

Topic	
<u>Year 1</u>	
	<u>Working Scientifically KS1</u> • asking simple questions and recognising that they can be answered in different ways • observing closely, using simple equipment • performing simple tests • identifying and classifying • using their observations and ideas to suggest answers to questions • gathering and recording data to help in answering questions. <u>Enquiry Ideas</u>

Seasonal Changes

NC Objectives

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

Vocabulary

Weather (sunny, rainy, windy, snowy etc.) , Seasons (winter, summer, spring, autumn), Sun, sunrise, sunset, Day length

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.

Prior Learning

EYFS:

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.

Future Learning

Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. (Y3 - Light)

Suggested Activities

- Collect information about the weather regularly throughout the year.
- Present this information in tables and charts to compare the weather across the seasons.
- Collect information, regularly throughout the year, of features that change with the seasons e.g. plants, animals, humans.
- Present this information in different ways to compare the seasons.
- Gather data about day length regularly throughout the year and present this to compare the seasons.

Scientists

Liam Dutton / Alex Beresford

(Weatherperson/Meteorologist)

<https://www.liamdutton.com/liam-dutton-biography>

Animals Including Humans

NC Objectives

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

Vocabulary

Head, body, eyes, ears, mouth, teeth, leg, tail, wing, claw, fin, scales, feathers, fur, beak, paws, hooves

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.

Prior Learning

EYFS:

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.

Future Learning

Y2:

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

Suggested Activities

- Make first-hand, close observations of animals from each of the groups.
- Compare two animals from the same or different groups.
- Classify animals using a range of features.
- Identify animals by matching them to named images.
- Classify animals according to what they eat.
- Make first-hand close observations of parts of the body e.g. hands, eyes.
- Compare two people.
- Take measurements of parts of their body.
- Compare parts of their own body.
- Look for patterns between people e.g. Do people with big hands have big feet?
- Classify people according to their features.
- Investigate human senses e.g. Which part of my body is good for feeling, which is not? Which food/flavours can I identify by taste? Which smells can I match?

Scientists

Chris Packham - Animal conservationist (Protected Characteristics - Disability - ASC/Aspergers)

<https://www.discoverwildlife.com/people/who-is-chris-packham-everything-you-need-to-know-about-the-winterwatch-presenter>

TV clip <https://www.bbc.co.uk/cbbc/watch/bp-big-bugs>

Everyday Materials

NC Objectives

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

Vocabulary

Object, material, wood, plastic, glass, metal, water, rock, brick, paper, fabric, elastic, foil, card/cardboard, rubber, wool, clay, hard, soft, stretchy, stiff, bendy, floppy, waterproof, absorbent, breaks/tears, rough, smooth, shiny, dull, see through, not see through

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.

Prior Learning

EYFS:

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

Future Learning

Y2:

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

Suggested Activities

- Classify objects made of one material in different ways e.g. a group of object made of metal.
- Classify in different ways one type of object made from a range of materials e.g. a collection of spoons made of different materials.
- Classify materials based on their properties.
- Test the properties of objects e.g. absorbency of cloths, strength of party hats made of different papers, stiffness of paper plates, waterproofness of shelters.

Scientists

Chester Greenwood

(Inventor of earmuffs)

<https://lemelson.mit.edu/resources/chester-greenwood>

Plants

NC Objectives

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

Vocabulary

Leaf, flower, blossom, petal, fruit, berry root, seed, trunk, branch, stem, bark, stalk, bud

Names of trees in the local area

Names of wild flowering and garden plants in the local area

Misconceptions

Some children may think:

- plants are flowering plants grown in pots with colored 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.

Prior Learning

EYFS:

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

Future Learning

Y2:

- Observe and describe how seeds and bulbs grow into mature plants.
- Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.
- Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)

Suggested Activities

- Make close observations of leaves, seeds, flowers etc.
- Compare two leaves, seeds, flowers etc.
- Classify leaves, seeds, flowers etc. using a range of characteristics.
- Identify plants by matching them to named images.
- Make observations of how plants change over a period of time.
- When further afield, spot plants that are the same as those in the local area studied regularly, describing the key features that helped them.

Scientists

Maria Sibylla Merian

(German artist, scientific illustrator, and naturalist)

https://www.nhm.ac.uk/discover/maria-sibylla-merian-metamorphosis-art-and-science.html?gclid=Cj0KCQjw8eOLBhC1ARIsAOzx5cGB841uL9PPTRISobXXs7PEHZqViuHI6uA90KbaMUWA-a_sst-ZVOwaAsSWEALw_wcB

<u>Year 2</u>	
	<u>Working Scientifically KS1</u> • asking simple questions and recognising that they can be answered in different ways • observing closely, using simple equipment • performing simple tests • identifying and classifying • using their observations and ideas to suggest answers to questions • gathering and recording data to help in answering questions. <u>Enquiry Ideas</u>

Everyday Materials

NC Objectives

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

Vocabulary

Names of materials: wood, plastic, glass, metal, water, rock, brick, paper, fabric, card, rubber; suitable/unsuitable, use/useful, hard/soft, stretchy/stiff, rigid/flexible, waterproof/absorbent, strong/weak, rough/smooth, transparent/opaque, shape, push/pushing, pull/pulling, twist/twisting, squash/squashing, bend/bending, stretch/stretching.

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.

Prior Learning

Y1:

- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.
- Describe the simple physical properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.

Future Learning

Y3:

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. **(Y3 - Rocks)**
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock. **(Y3 - Rocks)**
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance. **(Y3 - Forces and magnets)**

Y4:

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Suggested Activities

- Classify materials.
- Make suggestions about alternative materials for a purpose that are both suitable and unsuitable
- Test the properties of materials for particular uses e.g. compare the stretchiness of fabrics to select the most appropriate for Elastigirl's costume, test materials for waterproofness to select the most appropriate for a rain hat

Scientists

John McAdam

(Inventor of the modern road surface)

<https://kids.britannica.com/students/article/John-Loudon-McAdam/328699>

Victoria Callaghan

(Develops sustainable packaging for BASF plc)

<https://edu.rsc.org/job-profiles/market-development-manager/4013828.article>

Animals including Humans

NC Objectives

- notice that animals, including humans, have offspring which grow into adults
- find out about and describe the basic needs of animals, including humans, for survival (water, food and air)
- describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene

Vocabulary

As for year 1 plus: adult, young, baby, toddler, child, teenager, grow, offspring, survival, basic needs - water, food, air, hygiene, exercise, unhealthy, life cycle, nutrition

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.

Prior Learning

Y1:

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

Future Learning

Y3:

- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement

Y4:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Suggested Activities

- Ask people questions and use secondary sources to find out about the life cycles of some animals.
- Observe animals growing over a period of time e.g. chicks, caterpillars, a baby.
- Ask questions of a parent about how they look after their baby.
- Ask pet owners questions about how they look after their pet.
- Explore the effect of exercise on their bodies.
- Classify food in a range of ways, including using the Eatwell Guide.
- Investigate washing hands, using glitter gel.

Scientists**Elizabeth Garrett Anderson**

(First English woman to qualify as a doctor)

https://www.bbc.co.uk/history/historic_figures/garrett_anderson_elizabeth.shtml

Chris and Xand Van Tulleken

<https://www.bbc.co.uk/programmes/p09rty4g>

Plants

NC Objectives

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

Vocabulary

As for year 1 plus - light, shade, sun, warm, cool, water, grow, healthy

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.

Prior Learning

Y1:

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

Future Learning

Y3:

- Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers.
- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant.
- Investigate the way in which water is transported within plants.
- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

Y4:

- 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)**
- Recognise that environments can change and that this can sometimes pose dangers to living things. **(Y4 - Living things and their habitats)**

Suggested Activities

- Make close observations of seeds and bulbs.
- Classify seeds and bulbs.
- Research and plan when and how to plant a range of seeds and bulbs.
- Look after the plants as they grow - weeding, thinning, watering etc.
- Make close observations and measurements of their plants growing from seeds and bulbs.
- Make comparisons between plants as they grow.

Scientists

Joseph Banks

(Naturalist on Captain Cook's voyage around the World)

<https://kids.britannica.com/students/article/Sir-Joseph-Banks/310062>

Living Things and their Habitats

NC Objectives

- explore and compare the differences between things that are living, dead, and things that have never been alive
- identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other
- identify and name a variety of plants and animals in their habitats, including microhabitats
- describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food

Vocabulary

Living, dead, never been alive, suited, suitable, basic needs, food, food chain, shelter, move, feed, names of local habitats e.g. pond, woodland etc., names of micro-habitats e.g. under logs, in bushes etc.

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'.

Prior Learning

Y1:

- 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 change)**

Future Learning

Y3:

- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. **(Y3 - Plants)**

Y4:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose dangers to living things.
- Construct and interpret a variety of food chains, identifying producers, predators and prey. **(Y4 - Animals, including humans)**

Suggested Activities

- Explore the outside environment regularly to find objects that are living, dead and have never lived.
- Classify objects found in the local environment.
- Observe animals and plants carefully, drawing and labelling diagrams.
- Create simple food chains for a familiar local habitat from first-hand observation and research.
- Create simple food chains from information given e.g. in picture books (Gruffalo etc.).

Scientists

William Kirby (Father of modern entomology, the study of insects)

<https://www.linnean.org/news/2018/09/19/19th-september-2018-william-kirby>

Prem Singh Gill

https://nustem.uk/careers_resource/polar-scientist/ (slideshow)

Year 3

Cycle A

Working Scientifically LKS2

- asking relevant questions and using different types of scientific enquiries to answer them
- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- identifying differences, similarities or changes related to simple scientific ideas and processes
- using straightforward scientific evidence to answer questions or to support their findings.

Enquiry Ideas

Plants

NC Objectives

- identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers
- explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant
- investigate the way in which water is transported within plants
- explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

Vocabulary

Photosynthesis, pollen, insect/wind pollination, seed formation, seed dispersal – wind dispersal, animal dispersal, water dispersal

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.

Prior Learning

Y2:

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

Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 – Living things and their habitats)

Future Learning

Y4:

- 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)

Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)

Suggested Activities

- Observe what happens to plants over time when the leaves or roots are removed.
- Observe the effect of putting cut white carnations or celery in coloured water.
- Investigate what happens to plants when they are put in different conditions e.g. in darkness, in the cold, deprived of air, different types of soil, different fertilisers, varying amount of space.
- Spot flowers, seeds, berries and fruits outside throughout the year.
- Observe flowers carefully to identify the pollen.
- Observe flowers being visited by pollinators e.g. bees and butterflies in the summer.
- Observe seeds being blown from the trees e.g. sycamore seeds.
- Research different types of seed dispersal.
- Classify seeds in a range of ways, including by how they are dispersed.
- Create a new species of flowering plant.

Scientists

Dr Kelsey Byers

<https://www.youtube.com/watch?v=UIivpKBvAsU>

Animals Including Humans

NC Objectives

- identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat
- identify that humans and some other animals have skeletons and muscles for support, protection and movement

Vocabulary

Nutrition, nutrients, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, water, skeleton, bones, muscles, support, protect, movement, skull, ribs, spine, muscles, joints

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.

Prior Learning

Y2:

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

Future Learning

Y4:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Suggested Activities

- Classify food in a range of ways.
- Use food labels to explore the nutritional content of a range of food items.
- Use secondary sources to find out the types of food that contain the different nutrients.
- Use food labels to answer enquiry questions e.g. How much fat do different types of pizza contain? How much sugar is in soft drinks?
- Plan a daily diet to contain a good balance of nutrients.
- Explore the nutrients contained in fast food.
- Use secondary sources to research the parts and functions of the skeleton.
- Investigate patterns asking questions such as: ■ Can people with longer legs run faster? Can people with bigger hands catch a ball better?
- Compare, contrast and classify skeletons of different animals.

Scientists

Wilhelm Roentgen (Physicist who discovered x-rays)

<https://kids.britannica.com/students/article/Wilhelm-Roentgen/276765>

Rocks and Soils

NC Objectives

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

Vocabulary

Rock, stone, pebble, boulder, grain, crystals, layers, hard, soft, texture, absorb, water, soil, fossil, marble, chalk, granite, sandstone, slate, soil, peat, sandy/chalk/clay soil

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.

Prior Learning

Y2

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)**

Future Learning

Y6

Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. **(Y6 - Evolution and inheritance)**

Suggested Activities

- Observe rocks closely.
- Classify rocks in a range of ways, based on their appearance.
- Devise a test to investigate the hardness of a range of rocks.
- Devise a test to investigate how much water different rocks absorb.
- Observe how rocks change over time e.g. gravestones or old building.
- Research using secondary sources how fossils are formed.
- Observe soils closely.
- Classify soils in a range of ways based on their appearance.
- Devise a test to investigate the water retention of soils.
- Observe how soil can be separated through sedimentation.
- Research the work of Mary Anning.

Scientists

Mary Anning

<https://www.youtube.com/watch?v=Of5sK8p2rZY>

Light

NC Objectives

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

Vocabulary

Light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous

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.

Prior Learning

Y1

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)

Future Learning

Y5

Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky (Y5 Earth and Space)

Y6

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

Suggested Activities

- Explore how different objects are more or less visible in different levels of lighting.
- Explore how objects with different surfaces, e.g. shiny vs matt, are more or less visible.
- Explore how shadows vary as the distance between a light source and an object or surface is changed.
- Explore shadows which are connected to and disconnected from the object e.g. shadows of clouds and children in the playground.
- Choose suitable materials to make shadow puppets.
- Create artwork using shadows.

Scientists

Percy Shaw (Inventor of the cat's eye)

<https://museums.calderdale.gov.uk/percy-shaw>

Forces and Magnets

NC Objectives

- compare how things move on different surfaces
- notice that some forces need contact between two objects, but magnetic forces can act at a distance
- observe how magnets attract or repel each other and attract some materials and not others
- compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
- describe magnets as having two poles
- predict whether two magnets will attract or repel each other, depending on which poles are facing.

Vocabulary

Force, push, pull, twist, contact force, non-contact force, magnetic force, magnet, strength, bar magnet, ring magnet, button magnet, horseshoe magnet, attract, repel, magnetic material, metal, iron, steel, poles, north pole, south pole

Misconceptions

Some children may think:

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

Prior Learning

Y2

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)

Future Learning

Y5

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

Suggested Activities

- Carry out investigations to explore how objects move on different surfaces e.g. spinning tops/coins, rolling balls/cars, clockwork toys, soles of shoes etc.
- Explore what materials are attracted to a magnet.
- Classify materials according to whether they are magnetic.
- Explore the way that magnets behave in relation to each other.
- Use a marked magnet to find the unmarked poles on other types of magnets.
- Explore how magnets work at a distance e.g. through the table, in water, jumping paper clips up off the table.
- Devise an investigation to test the strength of magnets.

Scientists

William Gilbert (Doctor who developed the theory of magnetism)

<https://www.twinkl.co.uk/resource/william-gilbert-fact-file-t-sc-1721125003>

Year 4

Cycle B

Working Scientifically LKS2

- asking relevant questions and using different types of scientific enquiries to answer them
- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- identifying differences, similarities or changes related to simple scientific ideas and processes
- using straightforward scientific evidence to answer questions or to support their findings.

Enquiry Ideas

Living things and their habitats

NC Objectives

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

Vocabulary

Classification, classification keys, environment, habitat, human impact, positive, negative, migrate, hibernate

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.

Prior Learning

Y2

- Explore and compare the differences between things that are living, dead, and things that have never been alive.
- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.
- Identify and name a variety of plants and animals in their habitats, including microhabitats.
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.

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

Y3

- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (Y3 - Plants)

Future Learning

Y5

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

Suggested Activities

- Observe plants and animals in different habitats throughout the year.
- Compare and contrast the living things observed.
- Use classification keys to name unknown living things.
- Classify living things found in different habitats based on their features.
- Create a simple identification key based on observable features.
- Use fieldwork to explore human impact on the local environment e.g. litter, tree planting.
- Use secondary sources to find out about how environments may naturally change.
- Use secondary sources to find out about human impact, both positive and negative, on environments.

Scientists

Animals including Humans

NC Objectives

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

Vocabulary

Digestive system, digestion, mouth, teeth, saliva, oesophagus, stomach, small intestine, nutrients, large intestine, rectum, anus, incisor, canine, molar, herbivore, carnivore, omnivore, food chain, predator, prey producer

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".

Prior Learning

Y3

- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement

Future Learning

Y5

- Describe the changes as humans develop to old age.
- 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)

Suggested Activities

- Research the function of the parts of the digestive system.
- Create a model of the digestive system using household objects.
- Explore eating different types of food to identify which teeth are being used for cutting, tearing and grinding (chewing).
- Classify animals as herbivores, carnivores or omnivores according to the type of teeth they have in their skulls.
- Use food chains to identify producers, predators and prey within a habitat.
- Use secondary sources to identify animals in a habitat and find out what they eat.

Scientists

States of Matter

NC Objectives

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Vocabulary

Solid, liquid, gas, state change, melting, freezing, melting point, boiling point, evaporation, temperature, water cycle

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)
- clouds are made of water vapour or steam
- the substance on windows etc. is condensation rather than water
- the changing states of water (illustrated by the water cycle) are irreversible
- evaporating or boiling water makes it vanish
- evaporation is when the Sun sucks up the water, or when water is absorbed into a surface/material.

Prior Learning

Y2

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

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

Y3

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. (Y3 - Rocks)
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock. (Y3 - Rocks)
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance. (Y3 - Forces and magnets)

Future Learning

Y5

- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.
- Demonstrate that dissolving, mixing and changes of state are reversible changes.
- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Suggested Activities

- Observe closely and classify a range of solids. Observe closely and classify a range of liquids.
- Explore making gases visible e.g. squeezing sponges under water to see bubbles, and showing their effect e.g. using straws to blow objects, trees moving in the wind.
- Classify materials according to whether they are solids, liquids and gases.
- Observe a range of materials melting e.g. ice, chocolate, butter.
- Investigate how to melt ice more quickly.
- Observe the changes when making rocky road cakes or ice-cream.
- Investigate the melting point of different materials e.g. ice, margarine, butter and chocolate.
- Explore freezing different liquids e.g. tomato ketchup, oil, shampoo.
- Use a thermometer to measure temperatures e.g. icy water (melting), tap water, hot water, boiling water (demonstration).
- Observe water evaporating and condensing e.g. on cups of icy water and hot water.
- Set up investigations to explore changing the rate of evaporation e.g. washing, puddles, handprints on paper towels, liquids in containers.
- Use secondary sources to find out about the water cycle.

Scientists

Sound

NC Objectives

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

Vocabulary

sound, source, vibrate, vibration, travel, pitch (high, low), volume, faint, loud, insulation

Misconceptions

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 loud and low sounds are quiet.

Prior Learning

Y1

- 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)

Future Learning

KS3

- Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel - superposition.
- Frequencies of sound waves, measured in Hertz (Hz); echoes, reflection and absorption of sound.
- Sound needs a medium to travel, the speed of sound in air, in water, in solids.
- Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal.
- Auditory range of humans and animals.
- Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound.
- Waves transferring information for conversion to electrical signals by microphone.

Suggested Activities

- Classify sound sources.
- Explore making sounds with a range of objects, such as musical instruments and other household objects.
- Explore how string telephones or ear gongs work.
- Explore altering the pitch or volume of objects, such as the length of a guitar string, amount of water in bottles, size of tuning forks.
- Measure sounds over different distances.
- Measure sounds through different insulation materials.

Scientists

Electricity

NC Objectives

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

Vocabulary

Electricity, electrical appliance/device, mains, plug, electrical circuit, complete circuit, component, cell, battery, positive, negative, connect/connections, loose connection, short circuit, crocodile clip, bulb, switch, buzzer, motor, conductor, insulator, metal, non-metal

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.

Prior Learning

N/A

Future Learning

Y6

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

Suggested Activities

- Construct a range of circuits.
- Explore which materials can be used instead of wires to make a circuit.
- Classify the materials that were suitable/not suitable for wires.
- Explore how to connect a range of different switches and investigate how they function in different ways.
- Choose switches to add to circuits to solve particular problems, such as a pressure switch for a burglar alarm.
- Apply their knowledge of conductors and insulators to design and make different types of switch.
- Make circuits that can be controlled as part of a DT project.

Scientists

Year 5

Cycle B

Working Scientifically UKS2

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

Enquiry Ideas

Living Things and their Habitats

NC Objectives

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

Vocabulary

Life cycle, reproduce, sexual, sperm, fertilises, egg, live young, metamorphosis, asexual, plantlets, runners, bulbs, cuttings

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.

Prior Learning

Y4

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

Construct and interpret a variety of food chains, identifying producers, predators and prey. (Y4 - Animals, including humans)

Future Learning

Y6

- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics

Suggested Activities

- Use secondary sources and, where possible, first-hand observations to find out about the life cycle of a range of animals.
- Compare the gestation times for mammals and look for patterns e.g. in relation to size of animal or length of dependency after birth.
- Look for patterns between the size of an animal and its expected life span.
- Grow and observe plants that reproduce asexually e.g. strawberries, spider plants, potatoes.
- Take cuttings from a range of plants e.g. African violet, mint.
- Plant bulbs and then harvest to see how they multiply.
- Use secondary sources to find out about pollination.

Scientists

Animals including Humans

NC Objectives

- describe the changes as humans develop to old age.

Vocabulary

Puberty, gestation, , reproduction, adolescence, toddler, embryo, foetus, adulthood, baby

Misconceptions

.Some children may think:

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

Prior Learning

Y4

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Future Learning

Y6

- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.
- Describe the ways in which nutrients and water are transported within animals, including humans.
- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. (Y6 - Living things and their habitats)
- Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)

Suggested Activities

- This unit is likely to be taught through direct instruction due to its sensitive nature, although children can carry out a research enquiry by asking an expert e.g. school nurse to provide answers to questions that have been filtered by the teacher.
- Gestation periods/graphs

Scientists

Properties and changes in materials

NC Objectives

- compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Vocabulary

Thermal/electrical insulator/conductor, change of state, mixture, dissolve, solution, soluble, insoluble, filter, sieve reversible/non-reversible change, burning, rusting, new material, magnetic, permeable

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.

Prior Learning

Y4

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Future Learning

KS3

- Chemical reactions as the rearrangement of atoms.
- Representing chemical reactions using formulae and using equations.
- Combustion, thermal decomposition, oxidation and displacement reactions.
- Defining acids and alkalis in terms of neutralisation reactions.
- The pH scale for measuring acidity/alkalinity; and indicators.

Suggested Activities

- Investigate the properties of different materials in order to recommend materials for particular functions depending on these properties e.g. test waterproofness and thermal insulation to identify a suitable fabric for a coat.
- Explore adding a range of solids to water and other liquids e.g. cooking oil, as appropriate.
- Investigate rates of dissolving by carrying out comparative and fair test.
- Separate mixtures by sieving, filtering and evaporation, choosing the most suitable method and equipment for each mixture.
- Explore a range of non-reversible changes e.g. rusting, adding fizzy tablets to water, burning.
- Carry out comparative and fair tests involving non-reversible changes e.g. What affects the rate of rusting? What affects the amount of gas produced?
- Research new materials produced by chemists e.g. Spencer Silver (glue of sticky notes) and Ruth Benerito (wrinkle free cotton).

Scientists

Earth and Space

NC Objectives

- describe the movement of the Earth, and other planets, relative to the Sun in the solar system
- describe the movement of the Moon relative to the Earth
- describe the Sun, Earth and Moon as approximately spherical bodies
- use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Vocabulary

Earth, Sun, Moon, Mercury, Jupiter, Saturn, Venus, Mars, Uranus, Neptune

Spherical, Solar system, rotates, star, orbits, planets, axis, diameter, moon, rings, waxing, waning, crescent, gibbous, celestial body, star, axis, eclipse

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.

Prior Learning

Y1

- 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)

Future Learning

KS3

- Gravity force, weight = mass x gravitational field strength (g), on Earth $g=10 \text{ N/kg}$, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only).
- Our Sun as a star, other stars in our galaxy, other galaxies.
- The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.
- The light year as a unit of astronomical distance.

Suggested Activities

- Use secondary sources to help create a model e.g. role play or using balls to show the movement of the Earth around the Sun and the Moon around the Earth.
- Use secondary sources to help make a model to show why day and night occur.
- Make first-hand observations of how shadows caused by the Sun change through the day.
- Make a sundial.
- Research time zones.
- Consider the views of scientists in the past and evidence used to deduce shapes and movements of the Earth, Moon and planets before space travel.

Scientists

Forces

NC Objectives

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

Vocabulary

Force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears

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.

Prior Learning

Y3

- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

Future Learning

KS3

- Magnetic fields by plotting with compass, representation by field lines.
- Earth's magnetism, compass and navigation.
- 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.
- Moment as the turning effect of a force.
- 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.
- Forces measured in Newtons, measurements of stretch or compression as force is changed.

Suggested Activities

- Investigate the effect of friction in a range of contexts e.g. trainers, bathmats, mats for a helter-skelter.
- Investigate the effects of water resistance in a range of contexts e.g. dropping shapes through water and pulling shapes, such as boats, along the surface of water.
- Investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats.
- Explore how levers, pulleys and gears work.
- Make a product that involves a lever, pulley or gear.
- Research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation.

Scientists

Year 6

Cycle B

Working Scientifically UKS2

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

Enquiry Ideas

Living Things and their Habitats

NC Objectives

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

Vocabulary

Vertebrates, fish, amphibians, reptiles, birds, mammals, invertebrates, insects, spiders, snails, worms, flowering and non-flowering micro-organism, fungi, bacteria Carl Linnaeus, classification

Misconceptions

.Some children may think:

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

Prior Learning

Y5

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

Future Learning

KS3

- 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.
- Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.
- Differences between species.

Suggested Activities

- Use secondary sources to learn about the formal classification system devised by Carl Linnaeus and why it is important.
- Use first-hand observation to identify characteristics shared by the animals in a group.
- Use secondary sources to research the characteristics of animals that belong to a group.
- Use information about the characteristics of an unknown animal or plant to assign it to a group.
- Classify plants and animals, presenting this in a range of ways e.g. Venn diagrams, Carroll diagrams and keys.
- Create an imaginary animal which has features from one or more groups.

Scientists

Animals including Humans

NC Objectives

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

Vocabulary

Heart, pulse, rate, pumps, blood, blood vessels, transported, lungs, oxygen, carbon dioxide, nutrients, water, muscles, cycle, circulatory system, diet, exercise, drugs and lifestyle

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
- 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.

Prior Learning

Y5

- Describe the changes as humans develop to old age.
- 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)

Future Learning

KS3

- 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.
- The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases.
- The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.
- The structure and functions of the gas exchange system in humans, including adaptations to function.
- The mechanism of breathing to move air in and out of the lungs.
- The impact of exercise, asthma and smoking on the human gas exchange system.

Suggested Activities

- Create a role play model for the circulatory system.
- Carry out a range of pulse rate investigations: ■ fair test - effect of different activities on my pulse rate
- pattern seeking - exploring which groups of people may have higher or lower resting pulse rates
- observation over time - how long does it take my pulse rate to return to my resting pulse rate (recovery rate)
- pattern seeking - exploring recovery rate for different groups of people.
- Research the negative effects of drugs (e.g. tobacco) and the benefits of a healthy diet and regular exercise by asking an expert or using carefully selected secondary sources.

Scientists

Evolution and Inheritance

NC Objectives

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

Vocabulary

Offspring, sexual reproduction, vary, characteristics, suited, adapted, environment, inherited, species, fossils, natural selection

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.

Prior Learning

Y4

Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)

Future Learning

KS3

- Heredity as the process by which genetic information is transmitted from one generation to the next.
- 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.
- The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection.
- Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction.

Suggested Activities

- Design a new plant or animal to live in a particular habitat.
- Use models to demonstrate evolution e.g. 'Darwin's finches' bird beak activity.
- Use secondary sources to find out about how the population of peppered moths changed during the industrial revolution.
- Make observations of fossils to identify living things that lived on Earth millions of years ago.
- Identify features in animals and plants that are passed on to offspring and explore this process by considering the artificial breeding of animals or plants e.g. dogs.
- Compare the ideas of Charles Darwin and Alfred Wallace on evolution.
- Research the work of Mary Anning and how this provided evidence of evolution.

Scientists

Light

NC Objectives

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

Vocabulary

Straight lines, Light rays.

(Y3 vocabulary - light, light source, dark, absence of light, transparent, translucent, opaque, shiny, matt, surface, shadow, reflect, mirror, sunlight, dangerous

Misconceptions

Some children may think:

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

Prior Learning

Y3

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by an opaque object.

Find patterns in the way that the size of shadows change.

Y5

- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky (Y5 Earth and Space)

Future Learning

- Gravity force, weight = mass $\times$ gravitational field strength (g), on Earth $g=10$ N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only).
- Our Sun as a star, other stars in our galaxy, other galaxies.
- The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.
- The light year as a unit of astronomical distance.

Suggested Activities

- Explore different ways to demonstrate that light travels in straight lines e.g. shining a torch down a bent and straight hose pipe, shining a torch through different shaped holes in card.
- Explore the uses of the behaviour of light, reflection and shadows, such as in periscope design, rear view mirrors and shadow puppets.

	<u>Scientists</u>
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Electricity

NC Objectives

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

Vocabulary

Circuit, complete circuit, circuit diagram, circuit symbol, cell, battery, bulb, buzzer, motor, switch, voltage, conductor, insulator

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

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.

Prior Learning

Y4

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

Future Learning

KS3

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

Suggested Activities

- Explain how a circuit operates to achieve particular operations, such as to control the light from a torch with different brightnesses or make a motor go faster or slower.
- Make circuits to solve particular problems, such as a quiet and a loud burglar alarm.
- Carry out fair tests exploring changes in circuits.
- Make circuits that can be controlled as part of a DT project.

Other resources

<https://pstt.org.uk/unique-resources/a-scientist-just-like-me/> - A Scientist just like me (introducing children to scientists today in different roles from diverse backgrounds

<https://pstt.org.uk/resources/pictures-for-talk/> - Pictures for talk - full size pictures for children to discuss and information provided for teacher

<https://pstt.org.uk/resources/bright-ideas-time/> - Bright ideas Time - short discussion points for the start of a lesson