Brabourne CEP School

Whole School Knowledge in Science Progression Document – March 2020

Introduction

The aim of this document is to demonstrate how each year group progress within the strands of the Science National Curriculum. This Progression document is designed to also be a reference for Teachers when planning to see what objectives the children need to be taught currently, what they have previously covered and what steps are next, to ensure no overlapping of curriculum content or teaching at different year group levels. There is a Key Learning section to support teacher's own CPD. The document also provides additional ideas for further work to support the nature of working scientifically with ideas for the different types of enquiry: observing over time, pattern seeking, identifying, classifying and grouping, comparative and fair testing and researching using secondary sources, as well as possible Key Scientists and Linked Texts.

At Brabourne CEP School, we follow the Hamilton (Mixed Year) Scheme of Works as a guide for our planning. As our school set – up is mixed year groups in KS1 and KS2 we have made some adaptations to the KS1 and KS2 Science curriculum to accommodate this. Units such as Animals including Humans, and Living things and Their Habitats are taught in both cycles, however the content has been specifically planned to ensure there is no overlap-teaching between the mixed year groups.

Alongside Hamilton, we may also draw from other sources, such as CLEAPSS, Plan ASE, and Twinkl, to supplement work.

Brabourne Curriculum Overview Cycle A

<table>
<tr><th></th><th>Term 1</th><th>Term 2</th><th>Term 3</th><th>Term 4</th><th>Term 5</th><th>Term 6</th></tr>
<tr><td>Venus</td><td>Super Me
Our bodies
Senses</td><td>Hip Hip Hooray
Seasonal Change</td><td>Heroes
Our bodies
Senses</td><td>Wheels, Wings and Flying Things
Materials</td><td>Wonderful World
Life Cycles
Plants</td><td>Dinosaur Roar
Animals</td></tr>
<tr><td>Mars
Yr1 + Yr2</td><td colspan="2">Space – To Infinity & Beyond
Light and Dark</td><td colspan="2">An Island Life
Animals including Humans</td><td colspan="2">The Seaside
(Mantle of the Expert)
Materials and their Everyday Use</td></tr>
<tr><td rowspan="2">Neptune
Yr3 + Yr 4</td><td colspan="2">The Dark Ages</td><td colspan="2">The Sands of Time
(Mantle of the Expert)</td><td colspan="2" rowspan="2">The Environment
Plants</td></tr>
<tr><td>Light</td><td>Sound</td><td>Living things and their habitats (1)</td><td>Electricity</td></tr>
<tr><td rowspan="2">Jupiter
Yr 5 + Yr 6</td><td colspan="2">The World at War</td><td colspan="2">Welcome to the Jungle</td><td colspan="2" rowspan="2">Storms and Ship Wrecks
(Mantle of the Expert)
Forces (1)</td></tr>
<tr><td>Properties and Changes of Materials</td><td>Light</td><td>Animals Including Humans (1)</td><td>Living things and their Habitats (1)</td></tr>
</table>

Brabourne Curriculum Overview Cycle B

<table>
<tr><th></th><th>Term 1</th><th>Term 2</th><th>Term 3</th><th>Term 4</th><th>Term 5</th><th>Term 6</th></tr>
<tr><td>Venus</td><td>Super Me
Our bodies
Senses</td><td>Hip Hip Hooray
Seasonal Change</td><td>Heroes
Our bodies
Senses</td><td>Wheels, Wings and Flying Things
Materials</td><td>Wonderful World
Life Cycles
Plants</td><td>Dinosaur Roar
Animals</td></tr>
<tr><td>Mars
Yr1 + Yr2</td><td colspan="2">Houses and Homes
(Mantle of the Expert)

Materials and their Properties</td><td colspan="2">Once Upon A Time

Living things and their Habitats</td><td colspan="2">Down in the Jungle

Plants</td></tr>
<tr><td rowspan="2">Neptune
Yr3 + Yr 4</td><td colspan="2">Hard Times
(Rivers + Coasts and WW1)</td><td colspan="2">Between A Rock and a Hard Place
(incl. Local Study – the Church)</td><td colspan="2">The Ancient World – The Sands of Time
(Mantle of the Expert)</td></tr>
<tr><td>Living Things and their Habitats (2)</td><td>Forces and Magnets</td><td>Rocks</td><td>States of Matter</td><td colspan="2">Animals Including Humans</td></tr>
<tr><td rowspan="2">Jupiter
Yr 5 + Yr 6</td><td colspan="2">Back to the Future
(Mantle of the Expert)</td><td colspan="2">Natural Disasters</td><td colspan="2">Healthy Humans</td></tr>
<tr><td>Evolution and Inheritance</td><td>Electricity</td><td>Forces</td><td>Earth and Space</td><td>Living Things and their Habitats (2)</td><td>Animals Including Humans</td></tr>
</table>

Science in EYFS at Brabourne School

At Brabourne School children in the Reception year follow the Early Years Foundation Stage Curriculum. Science falls into the Early Learning Goal – The World and has the expectation that:

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes.

The Reception classroom is designed so that during daily sustained periods of learning through play, children are able to develop their skills in the above area. For example a progressive self- serve playdough station has the opportunity for children to measure and mix ingredients to make their own dough, observing and experimenting with the changes throughout the processes. Another example is outdoor water area, complete with resources to promote observational skills and enquiry skills. Whilst these areas are permanent features of the classroom the resources within them will be ever changing and based upon the observations and assessments that the adults make of the children whilst engaged in play, in order to enable the children to move forward in their learning.

The children in the Reception class make frequent use of the outdoor area, school grounds and local environments. Such learning opportunities will be planting, growing and caring for sunflowers, exploring seasonal change by observing our horse chestnut trees at different stages in the year, hunting for minibeasts at varying times of the year and visiting the local pond to pond dip, amongst many other things. Through the use of texts and videos and some trips, throughout the year children have further opportunities to make comparisons to different places. Children in the reception year also have the opportunity to observe and care for chicks/ducklings in the spring term to develop their knowledge and understanding of some animals.

In the reception year children will understand what is meant by the words **science, investigate** and **observe.**

Year 1 – Plants

National Curriculum Objectives

- **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.**
- **Identify and name the roots, trunk, branches and leaves of trees.**

Sticky Knowledge

- Plants grow from seeds/bulbs
- Plants need light and water to grow and survive
- Plants are important
- We can eat lots of plants

Vocabulary

Leaf petal stem root bud

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Children can identify some of the plants growing locally. These can be identified by looking at the key characteristics of the plant.
Plants have common parts, but they vary between the different types of plants. Some trees keep their leaves all year while other trees drop their leaves during autumn and grow them again during spring.

To achieve the above children:
• Can name trees and other plants that they see regularly
• Can describe some of the key features of these trees and plants e.g. the shape of the leaves, the colour of the flower/blossom
• Can point out trees which lost their leaves and those that kept them the whole year
• Can point to and name the parts of a plant, recognising that they are not always the same e.g. leaves and stems may not be green

Key Scientists that could be explored

Beatrix Potter
(Author & Botanist)

Linked Texts that could be explored

Tree: Seasons Come, Seasons Go
(Patricia Hegarty and Britta Teckentrup)

A Little Guide to Wild Flowers
(Charlotte Voake)

The Things That I LOVE about TREES
(Chris Butterworth)

Harry's Hazelnut
(Ruth Parsons)

Prior Learning

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)

Possibly Question(s):

- How do Plants grow?
- What do Plants need to grow?
- Do all plants need water?
- Are all plants green?
- Why do seeds look different?
- Can plants grow as big in the shade?
- What is the biggest/smallest/smelliest (etc) tree/flower/plant on the planet?

Future Learning

• Observe and describe how seeds and bulbs grow into mature plants. (Y2 - Plants)
• Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. (Y2 - Plants)
• Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)
• Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. (Y3 - Plants)
• Investigate the way in which water is transported within plants. (Y3 Plants)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Which type of compost grows the tallest sunflower? Which tree has the biggest leaves?	How can we sort the leaves that we collected on our walk?	How does a daffodil bulb change over the year? How does my sunflower change each week? How does the horse chestnut tree change over the year?	Do trees with bigger leaves lose their leaves first in autumn? Is there a pattern in where we find moss growing in the school grounds?	What are the most common British plants and where can we find them? How did Beatrix Potter help our understanding of mushrooms and toadstools?	How did Beatrix Potter help our understanding of mushrooms and toadstools? In the 1500s, tobacco plants were grown in Britain for medicine. How have our ideas about these plants changed?

Year 2 – Plants

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Observe and describe how seeds and bulbs grow into mature plants.** • **Find out and describe how plants need water, light and warmth to grow and stay healthy.**	• Plants grow from seeds/bulbs • Plants need light, water and warmth to grow and survive • Flowers make seeds to make more plants (reproduce) • Plants are important • We need plants to survive (to clean air, to eat) • We can eat different parts of the plants (leaves, stems, roots, seeds, fruit)	Seed trunk evergreen sun healthy	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	Plants may grow from either seeds or bulbs. These then germinate and grow into seedlings which then continue to grow into mature plants. These mature plants may have flowers which then develop into seeds, berries, fruits etc. Seeds and bulbs need to be planted outside at particular times of year and they will germinate and grow at different rates. Some plants are better suited to growing in full sun and some grow better in partial or full shade. Plants also need different amounts of water and space to grow well and stay healthy. To achieve the above children: • Can describe how plants that they have grown from seeds and bulbs have developed over time • Can identify plants that grew well in different conditions	Agnes Arber (Botanist) Alan Titchmarsh (Botanist & Gardener)	***The Tin Forest*** *(Helen Ward)* ***Jack and the Beanstalk*** *(Richard Walker)* ***Ten Seeds*** *(Ruth Brown)* **A Seed Is Sleepy** (Dianna Aston)

Prior Learning	Possibly Question(s):	Future Learning
• Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. (Y1 - Plants) • Identify and describe the basic structure of a variety of common flowering plants, including trees. (Y1 - Plants)	• Do cress produce seeds, how could we find out? • Do all plants produce flowers and seeds? • What is different between freshly cut and planted flowers? • Do plants flower all year round? • What are flowers for? • What happens to a plant after it has produced seeds?	• Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. (Y3 - Plants) • 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. (Y3 - Plants) • Investigate the way in which water is transported within plants. (Y3 -Plants) • Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Do cress seeds grow quicker inside or outside?	How can we identify the trees that we observed on our tree hunt?	What happens to my bean after I have planted it?	Do bigger seeds grow into bigger plants?	How does a cactus survive in a desert with no water?	How did George Washington Carver use science to improve farming in America?

Year 3 – Plants

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Identify and describe the functions of different parts of the flowering plant: roots, stem/trunk/leaves and flowers** • **Explore the part flowers play in a flowering plants life cycle, including: pollination, seed formation and seed dispersal** • **Explain the requirements of plants for life and growth (air, light, water, nutrients from soil, room to grow) and how they vary between plants** • **Know the way in which water is transported between plants**	• Plants are producers, they make their own food. • Their leaves absorb sunlight and carbon dioxide • Plants have roots, which provide support and draw water from the soil • Flowering plants have specific adaptations which help it to carry out pollination, fertilisation and seed production • Seed dispersal improves a plants chances of successful reproduction • Seeds/bulbs require the right conditions to germinate and grow. • Seeds contain enough food for the plant's initial growth	Seed dispersal, wind, animal, water	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	Many plants, but not all, have roots, stems/trunks, leaves and flowers/blossom. The roots absorb water and nutrients from the soil and anchor the plant in place. The stem transports water and nutrients/minerals around the plant and holds the leaves and flowers up in the air to enhance photosynthesis, pollination and seed dispersal. The leaves use sunlight and water to produce the plant's food. Some plants produce flowers which enable the plant to reproduce. Pollen, which is produced by the male part of the flower, is transferred to the female part of other flowers (pollination). This forms seeds, sometimes contained in berries or fruits which are then dispersed in different ways. Different plants require different conditions for germination and growth. <u>To achieve the above children</u>: • Can explain the function of the parts of a flowering plant • Can describe the life cycle of flowering plants, including pollination, seed formation, seed dispersal, and germination • Can give different methods of pollination and seed dispersal, including examples	**Jan Ingenhousz** (Photosynthesis) **Joseph Banks** (Botanist)	***The Hidden Forest*** *(Jeannie Baker)* ***George and Flora's Secret Garden*** *(Jo Elworthy)*
Prior Learning	**Possible Question(s):**	**Future Learning**	
• Observe and describe how seeds and bulbs grow into mature plants. (Y2 - Plants) • Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. (Y2 - Plants)	• How do plants reproduce? • Do all flowers look the same? • How do insects know which flowers to pollinate? • Why do flowers smell? • What do seeds do? • Can a plant live without its leaves? • Do grass/trees make flowers? • What conditions are perfect for a seed to grow? • Where do weeds come from? • How does the space between seeds affect how well they grow? • Does seed size match plant size? • Do plants take in water through their roots? • How does water move through the plant? • How do plants make their food? • How does light affect plant growth?	• Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats) • Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms. (KS3)	

	• How does a plant get carbon dioxide? •	

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the length of the carnation stem affect how long it takes for the food colouring to dye the petals? Which conditions help seeds germinate faster?	How many different ways can you group our seed collection?	What happens to celery when it is left in a glass of coloured water? How do flowers in a vase change over time?	What colour flowers do pollinating insects prefer?	What are all the different ways that seeds disperse?	

Year 1 – Animals Including Humans

National Curriculum Objectives

- **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**

Sticky Knowledge

- There are many different animals with different characteristics.
- Animals have senses to help individuals survive. When animals sense things they are able to respond.
- Animals need food to survive.
- Animals need a variety of food to help them grow, repair their bodies, be active and stay healthy.

Vocabulary

Head body feathers teeth paws

N.B.
The children need to be able to name and identify a range of animals in each group e.g. name specific birds and fish. They do not need to use the terms mammal, reptiles etc. or know the key characteristics of each, although they will probably be able to identify birds and fish, based on their characteristics.
The children also do not need to use the words carnivore, herbivore and omnivore. If they do, ensure that they understand that carnivores eat other animals, not just meat.
Although we often use our fingers and hands to feel objects, the children should understand that we can feel with many parts of our body.

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Animals vary in many ways having different structures e.g. wings, tails, ears etc. They also have different skin coverings e.g. scales, feathers, hair. These key features can be used to identify them.
Animals eat certain things - some eat other animals, some eat plants, some eat both plants and animals.
Humans have key parts in common, but these vary from person to person.
Humans (and other animals) find out about the world using their senses.
Humans have five senses – sight, touch, taste, hearing and smelling. These senses are linked to particular parts of the body.

To achieve the above children:
• Can name a range of animals which includes animals from each of the vertebrate groups
• Can describe the key features of these named animals
• Can label key features on a picture/diagram
• Can write descriptively about an animal
• Can write a What am I? riddle about an animal
• Can describe what a range of animals eat
• Can play and lead 'Simon says'
• During PE lessons, can follow instructions involving parts of the body

Key Scientists that could be explored

Chris Packham
(Animal Conservationist)

Linked Texts that could be explored

One Year with Kipper
(Mick Inkpen)

Snail Trail
(Ruth Brown)

Superworm
(Julia Donaldson & Axel Scheffler)

Prior Learning

• Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)

Possible Question(s):

- What do animals eat?
- Do all animals eat the same food?
- Which of our senses is the most accurate at identifying food?
- Do all animals hunt?
- Why are animals different colours and patterns?

Future Learning

• 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. (Y2 - Living things and their habitats)
• 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. (Y6 – Living things and their habitats)
• Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Is our sense of smell better when we can't see?	How can we organise all the zoo animals? What are the names for all the parts of our bodies?	How does my height change over the year?	Do you get better at smelling as you get older?	How are the animals in Australia/Artic/Africa etc different to the ones that we find in Britain? Do all animals have the same	What strange ideas did Italian scientist Luigi Galvani have about animals in 1780? Why did he think that? How did French doctor Renè Laennec's ideas improve medicine?

				senses as humans?	

Year 2 – Animals Including Humans

National Curriculum Objectives

- **Know that animals, including humans, have offspring which grow into adults**
- **Know the basic stages in a life cycle for animals, including humans.**
- **Find out and describe the basic needs of animals, including humans, for survival (water, food and air).**
- **Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.**

Sticky Knowledge

- Animals move in order to survive.
- Different animals move in different ways to help them survive.
- Exercise keeps animal's bodies in good condition and increases survival chances.
- All animals eventually die.
- Animals reproduce new animals when they reach maturity.
- Animals grow until maturity and then don't grow any larger.

Vocabulary

Growth child young/old germs disease

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Animals, including humans, have offspring which grow into adults. In humans and some animals, these offspring will be young, such as babies or kittens, that grow into adults. In other animals,such as chickens or insects, there may be eggs laid that hatch to young or other stages which then grow to adults. The young of some animals do not look like their parents e.g. tadpoles.
All animals, including humans, have the basic needs of feeding, drinking and breathing that must be satisfied in order to survive. To grow into healthy adults, they also need the right amounts and types of food and exercise. Good hygiene is also important in preventing infections and illnesses.

To achieve the above children:
Can describe how animals, including humans, have offspring which grow into adults, using the appropriate names for the stages
• Can state the basic needs of animals, including humans, for survival
• Can state the importance for humans of exercise, eating the right amounts of different types of food, and hygiene
• Can name foods in each section of the Eatwell Guide

Key Scientists that could be explored

Steve Irwin
(Crocodile Hunter)

Robert Winston
(Human Scientist)

Joe Wicks
(Personal Trainer)

Linked Texts that could be explored

The Gruffalo
(Julia Donaldson)

Meerkat Mail
(Emily Gravett)

Tadpole's Promise
(Jeanne Willis and Tony Ross)

Prior Learning

• Identify and name a variety of common animals that are carnivores, herbivores and omnivores. (Y1 - Animals, including humans)
• Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans)

Possible Question(s):

- How long do should my pets live for?
- Do all animals grow and live the same way?
- Do bigger animals live longer?
- Why are we all different heights?
- How and why do we grow and change?

Future Learning

• 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. (Y3 - Animals, including humans)
• Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (Y5 - Living things and their habitats)
• Describe the life process of reproduction in some plants and animals. (Y5- Living things and their habitats)
• Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. (Y6 - Animals, including humans)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Do amphibians have more in common with reptiles or fish? Do bananas make us run faster?	Which offspring belongs to which animal? How would you group things to show which are living, dead, or have never been alive?	How does a tadpole change over time? How much food and drink do I have over a week?	Which age group of children wash their hands the most in a day?	What food do you need in a healthy diet and why? What do you need to do to look after a pet dog/cat/lizard and keep it healthy?	When the first fizzy drink machine was invented in 1775, scientist Joseph Priestley said it was the cure to many health problems. What ideas do scientists have about fizzy drinks today? How did Florence Nightingale use maths to help her come up with ideas to improve nursing?

Year 3 – Animals Including Humans

National Curriculum Objectives

- **Identify that animals, including humans, need the right types and amount of nutrition, and they cannot make their own food; they get their nutrition from what they eat.**
- **Know how nutrients, water and oxygen are transported within animals and humans.**
- **Know about the importance of a nutritious, balanced diet.**
- **Identify that humans and some other animals have skeletons and muscles for support, protection and movement:**

Sticky Knowledge

- Different animals are adapted to eat different foods.
- Many animals have skeletons to support their bodies and protect vital organs.
- Muscles are connected to bones and move them when they contract.
- Movable joints connect bones.

Vocabulary

Skeleton bones muscle

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Animals, unlike plants which can make their own food, need to eat in order to get the nutrients they need.
Food contains a range of different nutrients – carbohydrates (including sugars), protein, vitamins, minerals, fats, sugars, water – and fibre that are needed by the body to stay healthy. A piece of food will often provide a range of nutrients.
Humans, and some other animals, have skeletons and muscles which help them move and provide protection and support.

To achieve the above children:
• Can name the nutrients found in food
• Can state that to be healthy we need to eat the right types of food to give us the correct amount of these nutrients
• Can name some bones that make up their skeleton, giving examples that support, help them move or provide protection
• Can describe how muscles and joints help them to move

Key Scientists that could be explored

Adelle Davis
(20th Century Nutritionist)

Marie Curie
(Radiation / X-Rays)

Linked Texts that could be explored

The Story of Frog Belly Rat Bone
(Timothy Basil Ering)

Funnybones
(Janet and Allan Ahlberg)

I Will Never Not Ever Eat a Tomato
(Lauren Child)

Goldilocks and the Three Bears
(Samantha Berger)

Prior Learning

• Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. (Y1 - Animals, including humans)
• Identify and name a variety of common animals that are carnivores, herbivores and omnivores. (Y1 - Animals, including humans)
• Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). (Y1 - Animals, including humans)
• Find out about and describe the basic needs of animals, including humans, for survival (water, food and air). (Y2 - Animals, including humans)
• Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. (Y2 - Animals, including humans)

Possible Question(s):

- Why do we need a skeleton?
- What types of skeleton are there?
- Are all skeletons the same?
- Can something survive without a skeleton?
- What happens if we break a bone?
- How do we move?
- Are bones that are bigger, stronger?
- Why do we need joints?
- Why do muscles get tired?
- Can we 'break' muscles?

Future Learning

• Describe the simple functions of the basic parts of the digestive system in humans. (Y4 - Animals, including humans)
• Identify the different types of teeth in humans and their simple functions. (Y4 - Animals, including humans)
• Construct and interpret a variety of food chains, identifying producers, predators and prey. (Y4 - Animals, including humans)
• Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. (Y6 - Animals, including humans)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the angle that your elbow/knee is bent affect the circumference of your upper arm/thigh? How does the skull circumference of girl compare with that of a boy?	How do the skeletons of different animals compare? How can we group the food that we eat?	How does our skeleton change over time? (from birth to death)	Do male humans have larger skulls that female humans?	Why do different types of vitamins keep us healthy and which foods can we find them in?	How did James Lind explain the cause of scurvy and what was his evidence? How did chemist, Marie Maynard Daly, use science to help us improve our diets?

Year 4 – Animals Including Humans

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **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**	• Animals have teeth to help them eat. • Different types of teeth do different jobs. • Food is broken down by the teeth and further in the stomach and intestines where nutrients go into the blood. • The blood takes nutrients around the body. • Nutrients produced by plants move to primary consumers then to secondary consumers through food chains.	Herbivore carnivore omnivore	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	Food enters the body through the mouth. Digestion starts when the teeth start to break the food down. Saliva is added and the tongue rolls the food into a ball. The food is swallowed and passes down the oesophagus to the stomach. Here the food is broken down further by being churned around and other chemicals are added. The food passes into the small intestine. Here nutrients are removed from the food and leave the digestive system to be used elsewhere in the body. The rest of the food then passes into the large intestine. Here the water is removed for use elsewhere in the body. What is left is then stored in the rectum until it leaves the body through the anus when you go to the toilet. Humans have four types of teeth: incisors for cutting; canines for tearing; and molars and premolars for grinding (chewing). <u>To achieve the above children</u>: • Can sequence the main parts of the digestive system • Can draw the main parts of the digestive system onto a human outline • Can describe what happens in each part of the digestive system • Can point to the three different types of teeth in their mouth and talk about their shape and what they are used for • Can name producers, predators and prey within a habitat Can construct a food chain	**Ivan Pavlov** (Digestive System Mechanisms) **Joseph Lister** (Discovered Antiseptics)	***Human Body Odyssey*** *(Werner Holzwarth)* ***Crocodiles Don't Brush Their Teeth*** *(Colin Fancy)* ***Wolves*** *(Emily Gravett)*

Prior Learning	Possible Question(s):	Future Learning
• Identify and name a variety of common animals that are carnivores, herbivores and omnivores. (Y1 - Animals, including humans) • Find out about and describe the basic needs of animals, including humans, for survival (water, food and air). (Y2 - Animals, including humans) • Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. (Y2 - Animals, including humans) • Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. (Y3 - Animals, including humans)	• What different types of food are there? • Why do we need a variety of different foods? • Do all organisms eat the same things? • Why do some people need different diets? (weightlifter vs marathon runner) • Why are teeth important? • What happens to our food? • What is our digestive system? • How does our food turn into poo and wee?	• Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. (Y6 - Animals, including humans) • Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function. (Y6 - Animals, including humans) • Describe the ways in which nutrients and water are transported within animals, including humans. (Y6 - Animals, including humans)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
In our class, are omnivores taller than vegetarians?	What are the names for all the organs involved in the digestive system? How can we organise teeth into groups?	How does an egg shell change when it is left in cola?	Are foods that are high in energy always high in sugar?	How do dentists fix broken teeth?	How has a visit to the dentist changed since ancient times?

Year 5 – Animals Including Humans

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Describe the changes as humans develop to old age.**	• Different animals mature at different rates and live to different ages. • Puberty is something we all go through, a process which prepares our bodies for being adults, and reproduction • Hormones control these changes; which can be physical and/or emotional. •	Puberty	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	When babies are young, they grow rapidly. They are very dependent on their parents. As they develop, they learn many skills. At puberty, a child's body changes and develops primary and secondary sexual characteristics. This enables the adult to reproduce. This needs to be taught alongside PSHE. To achieve the above children: • Can explain the changes that takes place in boys and girls during puberty • Can explain how a baby changes physically as it grows, and also what it is able to do	**Dr Steve Jones** (Genetisist) ***Prof Robert Winston*** (Human Scientist)	***Hair in Funny Places*** *(Babette Cole)* ***Giant*** *(Kate Scott)* ***You're Only Old Once!*** *(Dr. Seuss)*

Prior Learning	Possible Question(s):	Future Learning
• Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals, including humans)	• What do humans look like? • Do all animal embryos look the same? • How do humans change? • Why do humans change? • What causes puberty? • What changes do we go through during puberty? • Are there any patterns between vertebrate animals and their gestation periods?	• Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does age affect a human's reaction time? Who grows the fastest, girls or boys?	Can you identify all the stages in the human life cycle?	How do different animal embryos change?	Is there a relationship between a mammal's size and its gestation period?	Why do people get grey/white hair when they get older?	How and why has life expectancy in the UK changed since the Middle Ages?

Year 6 – Animals Including Humans

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **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.**	• The heart pumps blood around the body. • Oxygen is breathed into the lungs where it is absorbed by the blood. • Muscles need oxygen to release energy from food to do work. (Oxygen is taken into the blood in the lungs; the heart pumps the blood through blood vessels to the muscles; the muscles take oxygen and nutrients from the blood.) •	Heart, pulse, rate, pumps, blood, blood vessels, transported, lungs, oxygen, carbon dioxide, water, muscles, circulatory system,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	The heart pumps blood in the blood vessels around to the lungs. Oxygen goes into the blood and carbon dioxide is removed. The blood goes back to the heart and is then pumped around the body. Nutrients, water and oxygen are transported in the blood to the muscles and other parts of the body where they are needed. As they are used, they produce carbon dioxide and other waste products. Carbon dioxide is carried by the blood back to the heart and then the cycle starts again as it is transported back to the lungs to be moved from the body. This is the human circulatory system. Diet, exercise, drugs and lifestyle have an impact on the way our bodies function. They can affect how well out heart and lungs work, how likely we are to suffer from conditions such as diabetes, how clearly we think, and generally how fit and well we feel. Some conditions are caused by deficiencies in our diet e.g. lack of vitamins. This needs to be taught alongside PSHE. <u>To achieve the above children</u>: • Can draw a diagram of the circulatory system and label the parts and annotate it to show what the parts do • Produces a piece of writing that demonstrates the key knowledge e.g. explanation text, job description of the heart	**Justus von Liebig** (Theories of Nutrition and Metabolism) **Sir Richard Doll** (Linking Smoking and Health Problems) **Leonardo Da Vinci** (Anatomy) **William Harvey**	***Pig-Heart Boy*** *(Malorie Blackman)* ***Skellig*** *(David Almond)* ***A Heart Pumping Adventure*** *(Heather Manley)*

Prior Learning	Possible Question(s):	Future Learning
• Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. (Y2 - Animals, including humans) • Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat. (Y3 - Animals, including humans) • Describe the simple functions of the basic parts of the digestive system in humans. (Y4 - Animals, including humans) • Identify the different types of teeth in humans and their simple functions. (Y4 - Animals, including humans)	• Why do we need oxygen? • How do we breathe? • Do fish and plants breathe? • Do all living things need oxygen? • How does the size of a person's lungs affect their lung capacity? • Are there ways to increase/decrease our lung capacity? Is lung capacity fixed? • Why do we have blood? • How does our heart work? • How does size of muscle affect our pulse rate? • How does exercise effect our pulse rate? • How might the circulatory system of an elephant, a hummingbird, or a polar bear differ? • Is the air you breathe out, the same as that you breathe in?	• The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases. (KS3) • The effects of recreational drugs (including substance misuse) on behaviour, health and life processes. (KS3) • The structure and functions of the gas exchange system in humans, including adaptations to function. (KS3) • The mechanism of breathing to move air in and out of the lungs. (KS3) • The impact of exercise, asthma and smoking on the human gas exchange system. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time

How does the length of time we exercise for affect our heart rate? Can exercising regularly affect your lung capacity? Which type of exercise has the greatest effect on our heart rate?	Which organs of the body make up the circulation system, and where are they found?	How does my heart rate change over the day? How much exercise do I do in a week?	Is there a pattern between what we eat for breakfast and how fast we can run?	How have our ideas about disease and medicine changed over time?	What ideas did Edward Jenner have about small pox and how did he test them?

Year 6 – Evolution and Inheritance

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Know about evolution and can explain what it is.** • **Know how fossils can be used to find out about the past.** • **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- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago**	• Life cycles have evolved to help organisms survive to adulthood. • Over time the characteristics that are most suited to the environment become increasingly common. *NB: The following could be duplicated in Year 6 Living things and their habitats.* • Organisms best suited to their environment are more likely to survive long enough to reproduce. Organisms are best adapted to reproduce are more likely to do so. • Organisms reproduce and offspring have similar characteristic patterns. • Variation exists within a population (and between offspring of some plants) • Competition exists for resources and mates	Offspring, sexual reproduction, vary, characteristics,, adapted, inherited, species	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	All living things have offspring of the same kind, as features in the offspring are inherited from the parents. Due to sexual reproduction, the offspring are not identical to their parents and vary from each other. Plants and animals have characteristics that make them suited (adapted) to their environment. If the environment changes rapidly, some variations of a species may not suit the new environment and will die. If +the environment changes slowly, animals and plants with variations that are best suited survive in greater numbers to reproduce and pass their characteristics on to their young. Over time, these inherited <u>To achieve the above children</u>: • Can explain the process of evolution • Can give examples of how plants and animals are suited to an environment • Can give examples of how an animal or plant has evolved over time e.g. penguin, peppered moth • Give examples of living things that lived millions of years ago and the fossil evidence we have to support this • Can give examples of fossil evidence that can be used to support the theory of evolution	**Charles Darwin and Alfred Russel Wallace** (Theory of Evolution by Natural Selection) **Jane Goodall** (Chimpanzees)	***One Smart Fish*** *(Christopher Wormell)* ***The Molliebird*** *(Jules Pottle)* ***Our Family Tree*** *(Lisa Westberg Peters)*

Prior Learning	Possible Question(s):	Future Learning
• 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. (Y2 - Living things and their habitats) • Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals, including humans) • Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants) • Describe in simple terms how fossils are formed when things that have lived are trapped within rock. (Y3 - Rocks) • Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their	• Why are we all different? • What is variation, and why is it important? • How did life begin on Earth? • How do we change? • What is evolution? • What evidence is there for evolution? • How does evolution happen? • What reasons do animals become extinct? • Polar Bears habitat is rapidly changing, what possible futures do they face and can we predict which is most likely? • How did Darwin come up with the theory? • Why was his theory not initially accepted?	• Heredity as the process by which genetic information is transmitted from one generation to the next. (KS3) • A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model. (KS3) • The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection. (KS3) • Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction. (KS3)

habitats) • Describe the life process of reproduction in some plants and animals. (Living things and their habitats - Y5)		

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
What is the most common eye colour in our class?	Compare the skeletons of apes, humans, and Neanderthals – how are they similar, and how are they different? Can you classify these observations into evidence for the idea of evolution, and evidence against?	How has the skeleton of the horse changed over time?	Is there a pattern between the size and shape of a bird's beak and the food it will eat?	What happened when Charles Darwin visited the Galapagos islands? What ideas did American geneticist Barbara McClintock have about genes that won her a Nobel Prize?	What ideas did American geneticist Barbara McClintock have about genes that won her a Nobel Prize?

Year 4 – Living Things and Their Habitats

National Curriculum Objectives

- **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 danger to living things.**

Sticky Knowledge

- Living things can be divided into groups based upon their characteristics
- Environmental change affects different habitats differently
- Different organisms are affected differently by environmental change
- Different food chains occur in different habitats
- Human activity significantly affects the environment

Vocabulary

deforestation, environment, habitat

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Living things can be grouped (classified) in different ways according to their features. Classification keys can be used to identify and name living things. Living things live in a habitat which provides an environment to which they are suited (Year 2 learning).
These environments may change naturally e.g. through flooding, fire, earthquakes etc. Humans also cause the environment to change. This can be in a good way (i.e. positive human impact, such as setting up nature reserves) or in a bad way (i.e. negative human impact, such as littering). These environments also change with the seasons; different living things can be found in a habitat at different times of the year.

To achieve the above children:
• Can name living things living in a range of habitats, giving the key features that helped them to identify them
• Can give examples of how an environment may change both naturally and due to human impact

Key Scientists that could be explored

Cindy Looy
(Environmental Change and Extinction)

Jaques Cousteau
(Marine Biologist)

Linked Texts that could be explored

The Vanishing Rainforest
(Richard Platt)

The Morning I Met a Whale
(Michael Morpurgo)

Journey to the River Sea
(Eva Ibbotson)

Prior Learning

• Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. (Y1 - Plants)
• Identify and describe the basic structure of a variety of common flowering plants, including trees. (Y1 - Plants)
• Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals. (Y1 - Animals including humans)
• Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets). (Y1 – Animals, including humans)
• Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)

Possible Question(s):

- What food chains and webs are there in our local habitat?
- How does energy move through the food chain?
- How does removal of one species from an environment, affect others?
- How does environmental change affect different organisms?
- What are the most important things we could do to improve our outside area? (bug hotels, pond, compost, wildflowers to attract butterflies/bees etc)
  How does human activity affect our environment (local road expansion at J10? New homes at Sellindge? Driving to school instead of walking?)

Future Learning

• Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (Y5 - Living things and their habitats)
• Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)
• 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. (Y6 – Living things and their habitats)
• Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Does the amount of light affect how many woodlice move around? How does the average temperature of the pond water change in each season?	Can we use the classification keys to identify all the animals that we caught pond dipping?	How does the variety of invertebrates on the school field change over the year?	How has the use of insecticides affected bee population?	Why are people cutting down the rainforests and what effect does that have?	How did Jane Goodall learn about the habits and behaviours of chimpanzees and why does she still need to work to protect their habitat?

Year 5 – Living Things and Their Habitats

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• Know the life cycle of different living things, e.g. Mammal, amphibian, insect bird. • Know the process of reproduction in plants. • Know the process of reproduction in animals.	• Different animals mature at different rates and live to different ages. • Some organisms reproduce sexually where offspring inherit information from both parents. • Some organisms reproduce asexually by making a copy of a single parent. • Environmental change can affect how well an organism is suited to its environment. • Different types of organisms have different lifecycles.	Reproduction, Pollination, Dispersal, cell, fertilisation, pollination, young, mammal, egg, embryo, life cycle, plantlets, runners, bulbs, cuttings .	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	As part of their life cycle, plants and animals reproduce. Most animals reproduce sexually. This involves two parents where the sperm from the male fertilises the female egg. Animals, including humans, have offspring which grow into adults. In humans and some animals, these offspring will be born live, such as babies or kittens, and then grow into adults. In other animals, such as chickens or snakes, there may be eggs laid that hatch to young which then grow to adults. Some young undergo a further change before becoming adults e.g. caterpillars to butterflies. This is called a metamorphosis. Plants reproduce both sexually and asexually. Bulbs, tubers, runners and plantlets are examples of asexual plant reproduction which involves only one parent. Gardeners may force plants to reproduce asexually by taking cuttings. Sexual reproduction occurs through pollination, usually involving wind or insects. <u>To achieve the above children</u>: • Can draw the life cycle of a range of animals identifying similarities and differences between the life cycles • Can explain the difference between sexual and asexual reproduction and give examples of how plants reproduce in both ways	**James Brodie of Brodie** (Reproduction of Plants by Spores) **David Attenborough** (Naturalist and Nature Documentary Broadcaster)	***The Land of Neverbelieve*** *(Norman Messenger)* ***Mummy Laid an Egg*** *(Babette Cole)*
Prior Learning	**Possible Question(s):**	**Future Learning**	
• Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals, including humans) • Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants)	• What is a life cycle? What types of life cycles are there? • Are life cycles the same? • Do plants reproduce in the same ways as us? • How do plants spread their seeds?	• Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta. (KS3) • Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms. (KS3)	

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the level of salt affect how quickly brine shrimp hatch?	Compare this collection of animals based on similarities and differences in their lifecycle.	How do brine shrimp change over their lifetime? How does a bean change as it germinates?	Is there are relationship between number of petals and number of stamen?	What are the differences between the life cycle of an insect and a mammal?	How did the experiments and ideas of Jan Ingenhousz help improve our understanding of plants?

Year 6 – Living Things and Their Habitats

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Classify living things into broad groups according to observable characteristics and based on similarities and differences.** • **Give reasons for classifying plants and animals based on specific characteristics.**.	• Variation exists within a population (and between offspring of some plants) – *NB: this Key Idea is duplicated in Year 6 Evolution and Inheritance.* • Organisms best suited to their environment are more likely to survive long enough to reproduce. • Organisms are best adapted to reproduce are more likely to do so. • Organisms reproduce and offspring have similar characteristic patterns. • Competition exists for resources and mates.	Variation. Classification, flowering, nonflowering, vertebrates, fish, amphibians, reptiles, birds, mammals, invertebrate, microorganism,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	Living things can be formally grouped according to characteristics. Plants and animals are two main groups but there are other livings things that do not fit into these groups e.g. micro-organisms such as bacteria and yeast, and toadstools and mushrooms. Plants can make their own food whereas animals cannot. Animals can be divided into two main groups: those that have backbones (vertebrates); and those that do not (invertebrates). Vertebrates can be divided into five small groups: fish; amphibians; reptiles; birds; and mammals. Each group has common characteristics. Invertebrates can be divided into a number of groups, including insects, spiders, snails and worms. Plants can be divided broadly into two main groups: flowering plants; and non-flowering plants. <u>To achieve the above children</u>: • Can give examples of animals in the five vertebrate groups and some of the invertebrate groups • Can give the key characteristics of the five vertebrate groups and some invertebrate groups • Can compare the characteristics of animals in different groups Can give examples of flowering and non-flowering plants	**Carl Linnaeus** (Identifying, Naming and Classifying Organisms)	***Beetle Boy*** *(M G Leonard)* ***Insect Soup*** *(Barry Louis Polisar)* ***Fur and Feathers*** *(Janet Halfmann)*

Prior Learning	Possible Question(s):	Future Learning
• Recognise that living things can be grouped in a variety of ways. (Y4 - Living things and their habitats) • Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (Y4 – Living things and their habitats) • Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird. (Y5 - Living things and their habitats) • Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)	• Why do we need to classify living things? • How do we classify? • What are the difficulties with classification? (penguins, whales, platypus) • How do animals change over time? • Why does variation exist? • What happens if animals of different species breed? (hybrids) • What happens to house plants outside? • What are microorganisms? • How can we prevent the spread of disease? • Why do animals and plants compete – and what for?	• Differences between species. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the temperature affect how much gas is produced by yeast?	How would you make a classification key for vertebrates/invertebrates or	What happens to a piece of bread if you leave it on the windowsill for two weeks?	Do all flowers have the same number of petals?	What do different types of microorganisms do? Are they always harmful?	How did Carl Linneaus' ideas help us to group plants?

Which is the most common invertebrate on our school playing field?	microorganisms?				

Year 4 – Electricity

National Curriculum Objectives

- **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 the 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.**
- **Know the difference between a conductor and an insulator; giving examples of each. Safety when using electricity.**

Sticky Knowledge

- A source of electricity (mains of battery) is needed for electrical devices to work.
- Electricity sources push electricity round a circuit.
- More batteries will push the electricity round the circuit faster.
- Devices work harder when more electricity goes through them.
- A complete circuit is needed for electricity to flow and devices to work.
- Some materials allow electricity to flow easily and these are called conductors. Materials that don't allow electricity to flow easily are called insulators.

Vocabulary

electrical circuit,, conductor, insulator,

N.B.
Children in Year 4 do not need to use standard symbols for electrical components, as this is taught in Year 6.

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Many household devices and appliances run on electricity. Some plug in to the mains and others run on batteries. An electrical circuit consists of a cell or battery connected to a component using wires. If there is a break in the circuit, a loose connection or a short circuit, the component will not work. A switch can be added to the circuit to turn the component on and off.
Metals are good conductors so they can be used as wires in a circuit. Non-metallic solids are insulators except for graphite (pencil lead). Water, if not completely pure, also conducts electricity..

To achieve the above children:
• Can name the components in a circuit
• Can make electric circuits
• Can control a circuit using a switch
• Can name some metals that are conductors
• Can name materials that are insulators

Key Scientists that could be explored

Thomas Edison
(First Working Lightbulb)

Joseph Swan
(Incadesecant Light Bulb)

Linked Texts that could be explored

Until I Met Dudley
(Roger McGough)

Oscar and the Bird: A Book about Electricity
(Geoff Waring)

Electrical Wizard: How Nikola Tesla Lit Up the World
(Elizabeth Rusch)

Prior Learning

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)

Possible Question(s):

- What would life be like without electricity?
- What sorts of things use/need electricity?
- What electricity do I use?
- In which ways can we 'get' electricity? (mains/plugs/batteries/wireless)
- How do we make electricity?
- How do batteries work?
- How quickly can batteries run out? Does this make a difference depending on number of components?
- How does the number of batteries added to the circuit affect a device?
- What materials can carry electricity? (conductors/insulators)

Future Learning

• Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. (Y6 - Electricity)
• Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. (Y6 - Electricity)
• Use recognised symbols when representing a simple circuit in a diagram. (Y6 - Electricity)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the thickness of a conducting material affect how bright the lamp is? Which metal is the best conductor of electricity?	How would you group these electrical devices based on where the electricity comes from?	How long does a battery light a torch for?	Which room has the most electrical sockets in a house?	How has electricity changed the way we live? How does a light bulb work?	How has electricity changed the way we live?

Year 6 – Electricity

National Curriculum Objectives

- 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.

Sticky Knowledge

- Batteries are a store of energy. This energy pushes electricity round the circuit. When the battery's energy is gone it stops pushing. Voltage measures the 'push.'
- The greater the current flowing through a device the harder it works.
- Current is how much electricity is flowing round a circuit.
- When current flows through wires heat is released. The greater the current, the more heat is released.

Vocabulary

Electricity, electric current, mains, wires, bulb, battery cell, Circuit, voltage

N.B.
Children do not need to understand what voltage is, but will use volts and voltage to describe different batteries. The words "cells" and "batteries" are now used interchangeably.

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Adding more cells to a complete circuit will make a bulb brighter, a motor spin faster or a buzzer make a louder sound. If you use a battery with a higher voltage, the same thing happens. Adding more bulbs to a circuit will make each bulb less bright. Using more motors or buzzers, each motor will spin more slowly and each buzzer will be quieter.
Turning a switch off (open) breaks a circuit so the circuit is not complete and electricity cannot flow. Any bulbs, motors or buzzers will then turn off as well.
You can use recognised circuit symbols to draw simple circuit diagrams.

To achieve the above children:
• Can make electric circuits and demonstrate how variation in the working of particular components, such as the brightness of bulbs, can be changed by increasing or decreasing the number of cells or using cells of different voltages
• Can draw circuit diagrams of a range of simple series circuits using recognised symbols

Key Scientists that could be explored

Alessandro Volta
(Electrical Battery)

Nicola Tesla
(Alternating Currents)

Linked Texts that could be explored

Goodnight Mister Tom
(Michelle Magorian)

Blackout
(John Rocco)

Hitler's Canary
(Sandi Toksvig)

Prior Learning

• Identify common appliances that run on electricity. (Y4 - Electricity)
• Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. (Y4 - Electricity)
• Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery. (Y4 - Electricity)
• Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. (Y4 - Electricity)
• Recognise some common conductors and insulators, and associate metals with being good conductors. (Y4 - Electricity)

Possible Question(s):

- Do all batteries push as hard as each other?
- What is electricity?
- How does the voltage of a batters affect how much current is pushed?
- How does the length of time I leave the current flowing for affect the brightness of the bulb?
- How does number of bulbs affect the brightness of a bulb?
- Are all types of wires as good as conducting electricity?
- Why are wires insulated in plastic? Does type of material make a difference?
- Does length of wire make a difference?
- Does the type of circuit affect how the components work/long the battery lasts?
- What renewable ways can we generate electricity?
- How does current affect heat?
- What are the dangers of a short circuit?

Future Learning

• Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge. (KS3)
• Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current. (KS3)
• Differences in resistance between conducting and insulating components (quantitative). (KS3)
• Static electricity. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time

How does the voltage of the batteries in a circuit affect the brightness of the lamp? How does the voltage of the batteries in a circuit affect the volume of the buzzer? Which make of battery lasts the longest? Which type of fruit makes the best fruity battery?	How would you group electrical components and appliances based on what electricity makes them do?	How does brightness of bulb change as the battery runs out? How can we measure how quickly a battery is used up? Which brand of battery lasts the longest?	Does the temperature of a light bulb go up the longer it is on?	How has our understanding of electricity changed over time?	How have batteries changed over time?

Year 3 – Forces & Magnets

National Curriculum Objectives

- **Compare how things move on different surfaces.**
- **Know how a simple pulley works and use making lifting an object simpler**
- **Notice that some forces need contact between two objects, but magnetic forces can act at a distance.**
- **Observe how magnets attract and 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 with attract or repel each other, depending on which poles are facing.**
-

Sticky Knowledge

- Magnets exert attractive and repulsive forces on each other.
- Magnets exert non-contact forces, which work through some materials.
- Magnets exert attractive forces on some materials.
- Magnet forces are affected by magnet strength, object mass, distance from object and object material.

Vocabulary

Force friction magnet

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

A force is a push or a pull. When an object moves on a surface, the texture of the surface and the object affect how it moves. It may help the object to move better or it may hinder its movement e.g. ice skater compared to walking on ice in normal shoes.
A magnet attracts magnetic material. Iron and nickel and other materials containing these, e.g. stainless steel, are magnetic. The strongest parts of a magnet are the poles. Magnets have two poles – a north pole and a south pole. If two like poles, e.g. two north poles, are brought together they will push away from each other – repel. If two unlike poles, e.g. a north and outh, are brought together they will pull together – attract.
For some forces to act, there must be contact e.g. a hand opening a door, the wind pushing the trees. Some forces can act at a distance e.g. magnetism. The magnet does not need to touch the object that it attracts.

To achieve the above children:
• Can give examples of forces in everyday life
• Can give examples of objects moving differently on different surfaces
• Can name a range of types of magnets and showhow the poles attract and repel • Can draw diagrams using arrows to show the attraction and repulsion between the poles of magnets

Key Scientists that could be explored

William Gilbert
(Theories on Magnetism)

Andre Marie Ampere
(Founder of Electro-Magnetism)

Linked Texts that could be explored

The Iron Man
(Ted Hughes)

Mrs Armitage: Queen of the Road
(Quentin Blake)

Mr Archimedes' Bath
(Pamela Allen)

Prior Learning

Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)

Possible Question(s):

Wat are magnetic materials? How can we find out?

- Can I make a magnetic material non-magnetic?
- How far away does a magnet have to be before it attracts a magnetic material?
- How far away can the magnetic attraction between two magnets be experiences?
- Is the repulsive force the same size?
- How is the magnetic attraction of repulsion force affected by putting materials between the magnets?
- Are bigger magnets stronger?
  How could you use magnets to measure the number of pages in a book?

Future Learning

• Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. (Y5 -Forces)
• Identify the effects of air resistance, water resistance and friction, that act between moving surfaces. (Y5 - Forces)
• Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. (Y5 - Forces)
• Magnetic fields by plotting with compass, representation by field lines. (KS3)
• Earth's magnetism, compass and navigation. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the mass of an object affect how much force is needed to make it move? **Which magnet is strongest?** **Which surface is best to stop you slipping?**	Which materials are magnetic?	If we magnetise a pin, how long does it stay magnetised for?	Do magnetic materials always conduct electricity? Does the size and shape of a magnet affect how strong it is?	How have our ideas about forces changed over time? How have our ideas about magnets changed over time? How does a compass work?	How have our ideas about forces changed over time? How have our ideas about magnets changed over time?

Year 5 – Forces & Magnets

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object and the impact of gravity on our lives.** • **Identify the effects of air resistance, water resistance and friction, which act between moving surfaces.** • **Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.**	• Air resistance and water resistance are forces against motion caused by objects having to move air and water out of their way. • Friction is a force against motion caused by two surfaces rubbing against each other. • Some objects require large forces to make them move; gears, pulley and levers can reduce the force needed to make things move	Air resistance, Water resistance, Friction, Gravity, Newton, push, pull, opposing,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	A force causes an object to start moving, stop moving, speed up, slow down or change direction. Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall. Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water, or the air and water maybe moving over a stationary object. A mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. The small force moves a long. distance and the resulting large force moves a small distance, e.g. a crowbar or bottle top remover. Pulleys, levers and gears are all mechanisms, also known as simple machines. <u>To achieve the above children</u>: • Can demonstrate the effect of gravity acting on an unsupported object • Can give examples of friction, water resistance and air resistance • Can give examples of when it is beneficial to have high or low friction, water resistance and air resistance • Can demonstrate how pulleys, levers and gears work	Galileo Galilei (Gravity and Acceleration) Isaac Newton (Gravitation) Archimedes of Syracuse (Levers) John Walker (The Match)	The Enormous Turnip (Katie Daynes) Leonardo's Dream (Hans de Beer) The Aerodynamics of Biscuits (Clare Helen Welsh)

Prior Learning	Possible Question(s):	Future Learning
• Compare how things move on different surfaces. (Y3 - Forces and magnets) • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. (Y3 - Forces and magnets) • Observe how magnets attract or repel each other and attract some materials and not others. (Y3 - Forces and magnets) • 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. (Y3 - Forces and magnets) • Describe magnets as having two poles. (Y3 - Forces and magnets) • Predict whether two magnets will attract or repel each other, depending on which poles are facing. (Y3 - Forces and magnets)	• What actually is a force? • How can a force act on an object? • How can we see forces? • How can we measure forces? • How does the saltiness (salinity) of water affect the water resistance? • How does the length of a piece of a paper helicopter's wings affect the time it takes to fall? • How does the changing the shape of a piece of plasticine affect water resistance? • How does adding holes to a parachute affect the time it takes to fall? • How does the amount/depth of tread affect the friction between a shoe and a surface? • How can we use levers to lit more? • What is the most effective way to move an object? • How do see-saws work? • Can you create a pulley system to life a given load?	• Forces as pushes or pulls, arising from the interaction between two objects. (KS3) • Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces. (KS3) • Moment as the turning effect of a force. (KS3) • Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water. (KS3) • Forces measured in Newtons, measurements of stretch or compression as force is changed. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time

How does the angle of launch affect how far a paper rocket will go? How does the surface area of an object affect the time it takes to sink? How does the surface area of a parachute affect the time it takes to fall to the ground?	Can you label and name all the forces acting on the objects in each of these situations?	How long does a pendulum swing for before it stops?	Do all objects fall through water in the same way? How does surface area of parachute affect the time it takes to fall?	How do submarines sink if they are full of air?	How and why do objects move?

Year 5 – Earth and Space

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **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** • **Describe the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.**	• Stars, planets and moons have so much mass they attract other things, including each other due to a force called gravity. Gravity works over distance. • Objects with larger masses exert bigger gravitational forces. • Objects like planets, moons and stars spin. • Smaller mass objects like planets orbit large mass objects like stars. • Stars produce vast amounts of heat and light. • All other objects are lumps of rock, metal or ice and can be seen because they reflect the light of stars.	Earth, Sun, Moon, Axis, Rotation, Day, Night, orbit, spherical	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	The Sun is a star. It is at the centre of our solar system. There are 8 planets (can choose to name them, but not essential). These travel around the Sun in fixed orbits. Earth takes 3651/4 days to complete its orbit around the Sun. The Earth rotates (spins) on its axis every 24 hours. As Earth rotates half faces the Sun (day) and half is facing away from the Sun (night). As the Earth rotates, the Sun appears to move across the sky. The Moon orbits the Earth. It takes about 28 days to complete its orbit. The Sun, Earth and Moon are approximately spherical.. To achieve the above children: • Can create a voice over for a video clip or animation • Can show, using diagrams, the movement of the Earth and Moon • Can explain the movement of the Earth and Moon • Can show using diagrams the rotation of the Earth and how this causes day and night • Can explain what causes day and night	**Claudius Ptolemy and Nicolaus Copernicus** (Heliocentric vs Geocentric Universe) **Neil Armstrong** (First man on the Moon) **Helen Sharman** (First British astronaut) **Tim Peake** (First British ESA astronaut)	***The Skies Above My Eyes*** *(Charlotte Guillain & Yuval Zommer)* ***George's Secret Key to the Universe*** *(Lucy and Stephen Hawking with Christophe Galfard)* ***The Way Back Home*** *(Oliver Jeffers)*

Prior Learning	Possible Question(s):	Future Learning
• **Observe changes across the four seasons. (Y1 - Seasonal changes)** • **Observe and describe weather associated with the seasons and how day length varies. (Y1 - Seasonal changes)**	How does temperature/size/day length/year length change as you get closer/further to the sun? How does distance from a light source affect how much light hits an object? Does having more moons result in more light hitting a planet? How could you test this? How does speed/size of a meteorite affect the size of the moon crater formed? If the moon became heavier as a result of meteorite collisions what would happen to its position relative to Earth? If the mass of the Earth is 80x that of the moon, why is the gravity at the Earth's surface only 6x greater than at the surface of the moon? Why do we have day/night/months/years/seasons? Why does day length change? Why does shadow size change over the course of a day?	• Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only). (KS3) • Our Sun as a star, other stars in our galaxy, other galaxies. (KS3) • The seasons and the Earth's tilt, day length at different times of year, in different hemispheres. (KS3) • The light year as a unit of astronomical distance. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the length of daylight hours change in each season?	How could you organise all the objects in the solar system into groups?	Can you observe and identify all the phases in the cycle of the Moon?	Is there a pattern between the size of a planet and the time it takes to travel around the Sun?	What unusual objects did Jocelyn Bell Burnell discover? How do astronomers know what stars are made of? How have our ideas about the solar system changed over time?	Sun, Earth & Moon: What is moving and how do we know?

Year 1 – (ENERGY)Seasons and How They Change

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Observe changes across the four seasons** • **Observe and describe weather associated with the seasons and how day length varies.**	• Weather can change • There are lots of different types of weather: Rain, Sun, Cloud, Wind, Snow, etc • Days are longer and hotter in the summer • Days are shorter and colder in the winter • There are four seasons: Spring, Summer, Autumn, Winter.	Seasons, spring, summer, autumn, winter,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	In the UK, the day length is longest at mid-summer (about 16 hours) and gets shorter each day until mid-winter (about 8 hours) before getting longer again. The weather also changes with the seasons. In the UK, it is usually colder and rainier in winter, and hotter and dryer in the summer. The change in weather causes many other changes. Some examples are: numbers of minibeasts found outside; seed and plant growth; leaves on trees; and type of clothes worn by people. <u>To achieve the above children</u>: • Can name the four seasons and identify when in the year they occur • Can describe weather in different seasons over a year • Can describe days as being longer (in time) in the summer and shorter in the winter • Can describe other features that change through the year	Dr Steve Lyons (Extreme Weather) Holly Green (Meteorologist)	Tree: Seasons Come, Seasons Go (Patricia Hegarty and Britta Teckentrup) One Year with Kipper (Mick Inkpen) After the Storm (Nick Butterworth)
Prior Learning	**Possible Question(s):**	**Future Learning**	
Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)	• Why do more frequent days of rain saturate the ground? • How long does it take for the ground to dry after it has been raining? • Does more rain take longer to dry? • Do countries with higher temperatures have less rain? • How does rainfall and temperature change over time in our school grounds? • Which leaf is the strongest/best shade cover/best at directing water? • What do you notice about different leaves? • What purpose to leaves serve for a tree? • Why do you think leaves turn brown in Winter? • What colours can we find outside? Does this change across the seasons? • What effect does rain have on the environment? • What would happen if there was too much rain? • What would happen if there wasn't enough rain?	• Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (Y3 - Light) • Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky. (Y5 - Earth and space) • The seasons and the Earth's tilt, day length at different times of year, in different hemispheres. (KS3)	

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
In which season does it rain the most?	How could you organise all the objects in the solar system into groups?	How does the colour of a UV bead change over the day?	Does the wind always blow the same way?	Are there plants that are in flower in every season? What are they?	

Year 3 – (ENERGY) Light

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Recognise that they need light in order to see things and that dark is the absence of light.** • **Notice that light is reflected from surfaces.** • **Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.** • **Recognise that shadows are formed when the light from a light source is blocked by a solid object.** • **Find patterns in the way that the sizes of shadows change.**	• There must be light for us to see. Without light it is dark. • We need light to see things even shiny things. • Transparent materials let light through them and opaque materials don't let light through. • Beams of light bounce off some materials (reflection). • Shiny materials reflect light beams better than non-shiny materials. • Light comes from a source	Light source, reflect, block,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	We see objects because our eyes can sense light. Dark is the absence of light. We cannot see anything in complete darkness. Some objects, for example, the sun, light bulbs and candles are sources of light. Objects are easier to see if there is more light. Some surfaces reflect light. Objects are easier to see when there is less light if they are reflective. The light from the sun can damage our eyes and therefore we should not look directly at the sun and can protect our eyes by wearing sunglasses or sunhats in bright light. Shadows are formed on a surface when an opaque or translucent object is between a light source and the surface and blocks some of the light. The size of the shadow depends on the position of the source, object and surface.. <u>To achieve the above children</u>: • Can describe how we see objects in light and can describe dark as the absence of light • Can state that it is dangerous to view the sun directly and state precautions used to view the sun, for example in eclipses • Can define transparent, translucent and opaque • Can describe how shadows are formed	**James Clerk Maxwell** (Visible and Invisible Waves of Light)	The Owl Who Was Afraid of the Dark (Jill Tomlinson) The Dark (Lemony Snicket) The Firework-Maker's Daughter (Philip Pullman)

Prior Learning	Possible Question(s):	Future Learning
• Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans) • Describe the simple physical properties of a variety of everyday materials. (Y1 - Materials)	• A coin is lost, what would be the best way to find it? (Turn the lights out and see it shine? Use a torch to see it reflect?) • How does distance from a light source affect how bright it looks? • How does being in darkness affect your sense of hearing? • What colour would be the best to make a safety jacket from? • How does the colour of a material affect how reflective it is? • What would be the best material to make a blind for a baby's room? • How does thickness of a material affect how much light can pass through it? • How many pieces of tracing paper are as translucent as a single piece of white paper? • How does the shape of a mirror affect how the light reflects? • How can we change the darkness, size and shape of a shadow?	• Recognise that light appears to travel in straight lines. (Y6 - Light) • Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. (Y6 - Light) • Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes. (Y6 - Light) • Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. (Y6 - Light)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the distance between the shadow puppet and the screen affect the size of the shadow?	How would you organise these light sources into natural and artificial sources?	When is our classroom darkest? Is the Sun the same brightness all day?	Are you more likely to have bad eye sight and to wear glasses if you are older?	How does the Sun make light?	How have our ideas about eclipses changed over time?

Which pair of sunglasses will be best at protecting our eyes?					

Year 4 – (ENERGY) Sound

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Know how sound is made associating some of them with vibrating.** • **Know what happens to a sound as it travels from its source to our ears.** • **Know the correlation between the volume of a sound and the strength of the vibrations that produced it.** • **Know how sound travels from a source to our ears.** • **Know the correlation between pitch and the object producing a sound.**	• Sound travels from its source in all directions and we hear it when it travels to our ears. • Sound travel can be blocked. • Sound spreads out as it travels. • Changing the shape, size and material of an object will change the sound it produces. • Sound is produced when an object vibrates. • Sound moves through all materials by making them vibrate. • Changing the way an object vibrates changes it's sound. • Bigger vibrations produce louder sounds and smaller vibrations produce quieter sounds. • Faster vibrations (higher frequencies) produce higher pitched sounds	Wave sound vibration	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	A sound produces vibrations which travel through a medium from the source to our ears. Different mediums such as solids, liquids and gases can carry sound, but sound cannot travel through a vacuum (an area empty of matter). The vibrations cause parts of our body inside our ears to vibrate, allowing us to hear (sense) the sound. The loudness (volume) of the sound depends on the strength (size) of vibrations which decreases as they travel through the medium. Therefore, sounds decrease in volume as you move away from the source. A sound insulator is a material which blocks sound effectively. Pitch is the highness or lowness of a sound and is affected by features of objects producing the sounds. For example, smaller objects usually produce higher pitched sounds. <u>To achieve the above children</u>: • Can name sound sources and state that sounds are produced by the vibration of the object • Can state that sounds travel through different mediums such as air, water, metal • Can give examples to demonstrate how the pitch of a sound are linked to the features of the object that produced it • Can give examples of how to change the volume of a sound e.g. increase the size of vibrations by hitting or blowing harder • Can give examples to demonstrate that sounds get fainter as the distance from the sound source increases	**Aristotle** (Sound Waves) **Gailileo Galilei** (Frequency and Pitch of Sound Waves) **Alexander Graham Bell** (Invented the Telephone)	***Horrid Henry Rocks*** *(Francesca Simon)* ***Moonbird*** *(Joyce Dunbar)* ***The Pied Piper of Hamelin*** *(Natalia Vasquez)*

Prior Learning	Possible Question(s):	Future Learning
Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. (Y1 - Animals, including humans)	• How can you change the volume of a sound? • How does the size of an ear trumpet affect the volume of sound detected? • How does the type of material affect how well is blocks a sound? • How does thickness of material affect how well it blocks a sound? • Which materials vibrate better and produce louder sounds? Can we identify any patterns?	• Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition. (KS3) • Frequencies of sound waves, measured in Hertz (Hz); echoes, reflection and absorption of sound. (KS3) • Sound needs a medium to travel, the speed of sound in air, in water, in solids. (KS3) • Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal. (KS3) • Auditory range of humans and animals. (KS3) • Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound. (KS3)

	• Which materials make the best string telephone components? (tin cans, paper cups, plastic cups, wire, cable, string, plastic or elastic – predict and test) • How does length of the tube (when making a straw oboe) affect the pitch and volume? • Can you predict the relative pitch of tuning forks from the patterns of ripples they make in the water?	• Waves transferring information for conversion to electrical signals by microphone. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the volume of a drum change as you move further away from it? **How does the length of a guitar string/tuning fork affect the pitch of the sound?** **Are two ears better than one?**	Which material is best to use for muffling sound in ear defenders?	When is our classroom the quietest?	Is there a link between how loud it is in school and the time of day? If there is a pattern, is it the same in every area of the school?	Do all animals have the same hearing range?	How has our understanding and use of ultrasound changed over time? Since the 1800s, how has science helped people who are deaf?

Year 6 – (ENERGY) Light

National Curriculum Objectives

- **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.**
- **Know how simple optical instruments work, e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.**

Sticky Knowledge

- Animals see light sources when light travels from the source into their eyes.
- Animals see objects when light is reflected off that object and enters their eyes.
- Light reflects off all objects (unless they are black). Non shiny surfaces scatter the light so we don't see the beam.
- Light travels in straight lines.

Vocabulary

Light source, dark, reflect, ray, beam, straight, shadow, transparent, translucent, absorb, refraction

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Light appears to travel in straight lines, and we see objects when light from them goes into our eyes. The light may come directly from light sources, but for other objects some light must be reflected from the object into our eyes for the object to be seen.
Objects that block light (are not fully transparent) will cause shadows. Because light travels in straight lines the shape of the shadow will be the same as the outline shape of the object.

To achieve the above children:
• Can describe, with diagrams or models as appropriate, how light travels in straight lines either from sources or reflected from other objects into our eyes
• Can describe, with diagrams or models as appropriate, how light travels in straight lines past translucent or opaque objects to form a shadow of the same shape

Key Scientists that could be explored

Thomas Young
(Wave Theory of Light)

Ibn al-Haytham (Alhazen)
(Light and our Eyes)

Percy Shaw
(The Cats Eye)

Linked Texts that could be explored

Letters from the Lighthouse
(Emma Carroll)

The King Who Banned the Dark
(Emily Haworth-Booth)

Prior Learning

• Recognise that they need light in order to see things and that dark is the absence of light. (Y3 - Light)
• Notice that light is reflected from surfaces. (Y3 - Light)
• Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (Y3 - Light)
• Recognise that shadows are formed when the light from a light source is blocked by an opaque object. (Y3 - Light)
• Find patterns in the way that the size of shadows change. (Y3 - Light)
• 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. (Y5 - Properties and changes of materials))

Possible Question(s):

- How does the size of an object affect the size of a shadow?
- How does the distance between the light and the object change the size of a shadow?
- How does the distance between the object and the size of the screen affect the size of a shadow?
- How would a solar eclipse be different if:
  - The moon was a different size?
  - The earth span faster or slower?
  - The sun was larger or smaller?
  - If the earth and moon where the same size but further away in the solar system?
- How does the amount of aluminium foil scrunched affect how much light is scatters?
- How does the amount of polishing affect how well a piece of metal scatters light?
- How perfect are our mirrors? Do some scatter light more than others?
- What happens to light when it is shone through water? How is this affected by putting glitter, salt or talc in the water?
- How does a periscope/microscope/telescope work?

Future Learning

• The similarities and differences between light waves and waves in matter. (KS3)
• Light waves travelling through a vacuum; speed of light. (KS3)
• The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface. (KS3)
• Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye. (KS3)
• Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras. (KS3)
• Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the angle that a light ray hits a plane mirror affect the angle at which it reflects off the surface? Which material is most reflective?	Can you identify all the colours of light that make white light when mixed together? What colours do you get if you mix different colours of light together?	Does the temperature of a light bulb go up the longer it is on? How does my shadow change over the day?	Is there a pattern to how bright it is in school over the day? And, if there is a pattern, is it the same in every classroom?	Why do some people need to wear glasses to see clearly? How do our eyes adapt to different conditions?	Cameras detect light – how has our understanding of light and its effects changed camera design throughout history?

Year 1 – Materials

National Curriculum Objectives

- **Distinguish between and object and the material from which it is made.**
- **Identify and name a variety of everyday materials, including wood, metal, plastic, glass, 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 properties**

Sticky Knowledge

- There are many different materials that have different describable and measurable properties.
- Materials that have similar properties are grouped into metals, rocks, fabrics, wood, plastic and ceramics (including glass).
- The properties of a material determine whether they are suitable for a purpose.

Vocabulary

Hard soft rough smooth shiny

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

All objects are made of one or more materials. Some objects can be made from different materials e.g. plastic, metal or wooden spoons.
Materials can be described by their properties e.g. shiny, stretchy, rough etc.
Some materials e.g. plastic can be in different forms with very different properties.

To achieve the above children:
• Can label a picture or diagram of an object made from different materials
• Can describe the properties of different materials

Key Scientists that could be explored

William Addis
(Toothbrush Inventor)

Charles Mackintosh
(Waterproof coat)

John MacAdam
(roads)

Linked Texts that could be explored

The Great Paper Caper
(Oliver Jeffers)

Who Sank the Boat
(Pamela Allen)

The Story of Cinderella
(Walt Disney)

Prior Learning

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes. (Early Learning Goal)

Possible Question(s):

It is recommended that materials be taught three times through KS1. Give a theme for each topic e.g. buildings, exploration, toys, the seaside. Plan to investigate a couple of classes of materials and properties in each topic so children get a depth of experience each topic and cover all the classes of materials over the key stage

Buildings
- Which rocks are the least crumbly?
- Which materials absorb the most water?
- Which type of brick would be the easiest to drag to make a pyramid?
- Which material would be the strongest to use as a floor tile?

Toys & Nice things
- Which fabric would make the softest blanket?
- The baby has spilt her drink, which material would absorb the drink the best?
- We want to make a really slippy slide, which liquid would be best to use?
- Which chocolate will melt the fastest on a warm plate (a model of a warm hand)
- Which wrapping papers are strong enough to wrap and send a present?

Clothing & Materials
- Which material could be used to make a waterproof hat for the teacher when she is on the playground at playtime?
- Which plastic would be flexible enough to make a belt?
- Which material could I wrap my ice egg / snowman in to stop it melting, or would it make it melt quicker?
- What could I wrap a chicken egg in to keep it warm when it is waiting to hatch?
- What could you paint on the runaway gingerbread man that would allow him to swim the river and get away from the fox and not turn to mush?

Future Learning

• Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)
• Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses ofeveryday materials)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
Which materials are the most flexible? Which materials are the most absorbent?	We need to choose a material to make an umbrella. Which materials are waterproof?	What happens to materials over time if we bury them in the ground? What happens to shaving foam over time?	Is there a pattern in the types of materials that are used to make objects in a school?	How are bricks made? Which materials can be recycled?	How are building materials different now to when Queen Elizabeth I was on the throne? What ideas did Chinese monks have in 800 CE that led to their discovery of gunpowder?

Year 2 – Materials

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **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 shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.**	• Materials can be changed by physical force (twisting, bending, squashing and stretching)	Waterproof wood plastic metal glass	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	All objects are made of one or more materials that are chosen specifically because they have suitable properties for the task. For example, a water bottle is made of plastic because it is transparent allowing you to see the drink inside and waterproof so that it holds the water. When choosing what to make an object from, the properties needed are compared with the properties of the possible materials, identified through simple tests and classifying activities. A material can be suitable for different purposes and an object can be made of different materials. Objects made of some materials can be changed in shape by bending, stretching, squashing and twisting. For example, clay can be shaped by squashing, stretching, rolling, pressing etc. This can be a property of the material or depend on how the material has been processed e.g. thickness. <u>To achieve the above children</u>: • Can name an object, say what material it is made from, identify its properties and make a link between the properties and a particular use • Can label a picture or diagram of an object made from different materials • For a given object can identify what properties a suitable material needs to have • Whilst changing the shape of an object can describe the action used • Can use the words flexible and/or stretchy to describe materials that can be changed in shape and stiff and/or rigid for those that cannot • Can recognise that a material may come in different forms which have different properties	William Addis (Toothbrush Inventor) Charles Mackintosh (Waterproof coat) John MacAdam (roads)	***The Tin Forest*** *(Helen Ward)* ***Traction Man*** *(Mini Grey)* ***Three Little Pigs*** *(Lesley Sims)*

Prior Learning	Possible Question(s):	Future Learning
• Distinguish between an object and the material from which it is made. (Y1- Everyday materials) • Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials) • Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials) • Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials)	It is recommended that materials be taught three times through KS1. Give a theme for each topic e.g. buildings, exploration, toys, the seaside. Plan to investigate a couple of classes of materials and properties in each topic so children get a depth of experience each topic and cover all the classes of materials over the key stage <u>Buildings</u> • Which rocks are the least crumbly? • Which materials absorb the most water? • Which type of brick would be the easiest to drag to make a pyramid? • Which material would be the strongest to use as a floor tile? <u>Toys & Nice things</u> • Which fabric would make the softest blanket? • The baby has spilt her drink, which material would absorb the drink the best? • We want to make a really slippy slide, which liquid would be best to use? • Which chocolate will melt the fastest on a warm plate (a model of a warm hand) • Which wrapping papers are strong enough to wrap and send a present? <u>Clothing & Materials</u> • Which material could be used to make a waterproof hat for the teacher when she is on the playground at playtime? • Which plastic would be flexible enough to make a belt? • Which material could I wrap my ice egg / snowman in to stop it melting, or would it make it melt quicker? • What could I wrap a chicken egg in to keep it warm when it is waiting to hatch? • What could you paint on the runaway gingerbread man that would allow him to swim the river and get away from the fox and not turn to mush?	• Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. (Y3 - Rocks) • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. (Y3 - Forces and magnets) • 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. (Y5 - Properties and changes of materials) • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. (Y5 - Properties and changes of materials)

Possible Teaching Ideas					
Comparative tests	**Identify & Classify**	**Observation over time**	**Pattern Seeking**	**Research**	**Exploring How Scientific Ideas have changed over time**
Which shapes make the strongest paper bridge? Which material would be best for the roof of the little pig's house?	Which materials will float and which will sink? Which materials will let electricity go through them, and which will not? Which materials are shiny and which are dull?	How long do bubble bath bubbles last for? What will happen to our snowman?	How do materials change with heat? *leave outside in sunshine/windowsill/radiator* How does amount of water affect the strength of a kitchen towel?	How have the materials we use changed over time? How are plastics made?	How has glass making changed since it was first made in ancient Egypt? How have the materials that humans use for tools changed since the Stone Age

Year 3 – Materials - Rocks

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **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**	• There are different types of rock. • There are different types of soil. • Soils change over time. • Different plants grow in different soils. • Fossils tell us what has happened before. • Fossils provide evidence. • Paleontologists use Fossils to find out about the past. • Fossils provide evidence that living things have changed over time.	igneous, metamorphic, sedimentary, fossil,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	Rock is a naturally occurring material. There are different types of rock e.g. sandstone, limestone, slate etc. which have different properties. Rocks can be hard or soft. They have different sizes of grain or crystal. They may absorb water. Rocks can be different shapes and sizes (stones, pebbles, boulders). Soils are made up of pieces of ground down rock which may be mixed with plant and animal material (organic matter). The type of rock, size of rock pieces and the amount of organic matter affect the property of the soil. Some rocks contain fossils. Fossils were formed millions of years ago. When plants and animals died, they fell to the seabed. They became covered and squashed by other material. Over time the dissolving animal and plant matter is replaced by minerals from the water. <u>To achieve the above children</u>: • Can name some types of rock and give physical features of each • Can explain how a fossil is formed • Can explain that soils are made from rocks and also contain living/dead matter	**Mary Anning** (Discovery of Fossils) **Inge Lehmann** (Earth's Mantle)	***The Pebble in My Pocket*** *(Meredith Hooper)* ***Stone Girl, Bone Girl*** *(Laurence Anholt)* ***The Street Beneath My Feet*** *(Charlotte Guillain & Yuval Zommer)*

Prior Learning	Possible Question(s):	Future Learning
• Distinguish between an object and the material from which it is made. (Y1- Everyday materials) • Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials) • Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials) • Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials) • Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)	• How are the soils different? • Which do you think has best drainage? • Which is more likely to lead to flooding? • How many soil types have we found? • Where might you find more? • How might the soil be different in different countries? • What rock is best for a kitchen chopping board? What might be the issues with various materials and what they have to withstand? • What types of rocks are there? • How do rocks change? • What would grow best in your soil? • Why do you think worms are important to the creation of soil? • How can we use composting to make our own soil? • Does it currently look like real soil? • How long do you think this process will take and why? • How are fossils created? • Why do fossils help us find out about historical events? • If you could fossilise an object what would it be?	• Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. (Y6 - Evolution and inheritance) • The composition of the Earth. (KS3) • The structure of the Earth. (KS3) • The rock cycle and the formation of igneous, sedimentary and metamorphic rocks. (KS3)

Possible Teaching Ideas					
Comparative tests	**Identify & Classify**	**Observation over time**	**Pattern Seeking**	**Research**	**Exploring How Scientific Ideas have changed over time**
How does adding different amounts of sand to soil affect how quickly water drains through it? Which soil absorbs the most water?	Can you use the identification key to find out the name of each of the rocks in your collection?	How does tumbling change a rock over time? What happens when water keeps dripping on a sandcastle?	Is there a pattern in where we find volcanos on planet Earth?	Who was Mary Anning and what did she discover?	What were James Hutton's ideas about how rocks were made and what was his evidence? How did Mary Anning's work help us to understand prehistoric life?

Year 4 – Materials – Solids, Liquids and Gasses

National Curriculum Objectives	Sticky Knowledge	Vocabulary	
• **Compare and group materials together, according to whether they are solids, liquids or gases.** • **Observe that some materials change state when heated or cooled, and measure and research the temperature at which this happens in degrees Celsius.** • **Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.**	• Solids, liquids and gases are described by observable properties. • Materials can be divided into solids, liquids and gases. • Heating causes solids to melt into liquids and liquids evaporate into gases. d) Cooling causes gases to condense into liquids and liquids to freeze into solids. • The temperature at which given substances change state are always the same.	Solid, liquid, gas,	
	Key Learning *To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.*	**Key Scientists that could be explored**	**Linked Texts that could be explored**
	A solid keeps its shape and has a fixed volume. A liquid has a fixed volume but changes in shape to fit the container. A liquid can be poured and keeps a level, horizontal surface. A gas fills all available space; it has no fixed shape or volume. Granular and powdery solids like sand can be confused with liquids because they can be poured, but when poured they form a heap and they do not keep a level surface when tipped. Each individual grain demonstrates the properties of a solid. Melting is a state change from solid to liquid. Freezing is a state change from liquid to solid. The freezing point of water is 0oC. Boiling is a change of state from liquid to gas that happens when a liquid is heated to a specific temperature and bubbles of the gas can be seen in the liquid. Water boils when it is heated to 100oC. Evaporation is the same state change as boiling (liquid to gas), but it happens slowly at lower temperatures and only at the surface of the liquid. Evaporation happens more quickly if the temperature is higher, the liquid is spread out or it is windy. Condensation is the change back from a gas to a liquid caused by cooling. Water at the surface of seas, rivers etc. evaporates into water vapour (a gas). This rises, cools and condenses back into a liquid forming clouds. When too much water has condensed, the water droplets in the cloud get too heavy and fall back down as rain, snow, sleet etc. and drain back into rivers etc. This is known as precipitation. This is the water cycle. <u>To achieve the above children</u>: • Can create a concept map, including arrows linking the key vocabulary • Can name properties of solids, liquids and gases • Can give everyday examples of melting and freezing • Can give everyday examples of evaporation and condensation • Can describe the water cycle	**Anders Celcius** (Celcius Temperature Scale) **Daniel Fahrenheit** (Fahrenheit Temperature Scale / Invention of the Thermometer)	***Once Upon a Raindrop: The Story of Water*** *(James Carter)* ***Sticks*** *(Diane Alber)*

Prior Learning	Possible Question(s):	Future Learning
• Distinguish between an object and the material from which it is made. (Y1 - Everyday materials) • Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials) • Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials) • Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials) • Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials) • Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)	• How does the amount of water added to flour affect its state? • How does the amount of detergent added to water affect how slippy it is? • How does the temperature affect how viscous a liquid is (use cooking oil)? • Place a peach in a glass of lemonade and watch it spin. Why does it behave that way and can you prove it? • How does the material sprinkled on ice and snow affect how quickly it melts? • What chocolate would be best to smuggle? How does the type of chocolate affect its melting temperature? • What is the melting temperature of ice and how does it compare with the freezing temperature of water? • Is the melting temperature of wax the same as its freezing temperature?	• 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. (Y5 - Properties and changes of materials) • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution. (Y5 - Properties and changes of materials) • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. (Y5 - Properties and changes of materials) • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. (Y5 - Properties and changes of materials) • Demonstrate that dissolving, mixing and changes of state are reversible changes. (Y5 - Properties and changes of materials) • 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. (Y5 - Properties and changes of materials)

Possible Teaching Ideas					
Comparative tests	**Identify & Classify**	**Observation over time**	**Pattern Seeking**	**Research**	**Exploring How Scientific Ideas have changed over time**
How does the mass of a block of ice affect how long it takes to melt? How does the surface area of water affect how long it takes to evaporate? Does seawater evaporate faster than fresh water?	Can you group these materials and objects into solids, liquids, and gases? How would you sort these objects/materials based on their temperature?	Which material is best for keeping our hot chocolate warm? How does the level of water in a glass change when left on the windowsill?	Is there a pattern in how long it takes different sized ice lollies to melt? How does evaporation rate change as you add more salt to your water?	What are hurricanes, and why do they happen?	How have scientific tests for predicting the weather changed over time?

Year 5 – Properties and Changes of Material

National Curriculum Objectives

- **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.**
- **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.**
- **comparative and fair tests, for the particular uses of everyday materials, including wood, metals and plastic.**
- **Demonstrate that dissolving, mixing and changes of state are reversible changes.**
- **Explain that some changes result in the formation of new materials, and this kind of change is usually not reversible, including changes associated with burning and the action of acid on bicarbonate of soda**

Sticky Knowledge

- When two or more substances are mixed and remain present the mixture can be separated.
- Some changes can be reversed and some can't.
- Materials change state by heating and cooling.

Separating technique	Difference in property required
Filtration and sieving	A solid that does not dissolve in a liquid. Different sized solid bits
Magnets	Some materials magnetic others not
Evaporation	A solid dissolved in water and the solid has a high boiling temperature
Floating	Some materials float and other sink

- All matter (including gas) has mass.
- Sometimes mixed substances react to make a new substance. These changes are usually irreversible.
- Heating can sometimes cause materials to change permanently. When this happens, a new substance is made. These changes are not reversible.
- Indicators that something new has been made are: The properties of the material are different (colour, state, texture, hardness, smell, temperature)
- If it is not possible to get the material back easily it is likely that it is not there anymore and something new has been made (irreversible change)

Vocabulary

Solid, liquid, gas, properties, melt, freeze, condensation, evaporation, precipitation, collection, thermal/electrical insulator/conductor, dissolve, solution, soluble, insoluble, reversible/non-reversible change, permeable, soluble, property, magnetic,

Key Learning

To be secure in their learning pupils need to demonstrate their understanding of a concept by using scientific vocabulary when doing the following.

Materials have different uses depending on their properties and state (liquid, solid, gas). Properties include hardness, transparency, electrical and thermal conductivity and attraction to magnets. Some materials will dissolve in a liquid and form a solution while others are insoluble and form sediment. Mixtures can be separated by filtering, sieving and evaporation.
Some changes to materials such as dissolving, mixing and changes of state are reversible, but some changes such as burning wood, rusting and mixing vinegar with bicarbonate of soda result in the formation of new materials and these are not reversible.

To achieve the above children:
• Can use understanding of properties to explain everyday uses of materials, for example, how bricks, wood, glass and metals are used in buildings
• Can explain what dissolving means, giving examples
• Can name equipment used for filtering and sieving
• Can use knowledge of liquids, gases and solids to suggest how materials can be recovered from solutions or mixtures by evaporation, filtering or sieving
Can describe some simple reversible and non-reversible changes to materials, giving examples

Key Scientists that could be explored

Spencer Silver,
Arthur Fry and Alan Amron
(Post-It Notes)

Ruth Benerito
(Wrinkle-Free Cotton)

Linked Texts that could be explored

Itch
(Simon Mayo)

Kensuke's Kingdom
(Michael Morpurgo)

The BFG
(Roald Dahl)

Prior Learning

• Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)

Possible Question(s):

- What are mixtures?
- What does dissolving mean?

Future Learning

• Chemical reactions as the rearrangement of atoms. (KS3)
• Representing chemical reactions using formulae and using equations.(KS3)
• Combustion, thermal decomposition, oxidation and displacement reactions. (KS3)

• Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials) • 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. (Y3 - Forces and magnets) • Compare and group materials together, according to whether they are solids, liquids or gases. (Y4 - States of matter) • 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). (Y4 - States of matter) • Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. (Y4 – States of matter)	• Which of the following dissolve in water: sugar, bicarbonate of soda, oil, chocolate, coffees, dark vinegar and wax? • How does the amount of water used affect how much sugar will dissolve in it? • Which sweets dissolve in water? • How can we separate mixtures? • How can we clean our dirty water?	• Defining acids and alkalis in terms of neutralisation reactions. (KS3) • The pH scale for measuring acidity/alkalinity; and indicators. (KS3)

Possible Teaching Ideas

Comparative tests	Identify & Classify	Observation over time	Pattern Seeking	Research	Exploring How Scientific Ideas have changed over time
How does the temperature of tea affect how long it takes for a sugar cube to dissolve? Which type of sugar dissolves the fastest?	Can you group these materials based on whether they are transparent or not?	How does a container of salt water change over time? How does a sugar cube change as it is put in a glass of water?	Do all stretchy materials stretch in the same way? How does temperature affect how much solute we can dissolve?	What are microplastics and why are they harming the planet?	What did Stephanie Kwolek discover and why was it important?