Moortown Primary

Our curriculum guide: Science

Date: September 2023 and reviewed on an on-going basis

Introduction

This Curriculum Guide relates to Science, a core subject in the National Curriculum (Department for Education, 2014). It sits alongside similar documents for Early Years, Reading, Writing, Maths, Topics and others.

We want Sphere Federation schools to be happy and healthy places to learn. This core aim permeates our schools and their ethos, whether in the classroom or around and about school. (*At St James' CE Primary, this is expressed slightly differently: 'happy and healthy place to achieve and believe'.*)

The knowledge and skills we are required to teach are set out in the National Curriculum. We set these out in a year-group based sequence of learning (age-related expectations). Alongside these statutory curriculum requirements, there is additional or explicit learning, too.

Curriculum structure

The programmes of study set out in the National Curriculum can be grouped into the three main areas of science: biology, chemistry and physics. In the table below, the number in brackets indicates the number of times the unit appears across Key Stage 1 and 2 in the National Curriculum, although it's important to note the large overlap in many of the units, such as the four chemistry units.

Pupils are also taught about working scientifically – using practical scientific methods, processes and skills – through the teaching of the programmes of study.

biology	chemistry	physics
• animals, including humans (6) • living things and their habitats (4) • plants (3) • evolution and inheritance (1)	• materials (3) • states of matter (1) • rocks (1)	• seasonal changes (1) • light (2) • forces and magnets (2) • sound (1) • electricity (2) • earth and space (1)

working scientifically

Working scientifically skills ensure children learn about the discipline of Science as well as the substantive knowledge set out in the National Curriculum.
The skills are embedded within lessons. This allows children to revisit and secure these skills across a Science unit and across the years. Typically, there is sufficient time within the Science curriculum for children to plan and develop their own investigations. For example, an enquiry in Year 4 about the freezing points of different liquids may be developed by children into a subsequent activity which investigates if the freezing points change when liquids are mixed together.
Each science unit features scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. The five types of scientific enquiry are:

- observing over time
- pattern seeking
- identifying, classifying and grouping
- comparative and fair testing (controlled investigations)
- research using secondary sources

Key elements

The following are some of the key elements of our Science curriculum.

Cross-curricular links

Our Science curriculum goes beyond the statutory content set out in the National Curriculum – see our age-related expectations (below). Like English and Maths, Science is a **core subject** and is taught as a discrete subject. However, there are close links with other subjects. When reading cross-curricular texts, teachers support children to read as a 'subject expert': in this case, reading as a scientist. In addition, there are often links with many subjects. For example, Biology links to Geography (eg learning about the environment); and the collection and presentation of data links to Computing.

Spiritual, moral, social and cultural development (SMSC)

The National Curriculum states: 'Every state-funded school must offer a curriculum which is balanced and broadly based and which: promotes the spiritual, moral, cultural, mental and physical development of pupils at the school and of society' (2.1, p5). Science provides opportunities to promote SMSC; for example:

- spiritual: developing a sense of awe and wonder at the complexity and pattern in natural phenomena
- moral: looking at good and bad uses of drugs; moral issues in the human food chain
- social: looking at ways in which the environment needs protection
- cultural: scientific development in relation to others – water supplies, new varieties of flowers and food crops

Vocabulary

Within each Science unit of learning, there are key words and phrases that we want our children to know. These are subject-specific but might relate to previous as well as current units.

- At the start of the unit, there is a class assessment, where teachers introduce the key vocabulary and gauge the knowledge and understanding of the words as a whole class.
- Throughout the unit, these words are taught and used. Children might review/revise/re-cap key vocabulary at the start of lessons, too.
- At the end of the unit, children demonstrate their knowledge and understanding of the vocabulary. They may also use and apply the words in a review of some sort.

Resources

Teachers use the White Rose Science schemes of learning as the basis of their planning whilst using their professional judgement to adapt these to meet the needs of their class. The schemes of learning include:

- **Teacher guidance:** National Curriculum links, key questions, vocabulary, potential misconceptions, enquiry questions (when relevant), cross-curricular links, background subject knowledge
- **Small steps:** lessons are carefully sequenced ensuring coherent progression through a unit of learning; accompanying notes provide teachers with practical ideas and key knowledge
- **Working scientifically:** each step has a working scientifically skill focus which develops across year groups and has practical enquiry at their core, as well as opportunities to research scientific ideas; the scheme equips children with the working scientifically skills they need as well as opportunities to engage with the five scientific enquiry types

Scientists and careers

Across the Key Stage 1 and 2 Science curriculum, we've planned for children to learn about different scientists. The scientists we've chosen represent diversity across a range of different scientific fields. Some are especially known, such as Alexander Graham Bell and Charles Darwin. Others are less well-known but just as inspiring: female scientists and scientists from a non-white background, contemporary scientists, as well as celebrated pioneers from the past.

We've also make links between Science and related careers. The aim is to show children that people use science in a wide range of careers. For example, a talk from a structural engineer highlights how she uses KS2 forces knowledge in her career. Another talk from a sound engineer takes pupils on a tour of a theatre and how he needs to make sure that the audience can hear what's happening on stage. In all of these talks, children have the opportunity to ask the person questions about their career and education. We constantly look for these opportunities with STEM Ambassadors.

Revisiting prior learning

We teach Science as part of a spiral curriculum:

> *'A spiral curriculum is one in which there is an iterative revisiting of topics, subjects or themes throughout the course. A spiral curriculum is not simply the repetition of a topic taught. It requires also the deepening of it, with each successive encounter building on the previous one.'*
> 'What is a spiral curriculum?', R M Harden, 2009

Teachers provide regular opportunities for children to revisit prior learning through retrieval practice at the beginning of each lesson; this learning could be from the previous lesson, week, term or year. The science units are carefully planned to allow children to build on and revisit previously taught learning. For example, in one particular year, children learn about skeletons in the Autumn term and fossils in Spring, with one helping to inform the other.

Adaptive teaching

Adaptive teaching is about being responsive: adjusting teaching to better match pupil need. The extent of adaptation varies depending on individual contexts. Adaptations might include:

- targeted/tailored support
- additional practice
- breaking down content into smaller components
- teaching carefully selected groups
- well-chosen books and other resources

All three schools in Sphere Federation are inclusive and are committed to meeting the needs of children with SEND in **the most effective way** so that they achieve **the best possible outcomes**:

- we want pupils with SEND to acquire the knowledge and skills they need to reach their full potential,
- to be ready for the next stage in their education and,
- ultimately, to succeed in life.

To do this, we adapt how we implement the Science curriculum to meet the needs of pupils with SEND so that we can develop their knowledge, skills and abilities to apply what they know and can do with increasing fluency and independence. The adaptations we make are appropriate and reasonable, and are made in accordance with the Equality Act 2010 and the SEND code of practice.

Similarly, teachers provide opportunities for challenge and deeper learning. Challenge may be seen in pupils' exercise books: for example, teacher feedback which provides an additional task or thought-provoking question, or an open-ended activity that promotes reasoning. However, often the challenge may not be evident in books; for example, challenge might be provided by less support during the teacher input; an additional, practical task that isn't recorded; and teacher questioning which is targeted to meet the needs of different pupils.

Occasionally, teachers may also adapt teaching by deviating from the Science unit if it ensures learning is responsive and relevant. An example would be responding to significant local, national and world events, such as the Covid epidemic or a significant event in space. This flexibility is important as it provides opportunities for teachers to explore other aspects of learning within or beyond the Science curriculum – learning which is more spontaneous in that it meets children's questions, needs and interests in a responsive, more 'organic' way.

Monitoring and evaluating

We continually review the Science curriculum, evaluating its impact on children's learning over time.

We measure pupil achievement – the acquisition of knowledge and skills – and progress using a number of strategies, including:

- on-going teacher assessments, based on questioning in class, observations and pupil outcomes (which includes their work in books), supported by moderation in school and across Sphere Federation
- at the end of each half-term, pupils complete online assessments which provide teachers and senior leaders with information about impact and this informs next steps
- the acquisition of vocabulary and knowledge through book scrutinies, learning conversations and learning walks
- at the end of the year, more formal assessment, with data submitted to senior leaders who track attainment and progress to measure impact.

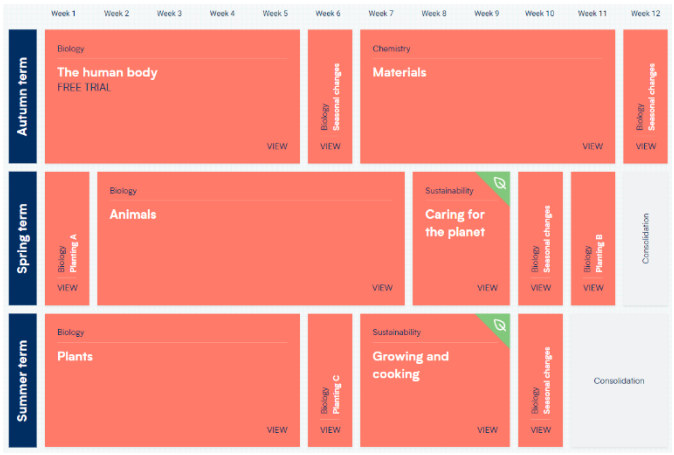
Scrutiny of progress in books and learning conversations with children are key ways to assess impact. We explore how successful our children have been in acquiring knowledge and skills in relation to their stage of learning. In conversations with children, teachers and school leaders ask questions relating directly to age-related expectations and to times when they might have needed more support or when they experienced greater challenge. Lesson visits and the monitoring of planning support our assessment of impact. Whole school areas for development are identified as a result of evaluating the impact of what we do.

We also evaluate impact by measuring pupil attitudes using a number of strategies, including feedback during learning conversations and in pupil and parent/carer surveys; attitudes and behaviour in lessons across the curriculum; and the quality of the work they produce, including taking pride in presentation.

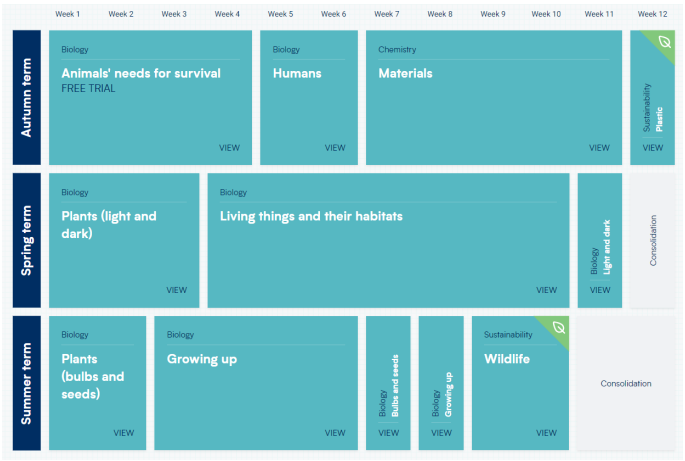
Long-term plans

We follow the White Rose Science schemes of learning. Teachers use professional judgement to adapt these to meet the needs of their class. The Science curriculum is split into units which are written for content rather than time. This ensures that children are developing a solid understanding of scientific processes and concepts.

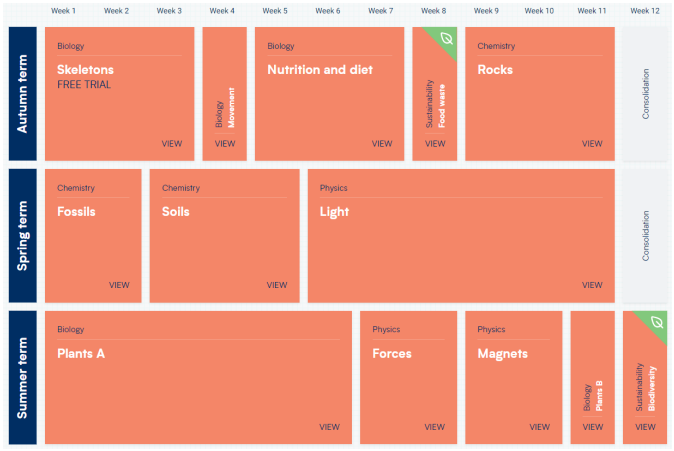
Year 1



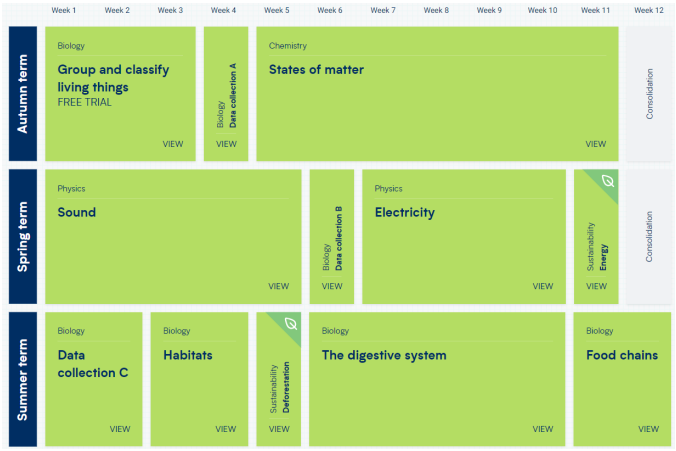
Year 2



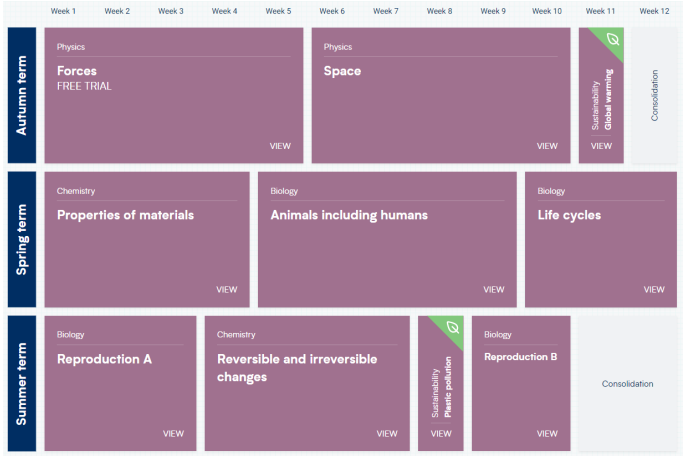
Year 3



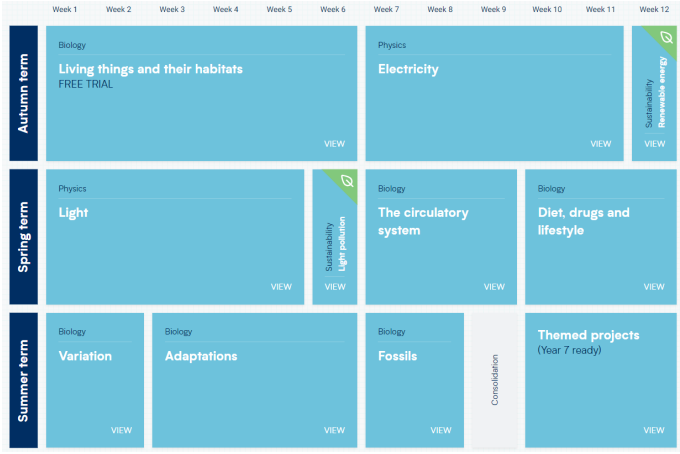
Year 4



Year 5



Year 6



Featured scientists

Across the Key Stage 1 and 2 Science curriculum, we've planned for children to learn around 25 different scientists. The scientists we've chosen represent diversity across a range of different scientific fields. Some are especially known, such as Alexander Graham Bell and Charles Darwin. Others are less well-known but just as inspiring: female scientists and scientists from a non-white background, contemporary scientists as well as celebrated pioneers from the past.

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Materials *(Autumn Unit 3)* Scientist: John Dunlop **Animals** *(Spring Unit 2)* Scientist: George Mottershead **Plants** *(Summer Unit 1)* Scientist: Jeane Baret	**Humans** *(Autumn Unit 2)* Scientist: Florence Nightingale **Animals** *(Autumn Unit 3)* Scientist: Charles Macintosh	**Skeletons** *(Autumn Unit 1)* Scientist: Marie Curie (focussing on her work on x-rays) **Fossils** *(Spring Unit 1)* Scientist: Mary Anning **Plants** *(Summer Unit 1)* Scientists: Sir Joseph Banks, Tom Hart-Dyke	**Group and classify living things** *(Autumn Unit 1)* Scientist: Jane Goodall **Sound** *(Spring Unit 1)* Scientist: Alexander Graham Bell **Electricity** *(Spring Unit 3)* Scientist: Maria Telkes **Food chains** *(Summer Unit 5)* Scientist: Washington Sheffield	**Forces** *(Autumn Unit 1)* Scientist: Isaac Newton, Galileo Galilei **Space** *(Autumn Unit 2)* Scientist: Galieo Galilei, Copernicus, Maggie Aderin-Pocock **Life cycles** *(Spring Unit 3)* Scientist: David Attenborough	**Living things and their habitats** *(Autumn Unit 1)* Scientist: Carl Linnaeus, Sarah Fowler **Electricity** *(Autumn Unit 2)* Scientist: Thomas Edison, Nikola Tesla **Light** *(Spring Unit 1)* Scientist: Alhazen **Diet, drugs and lifestyle** *(Spring Unit 4)* Scientist: Marie Maynard-Daly **Variation** *(Summer Unit 1)* Scientist: Charles Darwin

Age-related expectations: **Working scientifically**

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Ask questions • I can ask simple questions **Plan** • I can verbally state what I am going to investigate. **Make observations** • I can observe closely. **Take measurements** • I can carry out simple tests using non-standard measurements when appropriate. **Gather, record and classify data** • I can gather and record simple data. • I can sort objects and living things into groups based on simple properties. **Present findings** • I can explain what I found out to an adult or a partner. **Answer questions and make conclusions** • I can answer simple questions.	**Ask questions** • I can ask simple questions and recognise that they can be answered in different ways. **Plan** • I can make simple predictions based on a question. • I can identify what I will change and keep the same. **Make observations** • I can observe carefully, using simple equipment. **Take measurements** • I can perform simple tests using standard units when appropriate. **Gather, record and classify data** • I can gather and record data in different ways to help answer questions. • I can identify and classify. **Present findings** • I can talk about what I have found out and how they found out. (non-statutory). **Answer questions and make conclusions** • I can use my observations and ideas to suggest answers to questions.	**Ask questions** • I can ask questions and understand there are different enquiry types they could use to answer them. **Plan** • I can make relevant predictions. • I can identify what I will change, observe and keep the same. • With support, I can set up simple practical enquiries. **Make observations** • I can begin to use scientific equipment to make observations. **Take measurements** • I can carry out tests and simple experiments and take measurements using standard units. **Gather, record and classify data** • I can gather and record data to help in answering questions. • I can record findings using simple scientific language, drawings, labelled diagrams, bar charts, and tables. **Present findings** • I can report on findings from enquiries, including oral and written explanations. **Answer questions and make conclusions** • I can make simple conclusions. • I can use results, findings or observations to answer questions. **Evaluate** • I can suggest questions for further investigation.	**Ask questions** • I can ask relevant questions and use different types of scientific enquiries to answer them. **Plan** • I can set up simple practical enquiries, comparative and fair tests. • I can make predictions based on simple scientific knowledge. • I can identify what I will change, observe or measure and keep the same. **Make observations** • I can make systematic and careful observations. **Take measurements** • I can take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers. **Gather, record and classify data** • I can gather, record and classify data in a variety of ways to help answer questions. • I can record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables. **Present findings** • I can report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. **Answer questions and make conclusions** • I can use straightforward scientific evidence to answer questions or to support their findings. • I can use results to draw simple conclusions. • I can begin to identify differences, similarities or changes related to simple ideas or processes. **Evaluate** • I can begin to make predictions for new values, suggest improvements and raise further questions.	**Ask questions** • I can ask scientific questions and begin to understand which questions would be best suited to each enquiry type. **Plan** • I can make predictions based on scientific knowledge. • With support, I can plan different types of scientific enquiries. • Where appropriate, I can identify the dependent, independent and controlled variables. **Make observations** • I can use a range of scientific equipment to make systematic and careful observations. **Take measurements** • I can take accurate measurements using a range of scientific equipment • I can start to take repeat readings when appropriate. **Gather, record and classify data** • I can gather, record and classify data with increasing complexity to help answer questions. • I can record data using scientific diagrams and labels, classification keys, tables, bar and line graphs. **Present findings** • I can report and present on findings from enquiries, including conclusions. • I can begin to identify causal relationships in oral and written forms such as displays and other presentations. **Answer questions and make conclusions** • I can use scientific evidence to answer questions. • I can make conclusions based on scientific evidence and from my own testing and findings. • I can identify differences, similarities or changes related to simple ideas or processes. **Evaluate** • I can make predictions for new values, suggest improvements and raise further questions.	**Ask questions** • I can ask scientific questions and choose which enquiry type would be best suited to answer them. **Plan** • I can make predictions based on scientific knowledge. • I can plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary. **Make observations** • I can use a range of scientific equipment to make systematic and careful observations with increased complexity. **Take measurements** • I can take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. **Gather, record and classify data** • I can record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. **Present findings** • I can report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written form such as displays and other presentations. **Answer questions and make conclusions** • I can identify scientific evidence that has been used to support or refute ideas or arguments. • I can use scientific evidence to answer questions. • I can make conclusions based on scientific evidence and from my own testing and findings. **Evaluate** • I can use test results to make predictions to set up further comparative and fair tests. • I can suggest investigation improvements including accuracy of results.

Vocabulary: **Working scientifically**

Year 1,2 phase	Year 3,4 phase	Year 5,6 phase
both years	**both years**	**both years**
• **to investigate**: to explore something carefully • **to sort**: to arrange things into groups • **to identify**: to spot something • **to observe**: to notice something • **to compare**: to find similarities and/or differences • **to predict**: to say that something will happen in the future • **data**: a collection of information • **pattern**: something that happens in a repeated and regular way • **equipment**: the things needed for an investigation	• **scientific enquiry**: finding things out in a scientific way (comparative and fair tests; noticing patterns; observing changes over time; grouping and classifying things; using secondary sources to find things out) • **to record findings**: to document the data you have found (eg drawings, labelled diagrams, keys, charts, tables) • **to communicate results**: to explain what you have found from the data you have recorded • **to conclude**: to reach a final decision or judgement based on results • **to classify**: to arrange things in categories based on their characteristics • **comparative and fair test**: tests which look at the relationship between different variables • **relationship**: the way in which things are connected • **variable**: something that can be changed in an experiment • **accurate**: correct information • **systematic**: doing something in an ordered, methodical way • **secondary sources**: somebody else's research which may be necessary when a practical investigation is not possible • **practical**: actually doing something	• **scientific enquiry** finding things out in a scientific way (comparative and fair tests; noticing patterns; observing changes over time; grouping and classifying things; using secondary sources to find things out) • **evidence**: facts or information which indicate if something is true or valid • **to justify**: to show or prove something • **control variable**: a variable which needs to be kept the same during an experiment • **independent variable**: the variable that is being changed during an experiment • **dependent variable**: the variable being tested or measured during an experiment • **repeat readings**: repeating an experiment to ensure that the data gathered is reliable and not a fluke • **causal relationships**: a cause and effect relationship eg the tighter the string, the higher the pitch • **degree of trust**: the level of confidence in the results of an investigation • **further test**: these may be needed if a conclusion cannot be drawn from the results or a new question arises from your results which could be tested • **to refute**: to prove something to be wrong

Age-related expectations: **Biology**

Year 1

Animals including humans

The human body *(Autumn B1)*

- I can identify, name, draw and label the basic parts of the human body and say which part of the human body is associated with each sense.

Animals *(Spring B2)*

- I can identify and name a variety of common animals, including fish, amphibians, reptiles, birds and mammals.
- I can identify and name a variety of common animals that are carnivores, herbivores and omnivores.
- I can describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).

Plants *(Summer B1)*

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

Year 2

Animals including humans

Animal needs for survival *(Autumn B1)*

- I can find out about and describe the basic needs of animals, including humans, for survival (water, food, air).

Humans *(Autumn B2)*

- I can describe the importance for humans of exercise, eating the right amount of different types of food, and hygiene.

Growing up *(Summer B2)*

- I know that animals, including humans, have offspring, which grow into adults.

Plants

Light and dark *(Spring B1)*

- I can find out and describe how plants need water, light and suitable temperature to grow and be healthy.

Bulbs and seeds *(Summer B1)*

- I can observe and describe how seeds and bulbs grow into mature plants.

Living things and their habitats *(Spring B2)*

- I can explore and compare differences between things that are living, dead and things that have never been alive.
- I know that most living things live in habitats to which they are suited; I can describe how different habitats provide for the basic needs of different kinds of animals and plants; and how they depend on each other.
- I can identify and name a variety of plants and animals in their habitats, including micro-habitats.
- I can 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.

Year 3

Animals including humans

Skeletons, Movement *(Autumn B1, B2)*

- I can identify that humans and some other animals have skeletons and muscles for support, protection and movement.

Nutrition and diet *(Autumn B3)*

- I can identify animals, including humans, need the right types and amount of nutrition, and they cannot make their own food; they get nutrition from what they eat.

Plants *(Summer B1, B4)*

- I can identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers.
- I can 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.
- I can investigate the way in which water is transported within plants.
- I can explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal

Year 4

Animals including humans

The digestive system *(Summer B4)*

- I can describe the simple functions of the basic parts of the digestive system in humans.

Food chains *(Summer B5)*

- I can identify the different types of teeth in humans and their simple functions.
- I can construct and interpret a variety of food chains, identifying producers, predators and prey.

Living things and their habitats

Group and classify living things *(Autumn B1)*

- I know that living things can be grouped in a variety of ways.
- I can explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.

Habitats *(Summer B2)*

- I know that environments can change and that this can sometimes pose dangers to living things.

Year 5

Animals including humans *(Spring B2)*

- I can describe the changes as humans develop to old age.

Living things and their habitats

Life cycles *(Spring B3)*

- I can describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.

Reproduction A *(Summer B1)* **and B** *(Summer B4)*

- I can describe the life processes of reproduction in some plants and animals.

Year 6

Animals including humans

The circulatory system *(Spring B3)*

- I can identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- I can describe the ways in which nutrients and water are transported within animals, including humans.

Diet, drugs and lifestyle *(Spring B4)*

- I am aware of the impact of diet, exercise, drugs and lifestyle on the way my body functions.

Living things and their habitats *(Autumn B1)*

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

Evolution and inheritance

Variation *(Summer B1)*

- I know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.

Adaptations *(Summer B2)*

- I can identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Fossils *(Summer B3)*

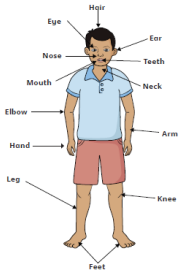
- I know that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.

Vocabulary: **Biology**

Year 1

Animals including humans

The human body *(Autumn B1)*



Animals *(Spring B2)*

- **animal**: a living creature
- **mammal**: an animal with hair or fur on its body
- **bird**: an animal with feathers, wings and a beak
- **fish**: animals that live in water and have fins and gills
- **amphibian**: an animal that lives on land and water
- **reptile**: an animal with dry scales on its body
- **carnivore:** an animal that eats other animals
- **herbivore:** an animal that eats plants
- **omnivore:** an animal that eats other animals and plants

Plants *(Summer B1)*

- **leaf:** the flat, usually green part of a plant
- **roots:** the underground part of a plant
- **flower:** the part of a plant that is often brightly coloured
- **stem:** the upright part of a plant, which is usually green
- **wildflower:** a plant that has not been chosen by humans to grow in their garden
- **garden flower:** a plant that has been chosen by humans to grow in their garden
- **deciduous tree:** a type of tree that loses its leaves in autumn
- **evergreen tree:** a tree that keeps its leaves all year round

Year 2

Animals including humans

Animal needs for survival *(Autumn B1)*

- **basic needs**: the things that an animal needs to live (air, water, food, shelter)
- **shelter**: a place that gives protection from weather or danger
- **shelter**: a place that gives protection from weather or danger
- **mammal**: an animal with hair or fur on its body
- **bird**: an animal with feathers, wings and a beak
- **fish**: animals that live in water and have fins and gills
- **amphibian**: an animal that lives on land and water
- **reptile**: an animal with dry scales on its body
- **insect**: a small animal that has three body sections and six legs

Humans *(Autumn B2)*

- **heart**: the muscle inside your chest which pumps blood around the body
- **exercise**: physical activities that make your body strong and healthy
- **germs**: tiny living things that can cause illness
- **hygiene**: keeping yourself and your surroundings clean

Growing up *(Summer B2)*

- **life cycle:** the stages a living thing goes through
- **offspring:** the young of a living thing
- **growth:** when a living thing gets bigger
- **egg:** contains the offspring of birds, amphibians and reptiles
- **adult:** the stage when a living thing is fully grown
- **parent:** an adult that has offspring

Plants

Light and dark *(Spring B1)*

- **plant:** a living thing that usually grows in soil
- **flower:** the part of a flower that blooms
- **seed:** a part of a plant that can grow into a new plant
- **fruit:** a part of a plant that contains seeds
- **vegetable:** a part of a plant that can be eaten as food

Year 3

Animals including humans

Skeletons *(Autumn B1)*

- **skeleton**: a collection of bones that provide protection and support movement; this appears different in different animals
- **exoskeleton**: a form of skeleton on the outside of an animal's body that provides support and protection
- **spine**: a group of small bones stacked on top of each other in the back; also known as the 'backbone'

Movement *(Autumn B2)*

- **joint**: a point where two or more bones meet
- **muscle**: works with joints and bones to allow movement
- **contracting**: a tightening and shortening motion
- **relaxing**: a relaxing and lengthening motion

Nutrition and diet *(Autumn B3)*

- **diet**: the food a living thing needs
- **balanced diet**: a diet that fulfills a person's nutritional needs
- **nutrition**: taking in and using food to keep the body healthy

Plants *(Summer B1, B4)*

- **leaf**: absorbs sunlight to make food for the plant
- **stem**: carries water to different parts of the plant
- **roots:** absorb water and nutrients from the soil and hold the plant in place
- **flower:** helps the plant to reproduce and create new life
- **soil:** contains water and nutrients that plants use to grow and stay healthy
- **germination:** the process of a seed breaking its coating and sending out its first leaves and roots
- **pollination:** the transfer of pollen from the male part of a plant to the female part of a plant
- **seed dispersal:** the movement of seeds away from the parent plant

Year 4

Animals including humans

The digestive system *(Summer B4)*

- **incisors**: flat teeth at the front of the mouth that are used to bite into food
- **canines**: sharp, pointed teeth that help with ripping and tearing
- **molars**: the large teeth at the back of the mouth used to grind and chew food
- **enamel**: the protective layer of a tooth
- **decay**: a process of a material breaking down
- **digestive system**: organs working together to break down food into smaller pieces
- **oesophagus**: the organ that pushes food from the mouth to the stomach
- **stomach**: the organ that squeezes and breaks down food
- **intestines (small and large)**: the organs that absorb nutrients and water from food
- **rectum:** part of the large intestine where waste exits the body

Food chains *(Summer B5)*

- TBC

Living things and their habitats

Group and classify living things *(Autumn B1)*

- **vertebrate**: an animal with a spine
- **invertebrate**: an animal without a spine
- **mammal**: an animal with a spine, fur or hair on its body and feeds its young on milk
- **bird**: an animal with a spine, feathers, wings and beak
- **fish**: animals with a spine that live in water and have fins and gills; most fish have scales
- **amphibian**: an animal with a spine that lives on land and in water
- **reptile**: an animal with a spine and dry scales on its body
- **flowering plant**: a plant that can produce flowers and fruit

Year 5

Animals including humans

(Spring B2)

- **foetus:** an unborn baby growing inside the mother's womb
- **womb:** the organ in mammals in which a baby develops
- **period:** normal bleeding from the vagina that is part of a female's monthly cycle
- **reproduce:** to produce offspring
- **hormone:** a chemical released by the body that causes physical and emotional changes during puberty
- **life expectancy:** the average time a person may expect to live
- **gestation:** the period of time that a foetus develops in its mother's womb

Living things and their habitats

Life cycles *(Spring B3)*

- **life cycle:** a series of stages a living thing goes through during its life
- **offspring:** the young of a living thing
- **metamorphosis:** the process by which the young form of an insect or amphibian changes into a distinct adult form

Reproduction A and B *(Summer B1) (Summer B4)*

- **pollination:** the transfer of pollen from the male part of a plant to the female part of a plant
- **pollen:** tiny grains which carry the male sex cell in plants
- **stamen:** the male parts of a flowering plant
- **pistil:** the female parts of a flowering plant
- **fertilisation:** the joining of a male and a female sex cell to create a new life
- **asexual reproduction:** the production of identical offspring from only one parent

Year 6

Animals including humans

The circulatory system *(Spring B3)*

- **circulatory system**: parts of the body that work together to move blood around the body
- **heart**: the organ responsible for pumping blood around the body
- **blood vessels**: tubes within the body that carry blood
- **red blood cells:** part of the blood that carries oxygen and removes waste products
- **white blood cells:** part of the blood that fights viruses and bacteria

Diet, drugs and lifestyle *(Spring B4)*

- **balanced diet:** a diet that fulfils a person's nutritional needs
- **calories:** a measure of energy taken from the food or drinks a person consumes
- **unsaturated fats:** fats that have a positive impact on the body
- **saturated fats:** fats commonly found in animal-based foods
- **drug:** a chemical that can change the way your body or brain functions
- **painkiller:** drugs that help the body dull pain

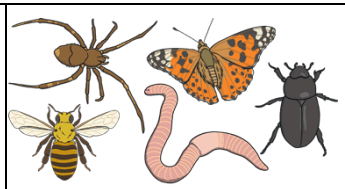
Living things and their habitats *(Autumn B1)*

- **organism**: a living thing such as an animal or a plant
- **classification key**: a way of separating organisms into groups or types
- **classification**: a method of arranging organisms into groups
- **characteristics**: features of an organism
- **microorganism**: tiny organisms such as bacteria, viruses and fungi
- **taxonomy**: the science of naming, describing and classifying organisms

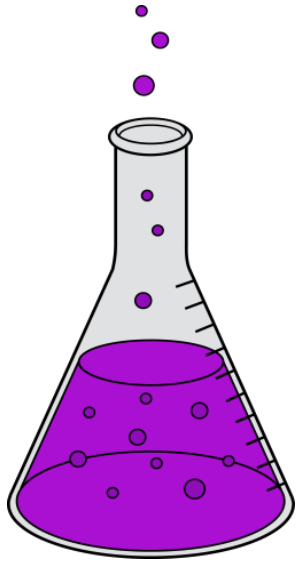
Evolution and inheritance

Variation *(Summer B1)*

- **variation**: differences between organisms

	• **stem:** the long and thin part of a plant that grows from the stem or branch • **leaf:** the flat, green part of a plant that grows from the stem or branch • **trunk:** the main stem of a tree • **branch:** the part of a tree that grows from the trunk **Bulbs and seeds** *(Summer B1)* • **bulb:** a part of a plant which stores food and is found underground • **seed:** a part of a plant that can grow into a new plant • **compost:** a material used to help plants grow **Living things and their habitats** *(Spring B2)* • **habitat:** a place where an animal or plant lives • **deciduous:** a tree that loses its leaves during autumn • **evergreen:** a tree that keeps its leaves all year round • **microhabitat:** a very small habitat • **diet:** the food eaten by an animal • **food chain:** the order in which energy is passed from one plant or animal to another when they are eaten • **living:** something that is alive • **dead:** something that was once living but is now not alive • **never alive:** something that has never been living		• **non-flowering plant**: a plant that does not produce flowers or fruit **Habitats** *(Summer B2)* • **habitat**: an area where animals and plants live • **rural habitat**: area of countryside with few buildings • **urban habitat**: area with many buildings where people live and work • **biodiversity**: the variety of living things in a habitat		• **inheritance**: the passing on of characteristics from parent to offspring • **desirable characteristics**: features of organisms that we prefer **Adaptations** *(Summer B2)* • **adaptations**: characteristics which improve the chances of survival in a habitat • **evolution**: the process where descendants develop different characteristics from their ancestors, eventually creating new species • **theory**: an explanation which is supported by the available evidence • **natural selection**: the process where organisms which are better adapted to their habitat are more likely to survive and reproduce **Fossils** *(Summer B3)* • **fossil**: the imprint in a rock of a living thing that lived a long time ago • **rock**: a natural material found on or underneath the Earth's crust • **palaeontologist**: a scientist who studies fossils

Age-related expectations: **Chemistry**

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Materials *(Autumn B3)* • I can distinguish between an object and the materials from which it is made. • I can identify and name a variety of everyday materials, including wood, plastic, glass, metal, water and rock. • I can describe the simple physical properties of a variety of everyday materials. • I can compare and group together a variety of everyday materials on the basis of their simple physical properties.	**Materials** *(Autumn B3)* • I can identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, rock, brick, paper and cardboard for particular uses. • I can find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. .	**Rocks** **Rocks** *(Autumn B5)* • I can compare and group different rocks on the basis of their appearance and simple physical properties. **Fossils** *(Spring B1)* • I can describe in simple terms how fossils are formed when things that have lived are trapped within rock. **Soils** *(Spring B2)* • I can recognise that soils are made from rocks and organic matter.	**States of matter** *(Autumn B3)* • I can compare and group materials together, according to whether they are solids, liquids or gases. • I can 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). • I can identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	**Properties and changes of materials** **Properties of materials** *(Spring B1)* • I can 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. • I know that some materials will dissolve in liquid to form a solution. • I can describe how to recover a substance from a solution. • I can use their knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. • I can give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. **Reversible and irreversible changes** *(Summer B2* • I can demonstrate that dissolving, mixing and changes of state are reversible changes. • I can 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: **Chemistry**

Year 1

Materials *(Autumn B3)*

- **material**: what an object is made from
- **soft**: a material that can easily change shape or is gentle to touch
- **hard**: not easily broken or bent
- **shiny**: a smooth surface that can reflect light easily
- **dull**: not clear, bright or shiny
- **rough**: a bumpy or uneven surface to touch
- **smooth**: an even surface to touch
- **melt**: when a solid changes to a liquid
- **freeze:** when a liquid changes to a solid

Year 2

Materials *(Autumn B3)*

- **natural material**: a material that comes from animals, plants or the Earth
- **man-made material**: a material made by humans
- **recycle**: to change rubbish into a material that can be used again
- **flexible**: can change shape easily
- **rigid**: cannot change shape easily
- **brittle**: can be easily broken
- **transparent**: materials you can see through
- **opaque**: materials you cannot see through
- **fabric**: a material made from weaving or knitting threads together

Year 3

Rocks

Rocks *(Autumn B5)*

- **rock**: a hard material made from one or more minerals
- **mineral**: a natural substance that makes up rock
- **crystal**: a clear, transparent mineral
- **grain**: a rough texture in a rock
- **layers**: sheets of rock that sit on top of each other (like layers of paper)
- **texture**: what something looks and feels like
- **reaction**: a change which can be observed (temperature, bubbles or colour
- **weathering**: the breaking down of rocks over time

Fossils *(Spring B1)*

- **fossil:** the remains or trace of a living thing that lived a long time ago
- **fossilisation**: the process through which a fossil is formed
- **sediment:** small pieces of soil, sand, gravel and small rocks

Soils *(Spring B2)*

- **soil:** a mixture of small rocks, organic matter and water
- **organic matter:** the remains of dead animals and plants
- **nutrients:** substances found in soil which help plants grow
- **absorb:** to take in water

Year 4

States of matter *(Autumn B3)*

- **solid**: a material or object with a defined shape and a fixed volume
- **liquid**: a state of matter with no fixed shape but a fixed volume
- **gas**: a state of matter with no fixed shape and no fixed volume
- **volume**: the amount of space a solid, liquid or gas takes up
- **states of matter**: these are solids liquids or gases
- **condensation**: that state change where gas turns to a liquid
- **evaporation**: the state change when a liquid turns to a gas
- **water cycle**: the natural recycling and movement of water on planet Earth
- **precipitation**: liquid or frozen water that falls back to Earth from the atmosphere (eg rain, hail, sleet or snow)
- **water vapour**: the gaseous state of water

Year 5

Properties and changes of materials

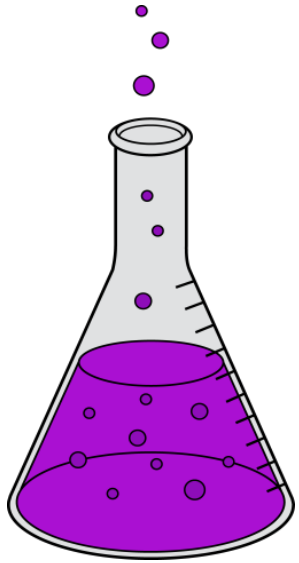
Properties of materials *(Spring B1)*

- **electrical conductor:** a material that lets electricity pass through it
- **electrical insulator:** a material that does not let electricity pass through it
- **thermal insulator:** a material that does not let heat pass through it easily or quickly
- **thermometer:** a piece of equipment used to measure temperature
- **anomalous result:** a result that does not fit in with the pattern of other results

Reversible and irreversible changes *(Summer B2*

- **dissolve:** when a solution is made from a liquid and one other substance
- **soluble:** can dissolve in a liquid
- **insoluble:** cannot dissolve in a liquid
- **solution:** made by dissolving a substance in a liquid
- **substance:** what something is made up of
- **mixture:** two or more substances that can easily be separated
- **evaporation:** the change of state from a liquid to a gas which happens slowly from the surface of a liquid
- **reversible change:** when a change can be undone to get the same substances back again
- **irreversible change:** when a change cannot be undone to get the same substance back again
- **chemical reaction:** a change where new substances are made

Year 6



Age-related expectations: **Physics**

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Seasonal changes *(Autumn B2, B4; Spring B4; Summer B4))* • I can observe changes across the four seasons. • I can observe and describe weather associated with the seasons and how day length varies. 		**Light** *(Spring B3)* • I know that I need light in order to see things and that dark is the absence of light. I know that light is reflected from surfaces. • I know that light from the sun can be dangerous and that there are ways to protect my eyes. • I know that shadows are formed when the light from a light source is blocked by an opaque object. • I can find patterns in the way that the size of shadows change. **Forces and magnets** **Forces** *(Summer B2)* • I can compare how things move on different surfaces. • I can notice that some forces need contact between two objects, but magnetic forces can act at a distance. **Magnets** *(Summer B3)* • I can observe how magnets attract or repel each other and attract some materials and not others. • I can 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. • I can describe magnets as having two poles. • I can predict whether two magnets will attract or repel each other, depending on which poles are facing.	**Sound** *(Spring B1)* • I can identify how sounds are made, associating some of them with something vibrating. • I know that vibrations from sounds travel through a medium to the ear. • I can find patterns between the pitch of a sound and features of the object that produced it. • I can find patterns between the volume of a sound and the strength of the vibrations that produced it. • I know that sounds get fainter as the distance from the sound source increases. **Electricity** *(Spring B3)* • I can identify common appliances that run on electricity. • I can construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. • I can 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. • I can recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit. • I can recognise some common conductors and insulators, and associate metals with being good conductors.	**Forces** *(Autumn B1)* • I can explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object. • I can identify the effects of air resistance, water resistance and friction that act between moving surfaces. • I know that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. **Earth and space** *(Autumn B2)* • I can describe the movement of the Earth, and other planets, relative to the Sun in the solar system. • I can describe the movement of the Moon relative to the Earth. • I can describe the Sun, Earth and Moon as approximately spherical bodies. • I can use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.	**Electricity** *(Autumn B2)* • I can associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. • I can 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. • I can use recognised symbols when representing a simple circuit in a diagram. **Light** *(Spring B1)* • I am aware that light appears to travel in straight lines. • I can 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. • I can 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. • I can use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

Vocabulary: **Physics**

Year 1

Seasonal changes *(Autumn B2, B4; Spring B4; Summer B4))*

- **season**: a part of the year
- **weather**: the conditions outside
- **daylight**: when it is light outside
- **night**: when there is no daylight
- **autumn**: the season after summer and before winter
- **winter**: the season after autumn and before spring
- **spring**: the season after winter and before summer
- **summer**: the season after spring and before autumn

Year 2

Year 3

Light *(Spring B3)*

- **light:** energy that is needed to see
- **light sources:** objects that give out light
- **natural light sources:** objects in nature that give out light
- **artificial light sources:** made by humans
- **reflection:** when light bounces off an object
- **opaque:** an object or material that does not allow any light to pass through it
- **translucent:** an object or material that allows some light to pass through it
- **transparent:** an object or material that allows all light to pass through it
- **shadow:** a dark area caused by an object blocking a source of light

Forces and magnets

Forces *(Summer B2)*

- **force:** a push or pull in a certain direction
- **contact force:** a push or a pull that affects objects that are touching
- **friction:** a contact force that is caused by one object being pushed across the surface of another
- **data:** information collected, such as facts, information or numbers

Magnets *(Summer B3)*

- **magnet:** an object that can pull a magnetic material
- **magnetic:** describes a material which can be pulled by a magnet
- **poles:** the two ends of a magnet, known as the north pole (N) and south pole (S)
- **attract:** a magnetic force that pulls
- **repel:** a magnetic force that pushes two magnets apart

Year 4

Sound *(Spring B1)*

- **sound:** vibrations that travel through the air, or another medium, and are heard when they reach an ear
- **vibration:** a quick back-and-forth movement
- **ear:** an organ in humans (and many other animals) that detects vibrations, allowing hearing
- **volume:** how loud or quiet a sound is
- **pitch:** how high or low a sound is
- **decibel (dB):** a measure of the loudness of a sound
- **insulate:** to protect something from the transfer of heat, sound or electricity
- **background noise:** any type of noise that is not the sound that you are listening to or measuring

Electricity *(Spring B3)*

- **circuit:** a closed path that energy can flow through
- **cell:** a portable store of energy
- **switch:** a device that opens and closes an electrical circuit
- **conductor:** a material that allows energy to flow through it
- **insulator:** a material that does not allow energy to flow through it

Year 5

Forces *(Autumn B1)*

- **friction**: the contact force between two surfaces that are touching each other
- **air resistance**: a type of friction between air and another object
- **water resistance**: a type of friction between a liquid an d another object
- **gravity**: an invisible force that pulls things down to the centre of the Earth (or other planets
- **repeatability**: the likelihood of getting similar results if the experiment is carried out again
- **anomalous result**: a result that does not fit the pattern; in maths, this is called an outlier
- **lever**: a rigid bar resting on a pivot, used to move a heavy load
- **gear**: a wheel and axle that has teeth along the wheel; mostly used in machines to increase speed

Earth and space *(Autumn B2)*

- the Solar System: a collection of the eight planets and their moons, which orbit the Sun
- **planets**: large, spherical objects that orbit stars
- **stars**: large balls of burning gas that release heat and light
- **orbit:** the path an object takes around another object
- **model:** a physical representation of an idea or process
- **heliocentric:** a model that proposed that the Sun was at the centre of the Solar System.
- **geocentric:** a model that proposed that the Earth was at the centre of the Solar System.
- **night:** when part of the Earth id facing away from the Sun
- **day:** when part of the Earth is facing towards the Sun

Year 6

Electricity *(Autumn B2)*

- **series circuit:** a circuit where all the components are in one single loop
- **current:** the flow of electricity in a circuit
- **voltage:** a measure of how strong the current is in a circuit; this is provided by the cell/battery

Light *(Spring B1)*

- **light source:** object that produces light
- **reflection:** the return of light from a material or surface
- **ray diagram:** a diagram that shows how light travels
- **shadow:** a dark area caused by an object blocking a source of light
- **solar eclipse:** when the Moon passes between Earth and the Sun and blocks the sunlight from reaching the Earth; this casts a shadow of the Moon on the Earth
- **medium:** any substance which can allow sound or light to pass through it

Appendix: scientific enquiry types

www.fascinate.manchester.ac.uk

Identifying, classifying & grouping


Comparative & fair testing
www.fascinate.manchester.ac.uk


Research using secondary sources
www.fascinate.manchester.ac.uk


Observing over time
www.fascinate.manchester.ac.uk


Pattern seeking
www.fascinate.manchester.ac.uk

Appendix: Strands of Science

PHYSICS

We are learning about **physics.**

We are **physicists.**

Physics is the study of forces (pushes and pulls) and energy.




CHEMISTRY

We are learning about **chemistry**.

We are **chemists**.

Chemistry is the study of the properties of substances and the changes they go through.

BIOLOGY

We are learning about **biology**.

We are **biologists**.

Biology is the study of living things.