 **Scientific Knowledge and Skills Progression Map**

## The national curriculum for science 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

**EYFS**

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| **EYFS** | **Statutory Objectives** | **Substantive Knowledge**  **(sticky learning)** | **Working Scientifically**  **(skills)** |
| **Understanding the World: The Natural World** | * **Explore the natural world around them, making observations and drawing pictures of animals and plants** * **Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class** * **Understand some important processes and changes in the natural world around them, including the seasons and changing states  of matter** | Explore the natural world around them.  Describe what they see, hear and feel whilst outside.  Name and describe people who are familiar to them  Observe and draw pictures of animals and plants around them  Use stories to make observations between different environments  Recognise some environments that are different to the one in which they live in  Observe and understand some process and changes in the natural world around them, including the seasons and changing states of matter  Discuss ways to solve problems  Test their ideas  Talk about what have done and what they have measured  Begin to ask adults questions  Begin to develop ideas of grouping, sequencing, cause and effect | Look  Observe  Name  Describe (using senses)  Sort or Group with support  Begin to ask questions and have their own ideas with the help of an adult  Look at simple primary and secondary sources  Begin to have ideas to find things our or test ideas  Begin to use different resourced and equipment with the help of an adult  Begin to draw simple pictures of findings, with help  Begin to talk to other people about what happened and what was seen (might talk about other senses) |
| **Personal, Social and Emotional Development – managing self** | * **Manage their own basic hygiene and personal needs, including dressing, going to the toilet and understanding the importance of healthy food choices** | **Key Vocabulary** |

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| **Whole School Knowledge and Skill Progression**  **Science Curriculum Map: Cycle A** | | | | | | |
| **Years 1 & 2**  **Classes 3, 4 & 5** | **Plants** | | **Animals including humans** | | **Seasonal Changes**  Taught throughout the year when seasons change | |
| **Years 3 & 4**  **Classes 6, 7 & 8** | **Rocks** | **Plants** | | **Animals**  **including**  **humans** | | **Sound** |
| **Years 5 & 6**  **Classes 9, 10 & 11** | **Earth and**  **Space** | **Forces** | | **Light** | | **Living things and their habitats** |

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| **Whole School Knowledge and Skill Progression**  **Science Curriculum Map: Cycle B** | | | | | | | | | |
| **Year 1 & 2**  **Class 3, 4 and 5** | **Everyday materials** | | | | | **Living things and their habitats** | | | |
| **Year 3 & 4**  **Class 6, 7, and 8** | **Forces and magnets** | **Living things and their habitats** | | **States of matter** | | | **Light** | | **Electricity** |
| **Year 5 & 6**  **Class 9, 10 and 11** | **Evolution and inheritance** | | **Properties and changes of materials** | | **Animals including humans** | | | **Electricity** | |

**Science Curriculum Overview: Years 1 & 2**

Pupils in year 1 and 2 should explore the world around them and raise their own questions. They should experience different types of scientific enquiries, including practical activities, and begin to recognise ways in which they might answer scientific questions. They should use simple features to compare objects, materials and living things and, with help, decide how to sort and group them, observe changes over time and, with guidance, they should begin to notice patterns and relationships. Pupils should ask people questions and use simple secondary sources to find answers. They should use simple measurements and equipment (for example, hand lenses, egg timers) to gather data, carry out simple tests, record simple data, and talk about what they have found out and how they found it out. With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language.

These opportunities for working scientifically should be provided across years 1 and 2 so that the expectations in the programme of study can be met by the end of year 2.

**Disciplinary Knowledge**

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| **Working Scientifically (skills)** | **Year 1** | **Year 2** |
| **Exploring and Observing** | Begin to use simple scientific language or **record** what they have noticed.  Look / **observe** closely and communicate changes over time.  Look / **observe** closely and communicate the features or properties of things in the real world.  **Observe** closely using their senses. | Use simple scientific language or **record**  what they have noticed.  **Observe** and describe simple processes / cycles / changes with  several steps  **Observe** closely and communicate  with increasing accuracy |
| **Grouping and Classifying** | **Name**  **Name** basic features  Say how things are similar or different.  **Compare** and contrast simple observable features / characteristics | **Name / identify**  **Sort** and **group** objects, materials or living  things by observable and/or behavioural  features.  **Compare** |
| **Questioning** | Ask simple questions about what they notice about the world around them.  Demonstrate curiosity by the questions they ask. | Raise their own logical questions based on or linked to things they have observed |
| **Research** | Use simple primary and secondary sources | Use simple and appropriate secondary sources (such as  books, photographs, videos and other technology) to find  things out / find answers. |
| **Planning and testing** | With help**, carry out** a simple test / comparative test.  **Talk** about ways of setting up a test. | Carry out simple comparative tests as part of a group, following a **method** with some independence  With support, make suggestions on a **method** for setting up a simple comparative test |
| **Using equipment and measures** | **Measure** using non-standard units e.g. how many lolly sticks / cubes / handfuls, etc.  Observe closely, using simple **equipment** (e.g. hand lenses, egg timers).  Compare | **Measure** using non-standard and simple standard measures (e.g. cm, time) with increasing accuracy  Correctly and safely use **equipment** provided to make observations and/or take simple measurements |
| **Communicating** | Add annotations to drawings or photographs.  Begin to use some simple scientific language  **Record** simple visual representations of observations made. | Record  Use simple scientific language with increasing accuracy (  **Record** simple data with some accuracy to help in answering questions;  With support or using frameworks, make decisions about how to complete a variety of tables/charts *(e.g. a 2*  *column table,* |
| **Conclusions** | Use recordings to talk about and describe what happened  Begin to use simple scientific language to talk about what they have found out or why something happened | With guidance, begin to notice **patterns** in their data  Use their recordings to talk about and describe what has happened  Begin to use simple scientific language to explain what they have found out.  Give a simple, logical reason why something happened *(e.g. I think …because…).*  Begin to discuss if the test was un**fair** |

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| **Year 1 & 2**  **Cycle A** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Plants** | * **Identify and name a variety of common, wild and garden plants, including deciduous and evergreen trees.** * **Identify and describe the basic structure of a variety of common flowering plants including trees.** | * Observing closely, perhaps using magnifying glasses, and comparing and contrasting familiar plants; describing how they were able to identify and group them, and drawing diagrams showing the parts of different plants including trees. * Pupils might keep records of how plants have changed over time, for example, the leaves falling off trees and buds opening; and compare and contrast what they have found out about different plants | Observing closely, perhaps using magnifying glasses, and comparing and contrasting familiar plants; describing how they were able to identify and group them, and drawing diagrams showing the parts of different plants including trees. Pupils might keep records of how plants have changed over time, for example, the leaves falling off trees and buds opening; and compare and contrast what they have found out about different plants. |
| **Substantive Knowledge**  **(sticky learning)** | **Identify and name** a variety of common wild and garden plants  **Identify and describe** the basic structure of a variety of common flowering plants including trees. | **Key Vocabulary** |  |
| **Animals including Humans** | * **identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals** * **identify and name a variety of common animals that are carnivores, herbivores and omnivores** * **describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets)** * **Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.** | * Pupils should use the local environment throughout the year to explore and answer questions about animals in their habitat. * They should understand how to take care of animals taken from their local environment and the need to return them safely after study. * Pupils should become familiar with the common names of some fish, amphibians, reptiles, birds and mammals, including those that are kept as pets. * Pupils should have plenty of opportunities to learn the names of the main body parts (including head, neck, arms, elbows, legs, knees, face, ears, eyes, hair, mouth, teeth) through games, actions, songs and rhymes. | Using their observations to compare and contrast animals at first hand or through videos and photographs, describing how they identify and group them; grouping animals according to what they eat; and using their senses to compare different textures, sounds and smells. |
| **Substantive Knowledge**  **(sticky learning)** | **Name** some common animals including fish, amphibians, reptiles, birds and mammals  **Name** a variety of common animals that are carnivores, herbivores and omnivores  **Describe and compare** some common animals  **Identify, name, draw and label** the basic parts of the human body  Say which part of the body is associated with each sense. | **Key Vocabulary** |  |
| **Seasonal Changes** | * **observe changes across the 4 seasons** * **observe and describe weather associated with the seasons and how day length varies** | * Pupils should observe and talk about changes in the weather and the seasons. Note: pupils should be warned that it is not safe to look directly at the sun, even when wearing dark glasses | Making tables and charts about the weather; and making displays of what happens in the world around them, including day length, as the seasons change. |
| **Substantive Knowledge**  **(sticky learning)** | **Observe** changes across the 4 seasons  **Observe and describe** weather associated with the seasons  **Describe** how day length varies with the seasons | **Key Vocabulary** |  |

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| **Year 1 & 2**  **Cycle B** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Everyday Materials** | * **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** | * Pupils should explore, name, discuss and raise and answer questions about everyday materials so that they become familiar with the names of materials and properties such as: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent. * Pupils should explore and experiment with a wide variety of materials, not only those listed in the programme of study, but including for example: brick, paper, fabrics, elastic, foil | Performing simple tests to explore questions, for example: ‘What is the best material for an umbrella? … for lining a dog basket? … for curtains? … for a bookshelf? … for a gymnast’s leotard?’ |
| **Substantive Knowledge**  **(sticky learning)** | **Distinguish between** an object and the material from which it is made  **Identify and name** a variety of everyday materials  **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  **Identify and compare** the suitability of everyday materials for particular uses  Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching | **Key Vocabulary** |  |
| **Living things and their Habitats** | * **Explore and compare the differences between things that are living, dead, and things that have never been alive. (Yr. .2)** * **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 (Yr. 2)** * **identify and name a variety of plants and animals in their habitats, including microhabitats (Yr. .2)** * **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. (Yr. 2)** | * Pupils should be introduced to the idea that all living things have certain characteristics that are essential for keeping them alive and healthy. * They should raise and answer questions that help them to become familiar with the life processes that are common to all living things. * Pupils should be introduced to the terms ‘habitat’ (a natural environment or home of a variety of plants and animals) and ‘microhabitat’ (a very small habitat, for example for woodlice under stones, logs or leaf litter). * They should raise and answer questions about the local environment that help them to identify and study a variety of plants and animals within their habitat and observe how living things depend on each other, for example, plants serving as a source of food and shelter for animals. * Pupils should compare animals in familiar habitats with animals found in less familiar habitats, for example, on the seashore, in woodland, in the ocean, in the rainforest | * Sorting and classifying things according to whether they are living, dead or were never alive, and recording their findings using charts. They should describe how they decided where to place things, exploring questions like: ‘Is a flame alive? Is a deciduous tree dead in winter?’ and talk about ways of answering their questions. * They could construct a simple food chain that includes humans (e.g., grass, cow, human). They could describe the conditions in different habitats and microhabitats (under log, on stony path, under bushes); and find out how the conditions affect the number and type(s) of plants and animals that live there. |
| **Substantive Knowledge**  **(sticky learning)** | **Explore** **and compare** the differences between things that are living, dead, and things that have never been alive. (Yr. 2)  **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 (Yr. 2)  **Identify** **and name** a variety of plants and animals in their habitats, including microhabitats (Yr. 2)  **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. (Yr. 2) | **Key Vocabulary** |  |

**Science Curriculum Overview: Years 3 & 4**

The principle focus of science teaching in lower KS2 (Year 3 and 4) is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationship between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. Pupils should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple, comparative and fair testing and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first to talk about and later, to write about what they have found out.

**Disciplinary Knowledge**

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| **Working Scientifically (skills)** | **Year 3** | **Year 4** |
| **Exploring and Observing** | Observe and record relationships  between structure and function | Discuss ideas and develop  descriptions from their observations using relevant scientific language and vocabulary  Observe and record relationships between structure and function or between different parts of a processes  Observe and record changes/stages over time |
| **Grouping and Classifying** | Decide ways and give reasons for sorting, grouping, classifying, identifying  Compare and contrast and begin to consider  the relationships between different things | Make a simple guide to local living things.  Use guides or simple keys to classify / identify [animals, flowering plants and nonflowering plants  Begin to give reasons for these similarities and differences |
| **Questioning** | Begin to understand that some questions can be tested in the classroom and some cannot.  Within a group suggest relevant questions | Ask / raise their own relevant questions with increasing confidence and independence that can be explored, observed, tested or investigated further  Choose / select a relevant question that can be answered [by research or experiment / test]. |
| **Research** | Find things out using a range of secondary sources of information | Make decisions about which information to use from a wide range of sources and make decisions about how to present their research |
| **Planning and testing** | Help to decide about how to set up a simple **fair test** and begin to recognise when a test is not **fair**.  Predict  As a group, begin to make some decisions | Carry out simple **fair tests** with increasing confidence  Start to make their own decisions about the most appropriate type of science enquiry they might use to answer scientific questions *(is a fair test the best way to investigate their question?)*  Explain their planning decisions and choices.  Make some of the planning decisions about what to change and measure / observe. |
| **Using equipment and measures** | Collect data from their own observations and measurements using notes / simple tables / standard units.  Make simple **accurate** measurements using whole number standard **units**, using a range of equipment.  Use equipment **accurate**ly to improve the detail of their measurements / observations | Begin to identify what data to collect.  Make more of the decisions  Data loggers and measure temperature in degrees Celsius (°C) using a thermometer.  Collect data from their own observations and measurements, using notes / simple tables / standard **units**.  Make **accurate** measurements using standard **units** [and more complex units and parts of units] |
| **Communicating** | Record and present findings using simple scientific language and vocabulary  *simple tables, bar charts (using scales chosen for them)*  With scaffold / support record, and present data in a variety of ways | Record findings using relevant scientific language and vocabulary  Tables and bar charts [where intervals and ranges agreed through discussion], displays or presentations.  Begin to select the most useful ways to collect, record, classify and present data from a range of choices. |
| **Conclusions** | With help, look for changes and simple patterns in their observations, data, chart or graph.  Use their results to consider whether they met their **predictions**.  draw a simple **conclusion** to answer their original question  Begin to recognise when a test is not **fair** and suggest improvements | Notice / find patterns in their observations and data. (Describe the effect of something on something else).  Evidence  Conclusion  Use relevant scientific language and vocabulary to begin to say / explain *why* something happened  Use results to suggest improvements, new questions and / or predictions for setting up further tests. |

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| **Year 3 & 4**  **Cycle A** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Rocks** | * **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** | * Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment. | * Observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. * Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed. * Pupils could explore different soils and identify similarities and differences between them and investigate what happens when rocks are rubbed together or what changes occur when they are in water. They can raise and answer questions about the way soils are formed. |
| **Substantive Knowledge**  **(sticky learning)** | Rocks can be grouped on the basis of their appearance and simple physical properties (some are hard, some are soft)  **F**ossils are formed when things that have lived are trapped within rock  **S**oils are made from rocks and organic matter | **Key Vocabulary** |  |
| **Plants** | * **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** | * Pupils should be introduced to the relationship between structure and function: the idea that every part has a job to do. They should explore questions that focus on the role of the roots and stem in nutrition and support, leaves for nutrition and flowers for reproduction. * Note: pupils can be introduced to the idea that plants can make their own food, but at this stage they do not need to understand how this happens | * Comparing the effect of different factors on plant growth, for example, the amount of light, the amount of fertiliser; discovering how seeds are formed by observing the different stages of plant life cycles over a period of time; looking for patterns in the structure of fruits that relate to how the seeds are dispersed. * They might observe how water is transported in plants, for example, by putting cut, white carnations into coloured water and observing how water travels up the stem to the flowers. |
| **Substantive Knowledge**  **(sticky learning)** | Flowering plants generally have the following parts: roots, stem/trunk, leaves and flowers  Each part performs a specific role for the plant.  Plants need air, light, water, nutrients from soil and room for life and growth  **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 | **Key Vocabulary** |  |
| **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** * **identify that humans and some other animals have skeletons and muscles for support, protection and movement** * **Describe the simple functions of the basic part 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.** | * Pupils should continue to learn about the importance of nutrition and should be introduced to the main body parts associated with the skeleton and muscles, finding out how different parts of the body have special functions. * Pupils should be introduced to the main body parts associated with the digestive system, for example the mouth, tongue, teeth, oesophagus, stomach and small and large intestine and explore questions that help them to understand their special functions | * Identifying and grouping animals with and without skeletons and observing and comparing their movement; exploring ideas about what would happen if humans did not have skeletons. * They might compare and contrast the diets of different animals (including their pets) and decide ways of grouping them according to what they eat. * They might research different food groups and how they keep us healthy, and design meals based on what they find out. * Comparing the teeth of carnivores and herbivores and suggesting reasons for differences; finding out what damages teeth and how to look after them. They might draw and discuss their ideas about the digestive system and compare them with models or images. |
| **Substantive Knowledge**  **(sticky learning)** | 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  The digestive system in humans is comprised into different parts and each has a special function  Identify the different types of teeth in humans and their simple functions  Teeth can be damaged and need to be cared for.  Living things rely on each other for food in the natural world; food chains and food webs can illustrate this relationship | **Key Vocabulary** |  |
| **Sound** | * **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.** | * Pupils should explore and identify the way sound is made through vibration in a range of different musical instruments from around the world; and find out how the pitch and volume of sounds can be changed in a variety of ways. | * Finding patterns in the sounds that are made by different objects such as saucepan lids of different sizes or elastic bands of different thicknesses. * They might make earmuffs from a variety of different materials to investigate which provides the best insulation against sound. * They could make and play their own instruments by using what they have found out about pitch and volume. |
| **Substantive Knowledge**  **(sticky learning)** | Sounds are made by something vibrating  Vibrations from sounds travel through a medium (solid, liquid, gas) to the ear  The pitch of a sound depends on the features of the object that produced it  The volume of a sound depends on the strength of the vibrations that produced it  Sounds get fainter as the distance from the sound source increases. | **Key Vocabulary** |  |

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| **Year 3 & 4**  **Cycle B** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Forces and Magnets** | * **Compare how things move on different surfaces** * **notice that some forces need contact between 2 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 2 poles** * **Predict whether 2 magnets will attract or repel each other, depending on which poles are facing.** | * Pupils should observe that magnetic forces can act without direct contact, unlike most forces, where direct contact is necessary (for example, opening a door, pushing a swing). * They should explore the behaviour and everyday uses of different magnets (for example, bar, ring, button and horseshoe) | |  | | --- | | * Comparing how different things move and grouping them * Raising questions and carrying out tests to find out how far things move on different surfaces and gathering and recording data to find answers their questions * Exploring the strengths of different magnets and finding a fair way to compare them * sorting materials into those that are magnetic and those that are not * Looking for patterns in the way that magnets behave in relation to each other and what might affect this, for example, the strength of the magnet or which pole faces another * Identifying how these properties make magnets useful in everyday items and suggesting creative uses for different magnets. | |
| **Substantive Knowledge**  **(sticky learning)** | A force is a push or pull  When an object moves on surface, the texture of the surface and the object affect how it moves. It may help or hinder its movement (ice skater compared to walking on ice in normal shoes)  A magnet attracts magnetic material  The strongest parts of the magnets are the poles  Magnets have two poles – a north pole and a south pole (two north poles are brought together they will push away from each other – repel. If two unlike poles are brought together they will pull together – attract) | **Key Vocabulary** |  |
| **Living things and their habitats** | |  | | --- | | * **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.** | | * Pupils should use the local environment throughout the year to raise and answer questions that help them to identify and study plants and animals in their habitat. They should identify how the habitat changes throughout the year. Pupils should explore possible ways of grouping a wide selection of living things that include animals and flowering plants and non-flowering plants. Pupils could begin to put vertebrate animals into groups such as fish, amphibians, reptiles, birds, and mammals; and invertebrates into snails and slugs, worms, spiders, and insects.   **Note:** Plants can be grouped into categories such as flowering plants (including grasses) and non-flowering plants, such as ferns and mosses.   * Pupils should explore examples of human impact (both positive and negative) on environments, for example, the positive effects of nature reserves, ecologically planned parks, or garden ponds, and the negative effects of population and development, litter or deforestation. | * using and making simple guides or keys to explore and identify local plants and animals * making a guide to local living things; raising and answering questions based on their observations of animals and what they have found out about other animals that they have researched |
| **Substantive Knowledge**  **(sticky learning)** | Living things can be grouped in a variety of ways  Classification keys can be used to help group, identify and name a variety of living things in their local and wider environment  Species depend on one another and their environment to survive  Environments can change and that this can sometimes pose dangers to living things. | **Key Vocabulary** |  |
| **States of Matter** | |  | | --- | | * **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.** | | * Pupils should explore a variety of everyday materials and develop simple descriptions of the states of matter (solids hold their shape; liquids form a pool not a pile; gases escape from an unsealed container). Pupils should observe water as a solid, a liquid and a gas and should note the changes to water when it is heated or cooled.   **Note:** Teachers should avoid using materials where heating is associated with chemical change, for example, through baking or burning. | * grouping and classifying a variety of different materials; * Exploring the effect of temperature on substances such as chocolate, butter, cream (for example, to make food such as chocolate crispy cakes and ice cream for a party). * They could research the temperature at which materials change state, for example, when iron melts or when oxygen condenses into a liquid. * They might observe and record evaporation over a period of time, for example, a puddle in the playground or washing on a line, and investigate the effect of temperature on washing drying or snowmen melting. |
| **Substantive Knowledge**  **(sticky learning)** | Materials can be solid, liquids or gases  Materials change state with heating and cooling  The rates of evaporation and condensation are affected by temperature  Evaporation and condensation play a part in the water cycle where water circulates between the Earth’s oceans, atmosphere and land. | **Key Vocabulary** |  |
| **Light** | * **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** | * Pupils should explore what happens when light reflects off a mirror or other reflective surfaces, including playing mirror games to help them to answer questions about how light behaves. * They should think about why it is important to protect their eyes from bright lights. * They should look for, and measure, shadows, and find out how they are formed and what might cause the shadows to change. Note: pupils should be warned that it is not safe to look directly at the sun, even when wearing dark glasses. | * Looking for patterns in what happens to shadows when the light source moves or the distance between the light source and the object changes. |
| **Substantive Knowledge**  **(sticky learning)** | Dark is the absence of light  Light is needed in order to see things  Light is reflected from materials  Light travels through some materials and not others  Light from the sun can be dangerous and that there are ways to protect their eyes  Shadows are formed when the light from a light source is blocked by an opaque object  The size of shadows change according to the size of the objects and the relative positions of the object and the light source | **Key Vocabulary** |  |
| **Electricity** | * **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 with light 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 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.** | * Pupils should construct simple series circuits, trying different components, for example bulbs, buzzers and motors, and include switches, and use their circuits to create simple devices. Pupils should draw the circuit symbols at this stage; these will be introduced in year 6. * Pupils might use the terms current or voltage but these should not be introduced or defined at this stage. Pupils should be taught about precautions for working safely with electricity. | * Observing patterns, for example, that bulbs get brighter if more cells are added, that metals tend to be conductors of electricity, and that some materials can and some cannot be used to connect across a gap in a circuit. |
| **Substantive Knowledge**  **(sticky learning)** | A circuit is a continuous loop of conducting materials  A complete closed circuit is needed for electricity to flow  The basic components of an electrical circuit are wires, bulbs, switches/buzzers, cell  A switch opens and closes a circuit  Some materials do not allow electricity to pass and these are called insulators  Some materials do allow electricity to pass and these are called conductors  Some common appliances run on electricity  Mains electricity can be dangerous | **Key Vocabulary** |  |

**Science Curriculum Overview: Years 5 & 6**

The principle focus of science teaching in upper key stage 2 (Years 5 & 6) is to enable pupils to develop a deeper understanding of a wide range of scientific ideas. They should do this by exploring and talking about their ideas; asking their own questions about scientific phenomena, and analysing functions, relationships and interactions more systematically. At upper KS2, they should encounter more abstract ideas and begin to recognise how these ideas help them to understand and predict how the world operates. They should also begin to recognise that scientific ideas change and develop over time. They should select the most appropriate ways to answer science questions, using different types of scientific enquiry, including observing changes over different periods of time, noticing patterns, grouping and classifying things, carrying out comparative and fait tests and finding things out using a wide range of secondary sources of information. Pupils should draw conclusions based on their data and observations, use evidence to justify their ideas, and use scientific knowledge and understanding to explain their findings.

**Disciplinary Knowledge**

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| **Working Scientifically (skills)** | **Year 5** | **Year 6** |
| **Exploring and Observing** | Evaluate their observations and suggest a further test, offer another question or make a **prediction.**  Observe (including changes over time) and suggest a reason for what they notice. | Use correct scientific knowledge and understanding and relevant scientific language to discuss their observations and explorations  Identify changes that have occurred over a very long period of time (evolution) and discuss how changes have impacted the world. |
| **Grouping and Classifying** | Suggest reasons for similarities and differences.  Decide which sources of information (and / or equipment and / or test) to help identify and classify. | Construct a classification key / branching database using more than two items.  Compare and contrast things beyond their locality and discuss advantages / disadvantages, pros / cons of the similarities and differences. |
| **Questioning** | Independently ask their own scientific questions taking some ownership for finding out the answers | Recognise scientific questions that do not yet have definitive answers  Refine a scientific question to make it Testable  Independently ask a variety of scientific questions and decide the type of enquiry needed to answer them. |
| **Research** | Find out how scientific ideas have changed / developed over time  Articulate and explain findings from their research using scientific knowledge and understanding. | Research how scientific ideas have developed over time and had an impact on our lives. |
| **Planning and testing** | Make decisions about which **variables** to change, measure and keep the same | Identify **variables** to change, measure and keep the same in order for a test to be **fair** |
| **Using equipment and measures** | Make their own decisions about what observations to make or measurements to use and how long to take them for (recognising the need for repeat readings on some occasions).  Units  Accurate | Decide whether to **repeat** any **readings** and justify the reason for doing so.  Make their own decisions about what measurements to take (and begin to identify the ranges used).  Use equipment fit for purpose to take measurements which are increasingly **accurate** and precise |
| **Communicating** | Use their developing scientific knowledge and understanding and relevant scientific language and terminology to communicate more abstract concepts  Present and explain their findings through talk, in written forms or in other ways (e.g. using technology) for a range of audiences / purposes.  Record data and results of increasing  Complexity using different formats e.g. tables, annotated scientific diagrams, classification keys, graphs and models. | Articulate understanding of the concept using scientific language and terminology when describing abstract ideas, observations and findings |
| **Conclusions** | Describe straightforward patterns in results linking cause and effect e.g. using er or the word ‘more’  Comment on the results and whether they **support** the initial **prediction.**  Use their scientific knowledge and understanding and appropriate scientific language and terminology to explain their findings and data and answer their initial question.  Draw a valid **conclusion** (explain *why* it happened) based on their data and observations  Begin to recognise how repeated readings improve the **reliability** of results.  Compare results with others and comment on how **reliable** they are. | Identify patterns in results collected and describe them using the **change and measure variables**  Independently form a conclusion which draws on the **evidence** from the test  Use scientific language and terminology to explain why something happened.  Describe how to improve planning to produce more **reliable** results |

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| **Year 5 & 6**  **Cycle A** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Earth and Space** | **Pupils should be taught to:**   * **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.** | * Pupils should be introduced to a model of the Sun and Earth that enables them to explain day and night. Pupils should learn that the Sun is a star at the centre of our solar system and that it has eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Pluto was reclassified as a ‘dwarf planet’ in 2006). They should understand that a moon is a celestial body that orbits a planet (Earth has one moon; Jupiter has four large moons and numerous smaller ones). * **Note:** Pupils should be warned that it is not safe to look directly at the Sun, even when wearing dark glasses. * Pupils should find out about the way that ideas about the solar system have developed, understanding how the geocentric model of the solar system gave way to the heliocentric model by considering the work of scientists such as Ptolemy, Alhazen and Copernicus. | comparing the time of day at different places on the Earth through internet links and direct communication; creating simple models of the solar system; constructing simple shadow clocks and sundials, calibrated to show midday and the start and end of the school day; finding out why some people think that structures such as Stonehenge might have been used as astronomical clocks. |
| **Substantive Knowledge**  **(sticky learning)** | The Sun, Earth and Moon are approximately spherical bodies  The sun is a star at the centre of our solar system  The Earth and the planets orbit the sun  A moon is a celestial body that orbits a planet  Earth has one Moon and the Moon’s orbit gives rise to the phases of the moon we observe on earth  The Earth’s rotation about its axis explains day and night and the apparent movement of the sun across the sky | **Key Vocabulary** |  |
| **Forces** | **Pupils should be taught to:**   * **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.** | * Pupils should explore falling objects and raise questions about the effects of air resistance. They should explore the effects of air resistance by observing how different objects such as parachutes and sycamore seeds fall. * They should experience forces that make things begin to move, get faster or slow down. Pupils should explore the effects of friction on movement and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel. Pupils should explore the effects of levers, pulleys and simple machines on movement. * Pupils might find out how scientists, for example, Galileo Galilei and Isaac Newton helped to develop the theory of gravitation. | Exploring falling paper cones or cup-cake cases, and designing and making a variety of parachutes and carrying out fair tests to determine which designs are the most effective.  They might explore resistance in water by making and testing boats of different shapes.  They might design and make products that use levers, pulleys, gears and/or springs and explore their effects. |
| **Substantive Knowledge**  **(sticky learning)** | Unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object  Air resistance, water resistance and friction, that act between moving surfaces  Air resistance, water resistance and friction slow moving objects  Some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. | **Key Vocabulary** |  |
| **Light** | **Pupils should be taught to:**   * **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.** | |  | | --- | | Pupils should build on the work on light in year 3, exploring the way that light behaves, including light sources, reflection and shadows. They should talk about what happens and make predictions. | | deciding where to place rear-view mirrors on cars; designing and making a periscope and using the idea that light appears to travel in straight lines to explain how it works. They might investigate the relationship between light sources, objects and shadows by using shadow puppets. They could extend their experience of light by looking a range of phenomena including rainbows, colours on soap bubbles, objects looking bent in water and coloured filters (they do not need to explain why these phenomena occur). |
| **Substantive Knowledge**  **(sticky learning)** | Light travels in straight lines  We see things because light travels from light sources to our eyes or light sources to objects and then to our eyes  Shadows have the same shape as the objects that cast them | **Key Vocabulary** |  |
| **Living Things and their Habitat** | |  | | --- | | **Pupils should be taught to:**   * **Describe the differences in the life cycle of a mammal, an amphibian, an insect and a bird** * **Describe the life processes of reproduction in some plants and animals** * **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** * **Give reasons for classifying plants and animals based on specific characteristics.** | | * Pupils should study and raise questions about their local environment throughout the year. They should observe life cycle changes in a variety of living things, for example, plants in the vegetable garden or flower border, and animals in the local environment. The should find out about the work of naturalists and animal behaviourists, for example, **David Attenborough and Jane Goodall** * Pupils should find out about different types of reproduction, including sexual and asexual reproduction in plants, and sexual reproduction in animals * Pupils should build on their learning about grouping living things in year 4 by looking at the classification system in more detail. * They should be introduced to the idea that broad groupings, such as micro-organisms, plants and animals can be subdivided. * Through direct observations where possible, they should classify animals into commonly found invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals). * They should discuss reasons why living things are placed in one group and not another. * Pupils might find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification. | * Observing and comparing the life cycles of plants and animals in their local environment with other plants and animals around the world (in the rainforest, in the oceans, in deserts areas and in prehistoric times) asking pertinent questions and suggesting reasons for similarities and differences. They might try to grow new plants from different parts of the parent plant, for example seeds, stem and root cuttings, tubers, bulbs. They might observe changes in an animals over a period of time (for example, by hatching and rearing chicks) comparing how different animals reproduce and grow. * Using classification systems and keys to identify some animals and plants in the immediate environment. * They could research unfamiliar animals and plants from a broad range of other habitats and decide where they belong in the classification system. |
| **Substantive Knowledge**  **(sticky learning)** | All livings things have a different life cycle with different stages – they are born, grow, reproduce, die  There are differences in the life cycles of mammals, amphibians, insects and birds  Living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals | **Key Vocabulary** |  |

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| **Year 5 & 6**  **Cycle B** | **Statutory Objectives** | **Non-statutory guidance** | **Pupils might work scientifically by:** |
| **Animals including Humans** | **Pupils should be taught to:**   * **Describe the changes as humans develop into old age** * **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.** | * Pupils should draw a timeline to indicate stages in the growth and development of humans. They should learn about the changes experienced in puberty. (Link to PSHE)  |  | | --- | | * Pupils should build on their learning from years 3 and 4 about the main body parts and internal organs (skeletal, muscular and digestive system) to explore and answer questions that help them to understand how the circulatory system enables the body to function. * Pupils should learn how to keep their bodies healthy and how their bodies might be damaged – including how some drugs and other substances can be harmful to the human body. | | * Pupils could work scientifically by researching the gestation periods of other animals and comparing them with humans; by finding out and recording the length and mass of a baby as it grows * Exploring the work of scientists and scientific research about the relationship between diet, exercise, drugs, lifestyle and health. |
| **Substantive Knowledge**  **(sticky learning)** | Describe the changes as humans develop to old age  Nutrients and water are transported via the circulatory system within animals, including humans  The circulatory system includes the heart, lungs, arteries, veins and blood  Know the function of the heart, blood vessels and blood (the heart is the pump; the blood vessels (arteries and veins) contain blood and the blood has different components which between them transport oxygen, nutrients and water around the body  Diet, exercise, drugs and lifestyle have an impact on our body’s function | **Key Vocabulary** |  |
| **Electricity** | **Pupils should be taught to:**   * **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.** | |  | | --- | | Building on their work in year 4, pupils should construct simple series circuits, to help them to answer questions about what happens when they try different components, for example, switches, bulbs, buzzers and motors. They should learn how to represent a simple circuit in a diagram using recognised symbols.  **Note:** Pupils are expected to learn only about series circuits, not parallel circuits. Pupils should be taught to take the necessary precautions for working safely with electricity | | Pupils might work scientifically by: systematically identifying the effect of changing one component at a time in a circuit; designing and making a set of traffic lights, a burglar alarm or some other useful circuit. |
| **Substantive Knowledge**  **(sticky learning)** | Electricity is transferred from the power supply to the components of a circuit  The brightness of a lamp or the volume of a buzzer is associated with the number and voltage of cells used in the circuit  Recognised symbols are used to represent a simple circuit in a diagram | **Key Vocabulary** |  |
| **Properties and changes of materials** | * **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.** | * Pupils should build a more systematic understanding of materials by exploring and comparing the properties of a broad range of materials, including relating these to what they learnt about magnetism in year 3 and about electricity in year 4. * They should explore reversible changes, including, evaporating, filtering, sieving, melting and dissolving, recognising that melting and dissolving are different processes. * Pupils should explore changes that are difficult to reverse, for example, burning, rusting and other reactions, for example, vinegar with bicarbonate of soda. * They should find out about how chemists create new materials, for example, Spencer Silver, who invented the glue for sticky notes or Ruth Benerito, who invented wrinkle-free cotton. * **Note:** Pupils are not required to make quantitative measurements about conductivity and insulation at this stage. It is sufficient for them to observe that some conductors will produce a brighter bulb in a circuit than others will and that some materials will feel hotter than others will when a heat source is placed against them. Safety guidelines should be followed when burning materials | * carrying out tests to answer questions, for example, ‘Which materials would be the most effective for making a warm jacket, for wrapping ice cream to stop it melting, or for making blackout curtains?’ * They might compare materials in order to make a switch in a circuit. * They could observe and compare the changes that take place, for example, when burning different materials or baking bread or cakes. * They might research and discuss how chemical changes have an impact on our lives, for example, cooking, and discuss the creative use of new materials such as polymers, super-sticky and super-thin materials. |
| **Substantive Knowledge**  **(sticky learning)** | Some solid materials will dissolve in liquid to form a solution and others will not  Substances can be separated from a solution  Mixtures can be separated through filtering, sieving and evaporating  Dissolving, mixing and changes in state are reversible changes  Some changes result in the formation of new materials and this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda. | **Key Vocabulary** |  |
| **Evolution and Inheritance** | **Pupils should be taught to:**   * **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.** | |  | | --- | | * Building on what they learned about fossils in the topic on rocks in year 3, pupils should find out more about how living things on earth have changed over time. * They should be introduced to the idea that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, Labradors are crossed with poodles. * They should also appreciate that variation in offspring over time can make animals more or less able to survive in particular environments, for example, by exploring how giraffes’ necks got longer, or the development of insulating fur on the arctic fox. * Pupils might find out about the work of palaeontologists such as **Mary Anning** and about how **Charles Darwin** and **Alfred Wallace** developed their ideas on evolution. * **Note:** At this stage, pupils are not expected to understand how genes and chromosomes work. | | * observing and raising questions about local animals and how they are adapted to their environment * comparing how some living things are adapted to survive in extreme conditions, for example, cactuses, penguins and camels. * They might analyse the advantages and disadvantages of specific adaptations, such as being on two feet rather than four, having a long or a short beak, having gills or lungs, tendrils on climbing plants, brightly coloured and scented flowers. |
| **Substantive Knowledge**  **(sticky learning)** | Living things have changed over time  Fossils provide information about living things that inhabited the Earth millions of years ago  Living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents  Characteristics of off-spring can be inherited or non-inherited  Adaption may lead to evolution  Animals and plants are adapted to suit their environments in different ways  Physical and behaviour characteristics of plants and animals are related to their survival or extinction | **Key Vocabulary** |  |