes and sizes. Industrial magnets are made by heating a piece of iron to a high temperature and then hammering it as it cools in a magnetic field. Children can make a magnet by stroking an existing magnet from one end to the other of an un-magnetised iron bar, nail or needle repeatedly in the same direction.

- Some iron alloys, e.g. steel, can also be made into magnets, although some stainless steel is not magnetic. Some 1p and 2p coins are attracted to magnets as they have a thin, copper coating over a steel disc. Those made before 1992 are magnetic; those made after are not! Most drink cans are made of aluminium and so are not attracted to a magnet. However, tin cans are attracted to magnets because they have a thin coating of tin over iron.
- In the investigation, children should find out that most materials are not magnetic.
- Children often find it difficult to understand the distinction between a magnet and the magnetic material. The difference can be easily illustrated in the following way. Show children what happens when two magnets are put together – they either attract or repel each other. Then show them what happens when a magnet is brought close to a magnetic material – it is always attracted.
- Magnets are used for many different things today. Everything that has an electric motor in it has a magnet. Compasses, speedometers, fridge magnets and Maglev trains all use a magnet as well.

CHILDREN'S MISCONCEPTIONS

- that magnets stick to objects because they have magical properties.
- that you can make a magnet out of all metals: in fact, they can only be made from iron, cobalt or nickel.
- that all metals are magnetic materials.
- that all silver-coloured items are attracted to a magnet: this is false, aluminium is silver but is not attracted.
- that larger magnets are stronger than smaller ones: this is also false, the size is not directly related.
- that magnetic field and gravity are somehow linked: they are not.
- that the Earth's magnetic pole is fixed: in fact, it is constantly moving.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: When do we use a push or pull force?
KQ2: How does the surface affect the way an object moves?
KQ3: Which magnet is the strongest?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Do magnets work through different materials?
KQ5: What is magnetism all about?
KQ6: Where are magnets used?
End of Unit Assessment: Rising Stars

Year 3
Summer 2: Consolidation - The nappy challenge

Unit Intent:

This topic looks at disposable nappies and provides opportunities for children to ask their own questions and make decisions on how to answer their questions using different scientific enquiry activities.

Core Knowledge Outcomes:

- **What is inside a nappy?** When a disposable nappy is taken apart, it can be seen to consist of a shaped pad covered in a soft liner and enclosed in a waterproof outer layer. The centre layer of the nappy is made from a mixture of wood pulp and cotton; these materials are used because they soak up (absorb) the baby's urine and retain the moisture in this layer so that the baby stays dry. In the very centre of this there are some small crystals; if you rub the centre part of the nappy over some black sugar paper, you may find that powder or small crystals drop out (absorbent polymers). If you have ever made fake snow using a white powder, you will know that the tiny crystals absorb (soak up) and retain moisture. So that any urine or faeces do not leak out, parts around the legs are elastic and the waistband is designed to be adjustable: usually the 'tabs' are made from plastic and are like Velcro.
- **Who invented disposable nappies?** An America woman named Marion Donovan is credited with inventing disposable nappies. She began designing in 1946 because she found the towelling nappies she used leaked through to her children's clothes. She began by using a shower curtain with a cloth nappy inside and used press studs to keep it together. Gradually she improved her design using paper that was strong and absorbent, but no one believed it was a good idea and it was not until 1961 that a man called Victor Mills used her idea to make Pampers. Disposable nappies are convenient. Some though would argue that they harm the environment; they make up around 4% of UK waste that goes into landfill. Parents use about 4–5 disposable nappies every day.
- **Other kinds of nappies** Other types of nappies are available such as cloth nappies and, more recently, bamboo nappies made from bamboo yarn that is said to be softer and more absorbent than a terry nappy. There are reusable nappies that have a throwaway liner inside a pair of waterproof baby pants that can be worn again.
- **How are nappies tested?** Nappies are tested by the manufacturer, mums' groups and Which? Magazine. These are the sorts of things they test.
  - 1. Absorption: the amount of urine (liquid) a nappy can hold.
  - 2. Rewet: after 5 minutes, is the surface of the nappy dry or wet?
  - 3. Leakage: if any urine or faeces leaks from the legs.
  - 4. Strength of the Velcro: how much force it takes to open a nappy and how many times the Velcro can be opened and sealed.
- **Who wears nappies?** Babies wear nappies, but so do astronauts (they are called 'Maximum Absorbency Garments'). Crew members on the Space Shuttle were given three disposable nappies because they would not be able to go to the toilet as the rocket was being launched or when it re-entered the Earth's atmosphere. They are also used when astronauts go outside on space walks. Some children and adults with medical problems also need to wear disposable nappies in the form of disposable pants.
- **Environmental impact** There are many arguments for and against both disposable and towelling nappies. One of the aims of primary science is to give children access to advantages and disadvantages so that they can engage in debate and understand that they have choices.

Disposable nappies	Towelling nappies
end up in landfill and can contaminate ground water result in human faeces going into landfill use resources to make them, e.g. trees and water use energy in the manufacturing process take hundreds of years to degrade use chemicals that can be irritants	use cotton that has to be grown, which includes use of fertiliser and transport use energy in the industry that makes nappies have to be washed so they use electricity, water and detergents

- The arguments for and against are not straightforward since disposable nappies are very convenient for parents to use and the nappy industry is working to reduce the environmental impact of its products.

Working Scientifically Outcomes:

- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Ask relevant questions and use different types of scientific enquiries to answer them.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Set up simple practical enquiries, comparative and fair tests.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What materials are used in a disposable nappy?
KQ2: What else do we want to know about a disposable nappy?
KQ3: How can we answer our questions?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Which properties make the nappy so successful?
KQ5: Are there more nappies thrown away each year than there are people living in the UK?
KQ6: Should disposable nappies be banned?
End of Unit Assessment: Rising Stars

Year 4

Year 4
Autumn 1: Sound

Unit Intent:

Children will already know many things about sound, even without any formal teaching of it. They will encounter how sounds are made on a variety of instruments and how they can be changed in volume, pitch and over distance. They will explore making sounds on a range of objects that aren't instruments, in order to investigate how sounds are created to make music.

Core Knowledge Outcomes:

- Identify how sounds are made, associating some of them with something vibrating.
- Recognise that vibrations from sounds travel through a medium to the ear.
- Find patterns between the pitch of a sound and features of the object that produced it.
- Find patterns between the volume of a sound and the strength of the vibrations that produced it.
- Recognise that sounds get fainter as the distance from the sound source increases.
- **Vibrations** Sound is produced by vibrations, even when it is hard to see them. The vibrations travel through the air and are detected by our ears. Within the ear is an ear drum which vibrates and turns the vibrations into signals to the brain, which then 'hears' the sounds. The speed of sound in air is approximately 340 m/s (metres per second). The denser the medium, the faster sound travels: for example, it travels faster through liquids than air, and even faster through solids. Sound will not travel through a vacuum, because sound needs particles to make the vibrations. No-one can hear anything in space. There is often a misconception regarding the terms 'sound' and 'noise'. Noise can be defined as unwanted sound.

- **Volume** The loudness (volume) of a sound depends on the size of the vibration: the bigger the vibration, the louder the sound. The greater the volume of air vibrating, the louder the sound will be. A large drum struck with the same force as a small drum will sound louder because the bigger drum can make more of the air move, simply by have a bigger 'skin' to vibrate. A vibrating tuning fork cannot be heard until the stem is placed on a table. This causes the table to vibrate very slightly, but there is a large volume of air in contact with it compared to the small volume of air in contact with the prongs of the tuning fork.
- **Pitch** Pitch refers to how high or low a sound is. A high-pitched sound has a high frequency. A low-pitched sound has a low frequency. Frequency is the number of vibrations per second. The pitch of a vibrating string depends on: The length of the string – the longer the string, the lower the pitch. The tension of the string – the tighter the string, the higher the pitch. The pitch of a vibrating air column (e.g. a bottle) depends on: The longer the air column, the lower the pitch. Whether the air column is open at one end or both ends. Other vibrations related to pitch: For striking a length of tubing, the shorter the tubing, the higher the note. For striking a glass bottle with different amounts of water in: the more water in the bottle, the more glass that can vibrate, so the lower the note.

CHILDREN'S MISCONCEPTIONS

- That 'noise' and 'sound' are the same.
- That 'volume' means how much liquid is there. It has two meanings, and this needs to be clarified with the children.
- That 'pitch' is related to a football playing field, or even a road covering.
- That 'volume' and 'pitch' are the same thing.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.
- Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How are sounds made?
KQ2: How can I change the volume and pitch of a sound?
KQ3: What is the link between the pitch of a sound and the object being played?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Is there any other way of hearing things louder without increasing the volume?
KQ5: Can you hear louder underwater or in the air?
KQ6: How can we muffle sounds?
KQ7: What have we learned about sound?
End of Unit Assessment: Rising Stars

Year 4
Autumn 2: Living Things

Unit Intent:

This topic teaches the children to recognise that living things can be grouped in a variety of ways. They explore and use keys to identify and name a variety of living things. Finally, they look at how changes to habitats can pose dangers to living things. Whilst most of the work for this topic can be carried out in spring and summer, it is important that children visit the local environment throughout the school year so that they continue to develop their understanding of seasonal changes and how these impact on living things.

Core Knowledge Outcomes:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose dangers to living things.
- There are millions of different plant and animal species in the world. It's currently estimated that there are around 1.3 million animal species (of which 1 million are insects!) and 320,000 plant species. We use the word 'species' to describe a group of living things that are so similar that they are able to interbreed to create a fertile offspring. Living things are divided into groups, with members of each group having similar features. The obvious first grouping is whether something is an animal or a plant (or fungus or microbe). Each time we divide the living things by particular characteristics, the groups become smaller, until we end up with the organism being identified. The process of classification makes it easier to identify a species when it is discovered, and to see whether it is an existing species or a new species. It can also help to see which species are closely related in evolutionary terms.
- **The animal kingdom** The animal kingdom can be divided into two broad groups based on whether they have a backbone (vertebrate) or not (invertebrate). The plant kingdom can also be divided into two group: flowering and non-flowering plants.
- **Invertebrates** Invertebrates are animals without backbones. They range from totally soft-bodied animals such as sponges and jellyfish, shelled animals such as mussels and barnacles to complex spiders and insects. Those with no skeleton at all and a body made of segments, e.g. earthworms, form part of a group called annelids. Other soft-bodied invertebrates are 'molluscs', which often have shells, such as mussels or snails. Some don't, such as octopus and squid. Myriapods (meaning 'many legs') have long, thin bodies with many segments and a hard exoskeleton (exo- meaning 'outside'). Centipedes have one pair of legs per body segment and can have between 20 and 300 legs. Millipedes have two pairs of legs per segment and can have between 36 and 400 legs – not the million legs that children think they have! The arachnids include spiders and scorpions. They have four pairs of legs and a two-part body. They have a hard exoskeleton which often forms lots of protective bristles. Insects are one of the most numerous groups on the planet, with over a million known species. Insects have a three-part body and three pairs of legs. Insects are the only invertebrates who are able to fly. This has played a major role in their success.
- **Vertebrates** The five groups of vertebrates are fish, amphibian, reptile, bird and mammal. Fish, reptiles and amphibians are cold-blooded. Amphibians have lungs which allow them to spend a lot of time out of water, but they return to water to lay lots of jelly-like eggs. Reptiles have dry scaly skin and live on land, where they lay their eggs – these look a lot like bird eggs. Mammals and birds are warm-blooded. Birds are covered in feathers and lay eggs with a hard shell. Mammals all have fur (or hair) – even if it is very fine, as in the case of whales and dolphins. They all give birth to live young and female mammals produce milk to feed them.
- **Flowering and non-flowering plants** Non-flowering plants include plants such as ferns and mosses. Conifers do not produce true flowers so are also considered non-flowering. They produce cones, which produce pollen and seeds in the same way as flowers. They are wind-pollinated. Ferns and mosses do not produce seeds – they reproduce by making, spores which can grow into new plants. Flowering plants include all other plants, including most trees, grasses and shrubs. They produce flowers, which produce pollen. Some flowers are adapted to attract insects for pollination, but other flowers use wind or water for pollination.

CHILDREN'S MISCONCEPTIONS

- That trees aren't plants.
- That insects aren't animals.
- That there are only two groups of living things: animals and plants.
- That all 'bugs' are insects.
- That all 'bugs' are small.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What is a classification key and how do we use one?
KQ2: How do scientists use classification keys?
KQ3: What living things can we find around our school?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What living things can we find around our school?
KQ5: Which different ways can we classify leaves?
KQ6: Bees- Friends or foes?
End of Unit Assessment: Rising Stars

Year 4
Spring 1: States of Matter

Unit Intent:

Children will learn about states of matter. They will compare and group materials together, according to whether they are solids, liquids or gases. They will observe that some materials change state when heated or cooled, and they will identify the part played by evaporation and condensation in the water cycle.

Core Knowledge Outcomes:

- Compare and group materials together, according to whether they are solids, liquids or gases.

- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.
- A material may exist in three states: solid, liquid, and gas. The state that a material is in depends on the temperature. Water, for example, is in its solid state (ice) at 0°C or below, liquid state (water) between 0 and 100°C and, at temperatures of 100 °C and above, water exists in the gas state, as steam. It is unique in having different names for each state of matter.
- When a sample of a material is in the solid state, you can hold it in your hands. You can form it into a pile. It is not easy to change the shape of a material in the solid state. You may question this: a sponge is a solid. You can squash a sponge, but it is the air you are 'squeezing', not the sponge itself.
- When a material is in the liquid state, you cannot hold it in your hands. It forms a pool, not a pile. Liquids take the shape of the bottom of the container they are in. Another misconception would be about sand being a solid but it runs through your fingers. You need to consider each grain as a tiny solid.
- In the gas state, a material escapes from an unsealed container. It spreads out to fill all the space available, and takes the shape of the entire container.
- When a sample of a material melts, it turns into a liquid, because heat has been applied. Pure water melts at 0°C and gold melts at 1064°C. You can tell a material is melting if, when taking in heat, it is present in both its solid and liquid states, such as an ice cube with a pool of water present.
- Pure water and gold melt very suddenly because they are pure substances. The melting point of a substance is the same, however big the sample. Margarine and chocolate are mixtures of substances. For this reason, they do not have sharp melting points, but melt over a range of temperatures.
- The reverse of this change of state, i.e. from liquid to solid, is called freezing. When cooled, a pure substance in its liquid state freezes when it reaches a certain temperature, which is also its melting temperature. It will remain at this temperature until all the liquid has frozen. The temperature at which a particular material freezes does not change no matter how much material is present. As with melting, it is only the time taken for the change to occur that increases with an increase in the amount of material.
- A mixture of salt and water freezes at a lower temperature than pure water. This means that lower temperatures can be achieved by mixtures of ice and salt than by ice alone. This principle is the reason for salting roads in winter.
- Evaporation can happen at any temperature. The higher the temperature, the faster a material evaporates.
- Evaporation is speeded up if moving air carries the particles away from the surface of the liquid. It is evaporation that dries wet clothes, and that dries the wet kitchen paper in the investigation in this unit.
- Boiling occurs throughout a material in the liquid state. Bubbles rise to the surface, where they escape to the air.
- A material can change from the gas state to the liquid state by condensing. Condensing happens at any temperature below the boiling point, but happens most readily at cold temperatures.
- These processes are linked in the water cycle.
- The Sun heats up a water source so that particles of water escape (evaporation takes place). The vapour rises and cools, or the vapour condenses into droplets. These gather together to form clouds, which it drops as rain once there is too much water for them to hold. Rain fills streams and rivers and other water sources so that the process continues in a cycle.
- Sometimes, water droplets in the atmosphere freeze to form tiny ice crystals. These tiny ice crystals may collide and stick together in clouds to form snowflakes. If the snowflakes get heavy enough, they fall to the ground as snow. Snow eventually melts, and moves into streams and rivers, so the water cycle continues. Hail, is a water droplet that has frozen after it has left the cloud.
- Top tip: The Met Office website (www.metoffice.gov. uk/learning) has some weather-related explanations, video clips and ideas for further activities.

CHILDREN'S MISCONCEPTIONS

- That materials always exist in just one state.
- That ice is a different material from steam or liquid water, not water in different states.
- Soft things are not solids.
- Powders are not solids because they can be poured and take the shape of their container, e.g. sand and flour.
- That only water boils.
- That there aren't temperatures below zero or above 100°C.
- That everything freezes at 0°C

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Is it a solid, liquid or gas?
KQ2: What happens when you leave ice at room temperature?
KQ3: Once a solid has turned into a liquid, can it become a solid again?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Does everything freeze?
KQ5: What is the process of evaporation?
KQ6: What is the water cycle?
End of Unit Assessment: Rising Stars

Year 4
Spring 2: Teeth and Eating

Unit Intent:

Children learn about digestion and different types of teeth, before moving on to explore deadly predators and their prey, in their exploration of food chains. They work scientifically throughout the topic, using enquiry, practical experiments and hands-on research to answer questions and investigate how we eat, why we eat and what we eat.

Core Knowledge Outcomes:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.
- Humans are omnivores, meaning we eat both plants and animals, and our teeth have evolved to suit our diet. Our canines are smaller than a carnivore's and we have flat molars to help us chew our food before swallowing, as plant material needs grinding before we can digest it.
- Our first set of teeth is known as our milk teeth. There are 20 teeth in total at this point: eight incisors, four canines, four premolars and four molars. Foods that are high in calcium, such as milk and other dairy products, are important in the formation of teeth and bones, and keep them strong and healthy, which is why children, who are growing bigger bones and new teeth, need full-fat (whole) milk and other dairy products as part of their diets. Between six and 12 years old, our milk teeth are gradually replaced with permanent teeth. There is a third set of molars called 'wisdom teeth' which appear in our late teens – although they may not come through at all. This means adults have 32 teeth. The jaw gets bigger as we grow older, so there is space for those teeth to appear. The human mouth contains 12 molars, eight premolars, four canines and eight incisors.
- The outer layer of tooth is called enamel. It is one of the hardest substances in the body. Below enamel is a layer of softer dentine and inside the tooth is the pulp, which contains blood vessels and nerve endings. Bacteria in the mouth eat away at enamel and cause plaque. If plaque is not removed regularly, it can build up and harden to form tartar, which builds up on our teeth and is difficult to remove. Some foods can stain our teeth, such as tea and coffee.
- **The digestive system** Our digestive system is made up of organs that take in food, including our mouths and teeth which start off digestion as a mechanical process, to then digest it chemically to extract energy and nutrients, and expel the remaining waste. Food contains large, complex chemicals such as carbohydrates, proteins and fats. To be of use to the body, they must be broken down into smaller chemicals: Carbohydrates are broken down into sugar. Proteins are broken into amino acids. Fats are broken into fatty acids and glycerol.
- Digestion starts in the mouth. Teeth provide mechanical breakdown of the food, then saliva moistens food so that it slides down the oesophagus into the stomach. The stomach is a bag of muscle that breaks up food by churning it around. It also contains hydrochloric acid, which kills off bacteria in the food, and enzymes, which further break down carbohydrates and proteins, starting the chemical breakdown of the food.
- After a few hours in the stomach, food travels down the duodenum (small intestine), where it is broken down further and sends the nutrients around the body in the blood. The solid waste such as fibre that can't be digested continues along into the large intestine, where water is removed. Then this passes out of the body via the colon and the anus.
- **Carnivores and herbivores** All living things need energy to survive. Plants are able to use the energy from the Sun to produce their own food. Animals are unable to make their own food so have to eat other living things to get their energy. Some animals have adapted to eating only other animals and get their energy from meat. These animals are known as carnivores. Animals that eat other animals are known as predators, with the animals that they eat known as prey, whether they are herbivores or carnivores. Some animals, including humans, have a diet comprising both animals and plants. These animals are known as omnivores. Well-known omnivores that the children might be familiar with include pigs, hedgehogs and rats. The teeth of carnivores are long and pointed. They have particularly long canine teeth to grip and kill their prey quickly. The incisors at the front of the mouth are used to strip flesh from the bones. Meat is easier to digest than plants, so does not need to be chewed so much. Plant material, however, is tougher to break down. Therefore herbivores' teeth are different from carnivores'. They have large, flat molars (back teeth) with ridges to help grind plants. Many do not have upper incisors, but instead a bony pad on their upper jaw. Herbivores can spend a long time chewing before the food is finally swallowed. They also have special bacteria in their guts to help break down plants

CHILDREN'S MISCONCEPTIONS

- That teeth grow continually.
- There are two tubes, one for food and another for drink.
- That the tube from the mouth stops at the stomach.
- That the digestive system covers every part of our bodies, with bits of food going directly to the legs to make you run, for example.

- That a predator can't be prey.
- That only herbivores are prey.
- That humans aren't predators or are not part of food chains.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.
- Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How clean are my teeth?
KQ2: How are all the teeth different and what functions do they have?
KQ3: How does food journey through the body?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How does the digestive system work?
KQ5: What are the key components to the food chain?
KQ6: Who is the predator and who is the prey?
End of Unit Assessment: Rising Stars

Year 4
Summer 1- Electricity

Unit Intent:

Children revisit some uses of electricity and the importance of safety before constructing simple circuits. Understanding how to change a circuit by changing its components makes up the third part of this topic, leading in a final application of knowledge and skills when the children design and make an alarm using their knowledge of circuits.

Core Knowledge Outcomes:

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.

- Recognise some common conductors and insulators and associate metals with being good conductors.
- Electricity is the most useful form of energy. It can be transformed into other forms of energy relatively easily. It makes things turn using motors, heats and lights up places like our homes, and produces sound in loudspeakers.
- Most mains electricity is produced in power stations and carried to users by overhead power lines. Power stations use coal, oil, gas or nuclear fuel to heat water, produce steam, drive a turbine and turn a generator to produce electricity.
- Batteries contain chemicals which react in a special way to produce an electric current. The current from a lemon battery is very small and will not light a bulb. But several fruit batteries will light a small LED. A potato can power a special clock, which can be purchased quite easily online.
- Voltage indicates the amount of energy delivered by a source of electricity. The voltage of the most common household batteries varies from around 1.5V to 12V, but some specialist batteries can be much higher. Mains electricity in this country is 230V. Overhead power cables carrying sufficient supply for thousands of users can carry voltages as high as 400,000V. The children may be aware of the term 'voltage', but they do not need to know about this in depth.
- Completely pure water does not conduct electricity, but when impurities that are present in our normal water supply get into it or when mixed with the salt on our skin, it does conduct. This is why you must never turn on the lights with wet hands. The spark produced by the flicking of the light switch will travel through the body, giving us a shock as it goes to earth.
- There are two types of circuit. A series circuit has all its components wired into one simple circuit: all the components are one after another, as in a series on television.
- A parallel circuit is one with different branches which behave like mini-circuits and can work independently of each other. Only simple series circuits are investigated in Key Stage 2.
- Conventional bulbs contain a filament made from wire. As electrons flow through the wire, they encounter resistance. It's like lots of people trying to squeeze through a small doorway. The more people or the smaller the gap, the more resistance felt. When a wire is very thin, it has a large resistance. The electrons get hot as they try to move through it (just as people do going through a small doorway!) and we can feel this. If it gets very hot, it glows – as in the filament of a light bulb.
- When investigating the changing of components in a circuit, the brightness of a bulb depends on the current or number of electrons passing through it. The more bulbs you have, the slower the electricity flows because the battery 'runs out of push', so the electrons flow more slowly, due to the resistance through the wires, and the bulbs, so the dimmer the light. The opposite is true of adding more batteries (the electricity flows faster).
- The batteries must be connected in series with positive terminals connected to negative ones. If a battery is reversed, its value is regarded as negative. So, if three batteries are connected in series and one is reversed, this will be equivalent to one battery.
- Metals are good conductors of electricity. Most non-metals do not conduct electricity. They are insulators. The rest of the information here is for your understanding but not the children at this stage.
- All materials are made of atoms, but metals are special. Instead of each atom being a separate entity (for the sake of neatness this is how we can picture them), metal atoms have electrons which are not tied to one particular atom. They are free to move within the metal in a 'sea' and this movement of electrons is what produces an electric current.
- Non-metals do not have these free electrons, so a current cannot pass through a non-metal.
- The exception is graphite, which conducts electricity but is a form of carbon. Carbon is a non-metal that can exist in different forms. One form is diamond, which is an insulator as it doesn't have free electrons.

CHILDREN'S MISCONCEPTIONS

- That electricity from batteries is not dangerous.
- That wires are made of plastic (as they are coated in it).
- That all metals conduct electricity.
- That a bulb uses the electricity.
- That both ends of the battery produce electricity.

- That the first bulb in a circuit will be brighter than the second in a circuit.

Working Scientifically Outcomes:

- Ask relevant questions and using different types of scientific enquiries to answer them – setting up simple practical enquiries, comparative and fair tests.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Which sources of electricity do we use?
KQ2: What are the dangers of electricity?
KQ3: How does a simple electric circuit work?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How does a switch change a circuit?
KQ5: Are all metals conductors?
KQ6: What can you make using circuits?
End of Unit Assessment: Rising Stars

Year 4
Summer 2: Consolidation - The big build (materials)

Unit Intent:

In this topic, children learn about building towers and bridges, starting with constructing tall towers, then exploring bridges, next they look at animals as builders and finally engage in researching famous engineers and architects and the structures they built. Children will already know many things about the materials they will encounter, how different materials stretch and their uses. They will use and develop working scientifically skills and understanding though comparative and fair tests, measuring, repeat readings and drawing and reading bar and line graphs.

Core Knowledge Outcomes:

- Bridges and towers can be made from many different materials such as wood, stone, bricks, iron and steel even plastic and glass fibre can be used. The material a bridge is made from is important but so is the shape, a material can be made stronger by changing its shape. Good shapes for bridges are arches and triangles. The reason triangles are so strong is that their shape is fixed, the angles cannot be changed once they have been made. However in squares and rectangles the angles can be changed – using pieces of card fixed with paper fasteners helps to show this.
- Bridges are essential for transport networks to be developed and not only to cross obstacles such as rivers, bays, gorges and canyons, but to join communities. The earliest bridges were beam bridges probably inspired by trees that had fallen over streams or gullys. This type of bridge requires the material laid across the gap to be strong and not bend or sag when a load (person, vehicle) is placed on it. When making bridges using paper or card a single sheet will not be a strong bridge, add a curved piece of card or paper underneath the bridge (an arch) then the structure resists the forces making the card beam bend. If a load, for example a weight, is placed on top of an arched bridge, the force of the

load pushing down is transferred to the sides of the arch which push outwards. The pillars or, for example, river bank, push back and so the bridge does not collapse.

- Triangles are very strong structures, so if a beam across a bridge is made using triangles then it will be strong. Children changing card or paper so that it is pleated like a fan can use this to make a structure that holds a greater load.
- Common types of bridges include beam bridges, arch bridges, suspension bridges, cantilever bridges, truss bridges and cable-stayed bridges. The type of bridge depends on what they are to be used for, cost and the ground where they are built.
- Historical bridge designers such as Isambard Kingdom Brunel and Thomas Telford created bridges, canals and tunnels without the technology we have today. However, even bridges built with modern technology can have problems as in the case of the Millennium Bridge which wobbled when lots of people were using the bridge at the same time.
- **Bridge disasters** There have been many famous bridge disasters such as the Tay Bridge in Scotland. On 28th December 1879, the central spans of the Tay bridge collapsed into the Firth of Tay, 75 people died because the bridge structure could not withstand gale force winds. The Tacoma Bridge disaster in 1940 was also caused by wind, causing the whole bridge to vibrate and twist, there are many video clips online showing this happening.
- **Why are towers built?** Towers are built because on the ground they take up very little space, but they can have a lot of floor space because the floors are built one on top of the other. So a tower will cover a small area on the ground but have over 100 floors which is a lot of space. More people can live or work in a tower compared to buildings that are only a couple of storeys high.
- **Engineers** Structural engineers design structures such as bridges, tunnels and buildings. The work with architects who design these structures, it is the structural engineer's job to make sure that the materials used, and the design can withstand forces such as the load (e.g. cars, people, trains) as well as wind, rain and even earthquakes. The structural engineer's role is to make sure that the building or bridge is safe.

Working Scientifically Outcomes:

- Ask relevant questions and use different types of scientific enquiries to answer them.
- Set up simple practical enquiries, comparative and fair tests.
- Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.
- Gather, record, classify and present data in a variety of ways to help in answering questions.
- Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables.
- Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.
- Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support their findings.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How do you bridge a stream?
KQ2: Which shape is the strongest for bridge pillars?
KQ3: How can we make the tallest tower?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How can we make the tallest tower?
End of Unit Assessment: Rising Stars

Year 5

Year 5
Autumn 1: Space- Out of this World

Unit Intent:

This In this topic, children learn about space. Starting with the Solar System, they look next at how ideas about space have changed over time before they explore what causes us to experience night and day on Earth.

Core Knowledge Outcomes:

- Describe the movement of the Earth and other planets relative to the Sun in the Solar System.
- Describe the movement of the Moon relative to the Earth.
- Describe the Sun, Earth and Moon as approximately spherical bodies.
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky.

- Our Solar System has a large star, the Sun, at its centre and eight planets and their moons, which orbit the Sun. All planets have almost circular orbits that lie within a nearly flat disc called the ecliptic plane. The vast majority of the Solar System's mass is in the Sun, with most of the remaining mass contained in Jupiter.
- The planets in order of their distance away from the Sun are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
- The four smaller inner planets, Mercury, Venus, Earth and Mars, are mainly composed of rock. The four outer planets, called the 'gas giants', are substantially more massive. The two largest, Jupiter and Saturn, are composed mainly of hydrogen and helium.
- The Solar System also contains many other objects such as the Asteroid Belt. This sits between the orbits of the planets Jupiter and Mars. It is made up of thousands of objects too small to be considered planets. Some are no larger than a grain of dust, while others, like Eros, can be more than 160 km across. A few, like Ida, even have their own moons. Some large objects, like Pluto, are now classified as dwarf planets.
- **Discovering the Solar System** The model of the Solar System has been refined over many centuries.
- Aristotle (384 BC–322 BC) proposed the geocentric model, with Earth at the centre of the Universe. The five known planets (Mercury, Venus, Mars, Jupiter and Saturn), the Moon, the Sun and the stars moved around Earth in perfect spheres.
- Ptolemy (c. 90–168 AD) refined the geocentric theory. Ptolemy said they did not travel in exact spheres but moved around the spheres on elliptic orbits, turning around on themselves.
- Alhazen (965–1038 AD) first used maths to describe the motions of the planets.
- Nicolaus Copernicus (1473–1543) made accurate observations of the Moon and the planets. He used maths to show that their movements could be explained much better if he put the Sun at the centre of the Solar System.
- Johannes Kepler (1571–1630) used maths to show that the orbit of a planet is an ellipse with the Sun at its focus and that it moves faster when it is closer to the Sun than when further away.
- Galileo Galilei (1564–1642) championed the heliocentric model and used telescopes to show that Jupiter had moons. A devout Roman Catholic, Galileo came into conflict with the church by challenging its doctrines. Hence, the biggest argument in history.
- In medieval times and before, it was commonly accepted that Earth was flat. Nowadays, we have photographic and other evidence to show that, like other planets and the Moon, Earth is spherical in shape.
- Earth and the Moon both move. Earth orbits the Sun once every 365 1 4 days and spins on its axis once a day. Although when you look up into the sky the Sun seems to move around the Earth, this is an illusion: in fact the Earth spins and causes night and day. The part of the Earth that faces the Sun is in daylight and the part that is not facing the Sun is in darkness.

- Before modern calendars, people used to keep track of the days by watching the phases of the Moon. One full cycle of the Moon's phases is approximately 28 days, which is very close to the amount of time we now know as one month. Its regular movement around Earth, as seen by its phases, gives rise to one 'month of time'.

CHILDREN'S MISCONCEPTIONS

- That there is only one Solar System – there are lots.
- That the Earth is at the centre of our Solar System.
- That there are stars in our Solar System other than the Sun. In fact, the Sun is the only star in our Solar System.
- That all planets have rocky surfaces. Some do, but the outer planets are gas giants.
- That planets can only be seen with a telescope. In fact, you can see Mercury, Venus, Mars, Jupiter and Saturn without a telescope.
- The Sun moves around the Earth and causes day and night (the spinning Earth causes it).
- That night-time is caused because the Sun goes to the back of the Earth. In fact, it is the Earth that moves.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What is at the centre of the solar system?
KQ2: Who were Copernicus and Galileo?
KQ3: What is a time zone?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How long does it take for the Moon to orbit the Earth?
KQ5: What is a moon crater?
KQ6: How are the planets different?
End of Unit Assessment: Rising Stars

Year 5
Autumn 2: Materials

Unit Intent:

In this topic, the children learn about materials and how they change. First they test properties of materials before looking at how materials dissolve, what a solution is and evaporation. Finally, children compare reversible and irreversible changes.

Core Knowledge Outcomes

- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal) and response to magnets.
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.
- Demonstrate that dissolving, mixing and changes of state are reversible changes.

- There are many ways to group materials from their colours to their textures, but there are also standard groupings such as metal and plastic. Standard groupings are based on properties and origins, which are not always easy to grasp, e.g. plastics have a huge range of properties.
- It is important that children experience how materials behave in their natural state and when changed, e.g. clay or a sheet of newspaper rolled up. This helps them appreciate why things are made from specific materials.
- The choice of a material for a particular job is often a compromise. For instance, silver is a better electrical conductor than copper, but it would be too expensive to use in electrical wires.
- Material chosen depends on the appearance, comfort, cost or all of these. For instance, wood, steel and plastic are all strong enough to make chairs and can all be manufactured into suitable shapes. Sometimes the properties of materials may be combined to produce a material that ends up with the properties of none of them. For example, copper is a soft metal and zinc is rather brittle, but together they make brass, which is hard and tough.
- **Solutions and mixtures** A mixture contains more than one substance. These are not chemically joined, which means they are easy to separate using their properties, e.g. size, magnetism and solubility. Mixtures can be:
    - Gas in solid (e.g. pumice stone); solid in solid (e.g. muesli).
    - Solid in gas (e.g. smoke); gas in gas (e.g. air); liquid in gas (e.g. clouds, mist and aerosol).
    - Gas in liquid (e.g. fizzy drinks); liquid in liquid (emulsion, e.g. milk); insoluble solid in liquid (suspension, e.g. muddy water); soluble solid in liquid (solution, e.g. salt water).
- This unit mainly covers soluble solids.
- A substance may dissolve in one liquid but not in another. For instance, nail varnish dissolves in acetone but not in water.
- A solution is usually transparent, even if it's coloured. Substances like instant coffee do not really dissolve; instead, small solid particles remain in suspension and the liquid is murky. Focus on the 'disappearance' of the solid granules as evidence of dissolving.
- When a solid is added to water, the water particles surround the solid edges. If the attraction between the water and solid particles, is greater than that between the solid particles then it will dissolve. This process is affected by things like temperature and the amount of solid. There is always a limit to how much solid can dissolve in a given amount of water.

CHILDREN'S MISCONCEPTIONS

- That 'material' just means 'fabric'. In fact, a 'science material' means any kind of matter in the world around us.
- That 'everyday materials' are single substances. Actually, they can be mixtures or compounds, e.g. brick, glass.
- They are comparing properties when they are comparing objects.
- Sometimes children confuse the following properties:
    - Tough and hard: a diamond is very hard, but if hit with a hammer it will shatter because it is brittle.
    - Tough and strong: polythene does not break when dropped but is not strong because it is easy to tear apart.
- That dissolving means that the substance has disappeared. If the liquid is evaporated the substance is still there but just cannot be seen.

Working Scientifically Outcomes

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Why that material?
KQ2: Which material makes the strongest carrier bag?
KQ3: What is a thermal conductor and a thermal insulator?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How does sugar dissolve?
KQ5: How do we sieve and filter?
KQ6: What is evaporation?
End of Unit Assessment: Rising Stars

Year 5
Spring 1: Living Things and their Habitats

Unit Intent:

In this topic children look at the life cycles of various species including mammals, amphibians, fish and birds. They also look at and describe the life process of reproduction in plants and animals.

Core Knowledge Outcomes:

- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.
- Describe the life process of reproduction in some plants and animals.
- **Plant reproduction** Flowers are the reproductive organs of a plant. They produce pollen and eggs, which then produce seeds. In sexual reproduction the male parts of the flower produce pollen and the female parts produce ova, or eggs. Both pollen and eggs contain half the genetic information necessary to make a new plant, in the same way that sperm and eggs do in animals. Plants cannot pollinate their own flowers: they need to get their pollen to the flowers of another plant. Often the pollen is carried by insects, but it can also be dispersed into the wind. When pollen lands on the stigma of another flower, it joins with the egg and their DNA combines. The egg is now fertilised. This will happen many times with all the eggs in the ovary. Asexual reproduction needs only one parent, unlike sexual reproduction, which needs two parents. This means that the offspring (new plant) is a clone (because there has not been a joining of genetic information). Asexual reproduction in plants can differ. Many plants develop underground food storage organs that later develop into the following year's plants. Potato plants and daffodil plants do this (tubers and bulbs). Others, such as the spider plant, Chlorophytum, produce side branches with plantlets on them. Strawberries produce runners with plantlets on them.

- **Animal reproduction** All animals grow from an egg. In insects, fish and amphibians, this egg is a ball of jelly and reptiles' eggs have leathery shells. The baby develops inside and then hatches when it is ready to come out. Mammals do start off as a tiny egg, but this egg stays inside the mother in a special area called the womb. The baby is known as an embryo. The baby is joined to the mother by a placenta, and it gets food and oxygen that way. Once the baby is developed enough, it is ready to be born. Many animals, including amphibians and insects, have a distinct juvenile form that looks very different from their adult form. This larval stage then undergoes a process of metamorphosis where it loses some features and gains new ones, e.g. a tadpole will lose its gills and tail and grow legs. Larvae may live in different environments, such as underground or in water, and may eat different foods. Some animals will spend most of their lives in a larval stage, becoming adults only to breed and produce eggs, after which they die. Fertilisation occurs when a single sperm fuses with a single egg. The genetic information of the two cells combines to produce an embryo that then develops further, usually within an egg or, in the case of mammals, inside the mother's womb. Many animals release thousands of eggs and millions of sperm (especially into the water) at a time. The large numbers increase the chances of a sperm meeting an egg, especially in animals where the male and the female may not spend much time in physical proximity. The eggs are abandoned by the parents and the young left to fend for themselves. Many of the offspring will get eaten or die, so many babies are needed to make sure just a few make it to adulthood to produce more offspring. In mammals and birds the eggs are kept inside the female and fertilised with sperm from the male. Fewer eggs are needed since the chances of fertilisation are higher. There is also a higher level of parental care after the offspring are born and therefore a higher chance of survival, so the numbers of offspring are lower.

CHILDREN'S MISCONCEPTIONS

- That sex is not something plants do, or that it takes two plants to produce seeds to make a new plant.
- That the life cycle begins at the baby / larval stage when in fact it begins at the egg stage (or embryo in mammals).
- That a sperm or egg contains a tiny baby inside it, and that fertilisation causes it to start growing. In fact, sperm and eggs each contain half the genetic information needed to make a whole new animal.
- They may also not know that it is possible to make new plants by growing runners or through taking cuttings.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: If grapes are seedless, how do you grow new grape plants?
KQ2: How do plants reproduce?
KQ3: Which came first, the chicken or the egg?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Why do some animals lay so many eggs?
KQ5: Why are some animals endangered?
KQ6: Are you for or against zoos?
End of Unit Assessment: Rising Stars

Year 5
Spring 2: Forces

Unit Intent:

In this topic children learn about forces and machines. They start with the force of gravity then study friction forces, including air and water resistance, before investigating how simple machines work.

Core Knowledge Outcomes:

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
- Identify the effects of air resistance, water resistance and friction that act between moving surfaces Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
- **Gravity** Gravity is an attractive, non-contact force. It is measured in Newtons (N). Any two objects have a force of gravity between them. This only becomes obvious when the objects have a very large mass, such as the Earth, Moon or Sun. Gravity gives weight to objects with mass and causes them to fall towards the centre of the Earth when dropped. The force of gravity on the Moon is less than that on the Earth. Galileo discovered that everything falls at the same speed. In 1658 he dropped two balls of different masses from the leaning tower of Pisa. He discovered they hit the ground at the same time. This contradicted the ideas of Archimedes and the accepted view that heavy objects fall faster than light objects. Sir Isaac Newton first set out the laws of gravity. His universal law of gravitation states that every mass in the universe attracts every other mass with a force that is directly proportional to their combined masses and inversely proportional to the square of the distance between them. Albert Einstein further developed the theory of gravity. He didn't believe it was a force at all. Instead, he said gravity was a distortion in the shape of space–time, otherwise known as 'the fourth dimension'. According to him, moving objects move in space–time, which fits with Newton's theory.
- **Friction** Friction is a force. It occurs when any two things rub against each other. These can be solid things, like your two hands rubbing together or a hammer hitting a nail. They can be gases, like the air slowing down your car. In this case, we call the friction air resistance. And finally, friction can occur in liquids, such as when water slows down a boat. The size of the friction force can be very big; two rough surfaces will generate more friction than two smooth surfaces. Air and water resistance are what's known as drag forces. These depend on the shape, size and speed of the object that is moving through the air or water. Streamlining jet planes or submarines reduces the air or water resistance, allowing the objects to move through air or water much better.
- **Taking measurements** Forces can be measured using a force meter / Newton meter. Force meters contain a spring connected to a hook. If the hook is fixed onto an object and pulled until the object starts to move, the spring stretches, the bigger the force applied (pull) the longer the spring stretches and the bigger the reading. Newton meters measure in Newtons (N), the higher the number the bigger the force.

CHILDREN'S MISCONCEPTIONS

- That heavy objects fall faster than lighter objects. In fact, they both fall at the same speed.
- That objects come to a stop when there is no friction. In fact, they'll keep on moving forever if they're left alone.
- That friction only occurs between solids and surfaces. Water and air resistance are examples of friction that involves a liquid and a gas.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.

- Report, and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Why is gravity important?
KQ2: Does the size of an object impact the amount of air resistance?
KQ3: What is friction?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What is water resistance?
KQ5: What forces are in play when you use a see-saw?
KQ6: How do pulleys work?
KQ7: How do gears work?
End of Unit Assessment: Rising Stars

Year 5
Summer 1: Growing Older

Unit Intent:
In this topic, children look at and describe the changes as humans develop to old age. Pupils draw a timeline to indicate stages in the growth and development of humans and learn about the changes experienced in puberty.

Core Knowledge Outcomes:

- Describe the changes as humans develop to old age.
- Humans, like all mammals, give birth to live young. The fertilised egg stays inside the female and develops in the womb. The baby is linked to the mother via a placenta, which gives the baby nutrients and oxygen and takes away waste products.
- The amount of time it takes for a baby to develop is called the gestation period. In humans this is roughly nine months (266 days). Smaller animals normally have a shorter gestation period than larger animals. For example, a mouse's gestation period is around 20 days and an African elephant's is 645 days.
- Human babies are highly dependent on their parents for a long time after birth. They start to walk at around one year old and learn to talk at about 18 months old. They grow rapidly. By the age of five a child can walk, talk and feed itself, but is still very dependent on its parents.
- The human life span can be split into a number of stages: infancy, childhood, adolescence, young adulthood, adulthood and old age. The actual length of these stages varies across different cultures and time periods.
- **Puberty**- This is the time when the body matures from that of a child to that of an adult. The body prepares itself for being able to produce children of its own. Puberty starts at different times, but usually around 10–14 in girls and 12–16 in boys. Puberty is triggered by hormones in the body – chemical messengers that travel around it. In boys, the testes develop and begin to produce sperm as well as the hormone testosterone. Testosterone causes boys to grow and become more muscular, their voices to 'break' and hair to start growing on their chest and face. In girls, the ovaries develop and begin to release the hormone oestrogen. As well as triggering the maturation and release of an egg once a month as part of the menstrual cycle, oestrogen causes girls to develop breasts and their hips to widen. In both boys and girls other hormones cause pubic and underarm hair to begin to grow. Spots are common for most teenagers; acne is caused by glands in the skin that produce a natural

oil called sebum. Puberty hormones make these glands produce extra sebum, which can clog the pores and cause spots. Remember to take care when discussing the changes that happen during puberty. Check with your school's PSHE/SMSC/SEAL coordinator for additional guidance.

- **Aging**- Ageing is the accumulation of changes in a person over time. Our bodies become less able to deal with stresses and disease, and our cells gradually become less able to replicate. Commonly, our hair will become grey or white and our skin will lose its elasticity and become wrinkled. Older people's bodies become more susceptible to diseases such as osteoporosis (weak bones) or arthritis (stiff / swollen joints). Eyesight and hearing often deteriorate too. The upper range of the sound frequencies that we can hear gradually decreases from the age of 18 onwards. This means that children will be able to hear higher sounds than even young adults and the older you get, the lower the upper limit will become. Due to improved healthcare more people are reaching old age. In Roman times, people who survived childhood could expect to live to about 50, but now we can expect to live much longer than that.

CHILDREN'S MISCONCEPTIONS

- That they know about pregnancy, especially if they have baby brothers or sisters, but they may not know exactly what happens.
- Have general misconceptions about puberty based on playground rumours.
- General misconceptions about what it's like to be old, based on limited observations of their elderly relatives or from the media.
- Everyone over about 21 is classed as 'old'.

Working Scientifically Outcomes:

- 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.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How does a baby develop?
KQ2: What are the different gestation period of different animals?
KQ3: What changes happen as we get older?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What is it like being a teenager?
KQ5: How does it feel to get old?
KQ6: What do older people think about getting old?
End of Unit Assessment: Rising Stars

Year 5
Summer 2: Amazing Changes

Unit Intent:

In this topic, the children learn about materials, how they change and which changes are reversible and irreversible. The topic concludes by looking at how these properties are applied in the real world.

Core Knowledge Outcomes:

- Demonstrate that dissolving, mixing and changes of state are reversible changes.
- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

- Reversible (physical) changes do not produce a new substance or change the amount of a substance. Reversible changes include liquid water to ice to liquid water.
- Irreversible (chemical) changes do produce new substances. Although no matter is lost or destroyed, some may become gas and float away. This sort of change is usually permanent and very difficult to reverse. Burning, rusting and chemical reactions (e.g. bicarbonate of soda and vinegar) are all examples of this. Here, the particles are combined into different substances. Clues that a chemical reaction has taken place might be:
    - A colour change (this can happen with physical changes too).
    - The production of gas.
    - The production of light or heat, or a change of temperature.
- A common misconception held by children is that when a chemical reaction takes place, especially one in which invisible gases are produced, the chemicals are 'used up' and the matter no longer exists. It is important to remind children that matter does not disappear in a reaction; it just changes form. Even if it is no longer visible, the matter is still present somewhere.
- **Bicarbonate of soda and vinegar** - The baking soda (sodium bicarbonate) is a base while the vinegar (acetic acid) is an acid. When they are mixed together they react together and form a gas carbon dioxide, this is a new material, so it is a chemical change and it is irreversible. It is the gas that fizzes as it escapes the solution. Changing the amount of baking soda and vinegar changes this reaction, either increasing or decreasing the reaction and amount of gas produced.
- **Milk and vinegar** - When vinegar is mixed with hot milk a protein called casein is extracted from the milk due to a reaction between the milk and vinegar. The casein sticks together and forms clumps or curds similar to plastic, and can be moulded and changed in shape.
- **Rust** - Rust is produced in a chemical reaction between iron, oxygen (dissolved in water) and is an example of oxidation, here it leads to corrosion. If rust is left it eats into the iron causing holes and gradually weakening the iron. Iron is often painted over not just for cosmetic purposes but to protect it, however, if the paintwork is scratched water can get to the metal surface causing a chemical reaction between the iron, water and oxygen resulting in rust. Rust is an irreversible change.
- **Burning-** Burning is a chemical reaction, a chemical change, a new material is formed and burning is not reversible. For burning to take place there must be three things: fuel, oxygen and a high enough temperature. This is called the 'fire triangle'.

CHILDREN'S MISCONCEPTIONS

- That burning and melting are similar.
- That burning and heating are the same.
- That smoke and steam are the same thing.
- When something burns it disappears for ever, it no longer exists.
- That rusting is a physical change; in fact it is a chemical reaction of iron with air and water: rust does not conduct electricity.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.

- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Are all chemical/ irreversible changes fast?
KQ2: Which variables impact your experiment the most?
KQ3: How can you make plastic?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Is rust a reversible or irreversible change?
KQ5: Why are some materials more flammable than others?
KQ6: Which new material do you think has had the most impact?
End of Unit Assessment: Rising Stars

Year 6

Year 6
Autumn 1: Classify Living Things

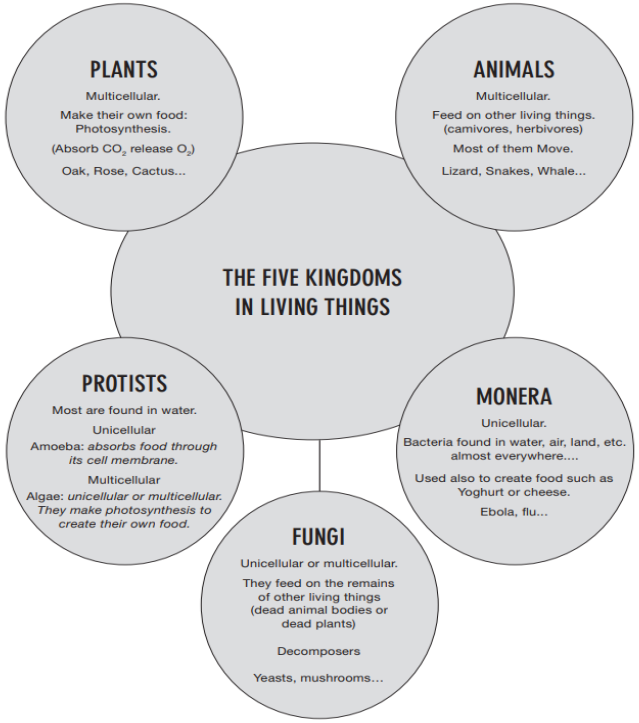
Unit Intent:
Children build on their learning about grouping living things in Year 4 by looking at the classification system in more detail. The topic is divided into two units, Children first revisit their knowledge of classification and creating keys, before developing their knowledge by looking at fungi and bacteria. Children also look at the work of Carl Linnaeus, the scientist who first made important the function of naming and classifying to 'identify' organisms.

Core Knowledge Outcomes:

- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics.
- **Living things** Living things are divided into groups, with members of each group having similar features. The obvious first grouping is animal or a plant, (covered in Year 4). Animals can be divided into invertebrates and vertebrates (Year 4 Programme of study). In this topic we will consider the other three groups: fungus, monera (microbes) and single-celled organisms called protists. Each time we divide up the living things by particular characteristics, the groups become smaller until we end up with the organism being 'identified'.
- **Animals** The animal kingdom can be divided into two broad groups based on whether they have a backbone (vertebrate) or not (invertebrate). Invertebrates range from totally soft-bodied animals such as sponges and jellyfish, shelled animals such as mussels and barnacles, to complex spiders and insects. Some invertebrates have an exoskeleton (exo = external or out), some have no hard structures at all. Invertebrates are subdivided into protozoa, annelids (worms), echinoderms (sea urchins), molluscs and arthropods (insects, crustaceans and arachnids).
- **Plants** The plant kingdom can also be divided into two groups, flowering and non-flowering plants. Flowering plants include sunflowers, roses and lilies, and non-flowering include mosses and ferns. There are some obvious differences between plants and animals. Plants are green and they can photosynthesise, whereas animals cannot. Photosynthesis is the process by which a plant uses the energy from the light of the sun to

produce its own food. Organisms such as coral are often thought to be plants, when in fact they are animals, but this can only be seen at the cellular level.

- **Fungi** Many children think that fungi are plants, but they are in fact a separate kingdom. Many fungi play the role of decomposers, breaking down plant and animal material. Mushrooms and toadstools are the reproductive parts – they appear above ground to spread spores. Mushrooms forming a fairy ring are usually all part of the same single organism. The mould that grows on our food is also a type of fungus. Other single-celled fungi, such as yeast, ferment sugar and produce ethanol (alcohol) and carbon dioxide gas. They are very important in making bread, as the gas causes bubbles in the dough and makes the bread rise.
- **Prokaryotes, including bacteria** Prokaryotes are the group that bacteria (and blue-green algae) belong to. Bacteria are a large and diverse group of single-celled organisms without a nucleus. They are microscopic and found almost everywhere on Earth. They can live in extreme environments, from boiling hot springs to deep in the oceans and even grow on nuclear waste. They are found in the intestines of many animals, including humans, and aid digestion. Other bacteria can cause infectious diseases such as cholera, tuberculosis and bubonic plague. Bacterial infections can be treated by antibiotics.
- **Protoctists** These are single cells or groups of single cells, the most well-known are amoeba and slime moulds. They are all single-celled organisms that are not bacteria.
- **Carl Linnaeus and classifying organisms** Carl Linnaeus (1707–1787) invented the two-part naming system that is used to classify species of living thing. Linnaeus realised that new plants were being discovered and named, but nobody gave much thought to which family or group they might belong to, or resemble. He started to classify plants into 24 classes according to the number and position of their stamens and pistils. Although later botanical knowledge revealed that this system was inadequate, it did lay the foundation for the science of plant taxonomy.



CHILDREN'S MISCONCEPTIONS

- That there are only two groups of living things – animals and plants.

- That plants are green and 'traditionally plant-like'.
- That coral is a plant.
- That fungi aren't alive.
- That mushrooms and other fungi are plants.
- That microbes are always bad.
- That all animals move and have legs.

Working Scientifically Outcomes

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What can you use when you find a plant that you do not recognise?
KQ2 and 3: How can we classify plants and animals in our local environment?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Who was Carl Linnaeus and why was he so important in classification?
KQ5: Why is bacteria sometimes good and sometimes bad?
KQ6: Is a mushroom a plant? How do you know?
End of Unit Assessment: Rising Stars

Year 6
Autumn 2: Healthy Bodies

Unit Intent:

In this topic children build on learning from Years 3 and 4 about the main body parts and internal organs (skeletal, muscular and digestive system). It considers life processes that are internal to the body, such as the circulatory system. The impact of lifestyle on bodies, particularly of humans, is also considered. Scientists are continually finding out what is good and bad for us, and their ideas do change as more research is carried out.

Core Knowledge Outcomes:

- 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.
- **Circulatory system** - The circulatory system is made up of the heart, the lungs, blood and the vessels it travels through. Its function is to transport nutrients, gases and wastes between the cells of the body and the digestive system, respiratory system and excretory system. It also carries

hormones for internal communication and co-ordination, and white blood cells for fighting disease, as well as assisting in maintaining body temperature. The heart is a huge muscle that never appears to rest. In fact it does rest – between each heart beat! It beats rhythmically, contracting two sets of chambers to act as a double pump to move blood around the body. It is about the size of a closed fist, and is protected by the ribs. The arteries carry blood away from the heart while veins return blood to it, the veins have valves that only allow the blood to travel one-way so that the blood keeps moving in the correct direction. One misconception the children may have is that the arteries carry only oxygenated blood, when in fact they carry some de-oxygenated blood too. It is more appropriate to talk about how the air we breathe in has oxygen in it, while the air we breathe out has less oxygen and more carbon dioxide. The right side of the heart pumps deoxygenated ('used') blood through the pulmonary circuit to the lungs, where it picks up oxygen and where carbon dioxide is released. The blood is then returned to the left side of the heart, which is sufficiently muscular and powerful to pump the blood through the systemic circuit to all tissues of the body, including the kidneys for waste removal, and the liver for blood sugar regulation.

- **Blood**- Blood is made of a watery yellow fluid called plasma that carries dissolved nutrients, hormones and proteins. It contains red blood cells, which carry gases around the body and make the blood appear red. It also carries white blood cells, which fight against disease. The blood also contains platelets, which form the scabs we get on a cut as part of the healing process.
- **Exercise and diet** - Exercise has many effects on the body. During exercise the heart rate and breathing rate increase to provide more oxygen to the muscles and to remove carbon dioxide quicker. Regular exercise can lead to stronger muscles and bones. The heart will become stronger with a reduced risk of heart disease. There is also an increase in lung capacity. To provide the energy for exercise, the body breaks down fats and sugars stored in the body. Regular exercise, along with a balanced diet, can prevent obesity. Exercise also has effects on mental health and mood. It releases endorphins which makes humans feel happier and more calm. During recent years there has been more focus on obesity in Britain with people getting bigger and less healthy. This has an effect on the NHS as it impacts on the nation's health. It is important that children are educated about the importance of health and diet to their lives. John Boyd Orr was born in Ayrshire, Scotland in 1880, the middle child of a family of seven. He was a medic in the trenches during World War I and witnessed how the poor diet and conditions led to the poor health of the soldiers he served with. After the war he set up the Rowett Research Institute. He was the first scientist to show that there was a link between poverty, poor diet and ill health. James Lind conducted one of the first ever clinical trials based on the theory that citrus fruits cured scurvy.
- **Drugs** - Smoking accounts for a quarter of all deaths by cancer in the UK. Cigarette smoke contains around 4000 different chemicals, including 70 that can cause cancer. It contains tar, which can damage the lungs and stain teeth and fingers as well as cause cancer. These can also damage the heart and blood vessels. The smoke also contains poisons such as hydrogen cyanide and carbon monoxide. The nicotine in cigarettes is very addictive, and many people find it very hard to give up smoking. These chemicals are contained in tiny doses, but accumulate in the body with every cigarette. The trend for using Vapes is not without issues for health, they still give a dose of nicotine and the vapour from e-cigarettes has chemicals in it that can be harmful to children. The liquid in e-smoking devices is also poisonous if drunk or if it comes into contact with the skin. Some children might believe that smoking fewer cigarettes means that they will not develop lung diseases or cancer. Research shows that smoking as little as one cigarette a day is bad for a person's health, making them nine times more likely to die from lung cancer as a non-smoker. Alcohol is also a drug, but not one that many consider in the same light as smoking. However, it is just as addictive. Alcohol causes damage to organs in the body too, this time the liver. The liver breaks down the alcohol as part of its detoxification process. However, it also produces chemicals that aid digestion, and if the liver is damaged through excess alcohol then these chemicals cannot be made. Drinking too much can also affect your emotional state, as it can make you feel very happy or send you into depression as you feel panicky.

CHILDREN'S MISCONCEPTIONS

- That blood only reaches some parts of the body.
- That the structure of the heart is how they imagine, e.g. romantic heart shaped.
- That the word diet means slimming and reduced calorie intake, rather than the idea that a person's diet is what they eat and drink.
- That you can't get addicted to alcohol.

- That just trying one cigarette is OK.
- The heart lies on the left side of the chest.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Do all animals have hearts?
KQ2: What happens to people's organs when they don't exercise?
KQ3: How can you measure the volume of air in your lungs?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: What constitutes a drug?
KQ5: What is the impact of smoking and alcohol on your body?
KQ6: Who is John Boyd Orr and why was he so important in science?
End of Unit Assessment: Rising Stars

Year 6
Spring 1: Evolution and Inheritance

Unit Intent:

Building on what they learned about fossils in Year 3, children find out more about how living things have changed over time. They are introduced to the idea that characteristics are passed from parent to their offspring, but that they are not exactly the same. They should also appreciate that variation over time can make animals more or less likely to survive in particular environments (adaptation). Children look at evolution and Charles' Darwin's theory of natural selection, as well as palaeontologist Mary Anning's work with fossils.

Core Knowledge Outcomes:

- 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.
- **Inheritance**- The way we look is controlled by our genes, which are a mixture of those from our parents – half from the mother and half from the father. Some characteristics are carried by a single pair of genes, others by lots of genes working together. Some characteristics, such as brown eyes, are dominant. If your mother has a blue-eyed gene and your father a brown version and these come together in the fertilised egg cell,

the brown will 'win' and you will have brown eyes. Only if you have two blue-eyed genes will you have blue eyes. In this way two people with brown eyes could both have the blue-eyed gene, and have a blue-eyed baby. In the case of identical twins, a fertilised egg splits in two. The genes in each half will be exactly the same, and so twins formed in this way will look identical in many ways. But even identical twins can look slightly different: they might decide to change their hair style, or hair colour, eat different diets, etc. These are environmental changes, rather than genetic ones. External features can also change how we look, as well as our genes.

- **Evolution**- The process of evolution by natural selection was proposed by Charles Darwin in 1858 and was based on work he carried out over the previous 30 years. It is important to note that animals do not 'choose' to change. They have an advantage over other animals, so will survive long enough to breed and pass on their characteristics. During his time on the Galapagos Islands, Darwin collected specimens of the different species of finch living on the island. It wasn't until he returned to the UK that he studied these specimens and realised how important they were. By noticing that finches on the different islands had beaks that were adapted to their environment, and realising that finches whose beaks weren't adapted wouldn't survive, Darwin was able to start working out his theory of evolution. Evolution is not 'just a theory'. There is an overwhelming amount of supporting evidence and scientists believe it is the best mechanism for explaining how the wide variety of life on Earth came about. The process takes place over very long timescales. For example, the evolution of the polar bear from the brown bear took between 100,000 and 250,000 years. Brown bears gradually moved north in search of food. Those bears best suited to life in the cold survived, and passed on those characteristics to their offspring.
- **Fossils** - Planet Earth is 4.6 billion years old. The first life began in the seas around 3.6 billion years ago. The earliest life were single-celled creatures like bacteria and algae. Gradually life became more complex and multicellular life began. Human beings have only been around for a tiny fraction of the Earth's history. If the entire history of the Earth was condensed into a 24-hour day, Homo sapiens wouldn't appear until a few seconds before midnight. Fossils tell us a lot about living things that died millions of years ago. The parts that become fossilised can tell us about how they looked, how big they were and even what they ate by looking at their teeth (and sometimes fossilised poo!). There are some things we can't work out so easily, such as their skin colour or texture, as skin does not fossilise. Areas such as Lyme Regis on the south coast of England are excellent places to find fossils. The cliffs are made of sedimentary rock, such as limestone and sandstone, that would have been at the bottom of the sea millions of years ago. Chalk cliffs are made from the skeletons of billions of microscopic sea creatures. Creatures that died in this sea would have sunk to the ocean floor and in some cases become buried and eventually become fossils. Millions of years later, the movement of the Earth's plates pushed the sea floor upwards, forming land. Fossil seashells have sometimes been found at the top of high mountains. A very famous site for fossils is called the Burgess Shale in Yoho National Park in the Canadian Rockies, 500 million years ago it used to be sea floor, but now is 2000 m above sea level!

CHILDREN'S MISCONCEPTIONS

- That boys will look like the father's side of the family and girls like their mother's side.
- That particular features are identical, such as mother's nose and father's eyes, rather than them being a blend of the two.
- That evolution can only happen over millions of years.
- That fossils are very large and only of dinosaurs.

Working Scientifically Outcomes:

- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How has life evolved over time?
KQ2: How did the work of Mary Anning influence science?
KQ3: What is the difference between inherited and environmental features?

Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How do plants and animals adapt to their surroundings?
KQ5: What would happen if plants and animals did not adapt?
KQ6: What is Charles Darwin's theory on evolutionary changes?
End of Unit Assessment: Rising Stars

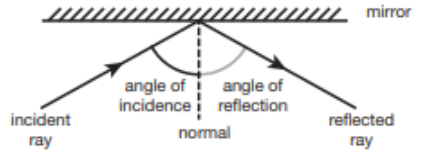
Year 6
Spring 2: Light

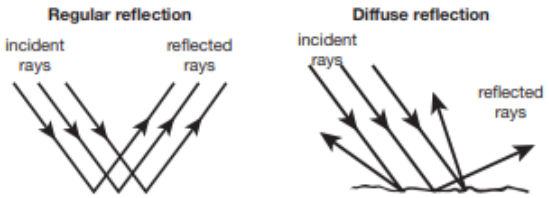
Unit Intent:

This The topic introduces the concept of light travelling in straight lines. It starts by looking at beams of light and how light travels to enable children to understand how we see things. This understanding is then applied to the production of shadows and starts to look at how light is reflected. The topic then takes the learning into the realm of coloured light and rainbows, using scientific skills to raise and answer questions. It builds on the work carried out in Year 3 on light, shadows and reflection.

Core Knowledge Outcomes:

- 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.
- **Light**- Visible light is a member of a family of waves known as the electromagnetic spectrum. All waves behave similarly. They all trvel in straight lines. Light travels faster than sound, (330m/s), which is why we see lightning before we hear thunder and why, when we look at someone hitting something from a distance, we see them make the action before we hear the sound. Because light travels in straight lines, the edges of light beams are straight and shadows are the same shape as the object casting them. If the light source is small, the edges of the shadows are sharp. If a large light source is used, the edges of the shadow are blurred. All objects reflect a small amount of light. Both Plato and Ptolemy developed theories which stated that we see things because the eyes emit rays. Superhero comics often show rays being emitted from the hero's eyes, which helps to generate the misconception that children may have about light coming from our eyes. The law of reflection states: 'The angle of incidence equals the angle of reflection'. The children don't need to be able to draw or use this at this stage, unless they notice this as part of their investigations. However, it will help you if they are struggling to work out how to position their mirrors in the activities. It also helps with the fact that all materials reflect light.





- When light passes from one material into another, it changes direction. The change in direction is known as refraction. When it passes from air into a more dense material, such as glass, Perspex or water, it changes direction towards the normal. When it passes from a more dense material into air, it changes direction away from the normal.

CHILDREN'S MISCONCEPTIONS

- That light comes out of our eyes.
- That we can see the features on shadows.
- That light bounces from our eyes to the object (this is illustrated in their diagrams rather than their speech).
- That light is made up of a single colour.
- That they can see round corners.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.
- Gather and record data to help in answering questions.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: How does light travel?
KQ2: What happens to your shadow throughout the day?
KQ3: Can light bend around corners?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: All objects reflect light – true or false?
KQ5: How does light travel in water?

KQ6: Who discovered the rainbow of colours and realised how they got there?
End of Unit Assessment: Rising Stars

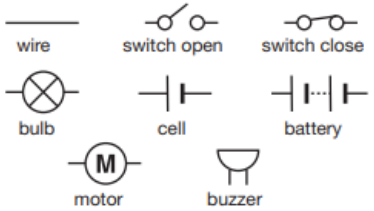
Year 6
Summer 1: Electricity

Unit Intent:

This topic builds on the Year 4 work on electricity, taking it into the scientific use of symbols for components in a circuit, as well as considering the effect in more detail of changing components in a circuit. The children have the opportunity to apply their learning by creating an electronic game.

Core Knowledge Outcomes:

- 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.
- **Circuits**- Before you start any work on circuits with the children, it is crucial that you test that all the batteries work, as well as the bulbs. A simple circuit will allow you to do this. Ensure you have plenty of spare batteries and bulbs handy as they do run out and blow respectively during lessons! Also ensure that the bulbs and batteries are rated correctly so the children don't blow too many or will not be able to see the light. A current will only pass around the circuit if it is complete. Any break in the circuit will reduce the current to zero throughout the whole circuit. To make representation of circuits easier and clearer, symbols are used, such as these:



- When getting the children to draw circuits, these should be completed with a ruler to make square circuits, rather than free-flowing wires. The positive end of the cell (single battery) is the longer line. A series of single batteries (cells) makes a 'battery'.
- **Resistors** - Resistors restrict or limit the flow of current in a circuit. Resistance is how easily electricity can pass through a material in a circuit. Different materials have different levels of resistance and this can be used to change the resistance in a circuit and change the brightness of a bulb. Good conductors, e.g. metals have a low resistance, they allow electricity to move through more easily than, for example, plastic, which therefore has high electrical resistance. Changing the length and the thickness of wire in a circuit will change the resistance. The thinner the wire the harder it is for electricity to move through, the thicker the wire the easier. The shorter the wire the less resistance, the longer the wire the greater the resistance.

CHILDREN'S MISCONCEPTIONS

- That a wire isn't a component.
- That if a bulb isn't working, it is a flat battery, but sometimes it is the voltage of the bulb compared to the battery that is wrong, or the blub that is blown.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: What symbols are used to represent a circuit?
KQ2: What are the key components of a complete circuit?
KQ3: Does adding another battery to a circuit make the bulb brighter or dimmer?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: How does a resistor change a circuit?
KQ5: How do we hide components in a game?
End of Unit Assessment: Rising Stars

Year 6
Summer 2: Consolidation - The Titanic

Unit Intent:

Children engage in a different approach to their science in this topic. They use their science and link it to an historical event in context; the sinking of the Titanic. This topic is based around applying the working scientifically skills that they have learned so far in their science lessons, to explore some of the scientific concepts behind the Titanic, e.g. floating and sinking. It can be used as a good opportunity to embed, assess and observe working scientifically skills, as well as laying foundations for transition to KS3 science.

Core Knowledge Outcomes:

- **Floating and sinking** - Floating, sinking and density is a topic that children will work on in more detail in secondary school. In this topic children will begin to develop and explore some basic ideas. Covering the Titanic also brings opportunities for activities in other curriculum areas. Some objects like wood, sponges and unpeeled oranges are less dense than water, so they will float. Hollow objects such as balloons, empty plastic bottles will float. These things float because they have air in them, and air is less dense than water; we say that these things are buoyant. The shape of an object can be changed so that even though the mass has not changed the increase in volume makes it less dense. For example, a plasticine ball placed in water, will sink, but flatten the plasticine and make it into a bowl shape and the volume is increased so it will float. This is the science behind why such a huge ship as the Titanic could float.
- **Hypothermia** - Hypothermia is a potentially dangerous drop in body temperature, and is usually caused when someone is exposed to cold temperatures for a period of time, such as when someone is in the sea or, for example, when a hiker gets lost or has an accident in poor weather. In water hypothermia can set in very quickly. On land it will be longer but the results are the same: their core temperature drops, the

person tires, becomes confused and drowsy, and if they fall asleep may die. If rescued in time the person may be wrapped in a blanket and a foil blanket to conserve heat, provided with warm drinks and taken to hospital.

Working Scientifically Outcomes:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, use a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Report and present 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.

Sequence of Learning (Key Questions/Key Assessment)

KQ1: Why do some objects float and some sink?
KQ2: How did The Titanic sink?
KQ3: How does the temperature of the surrounding water change when the iceberg is placed into the water?
Mid-Unit Assessment - Low-stakes quiz to inform T & L
KQ4: Which materials are the best thermal insulators?
KQ5: Why are life jackets so important?
KQ6: How much air is needed to lift the bottle?
End of Unit Assessment: Rising Stars