

Skills & Knowledge Progression: Science

National Curriculum aims & purpose:

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

Aims:

- 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
- equip pupils with the knowledge required to understand the uses and implications of science, today and for the future

School aims - skills, attitudes and knowledge that we would like all children to develop on their journey through the school

We want our children to have an interest in science and how it impacts our daily lives. We want them to constantly be asking questions, both 'big' and 'small', as they seek to better understand the world they live in and the fundamental scientific laws that govern it, from gravity to evolution to the way light travels. Moreover, we want to ensure that they understand the role that science (and scientists) has played in our past and how it will continue to play a vital role in our future, especially in the areas of healthcare and the environment. By the time that they leave education, we want all children to have become informed, curious, scientifically literate citizens, and our science curriculum is designed to build the broad foundations of that goal.

During science lessons, we will ensure that children are given the opportunity to ask ambitious questions and then plan and conduct investigations with the aim of answering these questions. In Years 1 and 2 their natural curiosity should be encouraged and they will be given the opportunity to talk about what they have found out. In Years 3 and 4, children will explore, talk about, test and develop ideas and begin to make some decisions about which types of scientific enquiry would be most effective. In Years 5 and 6, they will encounter more abstract ideas and begin to recognise that scientific ideas change and develop over time. Children will draw conclusions, use evidence to justify their ideas and use their understanding to explain their findings.

It is key that knowledge content and practical skills are taught hand-in-hand, with children developing and building on their factual knowledge as they journey through the school, making links between topics applying skills and understanding from previous learning to new areas as they are met. As part of this it is also vital that they are exposed to and specifically taught the essential scientific vocabulary related to each topic in order to demonstrate their knowledge and understanding effectively.

Links to learning in EYFS:

Understanding the World

- Comments and asks questions about aspects of their familiar world such as the place where they live or the natural world
- Can talk about some of the things they have observed such as plants, animals, natural and found objects.
- Talks about why things happen and how things work
- Developing an understanding of growth, decay and changes over time
- Shows care and concern for living things and the environment
- Looks closely at similarities, differences, patterns and change

Links to other subjects / curriculum areas:

- Use of ICT to collect data, analyse results and present findings
- History - the lives and impact of famous scientists from the past
- Geography - animal habitats from around the world, weather systems, rock formation
- Maths - Data handling
- English - posing and writing questions, presenting findings both verbally and through written observations and conclusions
- Art - using plants and animals in the local and wider environment as a starting point for art
- DT building structures using a variety of materials, selected for their properties and effectiveness

Experiences every child should have:

- Observing a range of plants and animals first-hand, in the local environment, parks, garden centres, zoos and other animal centres
- Growing their own fruits and vegetables all the way through from seed to the plate
- Creating electrical circuits and watching something they have constructed respond to their commands
- Make things go 'bang', react vigorously and create new substances through chemical reactions
- Be surprised by what happens and excited about what they discover when working practically
- Make discoveries through trial and error - and not being afraid to get things wrong
- Ask 'big questions' about life and the universe

Skills & Knowledge Progression: Science

Opportunities to develop and use Learning Powers in our curriculum

Curiosity	<ul style="list-style-type: none"> • Asking topic related questions and using different types of scientific enquiry to answer them • Looking at scientific evidence and using it to support or refute ideas and deepen understanding • Using scientific investigations to try out ideas, adapting the plan when things go wrong and exploring how changing variables can change the outcome • Closely observing the natural world around them using a range of equipment such as magnifying glasses and insect pooters
Independence	<ul style="list-style-type: none"> • Developing basic scientific enquiry skills so that children can undertake investigations with increasing independence • Planning their own scientific investigations, considering which variables to change and which to keep the same • Deciding how to report and present findings from enquiries, both in oral and written forms • Making their own predictions and drawing their own conclusions • Developing their own areas of interest within the science curriculum and finding opportunities to deepen learning through topic related books and websites
Empathy	<ul style="list-style-type: none"> • Considering the needs of all living things in our environment, especially when carrying out field work involving animals • Understanding the importance of the role of science in the future of our planet and how we can make positive contributions at home and at school (eg. through recycling, conserving energy and reducing waste) • Taking the interests of others into account when presenting or sharing work • Supporting peers and team members when enquiries are not going as planned, and helping them to find solutions
Perseverance	<ul style="list-style-type: none"> • Coping with setbacks, especially when carrying out scientific investigations • Making repeated small changes to scientific enquiries, persevering until solutions are found and an outcome is reached • Collecting data over extended periods of time eg. when finding out the best conditions for growing plants • Maintaining attention and clarifying information when being introduced to new and complex scientific knowledge such as magnetism, evolution and light
Reflectiveness	<ul style="list-style-type: none"> • Using results gathered as part of enquiries to draw simple conclusions • Suggesting improvements for completed tasks and raising further questions in light of new evidence • Considering the scientific evidence provided by the work of famous scientists and how this might influence their work • Taking feedback from others into account and using this to consider next steps
Cooperation	<ul style="list-style-type: none"> • Planning and carrying out scientific enquiries as a team, working collaboratively and sharing roles fairly • Presenting and sharing work with others, both written and oral • Working collaboratively and patiently when handling scientific equipment and resources which must be shared by the whole class • Contributing to whole class discussions and sharing observations and ideas to suggest answers to questions

Skills Progression: Scientific Enquiry

Year group	Ideas and Questions	Planning	Observing and Presenting
Year 1 & 2	<ul style="list-style-type: none"> ask simple questions and recognising that they can be answered in different ways recognise scientific and technical developments that help us 	<ul style="list-style-type: none"> perform simple tests or follows teachers' instructions with guidance, suggest what they will do with guidance, identify things to measure or observe that are relevant to the question use resources provided or chosen from a limited range use simple measurements and equipment to gather data suggest why a test is unfair 	<ul style="list-style-type: none"> observe closely (including changes over time), using simple equipment make measurements using non-standard units use simple secondary sources to find answers gather simple data to help answer questions record findings in a range of ways, eg. simple tables, diagrams, pictograms, sorting circles, bar charts and templates talk about their findings using everyday terms, text scaffolds or simple scientific language
Year 3 & 4	<ul style="list-style-type: none"> ask relevant questions and using different types of scientific enquiries to answer them explain the purposes of a variety of scientific and technological developments 	<ul style="list-style-type: none"> set up simple practical enquiries, comparative and fair tests begin to make decisions about what observations to make and how long to make them for begin to choose the type of simple equipment that might be used from a reasonable range use appropriate equipment and measurements with reasonable accuracy recognises when a simple fair test is needed with help, decide how to set up a fair test and control variables 	<ul style="list-style-type: none"> make systematic and careful observations make accurate measurements using standard units, using a range of equipment recognise when and how secondary sources might help answer questions that cannot be answered through practical investigations gather and record data in a variety of ways make decisions about how to record and analyse the data and prepare own formats for recording record and presents findings using drawings, labelled diagrams, keys, tally charts, Carroll diagrams, Venn diagrams, bar charts and tables report on findings from enquiries, in simple scientific language
Year 5 & 6	<ul style="list-style-type: none"> use their scientific experiences to explore ideas and raise different types of questions talk about how scientific ideas have developed over time recognise the applications of specific scientific ideas 	<ul style="list-style-type: none"> select and plan different types of scientific enquiries to answer questions make decisions about what observations to make, what measurements to use, how long to make them for and whether to repeat them choose the most appropriate equipment to make measurements explain how to use the equipment accurately recognise when and how to set up comparative and fair tests recognise and controls variables where necessary (eg. explains which variables need to be controlled and why) 	<ul style="list-style-type: none"> take measurements, in standard units, using a range of scientific equipment, with increasing accuracy and precision take repeat readings when appropriate recognise which secondary sources will be most useful to research their ideas begin to separate opinion from fact record data and results of increasing complexity, making own decisions about how to record calculate mean value where appropriate record and present findings using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs report on findings from enquiries, using relevant scientific language, in oral and written explanations such as displays and other presentations

Skills Progression: Scientific Enquiry

Year group	Looking For Patterns	Explaining Results	Evaluating
Year 1 & 2	<ul style="list-style-type: none"> use simple observable features to compare objects, materials and living things identify and classify (decides how to sort and group objects) with guidance, begin to notice changes (ie. cause and effect), patterns and relationships (ie. how one variable affects another) 	<ul style="list-style-type: none"> talk about what they have found out and how they found it out use their observations and ideas to suggest answers to questions use comparative language to describe changes, patterns and relationships 	<ul style="list-style-type: none"> with support, suggest whether or not what happened was what they expected with support, suggest different ways they could have done things
Year 3 & 4	<ul style="list-style-type: none"> use observable and other criteria to group, sort and classify in different ways (including simple keys and branching databases) identify differences, similarities or changes related to simple scientific ideas and processes with help, look for changes, patterns, and relationships in their data 	<ul style="list-style-type: none"> with help, use results to draw simple conclusions and answers questions using appropriate level of knowledge use straightforward scientific evidence to answer questions or to support their findings use relevant scientific language to discuss their ideas and communicate their findings 	<ul style="list-style-type: none"> with support, use results to suggest improvements to what they have done with support, raise further questions (eg. arising from the data) with support, make predictions for new values within or beyond the data collected
Year 5 & 6	<ul style="list-style-type: none"> use and develops keys and other information records to identify, classify and describe living things and materials identify conclusions, causal relationships and patterns 	<ul style="list-style-type: none"> draw valid conclusions, explains and interprets the results (including the degree of trust) using scientific knowledge and understanding (eg. recognises limitations of data) identify scientific evidence that has been used to support or refute ideas or arguments use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas 	<ul style="list-style-type: none"> make practical suggestions about how their working method could be improved (eg. the effect of sample size on reliability) use results to identify when further tests and observations might be needed use test results to make predictions and to set up further comparative and fair tests

Knowledge Progression: Materials & Physics

Year group	Materials	Light and Sound	Forces and Electricity
Year 1	<u>Everyday Materials</u> <ul style="list-style-type: none"> 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 perform simple tests to explore which material would be best suited to a specific purpose. 		
Year 2	<u>Uses of Everyday Materials</u> <ul style="list-style-type: none"> identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. recognise why it is important to recycle and reuse plastic describe how scientists have invented new materials (eg. Macintosh, Dunlop, McAdam) 		
Year 3/4 Cycle A (based on Year 3 curriculum)	<u>Rocks, Fossils and Soils</u> <ul style="list-style-type: none"> compare and group together different kinds of rocks on the basis of their appearance and simple physical properties begin to understand how igneous, sedimentary and metamorphic rocks are formed. relate the simple physical properties of some rocks to their formation. explore that different rocks react differently to forces (eg. rubbing, water) describe in simple terms how fossils are formed when things that have lived are trapped in rock. recognise that soils are made from rocks and organic matter. 	<u>Light and Shadow</u> <ul style="list-style-type: none"> name a number of light sources, including the sun 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 explore the way light is reflected from a mirror recognise that light from the sun can be dangerous and that there are ways to protect their eyes recognise that shadows are formed when light is blocked by an opaque object find patterns in the way that the size of shadows change. 	<u>Forces and Magnets</u> <ul style="list-style-type: none"> understand different types of forces, including pushes, pulls, gravity and friction. compare how things move on different surfaces notice that some forces need contact between two objects, but magnetism can act at a distance observe how magnets attract or repel each other and attract some materials and not others compare and group together everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials describe magnets as having two poles predict whether two magnets will attract or repel, depending on which poles are facing.

Knowledge Progression: Materials & Physics

Year 3/4 Cycle B
(based on Y4 curriculum)

Solids, Liquids and Gases

- 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
- 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.

Sound and Vibration

- 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 recognize that sounds get fainter as the distance from the sound source increase.

Circuits and Components

- identify appliances that run on electricity and describe some of the dangers of mains electricity
- construct a simple series electrical circuit, identifying and naming basic parts, including cells, wires, bulbs, switches and buzzers
- identify whether or not a lamp will light in a simple series circuit, based on whether it is part of a complete loop with a battery
- know that a switch can open/close a circuit
- recognize some common conductors and insulators, and associate metals with being good conductors.

Year 5/6 Cycle B
(based on Y5 curriculum)

Changing 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

Earth and Space

- 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.
- explain how ideas about the solar system have changed over time

Forces

- recognise that more than one force can act on an object
- 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 between moving surfaces
- recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
- explore how levers, pulleys and gears are used in everyday life (e.g. describe how having gears can make it easier to pedal a bike)

Year 5/6 Cycle B
(based on Year 6 curriculum)

Light

- 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
- draw diagrams to illustrate how light is travelling from the source to the eye
- explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
- use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.
- know that, when sunlight passes through some objects, coloured light is produced (for example in rainbows, soap bubbles and prisms).

Electricity

- 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.
- explore the thickness of a wire in a circuit know how to stay safe when using electricity

Knowledge Progression: Biology

Year group	Plants	Animals, Including Humans	Living Things & Their Habitats
Year 1	<u>In the Garden</u> <ul style="list-style-type: none"> 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. Identify the leaf, root, stem and flower of a plant. Identify the trunk, branch, roots and leaves of a tree. Sequence pictures that show how plants change over time. 	<u>Different Animals</u> <ul style="list-style-type: none"> 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. 	<u>Seasonal changes</u> <ul style="list-style-type: none"> observe changes across the four seasons observe and describe weather associated with the seasons and how day length varies. use descriptive words, photos and pictures to record changes collect evidence of changes (eg. leaves, seeds, flowers). observe and name types of weather (eg. rain, sun, wind, clouds).
Year 2	<u>Growing Plants</u> <ul style="list-style-type: none"> observe and describe how seeds and bulbs grow into mature plants find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. identify that seeds and bulbs do not need light to germinate and identify how this is different to the needs of a plant explain how plants in the desert survive with little water and plants in the rainforest survive with little light. 	<u>Growth and Survival</u> <ul style="list-style-type: none"> notice that animals, including humans, have offspring which grow into adults. recognise changes that take place as animals get older. find out about and describe the basic needs of animals, including humans, for survival (water, food and air) describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. 	<u>Habitats</u> <ul style="list-style-type: none"> explore and compare the differences between things that are living, dead, and things that have never been alive identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants identify and name a variety of plants and animals in their habitats describe how animals obtain their food from plants and other animals, using the idea of a simple food chain identify and name different sources of food.
Year 3/4 Cycle A (based on Year 3 curriculum)	<u>Investigating plants</u> <ul style="list-style-type: none"> 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, room to grow) and how they vary 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 dispersal. 	<u>Healthy Eating and Healthy Bodies</u> <ul style="list-style-type: none"> 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. identify and group animals with and without skeletons, comparing their movement. compare and contrast the diets of different animals, and decide ways of grouping them according to what they eat. 	

Knowledge Progression: Biology

Year group	Plants	Animals, Including Humans	Living Things & Their Habitats
Year 3/4 Cycle B (based on Year 4 curriculum)		<u>Teeth and Digestion</u> <ul style="list-style-type: none"> describe the simple functions of the basic parts of the digestive system in humans identify the different types of teeth in humans and their simple functions find out what damages teeth and how to look after them. compare the teeth of carnivores and herbivores and suggest reasons for the differences 	<u>Classification and Interdependence</u> <ul style="list-style-type: none"> recognise that living things can be grouped in a variety of ways explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment recognise that environments can change and that this can sometimes pose dangers to living things. construct and interpret a variety of food chains, identifying producers, predators and prey. identify the way habitats change over the year. explore impacts that humans can have on the environment (both positive and negative)
Year 5/6 Cycle A (based on Year 5 curriculum)		<u>Human Life Cycles</u> <ul style="list-style-type: none"> describe the changes as humans develop to old age. recognise stages in growth and development of humans including puberty 	<u>Life Cycles</u> <ul style="list-style-type: none"> describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird describe the life process of reproduction in some plants and animals. investigate the lives of famous naturalists (eg. David Attenborough or Jane Goodall). explore different types of reproduction, including sexual and asexual reproduction
Year 5/6 Cycle A (based on Year 6 curriculum)	<u>Classification</u> [building on prior learning from plants, animals and living things units] <ul style="list-style-type: none"> 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. devise own keys to classify organisms and objects recognise that broad groupings can be subdivided into increasingly specific groups 	<u>Humans and Health</u> <ul style="list-style-type: none"> 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. understand how to keep bodies healthy, and how their bodies might be damaged, including how some drugs and other substances can be harmful to the body. 	<u>Evolution and Inheritance</u> <ul style="list-style-type: none"> recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. explore the idea that characteristics are passed from parents to offspring (eg. considering different species of dogs).