Science Curriculum

Monksmoor Park CE Primary School

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Purpose of study

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key substantive knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

Aims

Our science curriculum aims to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the **uses and implications** of science, today and for the future.

Categories of knowledge in science

Science, at its most fundamental, seeks to explain the material world: why apples fall, why viruses spread and how painkillers work. These explanations are based on concepts, laws, theories and models that became established through scientific enquiry.

By learning about the products of science (substantive knowledge), pupils are able to explain the material world. But by also learning about how scientific knowledge gets established, through scientific enquiry, pupils learn about the nature and status of scientific knowledge. For example, recognising that scientific knowledge is open to revision in the light of new evidence and that an observation is different to an established scientific fact.

Substantive knowledge – the products of science

This is referred to as scientific knowledge and conceptual understanding in the national curriculum.
Examples of substantive knowledge include knowledge of: the concept of magnetism, the theory of evolution by natural selection, Newton's laws of motion and the heliocentric model of the solar system.

Disciplinary knowledge – the practices of science

Disciplinary knowledge refers to what pupils need to know about how science establishes and refines scientific knowledge. The National Curriculum outlines what pupils need to know about disciplinary knowledge through the 'working scientifically' sections.
Examples of disciplinary knowledge include knowledge of methods, measurement, variables and practical procedures. It should not just be associated with 'doing' practical work. Disciplinary knowledge comprises knowledge of concepts and procedures.

The interplay

Disciplinary knowledge should always be taught within a **substantive context** so that pupils can see the interplay between both categories of knowledge. For example, learning about atoms helps pupils to know what a model is, and knowing what a model is helps pupils to know what an atom is. In accordance with the guidance in the National Curriculum, our science curriculum scheme has clearly indicated a progression in the key scientific knowledge and concepts, from EYFS, Year 1 to Year 6. Each teaching sequence clearly indicates the aspects of knowledge to be developed. Where appropriate, it will also indicate the 'learning journey'; i.e. where the knowledge and concepts of that particular unit fit within the learning for that particular aspect of science as the child progresses through the primary phase.

'Disciplinary Knowledge' or Working Scientifically' through a constructivist approach to learning

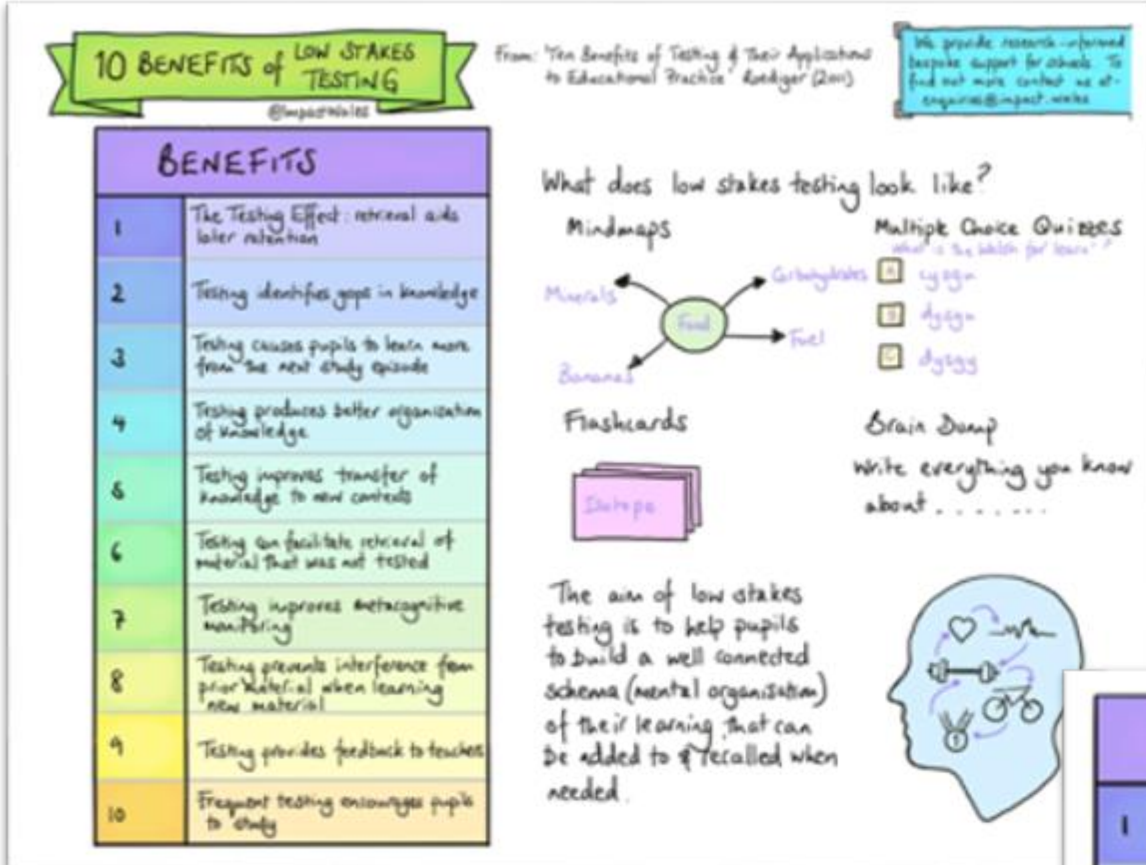
Throughout each and every unit of study the emphasis is on the children learning by doing. In accordance with the constructivist theory of learning, our teaching sequences units encourage the teachers to provide activities that will enable the children to test their previously held ideas. In doing so, they will also be encouraged to develop a bank of knowledge, skills and an understanding of the processes required to be able to do good science. In every teaching sequence the most suitable aspects of the statutory requirements for Working Scientifically have been selected. Each of these requirements will be thoroughly covered throughout both of the Key Stages.

Scientific vocabulary
Each teaching sequence contains a section outlining the most appropriate scientific vocabulary to be used when studying that particular area of science. This will help children to become familiar with, and use, technical terminology accurately and precisely.
Assessment
For each teaching sequence an assessment record sheet has been created. Each of these record sheets will allow teachers to record children's achievements during their studies for both the substantive knowledge aspects within a particular unit, and some of the requirements from Working Scientifically – the disciplinary knowledge. These record sheets, and the intended key knowledge included in the units of study will enable the teachers to identify what the children need to know or be able to do next, as well as support them at different times in the year to make summative judgements as to the children's attainment.

Progress

Knowing more
Remembering more,
Being able to do more!

End of unit assessments can take many forms - in our school progress is characterised by pupils knowing more, remembering more and being able to do more. Plans highlight planned assessment tasks that have been carefully designed to allow children to demonstrate their knowledge and understanding of new concepts or mastery of skills. These assessment tasks are used to inform future lessons.
PATs (Planned Assessment Tasks) or POPs (Proof of Progress tasks) or Checkpoints inform teacher assessments and judgements made at the end of each academic year. These strategies take many forms and will include low stakes tests, quizzes, planned tasks and activities.



BENEFITS		What it looks like in the classroom
1	The Testing Effect: retrieval aids later retention	Information retrieved from the memory leads to deeper learning. E.g. Multiple choice quizzes, mind maps, brain dumps
2	Testing identifies gaps in knowledge	Taking a test shows pupils what they do & don't know, so they can take control & prioritise future learning.
3	Testing causes pupils to learn more from the next study episode	When pupils take a test & then relearn certain information, they learn more from subsequent lessons.
4	Testing produces better organisation of knowledge	Retrieval practice causes pupils to make more connections between old & new learning, therefore schema are better organised.
5	Testing improves transfer of knowledge to new contexts	Testing induces readily accessible information that can be used flexibly to solve new problems.
6	Testing can facilitate retrieval of material that was not tested	Material that was not tested but is connected to the test is accessed during the testing process and so strengthened.
7	Testing improves metacognitive monitoring	Regular testing provides pupils with feedback on their own performance which enhances their ability to predict future performance
8	Testing prevents interference from prior material when learning new material	Pupils are more likely to retain older memories ahead of more recently learnt information. Testing enhances the more recently studied.
9	Testing provides feedback to teachers	When teachers have accurate feedback on pupils' learning they can create foussed teaching.
10	Frequent testing encourages pupils to study	Regular testing can develop excellent study habits & motivate pupils to relearn & study on a daily or weekly basis.

Our science curriculum has the following features

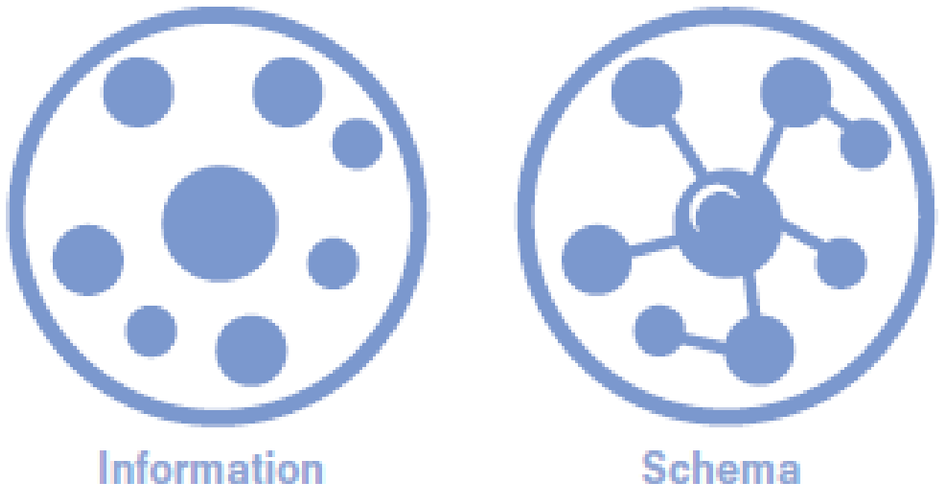
- Our science curriculum is planned to build increasingly sophisticated knowledge of the products (substantive knowledge) and practices (disciplinary knowledge) of science.
- Disciplinary knowledge (identified in the 'working scientifically' sections of the national curriculum) comprises knowledge of concepts as well as procedures. When pupils develop their disciplinary knowledge, they learn about the diverse ways that science generates and grows knowledge through scientific enquiry. This is not reduced to a single scientific method or taken to mean just data collection. Our curriculum outlines how disciplinary knowledge advances over time and teaches pupils about the similarities and differences between each science.
- Pupils are not expected to acquire disciplinary knowledge simply as a by-product of taking part in practical activities. Disciplinary knowledge is taught.
- Scientific processes such as observation, classification or identifying variables are always taught in relation to specific substantive knowledge. They are not seen as generalisable skills.
- Sufficient curriculum time allocated for pupils to embed what they have learned in long-term memory through extensive practice before moving on to new content.
- The component knowledge pupils need in order to read, write, represent and talk science is identified and well sequenced.
- Curriculum plans that consider how component knowledge introduced at one point in time influences future learning.
  This ensures that knowledge builds incrementally from pupils' prior knowledge and so pupils' misconceptions are less likely.
- The curriculum anticipates where pupils are likely to hold misconceptions.
  These are explicitly addressed, and pupils learn how the misconception is different to the scientific idea.

Building a Scientific Schema

What is a schema?

Schema theory states that all knowledge is organised into units. A schema is, therefore, a conceptual system for understanding knowledge.

A subject schema is a way of organising knowledge in a meaningful way; it is an appreciation of how facts are connected and the ways in which they are connected. A schema is distinct from information, which is just isolated facts that have no organisational basis or links. The diagram below shows the difference between information and a schema.



This document helps teachers to help their pupils form a science schema by:

- using **substantive knowledge** for the basis of schema
- strengthening the schema with **disciplinary knowledge**
- further deepening connections through tasks within and across the curriculum

Year 2023/ 24	Plants	Animals including humans	Materials Rocks, soils, properties and states of matter	Seasons	Living things	Forces	Sound	Electricity	Earth and space	Light	Evolution and Inheritance
EYFS											
Year 1	T4	T5 / T6	T1/T2	T3							
Year 2	T3	T5/T6	T1/2		T4						
Year 3	T6	T2/T3	T1			T4				T5	
Year 4		T5/T6	T2		T3		T4	T1			
Year 5		T6	T3/T4		T5	T1			T2		
Year 6		T3			T4			T2		T5	T1

Table 1 shows substantive knowledge content areas from the National Curriculum and ELGs.

Table 2 shows disciplinary knowledge content from the National Curriculum and ELGs.

	Methods to answer scientific questions	Apparatus and techniques, including measurement	Analysis, presentation and evaluation of scientific data to draw valid conclusions	Development of scientific knowledge over time and its implications
KS1	Asking simple questions. Identifying and classifying.	Gathering and recording data. Observing closely using simple equipment e.g. hand lens.	Using their observations and ideas to suggest answers to questions.	
Lower KS2	Using different types of scientific enquiries to answer questions. Setting up fair tests, make predictions.	Taking accurate measurements using standard units, use a range of equipment incl. thermometers.	Recording findings using bar charts, keys, tables, labelled diagrams. Draw conclusions. Make predictions for new values, suggest improvements.	Using scientific evidence to support findings.
Upper KS2	Planning different types of scientific enquiries. Recognising and controlling variables.	Taking measurements with increasing accuracy and precision. Taking repeat readings.	Scatter graphs, line graphs, causal relationships. Degree of trust in results.	Identifying scientific evidence used to support or refute ideas or arguments.

This document is designed to aid teachers in helping pupils to form a science schema within their long-term memories. Our Science Curriculum follows a simple model: **breadth of study, substantive knowledge, disciplinary knowledge, the lessons!**

The 'Big Ideas' of science

Physics

P1: The universe follows unbreakable rules that are all about forces, matter and energy.
P2: Forces are different kinds of pushes and pulls that act on all the matter that is in the universe. Matter is all the stuff, or mass, in the universe.
P3: Energy, which cannot be created or destroyed, comes in many different forms and tends to move away from objects that have lots of it.

Chemistry

C1: All matter (stuff) in the universe is made up of tiny building blocks.
C2: The arrangement, movement and type of the building blocks of matter and the forces that hold them together or push them apart explain all the properties of matter (e.g. hot/cold, soft/hard, light/heavy, etc).
C3: Matter can change if the arrangement of these building blocks changes.

Biology

B1: Living things are special collections of matter that make copies of themselves, use energy and grow.
B2: Living things on Earth come in a huge variety of different forms that are all related because they all came from the same starting point 4.5 billion years ago.
B3: The different kinds of life, animals, plants and microorganisms, have evolved over millions of generations into different forms in order to survive in the environments in which they live.

Earth science

E1: The Earth is one of eight planets that orbit the sun.
E2: The Earth is tilted and spins on its axis leading to day and night, the seasons and the climate.
E3: The Earth is made up of several layers, including a relatively thin rocky surface which is divided into tectonic plates, and the movement of these plates leads to many geologic events (such as earthquakes and volcanoes) and geographical features (such as mountains.)

EYFS

Light	• Know that eyes allow us to see.	Eye, Bright, Dark, See, Sight
Animals including Humans	• Know the five sense. • Know the basic parts of the human body. • Know the names of common farm animals and pets.	Humans Eyes, Eyebrows, Nose, Mouth, Ears, Head, Arm, Leg, Hand, Foot, Finger, Toe, Sight, Smell, Taste, Touch, Hearing Animals Duck, Chicken, Swan, Cow, Sheep, Pig, Horse, Donkey, Dog, Cat, Rabbit, Hamster
Materials	• Know how to describe objects using words such as smooth, rough, shiny, hard and soft. • Know that some objects are made out of materials such as plastic, word and metal. • Know that when water freezes it turns to ice.	hard, soft, wood, plastic, metal, smooth, rough, shiny, colour, water, ice, freeze
Living Things	• Know the names of common farm animals and pets.	Duck, Chicken, Swan, Cow, Sheep, Pig, Horse, Donkey, Dog, Cat, Rabbit, Hamster, Fish
Forces	• Know that magnets attract	Magnets, Magnetic, attract
Electricity	• Know that some objects need electricity	Electricity, Battery
Earth and space	• Know that we live on a planet called earth.	Earth, Moon, Stars

Understanding the World: **Marvellous me.** EYFS_provision_map_topics_04_ourselves.pdf	• Know how they have changed physically since they were a baby • Know and name the things that they can do things now which they couldn't do when they were a baby. • Recognise similarities and differences between themselves as a baby and their parents .	body parts - head, arms, leg, hand, foot, thigh, elbow internal body parts – heart, lungs, brain, stomach, muscles, senses – smell, taste, see, hear, listen, touch, feel sounds - loud, quiet, high pitch, low pitch, ear baby, toddler, child, teenager, adult, grow, change height, tall, taller, short, shorter
Understanding the World: **Celebrations** EYFS_provision_map_topics_02_birthdays__celebrations.pdf	• Know some different celebrations across the year, knowing how and why they are celebrated. Understand why we celebrate birthdays and know that there are similarities and differences between how people celebrate. • Beginning to understand 'why' and 'how' questions • Talk about why things happen and how things work • Eats a healthy range of foodstuffs and understands need for variety in food	material(s) - paper, card, tissue, natural, non-natural properties of materials - strong, weak, heavy, light, bendy, rough, smooth, rough, smooth, soft, hard, prickly, fluffy, spiky, squishy, shiny, dull, smelly, noisy senses - smell, noise, touch, texture shape, squashing, twisting, bending, stretching, push, pull, forces wind(y), shelter(ed) health, healthy food, food groups, protein, grains, fruit, vegetable, dairy, diet, hygiene, daily,
Understanding the World: **It's cold outside** EYFS_provision_map_topics_08_winter_snow__ice.pdf	• To discuss similarities and differences between the Polar regions and where we live in relation to climate, flora and fauna as well as indigenous people. To think about why there are differences. • Explore melting and freezing • To understand how animals have adapted to the climate in the polar regions • To understand the life cycle of an Emperor Penguin	Arctic, Antarctica, North Pole, South Pole, animals, mammal, bird, adaptation, camouflage, environment, fur, transparent, blubber, specie, threatened, climate change, Polar bear, Emperor Penguin, Arctic fox, Arctic hare, Walrus, caribou, inuit, tribe, igloo, melting, freezing, ice, snow, iceberg
Understanding the World: **Fairy Tales** EYFS_provision_map_storybooks_05_the_gingerbread_man-2.pdf	• Explore and compare different traditional tales from around the world. • Identify bird which live in our local area as part of the RSPB Big Garden Bird Watch 2022. • Make observations of animals and plants and explain why some things occur, and talk about changes	Traditional tale, story, beginning, middle, end, character, setting, story map, purpose, description, fiction, non-fiction, author, blurb, audience, reader
Understanding the World: **How does your garden grow? Plants** EYFS_provision_map_topics_01_animals_in_my_garden.pdf	• Know that there are four seasons. Understand what to wear in different seasons (spring/summer). • Understand that we wear different things at different parts of the day. • Know that there is a sequence to a day and year (Months of the year, when each season happens throughout the year) • Compare school to another environment	Autumn, Winter, Spring, Summer, warm, cold, sunny, frosty, foggy, storm, seasons, appropriate soft, hard, smooth, spiky, bumpy, hairy, juicy, sweet, sour, crunchy, furry, colourful

Understanding the World: **How does your garden grow? minibeasts** EYFS_provision_map_storybooks_14_the_very_hungry_caterpillar.pdf	• Know that there are four seasons. • Understand what to wear in different seasons (summer) • Understand that we wear different things at different parts of the day (summer safety). Know that there is a sequence to a day and year (When each season happens throughout the year). • Know that a butterfly starts life as an egg and changes to a caterpillar and then a butterfly To know that there are different religions. To know that when we read/listen to special stories we have to be respectful.	Autumn, Winter, Spring, Summer, warm, cold, sunny, frosty, foggy, storm, seasons, appropriate, life cycle, change, egg, caterpillar, chrysalis, cocoon, butterfly, painted lady

Adapt for your school

Understanding the World: **Out of this world.** EYFS_provision_map_topics_05_autumn_trees.pdf	• **Identify what is beyond the sky, including planets, asteroids, natural and man-made satellites etc…** • **Recognise how the orbit of the Earth effects our seasons.** • **Understand that day and night occurs due to the Earth rotating on its axis.** • **Recognise that the Sun is a star.** • **Observe how technology has allowed us to find out more about the Universe around us.** • **Explore how telescopes work.** • **To understand how technology has changed over time to help us understand more about Space. To talk about seasons and explain how these changes occur.**	**star, galaxy, Milky Way, planet, asteroid, moon, satellite, orbit, gravity, astronaut, International Space Station, Curiosity Rover, Hubble, telescope, rocket, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, solar system, gas**
Understanding the World: **Frozen** EYFS_provision_map_topics_08_winter_snow__ice.pdf	• To discuss similarities and differences between the Polar regions and where we live in relation to climate, flora and fauna as well as indigenous people. To think about why there are differences. • Explore melting and freezing • To understand how animals have adapted to the climate in the polar regions. • To understand the life cycle of an Emperor Penguin.	Arctic, Antarctica, North Pole, South Pole, animals, mammal, bird, adaptation, camouflage, environment, fur, transparent, blubber, specie, threatened, climate change, Polar bear, Emperor Penguin, Arctic fox, Arctic hare, Walrus, caribou, inuit, tribe, igloo, melting, freezing, ice, snow, iceberg
Understanding the World: **Fairy Tales** EYFS_provision_map_topics_01_animals_in_my_garden.pdf	• Explore and compare different traditional tales from around the world. • Identify bird which live in our local area as part of the RSPB Big Garden Bird Watch 2022. • Make observations of animals and plants and explain why some things occur, and talk about changes	Traditional tale, story, beginning, middle, end, character, setting, story map, purpose, description, fiction, non-fiction, author, blurb, audience, reader
Understanding the World: **Funny Bones** EYFS_provision_map_topics_04_ourselves.pdf	• Identify key parts of the body. • Recognise the different senses. • Understand how to keep themselves healthy and why it is important to do so. • To understand how we grow and develop from when we are first born. • To compare what we can do now which we couldn't when we were a baby. • Talk about the lives of the people around them and their roles in society. • Know some similarities and differences between things in the past and now, drawing on their experiences and what has been read in class.	Skeleton, bones, body, muscle, organ, brain, heart, lungs, liver, kidneys, artery, veins, skull, spine, ribs, clavicle, health, healthy food, food groups, protein, grains, fruit, vegetable, dairy, diet, hygiene, daily,

Understanding the World: **On the Farm** **EYFS_provision_map_topics_06_spring_farm.pdf**	• **To know some similarities and difference between farming in the past and now, drawing on their experiences and what has been read in class.** • **Explore the natural world around them, making observations and drawing pictures of animals and plants.**	**Mammal, bird, insect, life cycle, baby, young, parent, adult, egg, cow, calf, sheep, lamb, chicken, chick, horse, foal, goat, kid, duck, duckling, pig, piglet, grow, growth, crops, plants, harvest, farmer, tractor, past, present, machine, plough, horse-drawn, technology,**
Understanding the World: **Africa Alive** **EYFS_provision_map_storybooks_13_the_ugly_five.pdf**	• To explore the climate, environment and people of Africa. Focusing on traditional culture and comparing to our own. Children will make and eat traditional African dishes. • Compare a day in the life of a child in Rutland to a child from another country around the world to identify similarities and differences. • To understand the definitions of a predator and prey and use this to categorise a range of African animals. • To consider how African animals have adapted to their natural habitat. Adapt for your school	Africa, continent, country, Kenya, map, culture, similar, different, climate, rural, village, urban, city, town, instrument, music, Swahili, language, flora, fauna, adapted, natural habitat, mud cloth pattern, design, wildlife, safari, Big 5, Ugly 5, gum boot dancing, traditional, poverty, wealth, community, environment, savannah , desert, rainforest, Great Migration, lion, leopard, rhino, elephant, buffalo, wildebeest, crocodile, hyena, predator, prey

Progression in Light

Early Learning Goal	• Children know about similarities and differences in relation to places, objects, materials and living things. They talk aboutthe 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.
Year 1	• Children know how to identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense . **Animals including humans**.
Year 2	
Year 3	• Know that they need light in order to see things and that dark is the absence of light • Know that light is reflected from surfaces • Know that light from the sun can be dangerous and that there are ways to protect their eyes • Know that shadows are formed when the light from a light source is blocked by a solid object • Know how to find patterns in the way that the sizes of shadows change.
Year 4	
Year 5	
Year 6	• Know that light appears to travel in straight lines • Know that light travels in straight lines and use this idea to explain that objects are seen because they give out or reflectlight into the eye • Know that we see things because light travels from light sources to our eyes or from light sources to objects and then to oureyes • Know that light travels in straight lines and use this idea to explain why shadows have the same shape as the objects that cast them
KS3	• Know the similarities and differences between light waves and waves in matter. • Know light waves travel through a vacuum; Speed of light. • Know the transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface. • Know how to use a 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. • Know that light transfers energy from source to absorb are leading to chemical and electrical effects; Photosensitive material in the retina and in cameras. • Know colours and the different frequencies of light, white light and prism's (qualitative only) ; Differential colour effectsin absorption and diffuse reflection.

Light

Year 3

Essential Knowledge

Substantive knowledge:

- Know that they need light in order to see things and that dark is the absence of light
- Know that light is reflected from surfaces
- Know that light from the sun can be dangerous and that there are ways to protect their eyes
- Know that shadows are formed when the light from a light source is blocked by a solid object
- Know how to find patterns in the way that the sizes of shadows change.

Disciplinary knowledge:

- **To record findings as drawings**
- **To record findings as a bar chart**

Lesson Sequence

Retrieval Practice based on prior learning.

How can we see?

- we need light to see things and that darkness is the absence of light
- the Sun is a light source, but that the Moon is not and is merely reflecting light from the Sun
- many light sources give off light and heat
- sunglasses can protect eyes from sunlight but looking at the Sun directly – even with sunglasses – can damage the eyes

What does reflection mean?

- light is reflected when it travels from a light source and then 'bounces' off an object
- everything that we can see is either a light source or something that is reflecting light from a light source into our eyes

How are shadows created?

- opaque objects block light creating shadows and that light passes through transparent objects
- opacity/transparency and reflectiveness are properties of a material

How do shadows change?

- As objects move towards a light source, the size of the shadow increases
- show the changing of shadow size by drawing a diagram with straight lines representing light.

Prior Learning

- Explore how things work. (Nursery – Light)
- Talk about the differences in materials and changes they notice. (Nursery – Light)
- Describe what they see, hear and feel whilst outside. (Reception – Light)
- 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)

Vocabulary

- Light
- Light source
- Energy
- Reflection
- Shadow
- Block
- Bounce
- Bright
- Dull
- Dark
- Opaque
- Translucent
- Transparent

Common misconceptions

Some children may think:

- we can still see even where there is an absence of any light
- our eyes 'get used to' the dark
- the moon and reflective surfaces are light sources
- a transparent object is a light source
- shadows contain details of the object, such as facial features on their own shadow
- shadows result from objects giving off darkness.

Resources

Darkness, Sunlight and Reflection

Shadows

Year 3 – Light Assessment Record PLAN Examples of Work - **Light**	**WTS**	**EXS**	**GDS**	**Notes**
Know that they need light in order to see things and that dark is the absence of light				
Know that light is reflected from surfaces				
Know that light from the sun can be dangerous and that there are ways to protect their eyes				
Know that shadows are formed when the light from a light source is blocked by a solid object				
Know how to find patterns in the way that the sizes of shadows change.				
Disciplinary knowledge- Can everything make a shadow? • **To record findings as drawings** • **To record findings as a bar chart** Y3plan_Make_shadows_2020.docx	Can use their observations to decide whether or not a shadow has been formed by the material, *e.g. has sorted materials into two piles or recorded tick/cross.*	Can make observations and decide how to record them to answer the question, *e.g. independently records best to worst shadow*.	Recording communicates clearly how it answers the question, using appropriate vocabulary such as opaque, translucent and transparent.	

Light

Year 6

Essential Knowledge

Substantive knowledge:

- Know that light appears to travel in straight lines
- Know that light travels in straight lines and use this idea to explain that objects are seen because they give out or reflect light into the eye
- Know that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
- Know that light travels in straight lines and use this idea to explain why shadows have the same shape as the objects that cast them

Disciplinary knowledge:

- **To plan a scientific enquiry to answer questions**
- **To record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs**

Lesson Sequence

Retrieval Practice based on prior learning.

How does light travel?

- light travels in straight lines.
- translucent objects allow some light to pass through, but some of the light changes direction as it passes through the object; this means that something seen through a translucent object is not clearly defined
- draw a diagram to show why the shape of a shadow will match the shape of an object.

How does light reflect off objects?

- when light reflects off an object, the angle of incidence is equal to the angle of reflection
- a periscope takes advantage of the predictable angles of incidence and reflection to allow an image to be shown to a viewer

How is light refracted?

- when light passes from one medium to another (e.g. from air to water), it changes direction; this is called refraction; this happens because light travels at different speeds in different media.

How are colours formed?

- white light comprises all the colours of light
- white light refracted by two surfaces in a prism will spread out so that all of its constituent colours can be seen; this array of colours is called a spectrum; it happens because the different colours of that constitute white light travel at different speeds.

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)

Common Misconceptions

Some children may think:

- we see objects because light travels from our eyes to the object.

Vocabulary

- Angle of Incidence
- Angle of Reflection
- Refraction
- Spectrum
- Medium
- Prism
- Periscope
- Ray
- Inverted
- Defined
- Convex
- concave

Resources

How Light Travels

Year 6 – Light Assessment Record PLAN Examples of work - **Light**	WTS	EXS	GDS	Notes
Know that light appears to travel in straight lines				
Know that light travels in straight lines and use this idea to explain that objects are seen because they give out or reflect light into the eye				
Know that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes				
Know that light travels in straight lines and use this idea to explain why shadows have the same shape as the objects that cast them				
Disciplinary Knowledge - Raising and sorting light questions • **To plan a scientific enquiry to answer questions** • **To report as to the degree of trust in results** Y6plan-Light-questions-Plan.docx	Asks questions which have a direct stimulus, but needs support to develop a range of questions and/or to consider how they could be answered.	Contributes a range of questions, including some which can be turned into a form which can be investigated. Can identify how they could go about answering their questions.	Raises a range of investigable questions, but also recognises that there are many which cannot yet be answered.	
Disciplinary Knowledge – Investigating Shadows • **To record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs** Y6plan_Investigating_shadows_2020.docx	Requires support to take accurate measurements and and needs help to plot points accurately on a line graph.	Uses appropriate equipment to measure, e.g. a protractor for angle of light, a ruler to measure length of shadow to nearest mm. Takes precise measurements which are recorded accurately on a line graph.	Uses line graph to make further predictions, *e.g. if the angle of the light is 60°, the shadow will be 5cm.*	

Progression in Animals including Humans

Early Learning Goal	• Children know about similarities and differences in relation to places, objects, materials and living things. They talk aboutthe features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why somethings occur and talk about changes.
Year 1	• Know how to identify and name a variety of common animals that are birds, fish, amphibians, reptiles and mammals • Know how to identify and name a variety of common animals that are carnivores, herbivores and omnivores. • Describe and compare the structure of a variety of common animals (birds, fish, amphibians, reptiles and mammals, and including pets). • Know how to identify, name draw and label the basic parts of the human body and say which parts of the body is associated with each sense.
Year 2	• Know that animals, including humans, have offspring which grow into adults • Know the basic needs of animals, including humans, for survival (water, food and air) • Know the importance for humans to exercise, eat the right amounts of different types of food, and hygiene.
Year 3	• Know 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 • Know that humans and some animals have skeletons and muscles for support, protection and movement.
Year 4	• Know the simple functions of the basic parts of the digestive system in humans • Know the different types of teeth in humans and their simple functions • Know how to construct and interpret a variety of food chains, identifying producers, predators and prey.
Year 5	• Know the different types of teeth in humans and their simple functions. • Know the differences in the life cycles of a mammal, an amphibian, an insect and a bird. Living things and their habitats. • Know the life process of reproduction in some plants and animals. Living things under habitats.
Year 6	• Know how to identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood • Know the impact of diet, exercise, drugs and lifestyle on the way their bodies function • Know the ways in which nutrients and water are transported within animals, including humans. • Know how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals. Living things and their habitats. • Give reasons for classifying plants and animals based on specific characteristics. Living things and their habitats.
KS3	• Know that 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 ofmaternal lifestyle on the foetus through the placenta. • Know the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases. • Know the effects of recreational drugs (including substance abuse) on behaviour, health and life processes. • Know the structure and functions of the gas exchange system in humans, including adaptations to function. • Know the mechanism of breathing to move air in and out of the lungs. • Know the impact of exercise, asthma and smoking on the human gas exchange system.

Animals Including Humans

Year 1

Essential Knowledge

Substantive knowledge:

- Know how to identify and name a variety of common animals that are birds, fish, amphibians, reptiles and mammals
- Know how to identify and name a variety of common animals that are carnivores, herbivores and omnivores.
- Describe and compare the structure of a variety of common animals (birds, fish, amphibians, reptiles and mammals, and including pets).
- Know how to identify, name draw and label the basic parts of the human body and say which parts of the body is associated with each sense.

Disciplinary knowledge:

- **To sort and group animals with some help.**
- **To use observations and ideas to suggest answers to questions**

Lesson sequence

Retrieval Practice based on prior learning.

Are there different types of animals?

- a trout is an example of fish, a frog is an example of an amphibian; a lizard is an example of a reptile; a robin is an example of a bird; a rabbit and a human are examples of a mammal

Do animals feed in different ways?

- herbivorous animals eats plants; a carnivorous animal eats other animals; omnivorous animals eat both animals and plants
- a cat is an example of a carnivore; that a rabbit is an example of a herbivore; know that many humans are examples of omnivores (though not vegetarians)

What are the structures of different animals?

- fish, amphibians, reptiles, birds and mammals are similar in that they have internal skeletons and organs; these are known as vertebrates, which means they are animals that have a backbone
- fish are different in having gills so that they can breathe underwater **and** scaly skin
- amphibians are different in that they begin their lives with gills but then develop lungs and breath on land
- reptiles are different in that they breath air **and** have scaly skin
- birds are different to other animals in that they have feathers and wings
- mammals are different to other animals in that they have fur/hair **and** they feed milk to their young

What are the parts of the human body and how are they linked to our senses?

- feet, legs, arms, hands, torso, head, skin, ears, eyes, nose, mouth and tongue are part so the body and identify them
- eyes are associated with sight, ears with sound, nose with smell, tongue with taste and skin with touch.

Prior Learning

- Use all their senses in hands-on exploration of natural materials. (Nursery - Humans)
- Name and describe people who are familiar to them. (Reception - Humans)

Common Misconceptions

Some children may think:

- only four-legged mammals, such as pets, are animals
- humans are not animals
- insects are not animals
- all 'bugs' or 'creepy crawlies', such as spiders, are part of the insect group
- amphibians and reptiles are the same.

Vocabulary

- Birds
- Fish
- Amphibians
- Reptiles
- Scales
- Mammals
- Herbivore
- Carnivore
- Omnivore
- Senses
- Structure

Resources

1 & 3: Zoology

2: Animal diets

4: The Human Body and Taste, Eyesight and hearing, Touch and smell

Year 1 – Animals including Humans Assessment Record PLAN Examples of work - Animals Including Humans	WTS	EXS	GDS	Notes
Know how to identify and name a variety of common animals that are birds, fish, amphibians, reptiles and mammals				
Know how to identify and name a variety of common animals that are carnivores, herbivores and omnivores.				
Describe and compare the structure of a variety of common animals (birds, fish, amphibians, reptiles and mammals, and including pets).				
Know how to identify, name draw and label the basic parts of the human body and say which parts of the body is associated with each sense.				
Disciplinary Knowledge – Animal classification • **To sort and group animals with some help.** Y1plan_Animal_classn_2020-1.docx	Names some common animals. Needs support to sort or limited to common mammals, birds and fish.	Name a variety of common animals including fish /amphibians /reptiles / birds/mammals. Uses observations to classify into given scientific groupings including animal groups or omnivore/herbivore/carnivore and can explain how they are similar, *e.g. birds have feathers, frogs go in the water and out of water, they are all mammals because they are hairy.*	Can classify according to a range of features and give reasons for their choices, *e.g. some mammals live underwater, include other insect groups.* Names and classifies other animals which are not pictured.	
Disciplinary Knowledge – Body parts • **To use observations and ideas to suggest answers to questions** Y1plan_Body_parts_2020.docx	When prompted can name some body parts but does not suggest what these parts might do.	Can name a range of body parts. Can link body parts to senses, *e.g. I can smell things with my nose.*	Can talk about differences and similarities of body parts. Can name some internal organs, *e.g. heart, brain, lungs, stomach.*	

Animals Including Humans

Year 2

Essential Knowledge

Substantive knowledge:

- Know that animals, including humans, have offspring which grow into adults
- Know the basic needs of animals, including humans, for survival (water, food and air)
- Know the importance for humans to exercise, eat the right amounts of different types of food, and hygiene.

Disciplinary knowledge:

- **To use observations to suggest answers to questions**

Lesson sequence

Retrieval Practice based on prior learning.

What do the offspring of animals look like and how do they grow?

- plants and animals produced offspring that grow into adults.

What are the basic needs of animals and humans?

- animals, including humans, need food, water and air to survive

How do we stay healthy?

- people need to exercise often to help their body stay strong and fit
- keeping clean, including washing and brushing teeth, is an important part of staying healthy
- people need to eat a balance diet which is made up of a variety of foods.
- healthy foods include fruits and vegetables.

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)

Vocabulary

- Offspring
- Adult
- Survival
- Exercise
- Hygiene
- disease
- Growth
- Reproduction
- Child / Young

Common Misconceptions

Some children may think:

- an animal's habitat is like its 'home'
- all animals that live in the sea are fish
- respiration is breathing
- breathing is respiration.

Resources

1: Animal growth

2: Animal survival & food

3: Exercise and food

Year 2 – Animals including Humans Assessment Record PLAN Examples of work - Animals including humans	WTS	EXS	GDS	Notes
Know that animals, including humans, have offspring which grow into adults				
Know the basic needs of animals, including humans, for survival (water, food and air)				
Know the importance for humans to exercise, eat the right amounts of different types of food, and hygiene.				
Disciplinary Knowledge – comparing hand spans • **To use observations to suggest answers to questions** Y2plan_Handspans_2020.docx	Can make simple comparisons, saying which hand is smallest or biggest.	Can make comparisons using their observations/results to say which hands are bigger and smaller. Suggests reasons for differences in results *e.g. his hand is bigger because he has had longer to grow, she holds more cubes because she spreads out her fingers far to grab them.*	Can make predictions relating hand span to height, *e.g. a Year 6 will have bigger hands / will hold more cubes because….* Can raise further questions related to height that could be tested, *e.g. when do your hands stop growing?*	

Animals Including Humans

Year 3

Essential Knowledge

Substantive knowledge:

- Know 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
- Know that humans and some animals have skeletons and muscles for support, protection and movement.

Disciplinary knowledge:

- **To report findings from enquires**
- **To use evidence to answer questions**

Lesson sequence

Retrieval Practice based on prior learning.

Where do we get our nutrients from?

- proteins are good for growth, carbohydrates for energy and fruit and vegetables provide vitamins and minerals which help keep us healthy (e.g. calcium for healthy bones and teeth)

What is a balanced diet?

- getting the right amount of each food group (including over half of the diet made up of fruit, vegetables and carbohydrates) is called a balanced diet
- lack of a nutrient can cause ill health; for example, a lack of vitamin D leads to a disease called rickets

Why do we have a skeleton?

- animals, including humans, have a skeleton made up of solid objects.
- some animals (such as insects) have an exoskeleton – a solid covering on the outside of their body
- many invertebrates (such as earthworms and slugs) have water held inside by muscles which act like a skeleton
- skeletons provide support for muscles and protect the body; for example, the ribcage protects the vital organs in the human body
- human skeletons are made up of bones and cartilage

How do muscles work?

- muscles can only contract, so they must be arranged in pairs in the body so that as one contracts the other loosens

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)

Common Misconceptions

Some children may think:

- certain whole food groups like fats are 'bad' for you
- certain specific foods, like cheese are also 'bad' for you
- diet and fruit drinks are 'good' for you
- snakes are similar to worms, so they must also be invertebrates
- invertebrates have no form of skeleton.

Vocabulary

- Nutrients
- Carbohydrates
- Sugars
- Protein
- Vitamins
- Minerals
- Vertebrate
- Invertebrate
- Skeleton
- Exoskeleton
- Cartilage
- Muscles

Resources

1 & 2: Nutrition

3: Skeletons

4: Muscles

Year 3 – Animals including Humans Assessment Record PLAN Examples of work - Animals including humans	WTS	EXS	GDS	Notes
Know 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 Know that humans and some animals have skeletons and muscles for support, protection and movement.				
Disciplinary Knowledge – Investigating the human body • **To report findings from enquires** • **To use evidence to answer questions** Y3plan-Skeleton-Qs-Plan.docx	Can ask questions about the human body, e.g. *How big are people's heads? I wonder who has got the biggest feet?* Unable to relate the question to a suitable enquiry.	Can ask questions, and turn them into a form that can be investigated *e.g. Do Y6 children have bigger heads than Y4 children?*	Investigate more than one criteria e.g. Will taller people have wider arm spans and wider hand spans?	

Animals Including Humans

Year 4

Essential Knowledge

Substantive knowledge:

- Know the simple functions of the basic parts of the digestive system in humans
- Know the different types of teeth in humans and their simple functions
- Know how to construct and interpret a variety of food chains, identifying producers, predators and prey.

Disciplinary knowledge:

- **To record findings using labelled diagrams**
- **To use written explanations to report on findings from an enquiry**
- **To use results to draw simple conclusions, suggest improvements and raise further questions.**

Lesson sequence

Retrieval Practice based on prior learning.

What is digestion?

- food passes through the body with the nutrients being extracted and the waste products excreted, and that this process is called digestion
- the process of digestion involves breaking complex foodstuffs into simpler building blocks that can be absorbed by the body
- The process of digestion begins with food being chewed in the mouth by the teeth and saliva added

What are the parts of the digestive system?

- food is squeezed down the oesophagus towards the stomach. The stomach releases acid and enzymes to continue breaking down the food; the stomach is an organ; an organ is a part of living thing that is self-contained and has a specific important job
- further enzymes and bile break down the food further as it moves through the duodenum towards the small intestine
- the small intestine adds more enzymes and then absorbs the nutrients
- the large intestine absorbs water from the undigested food
- undigested food is stored in the rectum before being excreted through a muscle called the anus.

How does energy flow through a food chain?

- a food chain traces the path of energy through a habitat
- all energy for a food chain initially comes from the Sun which is absorbed and turned into energy by plants which are called producers
- consumers take in energy by eating
- an animal that is eaten by another is called prey, and that an animal that eats other animals is called a predator
- the first consumer in a food chain is called a primary consumer, the second is called a secondary consumer and above it is called a tertiary consumer

What are different types of teeth and how do we care for them?

- Know that a human has three types of teeth – incisors, canines and molars – and that these each perform different functions
- Know that incisors slice food, canines tear food (especially meat) and that molars grind food
- Know that children develop an initial set of teeth which are gradually replaced between the ages of 6 and 12

Prior 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)

Common Misconceptions

Some children may think:

- arrows in a food chains mean ‘eats’
- the death of one of the parts of a food chain or web has no, or limited, consequences on the rest of the chain
- there is always plenty of food for wild animals
- your stomach is where your belly button is
- food is digested only in the stomach
- when you have a meal, your food goes down one tube and your drink down another
- the food you eat becomes “poo” and the drink becomes “wee”

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Vocabulary

- Digestion
- Oesophagus
- Intestine
- Saliva
- Rectum
- Anus
- Incisor
- Canine
- Molar
- Producer
- Predator
- Prey

Resources

1 & 2: The digestive system

3: Food chains

4: Teeth

Year 4 – Animals including Humans Assessment Record PLAN Examples of work - Animals including humans	WTS	EXS	GDS	Notes
Know the simple functions of the basic parts of the digestive system in humans Know the different types of teeth in humans and their simple functions Know how to construct and interpret a variety of food chains, identifying producers, predators and prey.				
Disciplinary Knowledge – Digestion modelling • **To record findings using labelled diagrams** • **To use written explanations to report on findings from an enquiry** P5_Digestion_modelling.docx	Pupils take part in the modelling/diagram drawing, but cannot clearly explain the process.	Pupils use scientific vocabulary accurately when naming key parts of the digestive system in their modelling/presentation/diagram.	Pupils add further details or explanation from their independent research. Pupils identify problems with their modelling e.g. length of intestines.	
Disciplinary Knowledge – Teeth in liquids • **To use results to draw simple conclusions, suggest improvements and raise further questions** Y4plan_Teeth_in_liquid_2020.docx.	Describes differences, e.g. *the egg is OK in milk/water but not in coke.*	Can order liquids according to damage done to eggs and suggest reasons why. Able to raise further questions, *e.g. I thought sports drink/orange juice was a 'healthy' drink but it was not, I wonder whether these drinks contain a lot of sugar?*	Would be able to think about other liquids or factors including acid and carbonated drinks and suggest causal relationships, *e.g. the more acid/sugar in the drink, the worse the damage.* Can recognise problems with the test, e.g. *use of eggs not teeth, eggs were in liquid for 1 week but I do not keep coke in my mouth for 1 week!*	

Animals Including Humans

Year 5

Essential Knowledge

Substantive knowledge:

- Know the different types of teeth in humans and their simple functions.

Disciplinary knowledge:

- **To take measurements using a range of equipment**

RSE - What is puberty and what happens to our bodies at this time?

- Know that, during adolescence, our bodies change to allow us to reproduce.
- Know that these changes can be both physical and hormonal.
- Know that some of these changes are common to girls and boys whilst others are specific to the sexes.
- Know that these changes happen over time and at different speeds.

Lesson sequence

Retrieval Practice based on prior learning.

What are the main stages of the human life cycle?

- humans go through stages of development; they begin as fertilized eggs and then develop into embryos before developing into babies;
- once they are born, these newborn babies become infants (roughly 2 months to 2 years) then into young children (roughly 2-12 years old);
- children develop into adults during adolescence (roughly 12-16 years old) at which age they become physically capable of reproduction;
- as adults develop into old age (roughly 55+ years old) they experience changes in their body which require them to move more carefully and rest more frequently

Prior Learning

- Notice that animals, including humans, have offspring which grow into adults. (Y2 - Animals, including humans)

Common misconceptions

Some children may think:

- a baby grows in a mother's tummy
- a baby is "made".

Vocabulary

- Embryo
- Gestation
- Foetus
- Toddler
- Teenager
- Elderly
- Adolescents
- Development
- Infancy
- Puberty
- Hormones
- Genitals
- Menstruation
- Penis
- Womb
- Vagina
- Fallopian tubes

Resources

The Human Life Cycle

Year 5 – Animals including Humans Assessment Record **PLAN Examples of work - Animals including humans**	WTS	EXS	GDS	Notes
Know the different types of teeth in humans and their simple functions.				
Disciplinary Knowledge – Growth survey • **To take measurements using a range of equipment** Y5plan_Growth_survey_2020.docx	Can measure accurately in cm. Can record data in pre-made structure. Can identify highest and lowest results, describes pattern with support.	Can measure accurately in cm and mm. Can record data in their own structure. Can identify a pattern, suggest reasons for this pattern, and identify any anomalies.	Comments on accuracy of measurements, *e.g. if different people are measuring you must agree where to start.* Gives possible reasons for anomalies and indicates how these might be reduced if the investigation was to be repeated.	
RSE - What is puberty and what happens to our bodies at this time? • Know that, during adolescence, our bodies change to allow us to reproduce. • Know that these changes can be both physical and hormonal. • Know that some of these changes are common to girls and boys whilst others are specific to the sexes. • Know that these changes happen over time and at different speeds.				

Animals Including Humans

Year 6

Essential Knowledge

Substantive knowledge:

- Know how to identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood
- Know the impact of diet, exercise, drugs and lifestyle on the way their bodies function
- Know the ways in which nutrients and water are transported within animals, including humans.

Disciplinary knowledge:

- **Use test result to make predictions to set up further comparative and fair tests**

Lesson sequence

Retrieval Practice based on prior learning.

Do you know where the main organs are in your body?

- the heart and lungs are organs protected by the ribcage
- the heart is composed of four chambers: two atria and two ventricles; the aorta is the largest artery in the body and most major arteries branch off from it

Why do we have blood?

- blood travels around the body transporting nutrients that have been absorbed into the blood stream from digestion; blood also carries oxygen around the body which is used to power the body; this use of oxygen to create energy is called respiration

How does our blood get around our bodies?

- the heart beats, pumping blood around the body and that blood vessels carry the blood; arteries carry blood away from the heart; veins carry blood towards the heart; capillaries are tiny blood vessels that connect arteries and veins

What are the effects of diet, drugs and lifestyle?

- when we exercise, our heart beats more frequently so that the oxygen that is used around the body can be replenished; it returns to a resting heart rate afterwards; fitter people tend to have lower resting heart rates
- drugs are chemicals that have an impact on the natural chemicals in a person's; know that drugs can be harmful or helpful, depending on what they are and how they are used; know that all drugs can be harmful if overused
- alcohol and tobacco are examples of drugs that are legal to adults but that can have serious negative effects, such as liver disease and lung disease, respectively

Prior 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)

Common misconceptions

Some children may think:

- your heart is on the left side of your chest
- the heart makes blood
- the blood travels in one loop from the heart to the lungs and around the body
- when we exercise, our heart beats faster to work the muscles more
- some blood in our bodies is blue and some blood is red
- we just eat food for energy
- all fat is bad for you
- all dairy is good for you
- protein is good for you, so you can eat as much as you want
- foods only contain fat if you can see it
- all drugs are bad for you.

Vocabulary

- Heart
- Lungs
- Circulatory system
- Oxygenated
- De-oxygenated
- Blood vessels
- Veins
- Arteries
- Pulse
- Carbon dioxide
- Drugs
- Medicine

Resources

1: The heart and the circulatory system

2 & 3: The transport of water and nutrients

4: Diet & Exercise, drugs and lifestyle

Year 6 – Animals including Humans Assessment Record PLAN Examples of work - Animals including humans	WTS	EXS	GDS	Notes
Know how to identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood				
Know the impact of diet, exercise, drugs and lifestyle on the way their bodies function				
Know the ways in which nutrients and water are transported within animals, including humans.				
Disciplinary Knowledge – Human heart rate • **Use test result to make predictions to set up further comparative and fair tests** Y6plan-Heartrate-pose-Plan.docx	Children can explain that where the pulse rate goes up, this indicates that the heart is beating faster. They are aware that different children may have different resting pulse rates.	Children can use their data to make further predictions linking how hard the heart has to work with the heart rate, *e.g. When you are upside down the distance that the blood needs to be pumped upwards is greater, so your heart works harder and beats faster. Therefore, I predict that our pulse rates would rise if we raised our arms as the blood would also be pumped upwards.*	Can explain that it is important to measure the changing pulse rates of several children to get a good picture of the overall pattern as individuals might vary. Can use their tables or graphs to make predictions about different situations.	

Progression in Materials (including Rocks and Soils and States of Matter)

Early Learning Goal	• Children note 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.
Year 1	• Know how to distinguish between an object and the material from which it is made. • Know how to identify and name a variety of everyday materials, including wood, plastic, glass, water and rock. • Know the simple physical properties of a variety of everyday materials. • Know how to compare and group together a variety of everyday materials on the basis of their physical properties.
Year 2	• Know how to identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • Know that the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.
Year 3	• Know how to compare and group together different kinds of rocks on the basis of their appearance and simple physical properties • Know in simple terms how fossils are formed when things that have lived are trapped within rock • Know that soils are made from rocks and organic matter.
Year 4	• Know how to compare and group materials together, according to whether they are solids, liquids or gases • Know 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) • Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature
Year 5	• Know how to compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic • Know that dissolving, mixing and changes of state are reversible changes • Know 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.
Year 6	• Know that living things have changed overtime and that fossils provide information about living things that inhabited the earth millions of years ago. Evolution and inheritance.
KS3	• Know chemical reactions as the rearrangement of atoms. • Know how to represent chemical reactions using formulae and using equations. • Know combustion, thermal decomposition, oxidation and displacement reactions. • Know acids and alkaline in terms of neutralisation reactions. • Know the pH scale for measuring acidity / alkalinity; And indicators.

Materials (including Rocks and Soils and States of Matter)

Year 1

Essential Knowledge

Substantive knowledge:

- Know how to distinguish between an object and the material from which it is made.
- Know how to identify and name a variety of everyday materials, including wood, plastic, glass, water and rock.
- Know the simple physical properties of a variety of everyday materials.
- Know how to compare and group together a variety of everyday materials on the basis of their physical properties.

Disciplinary knowledge:

- **To ask simple questions and recognise they can be answered in different ways**
- **To perform simple tests**
- **To record simple data in order to answer a question**

Lesson sequence

Retrieval Practice based on prior learning.

What are objects made from?

- from observation how to distinguish between materials made of wood, plastic, glass, metal, water, rock
- an object is made from/of a material

What words can I use to describe materials?

- materials can be hard, soft, strong, weak, absorbent, heavy, light, solid and runny, smooth and rough; these descriptions denote the properties of a material

How can materials be grouped?

- materials can be grouped together by their properties.

Prior Learning

- Use all their senses in hands-on exploration of natural materials. (Nursery - Materials, including changing materials)
- Explore collections of materials with similar and/or different properties (Nursery - Materials, including changing materials)
- Talk about the differences between materials and changes they notice. (Nursery - Materials, including changing materials)

Common misconceptions

Some children may think:

- only fabrics are materials
- only building materials are materials
- only writing materials are materials
- the word 'rock' describes an object rather than a material
- 'solid' is another word for hard.

Vocabulary

- Materials
- Object
- Properties
- Wood
- Plastic
- Glass
- Metal
- Stone
- Rough
- Smooth
- Hard
- Flexible

Resources

1: Introduction to materials

2: Testing materials

3: Other properties of materials

Year 1 – Materials Assessment Record PLAN Examples of work - Everyday Materials	WTS	EXS	GDS	Notes
Know how to distinguish between an object and the material from which it is made.				
Know how to identify and name a variety of everyday materials, including wood, plastic, glass, water and rock.				
Know the simple physical properties of a variety of everyday materials				
Know how to compare and group together a variety of everyday materials on the basis of their physical properties.				
Disciplinary Knowledge – Ways to test reflectiveness • **To ask simple questions and recognise they can be answered in different ways** Y1plan_Reflectiveness_2020.docx	Can sort materials into two groups but not clear or gives a reason for the sorting that does not link to very reflective/less reflective. Or may not use a single criterion to sort: "these are colourful, these are shiny". May confuse reflection with other properties e.g. transparency or bright colours.	Describe how they sorted the materials according to how reflective they are, and how other groups used different ways to sort the materials.	Able to order the materials from most to least reflective and explain how the test helped them decide on this sequence. Can comment on effectiveness of different ways to test or compare the objects. May suggest what property of the material causes the reflectiveness.	
Disciplinary Knowledge – Ways to test transparency • **To ask simple questions and recognise they can be answered in different ways** Y1plan_Materials_-_Transparency.docx	Can sort materials into two groups but not clear or gives a reason for the sorting that doesn't link to transparency. May not use a single criterion to sort: "these are colourful, these are shiny". May confuse transparency with other properties e.g. reflection or bright colours.	Describe how they sorted the materials according to how transparent they are, and how other groups used different ways to sort the materials.	Able to order the materials from most to least transparent and explain how the test helped them decide on this sequence. Can comment on effectiveness of different ways to test or compare the objects.	
Disciplinary Knowledge – Floating and sinking • **To perform simple tests** • **To record simple data in order to answer a question** Y1plan_Float_and_sink_2020.docx	With support, they can say which objects float or sink during the test.	Children can carry out a simple test and describe what they find out through grouping the materials according to whether they float or sink.	Children show a systematic approach to carrying out an investigation and record their findings independently.	

Materials (including Rocks and Soils and States of Matter)

Year 2

Essential Knowledge

Substantive knowledge:

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

Disciplinary knowledge:

- **To use observations and ideas to suggest answers to questions**
- **To ask simple questions and recognise they can be answered in different ways**
- **To record simple data in order to answer a question**

Lesson sequence

Retrieval Practice based on prior learning.

What is the best materials for different jobs?

- materials can have useful properties for a given job (including being waterproof, strong, hard, soft, flexible, rigid, light or heavy.)
- many types of plastic are waterproof, that steel (a type of metal) is strong, that rock is hard, that cotton wool is soft, that rubber is flexible, that rock is rigid, that polystyrene (a type of plastic) is light and that iron (a type of metal) is heavy,

Can we change the shape of materials?

- applying forces to objects can change their shape

Prior 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)

Common misconceptions

Some children may think:

- only fabrics are materials
- only building materials are materials
- only writing materials are materials
- the word rock describes an object rather than a material
- solid is another word for hard.

Vocabulary

- Suitability
- Waterproof
- Absorbent
- Rigid
- Squash
- Bend
- Twist
- Stretch
- Transparent
- Reflective

Resources

1: Material strength

2: Changing materials

Year 2 – Materials Assessment Record PLAN Examples of work - Uses of everyday materials	WTS	EXS	GDS	Notes
Know how to identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses Know that the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.				
Disciplinary Knowledge – Waterproof materials • **To ask simple questions and recognise they can be answered in different ways** Y2plan_Waterproof_2020.docx	Describes their idea/test but it may not help to answer the question and does not consider alternative methods.	Explains different tests, *e.g. you can find out which is waterproof by --- or ---*	Comments on the best way to find out and understands that a comparison has to be fair, *e.g. I need to add the same amount of water.*	
Disciplinary Knowledge – Materials hunt • **To use observations and ideas to suggest answers to questions** • **To record simple data in order to answer a question** Y2plan-Materials-hunt-Do.docx	Describes some materials or objects, but finds it difficult to categorise into types of materials or explain what they recorded.	Records their observations of a range of objects made from different materials. In discussion, makes links between properties of materials and their uses.	Notes findings which are similar or different to their own. Continues to 'hunt' materials at other times and/or in other locations.	

Materials (including Rocks and Soils and States of Matter)

Year 3

Essential Knowledge

Substantive knowledge:

- Know how to compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- Know in simple terms how fossils are formed when things that have lived are trapped within rock
- Know that soils are made from rocks and organic matter.

Disciplinary knowledge:

- **To report on findings from enquiries**

Lesson sequence

Retrieval Practice based on prior learning.

How are different rocks grouped?

- there are three kinds of rocks: igneous, sedimentary and metamorphic
- granite and basalt are types of igneous rock and that igneous rocks form from molten rock below the Earth's crust
- limestone and sandstone are types of sedimentary rock which form when small, weathered fragments of rock or shell settle and stick together, often in layers
- marble and slate are types of metamorphic rock which form when rocks in Earth's crust get squashed and heated in processes such as when tectonic plates press against each other

How are fossils created?

- fossils form when a plant or animal dies and is quickly covered with silt or mud so that it cannot be rotted by microbes or eaten by scavenging animals;
- in time layers of sediment build, squashing the mud and turning it to stone around the dead plant or animal;
- the materials in the body are replaced by minerals that flow in water through the rock, leaving a rock in the shape of the animal or plant that was once there

What are soils made from?

- soil is made from tiny particles of rock broken down by the action of weather (weathering)

Prior 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)

Common misconceptions

Some children may think:

- rocks are all hard in nature
- rock-like, man-made substances such as concrete or brick are rocks
- materials which have been polished or shaped for use, such as a granite worktop, are not rocks as they are no longer 'natural'
- certain found artefacts, like old bits of pottery or coins, are fossils
- a fossil is an actual piece of the extinct animal or plant
- soil and compost are the same thing.

Vocabulary

- Igneous
- Metamorphic
- Sedimentary
- Molten
- Layers
- Fossil
- Crystals
- Grains
- Palaeontologist
- Silt
- Minerals
- Identification

Resources

1: Sedimentary and metamorphic rocks & Igneous rocks and minerals

2: Fossils

3: Soils

Year 3 – Materials Assessment Record PLAN Examples of work - Rocks	WTS	EXS	GDS	Notes
Know how to compare and group together different kinds of rocks on the basis of their appearance and simple physical properties				
Know in simple terms how fossils are formed when things that have lived are trapped within rock				
Know that soils are made from rocks and organic matter.				
Disciplinary Knowledge - Reporting on rocks • **To report on findings from enquiries** Y3plan_Rocks_report_2020.docx	Says which rock is 'best' but does not give reasons for this conclusion or use their results to make comparisons between the rocks.	Uses their results to order the rocks and can say (orally or with diagrams/writing) which rock is strongest/harder wearing.	Recommendations are clearly drawn from results and are presented appropriately for the audience. The report contains an explanation of how trustworthy the data is and explains that other factors may need to be tested, *e.g. marble is strong but may be slippery if it gets wet.*	

Materials (including Rocks and Soils and States of Matter)

Year 4

Essential Knowledge

Substantive knowledge:

- Know how to compare and group materials together, according to whether they are solids, liquids or gases
- Know 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)
- Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

Disciplinary knowledge:

- **To set up a fair-test and use results to draw simple conclusions**
- **To measure using thermometers**
- **To provide a written explanation**

Lesson sequence

Retrieval Practice based on prior learning.

What makes something a solid, liquid or a gas?

- things are composed of a material in one of three states of matter: solid, liquid or gas
- things are made of particles (tiny building blocks) and that these are organized differently in different states

What happens to materials when they are heated or cooled?

- materials can change state when temperature changes
- there are bonds between the particles (building blocks) in a solid; as temperature increases, these bonds are somewhat overcome as the particles absorb energy and solids can change into liquids; with a further increase in temperature, the particles become even more energetic and the bonds are overcome entirely so the liquid changes into a gas
- when solids turn into liquids, this is called melting and that the reverse process is called freezing
- the melting point of water is 0° C and that the boiling point of water is 100° C

What are evaporation and condensation?

- when liquids turn into gases, this is called evaporation and that the reverse process is called condensation

What is the water cycle?

- water flows around our world in a continuous process called the water cycle
- through evaporation, water on the Earth's surface moves to the air.
- rain condenses in clouds and falls to earth as rain, snow or hail in a process called precipitation

Prior 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)

Common misconceptions

Some children may think:

- 'solid' is another word for hard or opaque
- solids are hard and cannot break or change shape easily and are often in one piece
- substances made of very small particles like sugar or sand cannot be solids
- particles in liquids are further apart than in solids and they take up more space
- when air is pumped into balloons, they become lighter
- water in different forms – steam, water, ice – are all different substances
- all liquids boil at the same temperature as water (100 degrees)melting, as a change of state, is the same as dissolving
- steam is visible water vapour (only the condensing water droplets can be seen)

Vocabulary

- Solid
- Liquid
- Gas
- States of matter
- Evaporation
- Condensation
- Melting point
- Freezing point
- Water cycle
- Solidifying
- Precipitation

Resources

1: Solids & Liquids & Gases

2 & 3: Changes of state

4: The water cycle

Year 4 – Materials Assessment Record PLAN Examples of work - States of matter	WTS	EXS	GDS	Notes
Know how to compare and group materials together, according to whether they are solids, liquids or gases Know 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) Know the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature				
Disciplinary Knowledge – Drying materials • **To set up a fair-test and use results to draw simple conclusions** Y4plan_Drying_2020.docx	Can make suggestions about how to answer the question but needs support to explain which variables must be kept the same.	Can set up and carry out a fair test. Is able to say what is changed and that other factors which could affect evaporation are kept the same, e.g. *I will keep the same…amount of water, size of material.*	Recognises additional variables and could suggest some controls, e.g. *have a dry towel outside to check it doesn't rain, put under gazebo so if it rains it doesn't get more wet.*	
Disciplinary Knowledge – Measuring temperature • **To measure using thermometers** Y4plan_Measuring_temp_2020.docx	Recognise there are different ways to measure temperature. Takes measurements, but may need support to read scale. May not be consistent in their readings, e.g. need to be reminded to keep thermometer in water.	Make reasonably accurate measurements of temperature independently using correct units of measurement.	Can explain advantages and disadvantages of different measuring equipment, e.g. inaccuracy of forehead thermometer. Suggests other factors affecting readings (where held) and ways to improve measurements (repeat readings).	
Disciplinary Knowledge – Dunking biscuits • **To provide a written explanation** Y4plan_Materials_-_Dunking_biscuits.docx	Describes the best or worst biscuit, but does not make appropriate suggestions to make their method more fair or accurate e.g. *let's try frozen water next, to make it fair I'll use a digestive* (change variable).	Uses results to draw simple conclusions. Can also describe improvements to their method e.g. *needed to be more careful to not bash them on the side of the cup, would be better to use fresh water each time because there were bits floating in it, it's not really fair to have the double biscuits so could we break the bourbons in half next time.*	Considers degree of trust in results, shows awareness that it may not be possible to control some variables e.g. *it wasn't really fair because the temperature didn't stay the same but it would be really hard to keep it the same.*	

Materials (including Rocks and Soils and States of Matter)

Year 5

Essential Knowledge

Substantive knowledge:

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

Disciplinary knowledge:

- **To record data of increasing complexity using tables**
- **To use test results to make predictions to set up further comparative and fair test**
- **To plan a scientific enquiry that will answer a question**
- **To recognise variables when planning a fair-test**

Lesson sequence

Retrieval Practice based on prior learning.

What is a solution?

- in some solid materials the bonds between particles break when surrounded by a liquid; this allows the liquid to absorb the solid; when this happens, the solid is called a solute, the liquid is called a solvent and the result is a solution; when a solid does dissolve in a liquid it is described as being soluble in that solvent (e.g. sugar in water); when it cannot it is insoluble (e.g. sand in water)
- a given amount of solvent can only absorb a certain amount of solid before no more will dissolve; when this happens the liquid is said to be saturated

Can mixtures be separated?

- when a solvent is evaporated from a solution, the original solute is left behind; the remaining solid will often form crystals – the slower the solvent evaporates, the larger the crystals that will be formed
- dissolve a solute in a solvent and then how to evaporate the solvent to recover the solute
- filtering allows solids and liquids to be separated and that sieving allows solids made up of different sizes parts to be separated
- separate a mixture of sand, salt and small stones by sieving (to remove the small stones), followed by dissolving in water (so the salt is absorbed), followed by filtering to remove the sand from the mixture, followed finally by evaporation of the water to recover the salt

How does a material's properties suit its role?

- materials' different properties can be tested through acting upon them, including testing to find whether materials are magnetic, thermally conductive and electrically conductive;
- various properties of different materials make them suitable for a given function
- explain orally and in writing the reasons why various materials are suited or unsuited to a function

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)
- 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)

Common misconceptions

Lots of misconceptions exist around reversible and irreversible changes, including around the permanence or impermanence of the change. There is confusion between physical/chemical changes and reversible and irreversible changes. They do not correlate simply. Chemical changes result in a new material being formed. These are mostly irreversible. Physical changes are often reversible but may be permanent. These do not result in new materials e.g. cutting a loaf of bread. It is still bread, but it is no longer a loaf. The shape, but not the material, has been changed.

Some children may think:

- thermal insulators keep cold in or out
- thermal insulators warm things up
- solids dissolved in liquids have vanished and so you cannot get them back
- lit candles only melt, which is a reversible change.

Vocabulary

- Reversible
- Irreversible
- Thermal insulator
- Thermal conductor
- Electrical insulator
- Electrical conductor
- Mixture
- Solution
- Soluble
- Insoluble
- Dissolve
- Filter

Resources

1: Dissolving, mixtures and changes state

2: Separation by filtration and sieving and Separation by evaporation

3: Hardness and Transparency and magnetism

4: Burning & Acid and bicarbonate of soda

Materials (including Rocks and Soils and States of Matter) — Year 5

Essential Knowledge	Lesson sequence	Resources	Vocabulary
Substantive knowledge: • Know how to compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets • Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution • Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating • Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic • Know that dissolving, mixing and changes of state are reversible changes • Know 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. **Disciplinary knowledge:** • **To record data of increasing complexity using tables** • **To use test results to make predictions to set up further comparative and fair test** • **To plan a scientific enquiry that will answer a question** • **To recognise variables when planning a fair-test**	**Can all changes be reversed?** • a reversible change is one that can be reversed and that examples of this are mixing, dissolving and changes of state where no chemical reaction takes place • an irreversible change is one that cannot be reversed and that examples of this often involve a chemical change where a new material is made, often a gas (e.g. burning, boiling an egg, the reaction of bicarbonate of soda and acid)		• Reversible • Irreversible • Thermal insulator • Thermal conductor • Electrical insulator • Electrical conductor • Mixture • Solution • Soluble • Insoluble • Dissolve • Filter

Year 5 – Materials Assessment Record PLAN Examples of work - Properties and changes of materials	WTS	EXS	GDS	Notes
Know how to compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets				
Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution				
Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating				
Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic				
Know that dissolving, mixing and changes of state are reversible changes				
Know 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.				
Disciplinary Knowledge – Dissolving • **To plan a scientific enquiry that will answer a question** • **To recognise variables when planning a fair-test** Y5plan_Dissolving_2020.docx	Unclear about change or control variables, when planning or during the testing.	Can plan a fair test identifying one thing to change, one thing to measure/observe and important factors to keep the same. E.g. *We will change the type of liquid and measure the amount of time taken for the sugar to dissolve. We will keep the amount of liquid and the temperature of the liquid the same.*	Identifies a range of factors to keep the same. Plans an appropriate range of intervals for chosen variable, e.g. 50 ml, 100 ml, 150 ml. *E.g. We will increase the amount of water by 50ml each time. To make sure that our test is fair, we will keep the following the same: Amount of stirring, temperature of the water, size of sugar grains etc. We will take three sets of readings for each volume of water and take an average reading to increase the reliability of our results.*	
Disciplinary Knowledge – Thermal insulation layers • **To use test results to make predictions to set up further comparative and fair test** Y5plan_Insulation_layers_2020.docx	Suggests which insulators might be best but this is not linked to evidence from the first test. Needs support to carry out fair test	Uses evidence from the first test to support their prediction. Carries out a fair test independently. From own findings identifies which material is the best insulator, *e.g. this one because it took longer to cool.*	Compares own data with the original hypothesis & suggests reasons for similarities and differences, including any anomalies, *e.g. this one took longer to cool because….*	

Year 5 – Materials Assessment Record	WTS	EXS	GDS	Notes
Disciplinary Knowledge – Sugar cubes • **To record data of increasing complexity using tables** Y5plan_Sugar_cubes_2020.docx	Children note times, but recording is not be clear, e.g. measuring time to absorb or time to fall/dissolve.	Pupil recordings clearly show what was investigated. Results are recorded systematically in a table.	The results table follows the science format of 'change' in the left-column and 'measure' in the right column(s). Pupils recognise the need to repeat measures if they had more time and/or problems with the reliability of their data e.g. *it was hard to tell when it had fallen so we should have done it again to check.*	

Progression in Living Things

Early Learning Goal	• 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.
Year 1	• Know how to identify and name of variety of common wild and garden plants, including deciduous and Evergreen trees. Plants. • Know how to identify and describe the basic structure of a variety of common flowering plants, including trees. Plants. • Identify a name of variety of common animals including fish, amphibians, reptiles, birds and mammals. Animals including humans. • Know how to identify a name a variety of common animals that are carnivores, herbivores and omnivore. Animals including humans. • Describe and compare the structure of a variety of common animals fish, amphibians, birds and mammals, including pets. Animals including humans. • Observe changes across The Four Seasons. Seasonal change.
Year 2	• Know how to compare the differences between things that are living, dead, and things that have never been alive • Know 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. • Know how to identify and name a variety of plants and animals in their habitats, including micro-habitats • Know 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. • Know that animals, including humans, have offspring which grow into adults. Animals including humans.
Year 3	• Know the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. Plants.
Year 4	• Know that living things can be grouped in a variety of ways • Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment • Know that environments can change and that this can sometimes pose dangers to living things • Construct and interpret a variety of food chains, identifying producers, predators and prey. Animals including humans.
Year 5	• Know the differences in the life cycles of a mammal, an amphibian, an insect and a bird • Know the life process of reproduction in some plants and animals.
Year 6	• Know how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals • Know reasons for classifying plants and animals based on specific characteristics
KS3	• Know 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. • Know reproduction in plants, including flower structure, wind an insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms. • Know the difference between species.

Living Things

Year 2

Essential Knowledge

Substantive knowledge:

- Know how to compare the differences between things that are living, dead, and things that have never been alive
- Know 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.
- Know how to identify and name a variety of plants and animals in their habitats, including micro-habitats
- Know 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.

Disciplinary knowledge:

- **To perform simple comparative tests**
- **To observe closely**
- **To gather and record data to help answer a question**
- **To identify, group and classify**

Lesson sequence

Retrieval Practice based on prior learning.

Can you identify living, dead and non-living things?

- living things move, grow, consume nutrients and reproduce;
- dead things used to do these things, but no longer do;
- things that never lived have never done these things.

What shares our habitat?

- woodlice live under logs – an example of a microhabitat - as they need somewhere dark and damp so that they do not dry out
- frogs can live in ponds – an example of a microhabitat - as they water in which to lay their eggs (frogspawn)

How are living things suited to their own habitat?

- polar bears are an example of an animal adapted to its environment – thick fur for warmth and oily paw pads to ensure that they don't freeze to the ice.
- sharks are another example – smooth skin and streamlined shape for quick swimming; and gills for breathing underwater
- cacti are an example of a plant adapted to its environment – thick skin keeps a store of water safe; sharp spikes keep animals from stealing the water
- pine trees have thick bark and pine cones to protect against cold winters

What is a food chain?

- plants absorb energy from the Sun; that this energy is consumed by herbivorous animals; and that carnivorous animals eat other animals.
- the arrows on a food chain show the direction that the energy travels.

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)
- 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)
- Observe changes across the four seasons. (Y1 - Seasonal changes)

Common misconceptions

Some children may think:

- an animal's habitat is like its 'home'
- plants and seeds are not alive as they cannot be seen to move
- fire is living
- arrows in a food chain mean 'eats'.

Vocabulary

- Living
- Dead
- Non-living
- Habitat
- Micro-habitat
- Suited
- Basic needs
- Variety
- Food chain
- Depend

Resources

1: Dead or alive

2 & 3: Habitats and adaption

4: Animal food

Year 2 – Living Things Assessment Record PLAN Examples of work - Living things and their habitats	WTS	EXS	GDS	Notes
Know how to compare the differences between things that are living, dead, and things that have never been alive				
now 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.				
Know how to identify and name a variety of plants and animals in their habitats, including micro-habitats				
Know 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.				
Disciplinary knowledge – The feeding simulation • **To perform simple comparative tests** • **To observe closely** Y2_Feeding_simulation.docx	Children have difficulty performing the test, e.g. trouble sorting or counting the 'food'.	Children meeting the objective would be able to follow instructions to carry out the simulation and observe closely to sort the 'food'.	Children may consider the implications of repeatedly feeding in a plastic-rich environment. They may consider other implications e.g. plastic around feet/wings etc. They may go on to do their own research about the main plastic pollutants in the ocean.	
Disciplinary knowledge – Woodlice habitat • **To gather and record data to help answer a question** Y2plan_Woodlice_habitat_2020.docx	Says how many woodlice were found, *e.g. I found 3 woodlice.* Needs support to record on a tally chart or map.	Can draw a tally chart (after it's been modelled to them) or record on a map and explain why woodlice are found in a particular habitat, *e.g. I found 3 here and 3 there because it is dark.*	Can independently explain their tally chart / map, *e.g. There are more spiders here and more woodlice there…* Explaining why the woodlice might live there e.g. because of predators.	
Disciplinary knowledge – Nature spotters • **To identify, group and classify** Y2plan_Nature_spotters_2020.docx	Children may name animals already known to them e.g. ants and spiders with little reference to the spotter sheets. Children will not yet be linking the specific animal to its features e.g. *I know it's an ant because we have them in my garden.*	Children use spotter sheets to identify plants or animals e.g. *I think that is an earwig because it has a funny tail like on the sheet.* Children begin to classify e.g. *That woodlouse can't be an insect because it doesn't have 6 legs. The squirrel in the tree is all furry so it must be a mammal.*	Children can discuss the limitations of the spotter sheets e.g. *I think it is a kind of ladybird because it has the same kind of back and legs, but it is not the same as on the sheet, but the sheet can't have pictures of all the ladybirds.*	

Living Things

Year 4

Essential Knowledge

Substantive knowledge:

- Know that living things can be grouped in a variety of ways
- Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment
- Know that environments can change and that this can sometimes pose dangers to living things

Disciplinary knowledge:

- **To gather, record, classify and present data in a variety of ways to help in answering questions**

Lesson sequence

Retrieval Practice based on prior learning.

Can you group living things in different ways?

- animals can be grouped based on their physical characteristics (e.g. vertebrates and invertebrates) and based on their behaviour (e.g. herbivores, carnivores and omnivores)
- living things are divided into kingdoms: the animal kingdom, plants, fungi, bacteria, and single-celled organisms
- a species is a group of living things have many similarities that can reproduce together produce offspring

How are classification keys used to group living things within the local environment?

- a classification key uses questions to sort and identify different living things
- use a classification key to identify living things
- create a classification key to sort plants on the school premises

What happens when environments change?

- changes to the environment can make it more difficult for animals to survive and reproduce; in extreme cases this leads to extinction, where an entire species dies
- human activity – such as climate change caused by pollution - can change the environment for many living things, endangering their existence
- the polar bear is a famous example of climate change endangering the existence of a species; as the climate changes and gets warmer, the sea ice on which polar bears live reduces in amount making it harder for them to survive and reproduce

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)

Common misconceptions

Some children may think:

- the death of one of the parts of a food chain or web has no or limited consequences on the rest of the chain
- there is always plenty of food for wild animals
- animals are only land-living creatures
- animals and plants can adapt to their habitats, however they change
- all changes to habitats are negative.

Vocabulary

- Classification
- Classification keys
- Sorting
- Diverse
- Environment
- Grouped / grouping
- Survival
- Characteristics
- Human impact
- Extinction
- Deforestation

Resources

1 & 2: Classification

3: Extinction

Year 4 – Living Things Assessment Record PLAN Examples of work – Living things and their habitats	WTS	EXS	GDS	Notes
Know that living things can be grouped in a variety of ways				
Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment				
Know that environments can change and that this can sometimes pose dangers to living things				
Disciplinary knowledge – Local survey of living things • **To gather, record, classify and present data in a variety of ways to help in answering questions** Y4plan_Local_survey_2020.docx	Children can identify various living creatures by obvious differences and begin to suggest methods of grouping them.	Children identify that animals and plants can be classified in a number of possible ways including vertebrates and invertebrates, flowering and non-flowering plants.	All groups are sorted by the same characteristic and some groups may be sub-divided. Connections are made between types of living creatures and plants found in each group, e.g. *most insects live in a dark place under rocks or logs*.	

Living Things

Year 5

Essential Knowledge

Substantive knowledge:

- Know the differences in the life cycles of a mammal, an amphibian, an insect and a bird
- Know the life process of reproduction in some plants and animals.

Disciplinary knowledge:

- **To use scientific diagrams and labels**
- **To explain findings**

Lesson sequence

Retrieval Practice based on prior learning.

How do the life cycles of living things differ?

- the life cycle of a living thing is a series of stages of development starting with a fertilized egg in animals or a seed in many plants
- in mammals (e.g. dogs) an egg fertilised by a sperm develops in the womb into an embryo and is then born, fed on milk before it is weaned onto the food that is adapted to eat; it then develops to maturity in a period called adolescence after which it can reproduce and the cycle can begin again
- in amphibians (e.g. frogs) a fertilized egg develops into an embryo and then hatches into a tadpole; the tadpole develops adult characteristics, metamorphoses into the adult form after which it can reproduce and the cycle can begin again
- in many insects (e.g. butterflies) a fertilized egg develops into wingless feeding form called a larva (caterpillar); the larva feeds then later becomes a pupa (chrysalis) with a protective cocoon; inside this cocoon, the pupa metamorphoses into the adult butterfly after which it can reproduce and the cycle can begin again
- in birds (e.g. robins) a fertilized egg hatches in a nest (a hatchling) and is fed by its parents until it is ready to fly (i.e. becomes a fledgling); it then leaves the nest and grows into an adult after which it can reproduce and the cycle can begin again

How do plants reproduce?

- some plants reproduce asexually and some sexually.
- male gametes can be found in the pollen, and female gametes can be found in the ovary (ovules).
- pollination occurs when pollen from the anther is transferred to the stigma by insects.
- the pollen then travels down and meets the ovule, seeds are then formed (fertilisation).
- seeds are dispersed so that germination can begin again.
- some plants, such as strawberry plants, potatoes, spider plants and daffodils, use asexual reproduction to create a new plant. They are identical to the parent plant

How do animals reproduce?

- in animals, reproduction is sexual.
- sexual reproduction involves an egg being fertilised by a sperm.

Prior 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)

Common misconceptions

Some children may think:

- all plants start out as seeds
- all plants have flowers
- plants that grow from bulbs do not have seeds
- only birds lay eggs.

Vocabulary

- Sexual
- Asexual
- Reproduction
- Sperm
- Fertilisation
- Egg
- Live young
- Metamorphosis
- Larva
- Pupa

Resources

2: Plant reproduction

1 & 3: Animal life cycles and reproduction

Year 5 – Living Things Assessment Record PLAN Examples of work - Living things and their habitats	WTS	EXS	GDS	Notes
Know the differences in the life cycles of a mammal, an amphibian, an insect and a bird Know the life process of reproduction in some plants and animals.				
Disciplinary knowledge – Life cycles • **To use scientific diagrams and labels** • **To explain findings** Y5plan_Life_cycles_2020.docx	Children report either with little reference to their research, or using sections verbatim.	Children select relevant facts from their research to compare the life cycles of different animals. They describe the main stages of each life cycle. *e.g. The lifecycle of a cricket has 3 stages: egg, nymph and adult whilst the lifecycle of a frog has 5 main stages: eggs, tadpole, tadpole with legs, young frog and adult frog.*	Children make links to other areas e.g. animal classification, habitats, survival, life processes.	
Disciplinary knowledge – Seed dispersal • **To use scientific diagrams and labels** • **To explain findings** Y5_Seed_dispersal_survey.docx	Children record their findings but they may be unclear, unlabelled (seed dispersal) or unrepresentative of the area surveyed e.g. drawings of only fruits and no grasses.	Children meeting the objective would be able to record their findings in a way which is clear to others e.g. labelling diagrams with means of seed dispersal or creating a tally chart.	Considers plants where seed dispersal is not displayed e.g. at a different point in their life cycle or reproduces in a different way. May do additional research to identify unknown plants or find out more about seed dispersal.	

Living Things

Year 6

Essential Knowledge

Substantive knowledge:

- Know how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals
- Know reasons for classifying plants and animals based on specific characteristics

Disciplinary knowledge:

- **To plan the correct enquiry to answer a question**
- **To recognise which secondary sources will be the most useful to their research**
- **To identify scientific evidence that has been used to support or refute ideas or arguments**
- **To use scientific diagrams and labels**
- **To make a key to classify plants and animals**

Lesson sequence

Retrieval Practice based on prior learning.

What are micro-organisms?

- there are three types of micro-organism: viruses, fungi and bacteria. Of these three, viruses are often not really considered to be alive by many scientists, mainly because they don't have the 'machinery' to reproduce inside them.
- germs are disease-causing bacteria.

How can we classify all living things?

- the key features which distinguish between the main groups of vertebrates (animals with backbones) are their skin coverings and the place where they live.
- fish have scaly skin and live in water. They have gills that extract oxygen from the water.
- amphibians have smooth, moist skin. They live in damp places and can extract oxygen from the water through their skin –but most of the oxygen that they need comes in through their lungs.
- reptiles have scaly, dry, waterproof skin. They can live on land and they breathe using lungs.
- birds have feathers. They live on land and breathe air.
- mammals generally, have hairy, smooth, dry skin. Most live on the land. All breathe air.
- invertebrates are animals without backbones. Some of these animals include spiders, butterflies, slugs and bees.
- the main groups of the plant kingdom: algae, mosses and liverworts, ferns and seed-bearing plants.
- lichens are a special kind of living thing. They are an alga and a fungus living together.

Why are living things classified?

- all living things are classified as a way to organise the billions of organisms on Earth.

Prior 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)

Common misconceptions

Some children may think:

- all micro-organisms are harmful
- mushrooms are plants.

Vocabulary

- Micro organism
- Kingdom
- Domain
- Species
- Algae
- Bacteria
- Fungi
- Linnaean system
- Spores
- Taxonomist

Resources

1: Micro-organisms

2 & 3: Classification

Year 6 – Living Things Assessment Record PLAN Examples of work - Living things and their habitats	WTS	EXS	GDS	Notes
Know how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals Know reasons for classifying plants and animals based on specific characteristics				
Disciplinary knowledge – Invertebrate research • **To use scientific diagrams and labels** • **To make a key to classify plants and animals** Y6plan_Invertebrate_research_2020.docx	Report and present information about an animal. Explains some differences between animals, but lack of clarity about the classification groupings.	Explain all of the key characteristics of that group and how they differ from other groups. Able to justify why their chosen animal belongs to one invertebrate group and not another. E.g. a *ladybird is an insect as it has an exoskeleton, a three-part body and three pairs of jointed legs.*	Able to explain how invertebrates from a broad range of habitats are classified with reasons why. Could answer questions about an unfamiliar invertebrate and decide which group it belongs to.	
Disciplinary knowledge – Flower sampling • **Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary** Y6_Flower_sampling.docx	Children collect data but are not clear about what or why they are sampling. They may skew their results by seeking out the areas of high population to place their hoop.	Children meeting the objective would be able to select and apply a sampling technique to collect results to answer a question e.g. *we found more daisies in the hoops in the middle of the field than at the edge.*	Can explain the limitations of their sampling *e.g. the hoop landed on the leaves of the dandelion, but the flower was outside the hoop, so does that count? There were lots of daisies but our hoop never fell on them because it's just chance, maybe we need to do it more times.*	

Progression in Forces

Early Learning Goal	• 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.
Year 1	
Year 2	• Know how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. Materials.
Year 3	• Know how things move on different surfaces • Know that some forces need contact between two objects, but magnetic forces can act at a distance • Know how magnets attract or repel each other and attract some materials and not others • Know how to 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 • Know magnets as having two poles • Know whether two magnets will attract or repel each other, depending on which poles are facing.
Year 4	
Year 5	• Know that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • Know the effects of air resistance, water resistance and friction, that act between moving surfaces • Know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect
Year 6	
KS3	• Know magnetic fields by plotting with compass, representation by field lines. • Know Earth's magnetism, compass and navigation. • Know forces as pushes or pulls, arising from the interaction between two objects. • Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces. • Know Moment as the turning effect of a force. • Know 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. • Know force is measured in Newtons, measurements of stretch or compression as force is changed.

Forces

Year 3

Essential Knowledge

Substantive knowledge:

- Know how things move on different surfaces
- Know that some forces need contact between two objects, but magnetic forces can act at a distance
- Know how magnets attract or repel each other and attract some materials and not others
- Know how to 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
- Know magnets as having two poles
- Know whether two magnets will attract or repel each other, depending on which poles are facing.

Disciplinary knowledge:

- **To set up a fair-test**
- **Gather record and classify and present data in a variety of ways to help in answering questions**
- **To identify changes related to scientific ideas**
- **To use results to draw simple conclusion and provide an oral explanation of findings**

Lesson sequence

Retrieval Practice based on prior learning.

How does a force make something move?

- a force can be thought of as a push or a pull
- there are also non-contact forces that can act between objects without them touching and that magnetism is an example of a non-contact force

Does the surface affect the movement of an object?

- objects move differently on rough and smooth surfaces; objects resist movement more on rough surfaces because there is higher friction as the object moves

What effect do magnets have on materials?

- some materials are magnetic, meaning that they are attracted to a magnet, while other materials are non-magnetic

How do magnetic poles work?

- magnets have two poles called north and south
- like poles (south-south and north-north) of two magnets repel each other and that opposite poles of two magnets (north-south) attract each other
- there is a magnetic field around a magnet which is strongest at each pole

Prior Learning

- Explore how things work. (Nursery – Forces)
- Explore and talk about different forces they can feel. (Nursery – Forces)
- Talk about the differences between materials and changes they notice. (Nursery – Forces)
- Explore the natural world around them. (Reception – Forces)
- Describe what they see, hear and feel whilst outside. (Reception – Forces)
- 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)

Common misconceptions

Some children may think:

- the bigger the magnet the stronger it is
- all metals are magnetic.

Vocabulary

- Force
- Friction
- Surfaces
- Magnetic
- Non magnetic
- Repel
- Attract
- Poles
- Magnetic field
- Contact
- Resist

Resources

1 & 2: Friction

3 & 4: Magnetism

Year 3 – Forces Assessment Record PLAN Examples of work - Forces and magnets	WTS	EXS	GDS	Notes
Know how things move on different surfaces				
Know that some forces need contact between two objects, but magnetic forces can act at a distance				
Know how magnets attract or repel each other and attract some materials and not others				
Know how to 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				
Know magnets as having two poles				
Know whether two magnets will attract or repel each other, depending on which poles are facing.				
Disciplinary knowledge – Testing the strength of magnets • **To set up a fair-test** Y3plan_Magnet_tests_2020.docx	With support, can make suggestions about how to find which magnet is the strongest, *e.g. see how many paperclips the magnet will pick up.*	Can decide on an approach to answer the question, and what observations/measurements need to be made, *e.g. hold each magnet above the paperclips and measure the greatest distance each magnet can still attract them from.*	Can compare different ways of answering the question and whether they lead to the same sequence of strength of magnets, e.g. *The order was different when you measure the distance the paperclips jump because it is not very easy to know when this happened.*	
Disciplinary knowledge – Cars down ramps • **Gather record and classify and present data in a variety of ways to help in answering questions** Y3plan_Car_ramps_2020.docx	Measures distance with the equipment provided, recording with support. Predictions/explanations describe how things move (in isolation) e.g. *the car goes fast on plastic*.	Takes and records accurate measurements using standard units and presents findings in a table (or bar chart). Can compare how things move, e.g. *it goes quicker on wood and slower on grass.*	Systematically takes repeat readings and records all measurements in a table or bar chart. Can explain findings in terms of friction or describe general patterns e.g. *it will go further on a smoother surface because bumps slow it down.*	
Disciplinary knowledge – Balloon rockets • **To identify changes related to scientific ideas** • **To use results to draw simple conclusion and provide an oral explanation of findings** Y3plan_Balloon_rocket_2020.docx	Describes the results for different balloon tracks e.g. *it went far, it did terrible.*	Pupils draw conclusions by comparing results e.g. *the silver floss was faster because it was small and that means the balloon can flow nicely*. Pupils can suggest improvements for investigation set up *e.g. need a longer track, we didn't use the same balloon.*	Conclusions may draw on scientific ideas e.g. *the washing line was slippery so it caused less friction.* Evaluations note degree of trust in results *e.g. it's not fair because we used different balloons, the balloon could have gone further if the track was longer so we need to do it again.*	

Forces

Year 5

Essential Knowledge

Substantive knowledge:

- Know that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Know the effects of air resistance, water resistance and friction, that act between moving surfaces
- Know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect

Disciplinary knowledge:

- **To take repeated accurate measurements using a stopwatch**
- **To explain the degree of trust in results**
- **To use test results to make predictions to set up further fair-tests**

Lesson sequence

Retrieval Practice based on prior learning.

What keeps us grounded?

- gravity is a force that acts between all objects in the universe, but that it acts much more strongly between objects that have more mass and that are close together
- unsupported objects are pulled towards the Earth by the force of gravity

What slows us down?

- air resistance is a force felt by an object as it moves through the air; it is caused by the object bumping into the gas particles that make up air; the quicker an object moves, the more gas particles it bumps into and the more air resistance it experiences
- a falling object will accelerate until its air resistance matches the gravitational force pulling it down; at this point, the object will continue to move at this speed (called its terminal velocity) without getting any quicker or slowing down.
- a parachute's shape increases the air resistance that a falling object experiences, giving it a much lower terminal velocity

What keeps us afloat?

- water resistance is a force felt by an object as it moves through water; it is caused by the object bumping into the water particles
- the shape of an object determines how much air resistance or water resistance it experiences; shapes of object that experience little air resistance or water resistance are described as streamlined

How do pulleys, levers and gears work?

- some mechanisms – pulleys, levers and gears, allow a smaller force to have a greater effect.

Learning Opportunities

- 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)

Common misconceptions

Some children may think:

- the heavier the object the faster it falls, because it has more gravity acting on it
- forces always act in pairs which are equal and opposite
- smooth surfaces have no friction
- objects always travel better on smooth surfaces
- a moving object has a force which is pushing it forwards and it stops when the pushing force wears out
- a non-moving object has no forces acting on it
- heavy objects sink and light objects float.

Vocabulary

- Gravity
- Air resistance
- Water resistance
- Newtons
- Balanced
- Acceleration
- Particles
- Surface area
- Mass
- Upthrust
- Mechanisms
- Fulcrum

Resources

1: Gravity

2: Friction and Air resistance

3: Water Resistance

4: Levers, Pulleys and Gears

Year 5 – Forces Assessment Record PLAN Examples of work - Forces	WTS	EXS	GDS	Notes
Know that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object				
Know the effects of air resistance, water resistance and friction, that act between moving surfaces				
Know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect				
Disciplinary knowledge – Spinners • **To take repeated accurate measurements using a stopwatch** Y5plan_Spinners_2020.docx	With support, measures and records results in given table /graph. Needs help to work out averages.	Systematically takes repeat measurements and either chooses middle value or finds mean average to accurately plot points on a line graph.	Is able to explain why repeat readings improve reliability, and spots anomalous results. Can describe pattern and shows evidence of understanding of forces e.g. *the longer the wings the bigger the air resistance so it takes longer to fall, until the wings get too big.*	
Disciplinary knowledge – Aquadynamics • **To explain the degree of trust in results** Y5plan_Aquadynamics_2020.docx	Suggests which shape falls fastest but little recognition of issues with fairness or accuracy.	Evaluates how effectively variables were controlled, e.g. *We couldn't get the position the same because some shapes turned over at the surface slowly, so we didn't know whether to time from when it went in the water, or when it had turned over.*	Is able to repeat readings independently and explains how this increases accuracy, e.g. *it was difficult to know when to start timing so we took the middle value/mean average of three readings.*	

Progression in Sound

Early Learning Goal	• 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 may vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes.
Year 1	• know how to dentify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense. Animals including humans.
Year 2	
Year 3	
Year 4	• Know how sounds are made, associating some of them with something vibrating • Know that vibrations from a sound travel through a medium to the ear. • Know how to find patterns between the pitch of a sound and features of the object that produced it • Know how to find patterns between the volume of a sound and the strength of the vibrations that produced it. • Know that sounds get fainter as the distance from the sound source increases.
Year 5	
Year 6	
KS3	• Know that waves on water as undulations which travel through water with transverse motion ; These waves can be reflected, and add or cancel- superposition. • Know frequencies of sound waves, measured in Hertz; Echoes, reflection and absorption of sound. • Know sound needs a medium to travel, the speed of sound in air, in water, in solids. • Know sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; Sound waves are longitudinal. • Know auditory range of humans and animals. • Know pressure waves transferring energy; Used for cleaning and physiotherapy by ultrasound. • Know waves transfer information for conversation to electrical signals by microphone.

Sound

Year 4

Essential Knowledge

Substantive knowledge:

- Know how sounds are made, associating some of them with something vibrating
- Know that vibrations from a sound travel through a medium to the ear.
- Know how to find patterns between the pitch of a sound and features of the object that produced it
- Know how to find patterns between the volume of a sound and the strength of the vibrations that produced it.
- Know that sounds get fainter as the distance from the sound source increases.

Disciplinary knowledge:

- **To use a scientific enquiry to answer a question**
- **To identify differences, similarities or changes related to simple scientific ideas**

Lesson sequence

Retrieval Practice based on prior learning.

How is sound made?

- sound is generated when an object vibrates; some of the energy from the vibrating object is transferred to the air, making the air particles move
- sound is a form of energy that transfers in a longitudinal wave - like that seen in a slinky - *not* a transverse wave - like that seen in water ripples

How does sound travel?

- sound travels through a medium (e.g. particles in the air) and thus sounds does not travel through a vacuum which has no particles in it at all
- sound travels at different speeds through different objects; it travels at around 340 metres per second in air, much slower than light travels; this is why we often hear thunder after we see lightning as the light reaches our eye before the sound reaches our ears

How do we hear sounds?

- longitudinal sound waves are detected in the ear by humans and that the brain interprets this as the sounds we hear

How does the pitch of sound change?

- pitch is how high or low a sound is and that this is determined by how many vibrations per second are being made by the vibrating object; the number of vibrations per second is called frequency

How does sound change over a distance?

- volume is how loud or quiet a sound is and that this is determined by the amount of energy in the wave (e.g. from how hard or soft a percussion instrument is hit)
- The volume of a sound is quieter if the listener is further away from the object

Prior Learning

- Explore how things work. (Nursery – Sound)
- Describe what they see, hear and feel whilst outside. (Reception – Sound)
- 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)

Common misconceptions

Pitch and volume are frequently confused, as both can be described as high or low.

Some children may think:

- sound is only heard by the listener
- sound only travels in one direction from the source
- sound can't travel through solids and liquids
- high sounds are load and low sounds are quiet.

Vocabulary

- Source
- Vibrations
- Sound Waves
- Medium
- Pitch
- Volume
- Amplitude
- Decibel
- Frequency
- Energy

Resources

1: An introduction to sound

2: How sounds travel

3: Sound and volume

4: Sound and pitch

5: Sound and distance

Year 4 – Sound Assessment Record PLAN Examples of work - Sound	WTS	EXS	GDS	Notes
Know how sounds are made, associating some of them with something vibrating				
Know that vibrations from a sound travel through a medium to the ear.				
Know how to find patterns between the pitch of a sound and features of the object that produced it				
Know how to find patterns between the volume of a sound and the strength of the vibrations that produced it.				
Know that sounds get fainter as the distance from the sound source increases.				
Disciplinary knowledge – Investigating pitch • **To use a scientific enquiry to answer a question** Y4plan_Pitch_2020.docx	Can ask questions, e.g. *which makes the highest sound?* Makes some suggestions about what to do, but needs help in phrasing the question.	Can ask questions and turn them into a form that can be investigated. E.g. *How does the size of the drum affect the pitch?*	Can use their results to make a prediction to set up further comparative fair tests, e.g. *I know that a small drum makes a high pitch so will a small recorder make a higher pitch than a long one?*	
Disciplinary knowledge – String phones • **To identify differences, similarities or changes related to simple scientific ideas** Y4plan_String_phones_2020.docx	Can select the best string telephone but not explain why in terms of properties.	Can talk about features which make a good telephone, *e.g. all work when the string is tight, the bigger cup is better.*	Can relate observations to vibrations, *e.g. it doesn't work when you hold the string because you stop it vibrating.*	

Progression in Electricity

Early Learning Goal	• 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.
Year 1	
Year 2	
Year 3	
Year 4	• Know common appliances that run on electricity • Know how to construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers • Know 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 • Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit • Know some common conductors and insulators, and associate metals with being good conductors.
Year 5	
Year 6	• Know the brightness of a lamp or the volume of a buzzer is affected by the number and voltage of cells used in the circuit • Know reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches • Know recognised symbols when representing a simple circuit in a diagram.
KS3	• Know electric current, measured in am pairs, in circuits, series and parallel circuits, current ad where branches meet and current as flow of charge. • Know the potential difference, measured in volts, battery and bulb ratings; Resistance, measured in ohms, as the ratio of potential difference to current. • Know differences in resistance between conducting and insulating components- quantitative. • Static electricity.

Electricity

Year 4

Essential Knowledge

Substantive knowledge:

- Know common appliances that run on electricity
- Know how to construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers
- Know 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
- Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit
- Know some common conductors and insulators, and associate metals with being good conductors.

Disciplinary knowledge:

- **To set up a simple practical enquiry**
- **To record findings using drawings**
- **To use results to make predictions**

Lesson sequence

Retrieval Practice based on prior learning.

How is an electrical circuit created?

- current electricity is the flow of charged particles called electrons around a circuit
- more than one cell lined up to work together is called a battery
- wires – which contain a conductor inside them, usually made of metal – can allow electrical current to flow around a circuit
- when electrical current flows through a circuit components within that circuit – such as buzzers which make a noise and bulbs which emit light – begin to work

What is a complete and incomplete circuit?

- electrical current can flow if there is a complete circuit

How do switches work?

- a switch functions by completing or breaking a complete circuit

What are conductors and insulators?

- electrical current flows well through some materials, called electrical conductors, and poorly through other materials, called electrical insulators
- metals are good electrical conductors

Prior Learning

- Explore how things work. (Nursery - Electricity)

Common misconceptions

Some children may think:

- electricity flows to bulbs, not through them
- electricity flows out of both ends of a battery
- electricity works by simply coming out of one end of a battery into the component.

Vocabulary

- Circuit
- Cell
- Battery
- Appliances
- Conductor
- Insulator
- Switch
- Complete circuit
- Bulb
- Buzzer

Resources

1, 2 & 3: Circuits

4: Electrical conductors

Year 4 – Electricity Assessment Record PLAN Examples of work - Electricity	WTS	EXS	GDS	Notes
Know common appliances that run on electricity				
Know how to construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers				
Know 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				
Know that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit				
Know some common conductors and insulators, and associate metals with being good conductors.				
Disciplinary knowledge – Circuit products • **To set up a simple practical enquiry** • **To record findings using drawings** Y4plan_SciDT_-_Circuit_products.docx	Children cannot yet explain how they constructed their circuit to make the component work in their product, e.g. they may focus on the look of the product, rather than whether it works.	Children can explain/draw/show how they connected the components to make a circuit in the product.	Children may design a product with more than one working component and/or a switch. They will be able to explain how this affects the intensity of the components or any modifications they needed to make to get the same volume/brightness etc.	
Disciplinary knowledge – Electrical conductors • **To set up a simple practical enquiry** • **To record findings using drawings** • **To use results to make predictions** Y4plan_Elect_conductors_2020.docx	Can identify some (not all) objects that allow/do not allow electricity to pass through them but does not yet make generalisations.	Can describe the circuit and explain how their results (orally/written form) show that metals conduct electricity and most other materials do not.	Can also suggest other items to fit into the pattern and explore exceptions to the rule. Can apply the terms conduct/insulate to explain safety rules, e.g. not putting knife in toaster	

Electricity

Year 6

Essential Knowledge

Substantive knowledge:

- Know the brightness of a lamp or the volume of a buzzer is affected by the number and voltage of cells used in the circuit
- Know reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- Know recognised symbols when representing a simple circuit in a diagram.

Disciplinary knowledge:

- **Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary**
- **To use equipment and make systematic observations**

Lesson sequence

Retrieval Practice based on prior learning.

What effect does the number of cells have on the components in a circuit?

- as the number and voltage of cells in a circuit increases, the brightness of a bulb or the volume of a buzzer will increase (though too high a voltage may 'blow' the bulb or buzzer)

What might affect the function of components in a circuit?

- voltage is a measure of the power of a cell to produce electricity; it is a measure of the 'push' of electric current, **not** the size of the electric current
- predict whether components will function in a given circuit, depending on whether or not the circuit is complete; whether or not a switch is in an on or off position; and whether or not there is a cell to provide electrical current to the circuit
- two bulbs in a circuit can be wired up to create a series circuit or a parallel circuit; if one bulb blows in a series circuit the other will not shine as the circuit has been broken; in contrast, if one bulb blows in a parallel circuit, there will still be a complete circuit for the other bulb so it will continue to shine; use this knowledge to explain the advantages of using parallel circuits (e.g. in the lighting in homes)

How is an electrical circuit represented?

- draw simple circuit diagrams
- use recognized symbols for a battery, bulb, motor, buzzer and wire

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)

Common misconceptions

Some children may think:

- larger-sized batteries make bulbs brighter
- a complete circuit uses up electricity
- components in a circuit that are closer to the battery get more electricity.

Vocabulary

- Voltage
- Current
- Electron
- Component
- Series circuit
- Parallel circuit
- Circuit diagram
- Symbols
- Function
- Variation

Resources

Circuits

Year 6 – Electricity Assessment Record PLAN Examples of work - Electricity	WTS	EXS	GDS	Notes
Know the brightness of a lamp or the volume of a buzzer is affected by the number and voltage of cells used in the circuit				
Know reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches				
Know recognised symbols when representing a simple circuit in a diagram.				
Disciplinary knowledge – Bulb brightness • **Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary** Y6plan_Bulb_brightness_2020.docx	Can identify what they would like to change but may need support to explain what must be kept the same.	Identify a range of factors which may affect the brightness of the bulb and define a succinct scientific question to test, *e.g. What will happen to the (brightness of the bulb), if we change the (length of wire)?* Able to plan a fair test unaided, identifying the different types of variables: what to measure, what to change, what to keep the same	Can identify control variables for a range of investigation questions, *e.g. if we look at wire length we need to keep the voltage the same but if we look at voltage we need to keep the wires the same.* Notes difficulties with the 'life' of the components.	
Disciplinary knowledge – Conductive dough • **To use equipment and make systematic observations** Y6plan_Elect_-_Conductive_dough.docx	Pupils need support to create a circuit with the dough and find it difficult to explain how the LED/bulb lights up.	Pupils work systematically to create a range of circuits. They identify the dough as a conductor and recognise the need for a complete circuit (without a short circuit) in order for the LED/bulb to light.	Pupils explore the differences between circuits they have made e.g. comparing series and parallel circuits or different types of dough.	

Progression in Earth and Space

Early Learning Goal	• 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.
Year 1	• Know changes across The Four Seasons. Seasonal changes. • Know and describe weather associated with the seasons and how day length varies. Seasonal changes.
Year 2	
Year 3	
Year 4	
Year 5	• Know the movement of the Earth, and other planets, relative to the Sun in the solar system • Know the movement of the Moon relative to the Earth • Know the Sun, Earth and Moon as approximately spherical bodies • Know that the Earth's rotation explains day and night and the apparent movement of the Sun across the sky
Year 6	
KS3	• Know gravity force, weight equals mass times gravitational field strength, on earth gravity equals 10 newtons per kilogramme, different on other planets and stars; gravity forces between earth and moon, and between earth and sun- qualitative only. • Know our son as a star, are the stars in the Galaxy, are the galaxies. • Know the seasons and the earths tilt, day length at different times of year, in different hemispheres. • Know the light year as a unit of astronomical distance.

Earth and Space

Year 5

Essential Knowledge

Substantive knowledge:

- Know the movement of the Earth, and other planets, relative to the Sun in the solar system
- Know the movement of the Moon relative to the Earth
- Know the Sun, Earth and Moon as approximately spherical bodies
- Know that the Earth's rotation explains day and night and the apparent movement of the Sun across the sky

Disciplinary knowledge:

- **To plan a scientific enquiry to answer a question**
- **To gather and record data using tables and graphs.**
- **Report and present findings from enquiries using appropriate scientific language**

Lesson sequence

Retrieval Practice based on prior learning.

What shape are the planets in our solar system?

- a celestial body is a large object in the universe
- there are eight major planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

How do the planets move around the solar system?

- a star is an exceptionally hot ball of gas, originally made from hydrogen and helium and that the Sun is a star
- a planet (e.g Earth) is defined as a spherical celestial body that orbits a star and that has cleared the neighbourhood of its orbit of other objects, some of which crash into the planet and others that become moons of that planet
- it was once thought that everything orbited the Earth, but that scientists like Copernicus and Galileo used telescopes and measurement to show that the Earth orbited the Sun
- all the planets in the solar system orbit the Sun and that the further away they are from the Sun, the longer their orbit

How does the moon move around the Earth?

- a satellite orbits a planet and that moons are natural satellites
- the Moon orbits the Earth roughly every 28 days
- as the Moon orbits the Sun, different parts of it are lit up by the Sun, which is why we see a different shape lit up on the Moon as the lunar cycle progresses
- a solar eclipse occurs when the Moon is between the Sun and the Earth, casting a shadow on the Earth; a lunar eclipse occurs when the Earth is between the Sun and the Moon, casting a shadow on the Moon

What causes night and day?

- night and day are the result of the Earth rotating on its axis
- the Earth spins around an imaginary line through its centre called an axis and that this axis is tilted relative to the Earth's orbit

What causes the seasons on Earth?

- the Earth spins around an imaginary line through its centre called an axis and that this axis is tilted relative to the Earth's orbit
- the tilt of the Earth towards and away from the Sun's light as the Earth orbits the Sun leads to the seasons as during winter the light is spread over a wider area

Prior Learning

- Explore the natural world around them. (Reception – Earth and space)
- Describe what they see, hear and feel whilst outside. (Reception – Earth and space)
- 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)

Common misconceptions

Some children may think:

- the Earth is flat
- the Sun is a planet
- the Sun rotates around the Earth
- the Sun moves across the sky during the day
- the Sun rises in the morning and sets in the evening
- the Moon appears only at night
- night is caused by the Moon getting in the way of the Sun or the Sun moving further away from the Earth.

Vocabulary

- Planet
- Sphere
- Solar system
- Satellite
- Moon
- Eclipse
- Rotation
- Orbit
- Axis
- Hemisphere
- Waxing
- Waning

Resources

The Solar System

The Earth and the Moon

Year 5 – Earth and Space Assessment Record PLAN Examples of work - Earth and space	WTS	EXS	GDS	Notes
Know the movement of the Earth, and other planets, relative to the Sun in the solar system				
Know the movement of the Moon relative to the Earth				
Know the Sun, Earth and Moon as approximately spherical bodies				
Know that the Earth's rotation explains day and night and the apparent movement of the Sun across the sky				
Disciplinary knowledge – Space travel questions • **To plan a scientific enquiry to answer a question** Y5_Space_travel_Qs.docx	Struggles to convert ideas into questions that can be researched. May find it difficult to stay focused on one question at a time.	Raises a range of questions about space travel and can select some for research. Maintains line of enquiry to find answers to some of the questions.	Aware that some questions are not possible to answer, or for some there is disagreement between scientists. Raises issues like lack of diversity in astronauts or the costs (monetary and environmental) of space travel.	
Disciplinary knowledge – Space craters • **To gather and record data using tables and graphs.** Y5plan_Space_craters_2020.docx	Records measurements in a simple table / graph but needs adult support to record measurements and plot values.	Can make decisions about what to record and where to put information in a simple table and graph. Can calculate/plot mean or median if repeat measurements have been taken.	Notice and discuss anomalous results or discount them from the data, suggesting possible explanations for them linked to their investigation.	
Disciplinary knowledge – Solar system • **Report and present findings from enquiries using appropriate scientific language** Y5plan_Solar_system_research.docx	Presents planet research in a way which lacks clarity or new information.	Presents planet research clearly, demonstrating an understanding of the planet's position in the solar system.	Presents in an interactive way, which engages the audience. Compares a range of features about different planets.	

Progression in Evolution

Early Learning Goal	• 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 may vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes.
Year 1	
Year 2	• Know 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. Living things and their habitats.
Year 3	• Know in simple terms how fossils are formed when things that have lived are trapped within rock. Materials - rocks.
Year 4	• Know that environments can change and that this can sometimes pose dangers to living things. Living things and their habitats.
Year 5	
Year 6	• Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. • Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents • Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.
KS3	• Know that heredity is the process by which genetic information is transmitted from one generation to the next. • Know 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. • Know that the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection. • Know that 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.

Evolution

Year 6

Essential Knowledge

Substantive knowledge:

- Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.
- Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
- Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Disciplinary knowledge:

- **To identify scientific evidence that has been used to support or refute ideas or arguments**
- **To record observations in a results table**
- **Explain degree of trust in results**

Lesson sequence

Retrieval Practice based on prior learning.

How have living things changed over time?

- all life on Earth began from a single point around 4.5 billion years ago
- living things changes over time and that this gradual change is called evolution
- The gradual change of species over millions of years can be observed by looking at examples of fossil

What do offspring inherit from their parents?

- offspring can vary and are not identical to their parents
- there is also competition to survive and reproduce and that members of a species with advantageous characteristics survive and reproduce - these characteristics are passed down to their offspring;
- members of a species with less advantageous characteristics do not survive and reproduce – these characteristics are **not** passed down to offspring

How have plants and animals adapted to suit their environment?

- natural selection is the cause of this change;
- natural selection works as across a species there is natural variation within a species;
- Charles Darwin posited this theory of evolution by natural selection

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

Common misconceptions

Some children may think:

- adaptation occurs during an animal's lifetime: giraffes' necks stretch during their lifetime to reach higher leaves and animals living in cold environments grow thick fur during their life
- offspring most resemble their parents of the same sex, so that sons look like fathers
- all characteristics, including those that are due to actions during the parent's life such as dyed hair or footballing skills, can be inherited
- cavemen and dinosaurs were alive at the same time.

Vocabulary

- Evolution
- Natural selection
- Variation
- Advantageous
- Survival
- Environment
- Fossils
- Inheritance
- Offspring
- Adaptation
- Characteristic

Resources

1: Evolution

2: Inheritance

3: Adaption

Year 6 – Evolution Assessment Record PLAN Examples of work - Evolution and inheritance	WTS	EXS	GDS	Notes
Know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.				
Know that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents				
Know how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.				
Disciplinary knowledge – Bird beaks • **To identify scientific evidence that has been used to support or refute ideas or arguments** P7_Bird_beaks.docx	Pupils say which 'beak' will pick up the most or least but do not reflect on this when collecting results or relate this to implications for survival.	Pupils make predictions about the survival of the 'birds' based on the amount of 'food' picked up by each beak.	Pupils consider other environmental impacts for the 'birds', other characteristics/adaptations or behavioural solutions (e.g. migrating).	
Disciplinary knowledge – Camouflage moths • **To record observations in a results table** Y6_Camouflaged_moths.docx	Recorded findings are not clear enough to be understood by others.	Findings are recorded in a table that can be understood by others.	Can explain the limitations of the simulation. May record in more detail or repeat observations.	
Disciplinary knowledge – Fossil habitats • **To identify scientific evidence that has been used to support or refute ideas or arguments** Y6plan_Fossil_habitats_2020.docx	Ideas about the creature are limited or lacking in use of evidence from fossil, research or comparisons with modern animals.	Can explain how fossils are formed. Can identify evidence to support ideas, from fossil, research or comparisons with modern animals.	Considers what can be known about appearance, habits and habitats from fossil evidence. Describes potential sources of error.	
Disciplinary knowledge – Egg strength • **Explain degree of trust in results** Y6plan_Egg_strength_2020.docx	Understands the need to be 'fair' / 'same' across all eggs. When prompted, can look for possible problems with the test (holding egg differently, putting weights on with different force).	Can identify a range of factors that need to be consistent, e.g. egg position, how weight applied, how egg held in place, etc. Can consider which variables were hard to control and offers suggestions for improving the test.	Can anticipate potential problems, evaluates throughout the process and makes adjustment – but mindful that changes could affect the consistency of results. Problem solves, *e.g. We ran out of actual weight so used substitutes and weighed them on scales.*	

Progression in Plants

Early Learning Goal	• 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.
Year 1	• Know a variety of common wild and garden plants, including deciduous and evergreen trees • Know the basic structure of a variety of common flowering plants, including trees
Year 2	• Know how seeds and bulbs grow into mature plants • Know how plants need water, light and a suitable temperature to grow and stay healthy. • Know a variety of plants and animals in their habitats, including microhabitats. Living things and their habitats.
Year 3	• Know the functions of different parts of plants; roots, stem, leaves and flowers. • Know the requirements of plants for life and growth (air, light, nutrients from soil and room to grow) and how they vary from plant to plant. • know the ways in which water is transported within plants. • Know the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal
Year 4	• Know that living things can be grouped in a variety of ways. Living things and their habitats. • Know how to use classification keys to help group, identify and name a variety of living things in their local and wider environment. Living things and their habitats. • Know that environments can change and that this can sometimes pose danger to living things. Living things and their habitats.
Year 5	• Know the life process of reproduction in some plants and animals. Living things on their habitats.
Year 6	• Know how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals. Living things and their habitats. • Know reasons for classifying plants and animals based on specific characteristics. Living things and their habitats.
KS3	• Know reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.

Plants

Year 1

Essential Knowledge

Substantive knowledge:

- Know a variety of common wild and garden plants, including deciduous and evergreen trees
- Know the basic structure of a variety of common flowering plants, including trees

Disciplinary knowledge:

- **Observe closely using simple equipment**

Lesson sequence

Retrieval Practice based on prior learning.

What is a plant?

- a rose bush, a sunflower and a dandelion by sight
- an oak tree, a birch tree and a horse chestnut tree by sight

What is the basic structure of a plant?

- a flowering plants consist of roots, stem, leaves and flowers, and that a tree's stem is called a trunk

Are trees green all year round?

- evergreen trees maintain their leaves throughout the year and that deciduous trees shed their leaves in autumn

Where can you find plants?

- the differences between plants that grow in the wild and those that we cultivate in our gardens.

Prior Learning

- Plant seeds and care for growing plants. (Nursery – Plants)
- Understand the key features of the life cycle of a plant and an animal. (Nursery – Plants)
- Begin to understand the need to respect and care for the natural environment and all living things. (Nursery – Plants)
- Explore the natural world around them. (Reception – Living things and their habitats)
- Recognise some environments that are different to the one in which they live. (Reception – Living things and their habitats)

Common misconceptions

Some children may think:

- plants are flowering plants grown in pots with coloured petals and leaves and a stem
- trees are not plants
- all leaves are green
- all stems are green
- a trunk is not a stem
- blossom is not a flower.

Vocabulary

- Roots
- Trunk
- Stem
- Leaf
- Flower
- Tree
- Deciduous
- Evergreen
- Wild
- Petal

Resources

Planting

Identifying plants

Planting review

Year 1 – Plants Assessment Record PLAN Examples of work - Plants	WTS	EXS	GDS	Notes
Know a variety of common wild and garden plants, including deciduous and evergreen trees Know the basic structure of a variety of common flowering plants, including trees				
Disciplinary knowledge – Plant structure • **Observe closely using simple equipment** Y1plan_Plant_structure_2020.docx	Describe what they can see using everyday language. With support, label the basic structure of a plant.	Can describe and point to the basic structure of a plant and a tree using scientific language, *e.g. leaves, flowers, petals, fruit, roots, bulb, seed, trunk, branch, stem.* May begin to explain what the parts of the plant are for.	Can use their observations to make comparisons between different plants or between different plant parts, *e.g. that plant has a thicker/taller stem than that one, the petals are smaller than the leaves.*	
Disciplinary knowledge – Leaf look • **Observe closely using simple equipment** Y1plan_Plants_-_Leaf_look.docx	Children draw a leaf but shape may not be accurate or features are missing	Children can draw a leaf outline accurately and show hairs/veins when present.	Children compare the features of different leaves.	

Plants

Year 2

Essential Knowledge

Substantive knowledge:

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

Disciplinary knowledge:

- **Observe closely, using simple equipment**

Lesson sequence

Retrieval Practice based on prior learning.

What is the life cycle of a plant?

- seeds and bulbs need to be buried underground in soil and that they will grow into adult plants under the right conditions (water, warmth)

What does a plant need to grow?

- plants that are deprived of light, food or air will not grow and will die.

Learning Opportunities

- 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)

Vocabulary

- Seeds
- Bulbs
- Life cycle
- Germination
- Temperature
- Nutrients
- Conditions
- Shoot
- Sprout
- Seed dispersal

Common misconceptions

Some children may think:

- plants are not alive as they cannot be seen to move
- seeds are not alive
- all plants start out as seeds
- seeds and bulbs need sunlight to germinate.

Resources

Planting

Plant growth

Year 2 – Plants Assessment Record PLAN Examples of work - Plants	WTS	EXS	GDS	Notes
Know how seeds and bulbs grow into mature plants				
Know how plants need water, light and a suitable temperature to grow and stay healthy.				
Disciplinary knowledge – Plant growth • **Observe closely, using simple equipment** Y2plan_Plant_growth_2020.docx	Describes observable differences at the time of asking e.g. which plant is the tallest and shortest.	Observes and records the appearance of the plants over time (drawing or annotated photo). Can compare the height and/or features of the plants over time e.g. *this one was fine to start with but now it's much smaller.*	Make a range of comparisons between the plants in different conditions, e.g. colour, droopiness, height, number of leaves.	

Plants

Year 3

Essential Knowledge

Substantive knowledge:

- Know the functions of different parts of plants; roots, stem, leaves and flowers.
- Know the requirements of plants for life and growth (air, light, nutrients from soil and room to grow) and how they vary from plant to plant.
- know the ways in which water is transported within plants.
- Know the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal

Disciplinary knowledge:

- **To make systematic and careful observations**
- **To make measurements using standard units**

Lesson sequence

Retrieval Practice based on prior learning.

What is the role of a flower?

- the function of a flower is reproduction, where flowers of the same kind exchange pollen – made by an anther – in a process called fertilisation, and a structure in the flower's ovary called an ovule becomes a seed; the ovary then becomes a fruit which helps the seed leave the plant in a process called dispersal

What are the functions of different plant parts?

- different parts of plants have one or more functions (jobs)
- the stem holds up the leaves so that they can gather light to make food and holds up the flowers so that they can receive pollen and disperse their fruits; know that the stem also transports water and minerals from the roots to the other parts of the plant
- the leaves make food by trapping light and using its energy to turn carbon dioxide and water into carbohydrates

How is water transported?

- the roots collect water and minerals from the soil, and hold the plant firmly in the ground

What are a plant's requirements for life?

- plants need water, light and nutrients to grow.

Prior 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)

Common misconceptions

Some children may think:

- plants eat food
- food comes from the soil via the roots
- flowers are merely decorative rather than a vital part of the life cycle in reproduction
- plants only need sunlight to keep them warm
- roots suck in water which is then sucked up the stem.

Vocabulary

- Function
- Minerals
- Absorb
- Pollination
- Seed formation
- Reproduction
- Fertilisation
- Anther
- Ovary
- Ovule
- Pollen

Resources

2: Roots, Leaves, Stems, Flowers

3: Plant growth light and water

4: Plant growth nutrients and room

Year 3 – Plants Assessment Record PLAN Examples of work - Plants	WTS	EXS	GDS	Notes
Know the functions of different parts of plants; roots, stem, leaves and flowers. Know the requirements of plants for life and growth (air, light, nutrients from soil and room to grow) and how they vary from plant to plant. know the ways in which water is transported within plants. Know the role of flowers in the life cycle of flowering plants, including pollination, seed formation and seed dispersal				
Disciplinary knowledge – Measuring plants • **To make systematic and careful observations** • **To make measurements using standard units** Y3plan_Measuring_plants_2020.docx	With support, can measure a volume of water and height of the plant (to nearest cm).	Can measure accurately the volume of water (to nearest 10 ml) and height of a plant (to nearest half cm).	Measures accurately volume of water given to plants, and heights (mm). Explain importance of and suggests ways to improve accuracy (repeat readings).	
Disciplinary knowledge – Plant close observations • **To make systematic and careful observations** Y3_Close_obs_of_plants.docx	Children's talk or drawings do not demonstrate close observation e.g. draw a 'classic' flower rather than the one in front of them. They may be unable to name plant or flower parts, or role in life cycle.	Children meeting the objective would be able to demonstrate close observation in their drawings or discussion of parts of a flower e.g. noticing differences and similarities between the flower parts.	May consider how flowers are shaped to enhance wind or insect pollination.	

Progression in Seasons

Early Learning Goal	• 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 may vary from one another. They make observations of animals and plants and explain why some things occur and talk about changes.
Year 1	• Know the changes across the four seasons • Know weather associated with the seasons and how day length varies.
Year 2	
Year 3	• Know that light from the sun can be dangerous and that there are ways to protect their eyes. Light.
Year 4	
Year 5	• Know the earth's rotation to explains day and night and the apparent movement of the sun across the sky. Earth and space.
Year 6	
KS3	• Know the seasons and the earth's tilt, day length at different times of the year, in different hemispheres.

Seasons

Year 1

Essential Knowledge

Substantive knowledge:

- Know the changes across the four seasons
- Know weather associated with the seasons and how day length varies.

Disciplinary knowledge:

- **To observe**
- **To record data to help in answering questions**

Lesson sequence

Retrieval Practice based on prior learning.

What are the seasons of the year?

- the Earth orbits the sun with one orbit constituting a year of 365/366 days and that this period of time I divided into seasons.
- the seasons are summer, winter, autumn and spring.

Does the weather change with the season?

- weather changes through the year, getting hotter in the summer and colder in the winter
- the winter is likely to bring ice on the ground when water freezes due to the cold

How much daylight is there in the different seasons?

- days are longer in the summer and shorter in winter

What happens to nature in the different seasons?

- plants and animals adapt to the weather and day length of the seasons.
- baby animals are born and that some animals hibernate due to a lack of food in winter.

Prior Learning

- Understand the key features of the life cycle of a plant and an animal. (Nursery – Plants & Animals, excluding humans)
- Explore the natural world around them. (Reception – Seasonal changes)
- Describe what they see, hear and feel whilst outside. (Reception - Seasonal changes)
- Understand the effect of changing seasons on the natural world around them. (Reception – Seasonal changes)

Vocabulary

- Spring
- Summer
- Autumn
- Winter
- Season
- Daylight
- Temperature
- Months
- Weather

Common misconceptions

Some children may think:

- it always snows in winter
- it is always sunny in the summer
- there are only flowers in spring and summer
- it rains most in the winter.

Resources

1: The seasons

2: Weather around the world

3: Day length

Year 1 – Seasons Assessment Record PLAN Examples of work - Seasonal Changes	WTS	EXS	GDS	Notes
Know the changes across the four seasons Know weather associated with the seasons and how day length varies.				
Disciplinary knowledge – Seasonal change • **To observe** • **To record data to help in answering questions** Y1plan_Seasonal_change_2020.docx	With support, children can observe and record what they see at the time.	Observe, record and describe changes in e.g. plants, temperature and the weather across the four seasons.	Use records of data from previous sessions to begin to make links between their observations and to offer explanations for seasonal change, *e.g. I saw more flowers in spring because it is getting warmer, it is colder in the winter because we get less sunlight.*	

Disciplinary Knowledge Coverage by Strand

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Plants	• Observe closely using simple equipment	• Observe closely, using simple equipment	• To make systematic and careful observations • To make measurements using standard units			
Animals including humans	• To sort and group animals with some help. • To use observations and ideas to suggest answers to questions	To use observations to suggest answers to questions	• To report findings from enquires • To use evidence to answer questions	• To record findings using labelled diagrams • To use written explanations to report on findings from an enquiry • To use results to draw simple conclusions, suggest improvements and raise further questions.	• To take measurements using a range of equipment	• Use test result to make predictions to set up further comparative and fair tests
Materials Rocks, soils, properties and states of matter	• To ask simple questions and recognise they can be answered in different ways • To perform simple tests • To record simple data in order to answer a question	• To use observations and ideas to suggest answers to questions • To ask simple questions and recognise they can be answered in different ways • To record simple data in order to answer a question	• To report on findings from enquiries	• To set up a fair-test and use results to draw simple conclusions • To measure using thermometers • To provide a written explanation	• To record data of increasing complexity using tables • To use test results to make predictions to set up further comparative and fair test • To plan a scientific enquiry that will answer a question • To recognise variables when planning a fair-test	
Seasons	• To observe • To record data to help in answering questions					

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Living things		• To perform simple comparative tests • To observe closely • To gather and record data to help answer a question • To identify, group and classify		To gather, record, classify and present data in a variety of ways to help in answering questions	• To use scientific diagrams and labels • To explain findings	• Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary • To use scientific diagrams and labels • To make a key to classify plants and animals
Forces			• To set up a fair-test • Gather record and classify and present data in a variety of ways to help in answering questions • To identify changes related to scientific ideas • To use results to draw simple conclusion and provide an oral explanation of findings		• To take repeated accurate measurements using a stopwatch • To explain the degree of trust in results • To use test results to make predictions to set up further fair-tests	
Sound					• To use a scientific enquiry to answer a question • To identify differences, similarities or changes related to simple scientific ideas	
Electricity				• To set up a simple practical enquiry • To record findings using drawings • To use results to make predictions		• Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary • To use equipment and make systematic observations

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Earth and Space					• To plan a scientific enquiry to answer a question • To gather and record data using tables and graphs. • Report and present findings from enquiries using appropriate scientific language	
Light			• To record findings as drawings • To record findings as a bar chart			• To plan a scientific enquiry to answer questions • To record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
Evolution and Inheritance						• To identify scientific evidence that has been used to support or refute ideas or arguments • To record observations in a results table • Explain degree of trust in results

Disciplinary Knowledge Progression – Years 3 and 4		
National Curriculum objectives	Year 3	Year 4
Ask relevant questions and use different types of scientific enquiries to answer them	Light	Sound
Set up simple practical enquiries, comparative and fair tests	Forces	States of Matter Electricity
Make systematic and careful observations and where appropriate, take accurate measurements with standard units, using a range of equipment, including thermometers and data loggers	Plants	States of Matter
Gather, record and classify and present data in a variety of ways to help in answering questions	Forces	Living Things
Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables	Light	Animals including Humans Electricity
Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	Animals including Humans Rocks	Animals including Humans States of Matter
Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions	Forces	Animals including Humans States of Matter Electricity
Identify differences, similarities or changes related to simple scientific ideas and processes	Forces	Sound
Use straightforward scientific evidence to answer questions or to support his/her findings	Animals including Humans	Animals including Humans

Disciplinary Knowledge Progression – Years 1 and 2		
National Curriculum objectives	Year 1	Year 2
Ask simple questions and recognise that they can be answered in different ways	Materials	Materials
Use simple equipment to observe closely	Plants	Plants
Perform simple tests	Materials	Living Things
Identify and classify	Animals including Humans	Living Things
Use his/her observations and ideas to suggest answers to questions	Animals including Humans	Animals including Humans Materials
Gather and record data to help in answering questions	Materials Seasons	Materials Living Things

Disciplinary Knowledge Progression – Years 5 and 6

National Curriculum objectives	Year 5	Year 6
Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary	Materials Earth and Space	Living Things Electricity Light
Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate	Animals including Humans Forces	Electricity
Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs	Materials Living Things Earth and Space	Living Things Light
Use test results to make predictions to set up further comparative and fair tests	Materials Forces	Animals including Humans
Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations	Living Things Forces Earth and Space	Evolution and Inheritance Electricity Light
Identify scientific evidence that has been used to support or refute ideas or arguments	Earth and Space	Evolution and Inheritance

Disciplinary Knowledge – Working Scientifically

	National Curriculum Objectives	Disciplinary Knowledge	Vocabulary
Year 1	• Ask simple questions and recognise that they can be answered in different ways • Use simple equipment to observe closely • Perform simple tests • Identify and classify • Use his/her observations and ideas to suggest answers to questions • Gather and record data to help in answering questions	Know that we can ask questions about the world and that when we observe the world to answer these questions, this is science Know that we can use magnifying glasses to observe objects closely Know that we can test our questions to see if they are true Know that objects can be identified or sorted into groups based on their observable properties Know that we can write down numbers and words or draw pictures to record what we find	properties, observe, test, magnifying glass, object, record, equipment
Year 2	• Ask simple questions and recognise that they can be answered in different ways including use of scientific language • Use simple equipment to observe closely including changes over time • Communicate his/her ideas, what he/she does and what he/she finds out in a variety of ways • Perform simple comparative tests • Identify, group and classify • Use his/her observations and ideas to sugeest answers to questions noticing similarities, differences and patterns • Gather and record data to help in answering questions including from secondary sources of information		

Disciplinary Knowledge – Working Scientifically

	National Curriculum Objectives	Disciplinary Knowledge	Vocabulary
Year 3 Year 4	• Ask relevant questions and use different types of scientific enquiries to answer them • Set up simple practical enquiries, comparative and fair tests • Make systematic and careful observations and where appropriate, take accurate measurements with standard units, using a rnage of equipment, including thermometers and data loggers • Gather record and classify and present data in a variety of ways to help in answering questions • Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables • Report on findings from enquiries, including oral and written explanations, displays or presentations of resultsand conclusions • Use results to draw simple conclusions, make preditctions for new values, suggest improvements and raise further questions • Identify differences, similarities or changes related to simple scientific ideas and processes • Use straightforward scientific evidence to answer questions or to support his/her findings	• Know that we can ask questions and answer them by setting up scientific enquiries • Know how to make relevant predictions that will be tested in a scientific enquiry • Know that in a fair test one thing is altered (independent variable) and one thing that may change as a result is measured (dependent variable) while all other conditions are kept the same • Know how to use a range of equipment to measure accurately, including thermometers, data loggers, rulers and stopwatches • Know how to draw bar charts; how to label a diagram using lines to connect information to the diagram; how to use a coloured key how to draw a neat table; how to draw a classification key; how to show the relationship between an independent variable in a two-way table; and how to label specific results in a two-way table • Know – with structured guidance - how to write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion • Know how to precis a scientific enquiry write-up into a brief oral discussion of what was found in a scientific enquiry • Know that scientific enquiries can suggest relationships, but that they do <u>not</u> prove whether a prediction is true • Know that scientific enquiries are limited by the accuracy of the measurements (and measuring equipment) and by the extent to which conditions can vary even, and that repeating enquiries, measurements and taking measures to keep conditions as consistent as possible can improve an enquiry • Know that the conclusions of scientific enquiries can lead to further questions, where results can be clarified or extended to different contexts (e.g. effect of changing sunlight on a plant – does this work with other plants / different types of light / etc) • Know that they can draw conclusions from the findings of other scientists • Know that a theory is an explanation of observations that has been tested to some extent and that a hypothesis is an explanation that has not yet been tested, but that can be tested through a scientific enquiry	prediction, measurement, enquiry, dependent variable, independent variable, fair test, similar, theory, hypothesis

Disciplinary Knowledge – Working Scientifically

	National Curriculum Objectives	Disciplinary Knowledge	Vocabulary
Year 5	• Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • Use test results to make predictions to set up further comparative and fair tests • Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations • Identify scientific evidence that has been used to support or refute ideas or arguments	• Know how to choose appropriate variables to test a hypothesis (e.g. plant height as a dependent variable when measuring effect of light on plant growth) • Know how to identify conditions that were imperfectly controlled and can explain how these might affect results • Know how to accurately use further measuring devices, including digital and analogue scales, measuring cylinders and beakers, recognizing the relative accuracy of each device • Know how and when to repeat measurements, how to find an average of a set of measurements and how to recognize and remove outliers from a set of data, justifying the removal as a potential mis-measurement • Know how to independently write a simple scientific enquiry write-up including an introduction, a list of equipment, a numbered method, a detailing of results and a conclusion • Know how to present brief oral findings from an enquiry, speaking clearly and with confidence and using notes where necessary • Know examples of instances where scientific evidence has been used to support or refute ideas or arguments (e.g. fossil records as evidence of natural selection)	line graph, relationship, outlier
Year 6	• Plan different types of scientific enquiries to answer their own or others' questions, including recognising and controlling variables where necessary • Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • Use test results to make predictions to set up further comparative and fair tests • Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations • Identify scientific evidence that has been used to support or refute ideas or arguments • Describe and evaluate their own and other people's scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources. • Group and classify things and recognise patterns • Find things out using a wide range of secondary sources of information • Use appropriate scientific language and ideas from the national curriculum to explain, evaluate and communicate his/her methods and findings		

Assessment links

Year Group	Assessment links
Year 1	Animals Including Humans Everyday Materials Plants Seasonal Changes
Year 2	Animals including humans Living things and their habitats Plants Uses of everyday materials
Year 3	Animals including humans Forces and magnets Light Plants Rocks
Year 4	Animals including humans Electricity Living things and their habitats Sound States of matter
Year 5	Animals including humans Earth and space Forces Living things and their habitats Properties and changes of materials
Year 6	Animals including humans Electricity Evolution and inheritance Light Living things and their habitats

Questions for the Science Coordinator	Response
Outline your roles and areas of responsibility - what training have you had? What's working well in this subject area - Science? Key achievements in this subject area - things to celebrate? Challenges? Areas to be developed - priorities? Why - rationale? How are you supported to do your leadership role effectively? Have you made any recent changes to your subject curriculum? Why? Intent Briefly describe the school's vision, aims and ambition for Science? The intent. Talk me through your curriculum - the big picture of your science curriculum, Where has it comes from and what are you trying to achieve? What do you want pupils to have achieved and experienced by the time they leave (in top-level detail)? Ultimate goals What impression you want this subject to leave on pupils? What is science's profile within the school? How is the science curriculum personalised to the needs of your school context and its pupils? NC requirements What are the timetabling arrangements for your subject? Have you allocated enough time to particular units or topics to make sure they're broad and deep enough? How is the curriculum for this subject area planned/designed/organised/mapped out? Why? What is the RATIONALE for the ordering of the content? How do you know what is taught term by term in this subject? Do all teachers know what pupils need to know, and be able to do, by the end of the unit/term/year? Are the knowledge - concepts, skills, vocabulary and understanding you want pupils to gain clearly laid out in your science curriculum maps and/or planning?	

Questions for the Science Coordinator	Response
How does the school plan for progression in science? What does it mean to get better in science? Knowing more and remembering more. Knowledge, vocabulary, concepts, enquiry What are the most important concepts pupil learned during the early years? Can you show me how you have sequenced knowledge within a topic our unit for other year groups? Can you show me an example where pupils learn about animals plants different environments seasons or changes of matter? What specific knowledge and vocabulary are they learning can you use a specific example from your curriculum to show me what pupils learning in early years prefer prepares them for year one Working scientifically – how is this developed across the school? (Develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them (Observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing and researching using secondary sources) • Scientific VOCABULARY • The uses and implications of science, today and for the future. Can you show me how the curriculum is organised to ensure pupils knowledge of working scientifically advances over time? Can you show me how pupils' knowledge of fair testing advances over time in the curriculum? What other scientific methods do pupils learn about? How have you decided what knowledge/skills you expect pupils to learn in science? How do plans take into account pupils' prior knowledge and understanding?	

Questions for the Science Coordinator	Response
How do teachers ensure pupils are challenged in science? Are tasks challenging and appropriate to ensure children become historians? How well does your school ensure high expectations in science? Which aspects of your science curriculum are revised and repeated? Why? How? When? Outline your school's approach to assessment in science - rationale Formative and summative assessment strategies What is the school's way of measuring progress? How do teachers ensure that pupils have learned/understood/remembered the key concepts for each unit - long term? How do you capture this information? What are the typical gaps in pupils' knowledge and skills in this subject area? Is the curriculum planned and sequenced to address these gaps? How strong is teacher subject knowledge? How do you adapt the curriculum to meet different needs (SEND and HAP) How ambitious is your curriculum for SEND or disadvantaged pupils? How do you ensure your intent is implemented fully and successfully across the school? Is the planned curriculum the enacted curriculum? HDYK How well does the teaching develop pupils written work? How do you evaluate the effectiveness or impact of this subject? What is your monitoring telling you? Data? Pupil interviews: What do the children say about this subject? Work scrutiny: What do we see in books/lessons? Staff discussions: Does the curriculum design help pupils know and remember more?	

Questions for the Science Coordinator	Response
Planning scrutiny: Is planning effective? Lesson visits: What do we see in lessons? Have you had the chance to provide any training to staff in your subject? What was the focus? How do you ensure a teaching assistants have sufficient knowledge of the curriculum to support their pupils What steps are you taking to address any areas of under-achievement? What are you doing to address any other issues that have arisen as a result of your analysis/ evaluations/monitoring activities in this subject area? Action plan discussion Key priorities and key actions to address them.	