

SCIENCE CURRICULUM

'I am among those who think that science has great beauty. A scientist in a laboratory is not only a technician: they are also a child placed before natural phenomena which impress them like a fairy tale.'

Marie Curie

Science: Intent

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

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


We recognise that, despite girls outperforming boys in primary education, many women end up in lower-skilled, lower-paid jobs, and are less likely to specialise in science subjects. With this in mind, we have placed an emphasis on highlighting to our girls the opportunities in science, both in higher education and for future careers, and on engaging their curiosity and interest in science.

What do we want the children to know?

Key Stage 1	YEAR 3	YEAR 4	YEAR 5	YEAR 6	KEY STAGE 3	
Plants: Naming plants and trees and structure Seed/ Bulb to mature Animals: Name common animals/types. Living and Dead Habitats Food chains Humans: Parts of body relate to senses. Offspring, survival needs and health and hygiene	Plants: Functions, requirements Humans: Nutrition, Skeletons and Muscles	Living things: Habitats Humans: Digestion, teeth, food chains	Living Things: Life Cycles, Reproduction Humans: Development and getting old	Evolution and inheritance Living Things: Classification Humans: Heart, Diet, drugs, water	BIOLOGY Cells and organisation The skeletal and muscular systems Nutrition and digestion Gas exchange systems Reproduction Health	Material cycles and energy Photosynthesis Cellular respiration Interactions and Interdependencies Relationships in an ecosystem Genetics and evolution Inheritance, chromosomes, DNA and genes
		Sound			PHYSICS Calculation of fuel uses and costs in the domestic context Energy changes and transfers Changes in systems Describing motion Forces Pressure in fluids Balanced forces	Forces and motion Observed waves Sound waves Energy and waves Light waves Current electricity Static electricity Magnetism Matter: Physical changes Matter: Particle model Energy in matter Space physics
	Light:			Light: Travel, eye, reflection		
	Forces and Magnets		Forces: Mechanisms, gravity, resistance/friction			
	Electricity			Electricity: changing, symbols		
			Earth and Space			
Seasonal Changes	Rocks				CHEMISTRY The particulate nature of matter Atoms, elements and compounds Pure and impure substances.	Chemical reactions Energetics The periodic table Materials Earth and atmosphere.
Everyday Material Suitability and simple properties		States of Matter	Properties and changes of materials			

Year 3 Plants

Key vocabulary: Flower, grow, leaves, roots, stem/trunk, nutrients, water, soil, pollination, seed dispersal, photosynthesis

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- identify parts of flowering plants
 - recognise that plants need light, water and warmth and healthy leaves, roots and stems in order to grow well
 - know that plants make their own food
 - know that water travels from the roots up the stem
 - sequence pictures to show the life cycle of a plant

Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers

- describe why healthy roots and a healthy stem are needed for plants to grow
- recognise that the leaves of a plant are associated with healthy growth and more specifically nutrition
- know that fertilisers contain minerals
- understand that plants absorb minerals from the soil
- describe how changes to light and fertiliser affect plant growth

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


- describe how the stem has a role in support and nutrition (transport of water)
- describe why plants need flowers
- describe the role of bees and insects in pollination
- describe how pollen and seeds are dispersed

Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal

- *explain why healthy roots and a healthy stem are needed for plants to grow*
- explain that differences in plant growth are due to the amount of light and/or water
- compare methods of seed dispersal
- compare the roots of different plants (e.g. desert plants or rainforest tree)

Year 3 Animals including humans

Key Words: skeleton, bones, joints, diet, nutrition, muscles, movement

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- identify some foods needed for a healthy and varied diet
 - know they have bones and muscles in their body
 - state that they and other animals have skeletons
 - identify animals that do not have an internal skeleton (invertebrates)
 - group animals with and without an internal skeleton
 - recognise that their skeletons grow as they grow

 - name the components of a healthy and varied diet
 - describe how their diet is balanced

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


- describe some observable characteristics of bones
- describe the main functions of their skeletons
- state that movement depends on both skeleton and muscles
- state that when one muscle contracts another relaxes

Identify that humans and some other animals have skeletons and muscles for support, protection and movement

- describe an adequate and varied diet for humans, recognising that there are many ways of achieving this
- describe problems associated with broken bones or bones diseases
- describe some advantages of having an internal skeleton over no skeleton or an exoskeleton
- describe the role of different food groups
- compare and contrast diets of animals including pets

Year 3 Light

Key Words: shadow, transparent, translucent, opaque, protection, reflection, shiny, dark, light source, sun

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- name a number of light sources, including the sun
 - recognise that they cannot see in the dark
 - state that reflections can be seen in shiny surfaces
 - makes generalisations about shiny surfaces (e.g. smooth)
 - recognise that light travels from a source
 - recognise that when light is blocked, a shadow is formed
 - make observations of changes in shadows
 - describe and compare some light sources
 - state that light sources are seen when light from them enters the eyes

Recognise that light from the sun can be dangerous and that there are ways to protect their eyes

Recognise that they need light in order to see things and that dark is the absence of light

- explain that places are dark because there is no light and a light source is needed to help us see in such places

Notice that light is reflected from surfaces

- demonstrate light travelling using a torch and record light bouncing off a mirror
- identify suitable reflective clothing for travelling in the dark
- explain that they cannot see shiny objects in the dark because there are no light sources

Recognise that shadows are formed when the light from a light source is blocked by a solid object


- recognise that shadows are similar in shape to the objects forming them
- explain that shadows are formed when light from a source is blocked
- state that even transparent objects block some light and form shadows
- describe the difference in shadows cast by opaque, translucent and transparent materials
- explore how to make shadows of different shapes and sizes

Find patterns in the way that the size of shadows change

- use ideas about shadows to make predictions about the shadows formed by different objects or materials
- describe how the length of a shadow changes throughout the day as the sun moves across the sky
- describe how nocturnal animals are adapted to use what little light there is or their other senses in the dark (e.g. cats, aye-aye, lemurs)
- describe how Percy Shaw invented cat's eyes and explain their importance to road safety

Year 3 Forces and magnets

Key Words: magnet, magnetic field, attract, repel, pushing, pulling, direction, force, friction, surface, poles, north, south

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- recognise that pushes and pulls are forces
 - recognise that a force acts in a particular direction
 - observe the movements, shape and direction of objects when forces act on them
 - identify friction as a force
 - observe and explore how friction affects the movement of objects
 - classify materials as magnetic or non-magnetic
 - recall that magnets have a north and a south pole

 - describe how to make a familiar object start moving by pushing or pulling
 - describe how to use pushes and pulls to make familiar objects speed up, slow down, change direction or shape
 - produce annotated drawings showing the direction of force needed to make an object move
 - describe some ways in which friction between solid surfaces can be increased or decreased

Compare how things move on different surfaces

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 the difference between a magnet and a magnetic material
- describe what happens when some materials are put near a magnet

Notice that some forces need contact between two objects, but magnetic forces can act at a distance

- recall that magnets have a north and a south pole

Describe magnets as having two poles


- describe the direction of forces between magnets

Predict whether two magnets will attract or repel each other, depending on which poles are facing

- describe some everyday uses of magnets
- explain that a compass works by lining up with the Earth's magnetic field
- describe how lodestone was found to be a naturally occurring magnet and was used as the first compass for navigation

Year 3 Rocks

Key Words: rocks, soil, permeable, impermeable, filter, Earth, fossils, organic matter, sedimentary, metamorphic, igneous

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- observe the characteristics of a variety of rocks
 - name and describe the characteristics of several rocks
 - identify fossils in rocks
 - understand that there are rocks under the Earth's surface
 - recognise that soil is a mixture of different materials and living things

- classify rocks from the evidence of investigations
- explain that rocks are used for different purposes dependent on their physical properties
- explain that different types of rock react differently to physical forces (e.g. water, rubbing)

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 soil contains dead plants and animals
- recognise that there is rock under all surfaces and that soils come from rocks

Recognise that soils are made from rocks and organic matter

- relate the simple physical properties of some rocks to their formation
- explain how a model (e.g. biscuits, chocolate bars) can be used to represent sedimentary, metamorphic and igneous rocks
- describe how Mary Anning discovered fossils
- explain why we do not see the soft parts of animals in fossils
- explain why we might find lots of the same types of rock in one place
- explain why certain rocks are used for different purposes and why some rocks could be used for these jobs for example:
 - Marble- kitchen worktops or statues
 - Slate roof tiles
 - Granite walls

Year 4 Animals including humans - NC statement regarding food chains moved to living things and their habitats

Key Words: teeth, enamel, incisors, canines, premolars, molars, digestive system, digestion, mouth, saliva, oesophagus, stomach, intestine, anus

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- identify a wider range of body parts, including some internal organs (large intestine, small intestine, brain, lungs, heart, stomach, oesophagus)
 - locate and name the different organs in the digestive system
 - recognise they need to take care of their teeth
 - name the different types of teeth

describe the simple functions of the basic parts of the digestive system in humans

- describe the role of each organ in the digestive system
- describe the role of each type of teeth in digestion

identify the different types of teeth in humans and their simple functions

- explain how they should look after their teeth and recognise why they need to do so
- state that animals have different diets and may have different kinds of teeth

- explain why humans do not have a full set of adult teeth at birth
- explain why food needs to be broken down
- explain why dentists are concerned about the amount of sugar children have
- explain how fossilised teeth give us clues about an animals' diet

explain why the teeth of certain types of animals need to be different

Year 4 Living things and their habitats - Including Food chain POS statement from animals including humans

Key Words: Classify, Characteristic, producer, predator, prey, environments, food chain, environment, habitats, Mammal, Reptile, Fish, Amphibian, Bird

- recognise that animals can be grouped into vertebrates and invertebrates
- identify that some animals feed on other animals and some on plants
- explore ways of grouping living things including animals and plants (flowering and non-flowering)
- represent feeding relationships with simple food chains

Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment

Recognise that living things can be grouped in a variety of ways

- describe some of the characteristics of the vertebrate (fish, mammals, amphibians, reptiles and birds) groups (e.g. warm-blooded, have fur, lay eggs)
- group animals into vertebrate (fish, mammals, amphibians, reptiles and birds) and invertebrates groups (snails, slugs, spiders, worms and insects)
- recognise that green plants are the ultimate source of food for all animals
- recognise that a food chain must always start with a green plant (a producer)
- represent feeding relationships within a habitat with food chains beginning with a green plant which 'produces' food for the other organisms
- use and understand the terms: producer, predator and prey

Construct and interpret a variety of food chains, identifying producers, predators and prey (Teacher Note: statement moved from NC 'Animals including humans' to improve progression within topics)

- know the function of some of the more complex features which aid survival in specific habitats (e.g. gills, blubber, camouflage)
- describe why different animals and plants live in different habitats

Recognise that environments can change and that this can sometimes pose dangers to living things

- describe how humans can cause changes to environments
- explain that different organisms are found in different habitats because of differences in environmental factors

- use food chains to predict what might happen to the numbers of an organism if there are suddenly more predators or less prey
- explain why it is necessary to use a reasonably large sample when investigating the preferences of small invertebrates
- describe how humans have negatively impacted environments (e.g. pollution, deforestation, introduction of invasive species)
- explain why some animals are hard to classify (e.g. platypus, echidna, bat, flightless birds)

Year 4 Materials- Solids, liquids and gases

Key Words: Solid, liquid, gas, mass, properties, behaviour, freezing, melting, evaporating, heat, cooling, reverse

- name some solids and liquids
- state that air is a gas
- state some differences between solids, liquids and gases
- observe what happens to a variety of materials when they are heated (e.g. chocolate, ice cream, butter, water)
- describe what happens to water when it is heated and cooled
- recognise that these processes can be reversed
- state that ice, water and steam are the same material
- identify the processes of melting, freezing, evaporation and condensation

- recognise everyday substances as mixtures of solids, liquids and/or gases
- recognise that air is a material and that it is one of a range of gases which have important uses
- recognise that gases flow from place to place
- know that gases can be easily compressed
- describe the differences between solids and liquids
- compare simple solids and liquids (e.g. in terms of ease of squashing or pouring)

Compare and group materials together, according to whether they are solids, liquids or gases

- make clear distinctions between the properties of solids, liquids and gases
- identify a wide range of contexts in which changes of state take place
- describe a few examples where these changes occur
- recognise that for a substance to be detected by smell, some of it must be in the gas state

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)

- describe how when ice melts it turns to liquid and how when water freezes it becomes ice
- describe how these processes can be reversed
- describe how liquids evaporate to form gases and how gases condense to form liquids
- sequence the changes that happen in the water cycle
- describe the water cycle in terms of these processes
- explain the relationship between liquids and solids in terms of melting and freezing
- explain the relationship between liquids and gases in terms of evaporation and condensation

Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature

- know that temperature can affect the rate of evaporation or condensation
- describe the effect of temperature on evaporation
- explain how changing conditions affects processes such as evaporation and condensation
- identify a range of contexts in which changes take place (e.g. evaporation of puddles in the school playground or from clothes on the washing line, condensation in the bathroom)

- describe the behaviour and properties of gases
- make clear distinctions between the properties of solids, liquids and gases
- explain why granular solids have some of the properties associated with liquids
- explain why some substances are hard to classify as solids, liquids and gases (e.g. whipped cream, mousse, mayonnaise, muddy water, fizzy drinks, cornflour and water)
- compare the boiling point of different liquids
- explore the effect of salt on ice

explain why salt is put on the roads in winter

Year 4 Sound

Key Words: Pitch, Vibration, Sound, Tension, Air, ear, musical, instrument, loudness, volume

- recognise and describe many sounds and sound sources
- state that they hear sounds through their ears
- recognise that when sounds are generated by objects, something moves or vibrates
- describe differences in pitch and volume
- describe what they observe when they move further away from a source of sound

Identify how sounds are made, associating some of them with something vibrating

- identify what is vibrating in a range of musical instruments
- generalise that sounds are produced when objects vibrate
- describe how sounds are generated by specific objects
- suggest ways of producing sounds

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

- distinguish between pitch and volume (loudness)
- know that altering vibrations alters the pitch or volume
- suggest how to change the loudness of the sounds produced by a range of musical instruments
- explore how to vary the pitch and volume of sounds from a variety of objects or instruments

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

- describe what they observe when they move further away from the source of a sound
- describe ways in which the pitch of a sound made by a particular instrument or vibrating object can be raised or lowered
- generalise the effects of changes on sound (e.g. the tighter the tension the higher the pitch)
- group instruments independently by the way sounds are produced
- recognise that sounds travel through solids, water and air
- explore how sound travels through a variety of materials
- identify suitable materials to use for sound insulation
- recognise that sound can be reflected from a surface which can cause an echo
- describe how some animals use echo-location

Year 4 Electricity

Key Words: Conductor, Insulator, Conduct, Circuit, Complete, series, electricity, application, cell, wire, bulbs, switch, buzzer

Identify common appliances that run on electricity

- identify mains operated and battery operated devices
- describe some of the dangers associated with mains electricity
- name some components of a simple electrical circuit
- know that batteries are sources of electricity
- recognise that for a circuit to work it must be complete
- construct a working circuit
- identify materials as conductors or insulators

Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers

- make drawings of simple working circuits (pictorial only circuit symbols covered in year 6)
- make circuits from drawings provided

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

- describe the effect of making and breaking one of the contacts on a circuit
- explain why some circuits work and others do not

Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit

- describe how switches work
- construct a home-made switch
- construct simple circuits and use them to test whether materials are electrical conductors or insulators

Recognise some common conductors and insulators, and associate metals with being good conductors

- are methodical in tracing faults in simple circuits
- relate knowledge about conductors and insulators to their use in electrical appliances
- describe the use of conductors and insulators in components including connecting wires

identify graphite and playdough as non-metal conductors and explain why this is unusual

Year 5 Combined topics:

Living things and their habitats including statement from **Animals including humans** to enable progression within a topic and greater coherence between ideas

Key Words: pregnancy/gestation, reproduction, lifespan, sexual maturity, offspring, fertilisation, sexual, asexual



- sequence the life cycles of a variety of plants and animals
- name the parts of a flower
- name the parts of the human reproductive system
- identify ways in which the appearance of humans changes as they get older
- identify some characteristics that will not change with age
- recognise stages in growth and development of humans including puberty

- recognise the similarities in the life cycles of plants, animals and humans

Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird

- describe the functions of some parts of a flower
- describe the main functions of parts of a plant involved in reproduction
- describe the processes of sexual and asexual reproduction in plants
- describe the simple functions of parts of the human reproductive system

Describe the life process of reproduction in some plants and animals

- compare methods of seed dispersal
- know that most animals reproduce by sexual reproduction

Describe the changes as humans develop to old age (Teacher note: statement taken from year 5 'Animals including humans' programme of study)

- compare internal and external fertilisation in animals
- explain that living things need to reproduce if the species is to survive
- compare gestation periods (pregnancy) of different animals
- explain what is unusual about the life cycle of a kangaroo or koala

Year 5 Materials-Properties of Materials

Key Words: dissolving, hardness, transparent, conductivity, materials, filtration, evaporation, separating, reversible, irreversible, burning, temperature

- observe and explore the properties of materials (e.g. hardness, transparency, magnetism, electrical and thermal conductivity)
- identify some materials that are good thermal insulators and some everyday uses of these
- recognise that metals are both good thermal and good electrical conductors
- recognise that salt or sugar dissolves in water but sand won't
- recognise that dissolving is a reversible change
- recognise that changes of state are reversible
- recognise the hazards of burning materials

- suggest why particular materials are used for different jobs depending on their properties

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

Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic

- name some materials that will and some that will not dissolve in water
- recognise that although it is not possible to see a dissolved solid, it remains in the solution
- describe melting and dissolving and give everyday examples of each
- identify and explore factors that affect the rate at which a solid dissolves
- separate an undissolved solid from a liquid by filtering
- recognise that an undissolved solid can be separated from liquid by filtering
- recognise that a solid can be recovered from a solution by evaporation
- describe the properties of mixtures which can be separated by filtration
- describe some methods that are used to separate simple mixtures
- explain that when solids dissolve they break up so small they can pass through the holes in the filter paper

Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution

- use knowledge about how a specific mixture can be separated to suggest ways in which other similar mixtures might be separated

Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating

- recognise that some changes can be reversed and some cannot

Demonstrate that dissolving, mixing and changes of state are reversible changes

- observe and explore a variety of chemical changes (e.g. burning)
- identify whether some changes are reversible or not
- classify some changes as reversible (e.g. dissolving) and others as irreversible (e.g. burning)
- recognise that irreversible changes often make new and useful materials
- describe what happens when acid and bicarbonate of soda are mixed

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

- explain that in some cases the new materials made are gases and identify some evidence for the production of gases (e.g. vigorous bubbling)
- describe the difference between melting and dissolving
- recognise that inks and dyes are often mixtures of different colours and these can be separated by chromatography
- explain why ink or dye moves up the paper in chromatography
- describe the properties of new materials (e.g. aerogel, silly putty, wrinkle-free cotton)
- explain why some materials are good thermal insulators

Year 5 Earth and Space

Key Words: Earth, Sun, Moon, Planets, Orbit, rotation, Spherical, gravity, axis, day, night

- identify and name the components of the solar system (i.e. Sun, Moon, Earth and other planets)
- locate the Sun, Earth and other planets in the solar system
- recognise that the Earth and other planets orbit the Sun
- recall that the Earth takes one year to orbit the Sun
- recall that the Earth rotates on its' axis and this takes one day
- recognise that the Moon orbits the Earth
- recall that a shadow from the Sun changes over the course of a day

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

- recognise that the Earth, Sun and Moon are spherical and support this with some evidence
- recognise that it is daylight in the part of the Earth facing the Sun
- explore and describe how a shadow from the Sun changes over the course of a day
- explain in terms of the rotation of the Earth why shadows change and the Sun appears to move across the sky during the course of the day

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

- explain why it is night time in Australia when it is day time in England
- explain that gravity is a force of attraction and it is what holds the planets in orbit around the Sun and the Moon in orbit around the Earth
- explain that the changes in the appearance of the Moon over a period of 28 days arise from the Moon orbiting the Earth once every 28 days
- use simple physical models to explain effects that are caused by the movement of the Earth
- explain how ideas about the solar system have changed over time

Year 5 Forces

Key Words: force, friction, gravity, weight, Air resistance, water resistance, speed, Newtons, falling, pulleys, gears, levers

- identify that force is measured in Newtons
- name simple forces such as gravity, friction and air resistance
- recognise that more than one force can act on an object
- recognise that air resistance slows things down
- recognise that friction can be useful or not useful
- identify weight as a force

- draw force diagrams with arrows showing the direction of forces acting on an object
- observe and explore the effect of several forces on objects

Identify the effects of air resistance, water resistance and friction, that act between moving surfaces

- describe some situations in which there is more than once force acting on an object
- describe and explain the motion of some familiar objects in terms of several forces acting on them
- identify forces on an object as either balanced or unbalanced
- use the terms 'balanced' and unbalanced' when describing several forces on an object
- explain that balanced forces on an object cause it to remain stationary or travel at the same speed
- explain that unbalanced forces on an object cause it to speed up, change shape or slow down

Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object


- understand that air resistance is the frictional force of air on objects moving through it
- describe some of the factors that increase friction between solid surfaces and increase air and water resistance
- describe situations in which frictional forces are helpful as well as those in which frictional forces are unhelpful
- explore the effects of levers, pulleys and gears

Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect

- describe how levers, pulleys and gears are used in everyday life (e.g. having gears can make it easier to pedal a bike, a bottle opener makes it easier to open a bottle lid)
- explain how introducing gears onto bikes has changed cycling
- compare the tread on bicycle tyres according to how much friction they need
- identify streamlined objects and describe why they have been designed in this way (e.g. cycling helmets, formula 1 cars, dolphins)

Year 6 Animals including humans

Key Words: pulse, heart, exercise, blood, oxygen, resting, circulatory system, smoking, blood vessels, arteries, diet, drugs, lifestyle, medicines

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- identify and name the parts of the circulatory system
 - know that the heart is made of muscle
 - state how to measure pulse rate
 - recognise that pulse rate is a measure of how fast the heart is beating
 - identify some of the harmful effects of smoking
 - identify food as a fuel for the body
 - describe what the heart and blood vessels do

Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood


- discover that during exercise the heart beats faster to take blood more rapidly to the muscles
- make careful measurements of pulse rate
- describe the different functions of the blood (e.g. transporting and protecting)
- know that the blood comes from the heart in arteries and returns to the heart in veins
- know that blood carries oxygen and other essential materials around the body

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

- recognise that care needs to be taken with medicines and that they can be dangerous
- give several reasons why it is sometimes necessary to take medicines
- identify some harmful effects of drugs
- name the major groups into which food is categorised and identify sources for each group
- describe the main function of organs of the human body
- explain the effect of diet on particular organs of the body / aspects of health
- explain the effect of exercise on particular organs of the body/aspects of health
- explain how ideas about the circulatory system have changed over time
- explain how ideas about smoking have changed over time
- explain why advice on diet changes (e.g. butter vs margarine, five a day, tax on sugary drinks)

Year 6 Living things and their habitats

Key Words: characteristics, respiration, sugar, oxygen, carbon dioxide, yeast, microorganism

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- recognise that there is a wide variety of living things
 - identify vertebrates and invertebrates
 - name and describe the five vertebrate groups
 - understand there are living things that are too small to be seen and these can affect our lives
 - recognise that there are many micro-organisms, some which can cause illness or decay

 - understand why classification is important

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

- recognise that there are useful micro-organisms which can be used in food production
- describe how micro-organisms feed, grow and reproduce like other organisms
- describe evidence, from investigations, that yeast is living
- explain how micro-organisms can move from one food source to another or from one animal to another

- devise own keys to classify organisms and objects
- describe early ideas about classification (e.g. Aristotle)
- compare the rate of reproduction in microorganisms to other animals
- describe how the development of the microscope has contributed to our understanding of microorganisms
- describe how ideas about hygiene have changed over time (e.g. Semmelweis)

Year 6 Evolution and Inheritance

Key Words: Evolution, inheritance, variation, adaption, fossils, bacteria, organisms,

- recognise variation in different species (e.g. dogs, horses)
- describe how animals and plants are adapted to their environments
- recognise that animals have to compete for food
- describe how animals avoid predators (e.g. speed, camouflage)
- recognise that offspring have some of the features of their parents

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

- explain how being well adapted to an environment means an organism is more likely to survive

Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago

- explain why we do not have a complete fossil record
- explain that animals which are better adapted to an environment are more likely to survive, reproduce and pass on characteristics to their offspring meaning the animal species will gradually change and evolve (giraffe with the tallest neck could reach more leaves to feed on)
- describe the story of the peppered moth and how this provides evidence for natural selection
- explain how antibiotic resistant bacteria provide evidence for natural selection
- explain why we can see evidence for natural selection in fast reproducing organisms like bacteria (e.g. antibiotic resistant bacteria and pesticide resistant insects)
- explain how the introduction of a new species to an isolated environment can affect native species (e.g. Dodo, Kakapo or Stephen's Island Wren)
- compare the ideas of Darwin and Lamarck about evolution

Year 6 Light

Key Words: Light, Source, reflection, straight, opaque, translucent, transparent, shadow, prism

- describe reflection as light 'bouncing off' objects
- explore how light travels using torches and periscopes

- understand that in order to be seen, all non-luminous objects must reflect light

Recognise that light appears to travel in straight lines

- diagrammatically represent light from sources and bouncing off reflective surface using arrows

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

- draw diagrams to illustrate how light is travelling from the source to the eye

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

- describe a variety of ways of changing the size of the shadow produced by an object
- describe the relationship between the size of a shadow and the distance between the light source and an object
- diagrammatically represent the formation of shadows using arrow convention

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)
- describe how curved mirrors distort a reflection.

Year 6 Electricity

Key Words: batteries/cells, circuit, conventional symbols, brightness, loudness, components, voltage

- know that the 'amount' of electricity (voltage) depends on the number of batteries
- construct some working series circuits with specified components
- recognise conventional circuit symbols

Use recognised symbols when representing a simple circuit in a diagram

- draw circuit diagrams and construct circuits from diagrams using conventional symbols
- explore how to change the brightness of bulbs and the volume of a buzzer
- recall what causes the brightness of bulbs or the volume of a buzzer to change
- compare different circuits (e.g. for brightness of bulb)
- recall that the amount of electricity is measured in voltage

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

- explore the effect of thickness of a wire in a circuit
- describe the differences between wires usually used for circuits and fuse wires
- describe what would happen if all lights in a home were connected in the same circuit and one broke
- explain current in circuits using simple models and analogies (e.g. piped water, bicycle chain, children and sweets)

The Scientific Child: What are the skills we teach?

	LOWER SCHOOL By the end of Year 4	UPPER SCHOOL – By the end of Year 6
Ideas, Questions and Planning		
Ideas and questions	asks relevant questions and uses different types of scientific enquiries to answer them ¹ explains the purposes of a variety of scientific and technological developments ² .	uses their scientific experiences to explore ideas and raise different types of questions talks about how scientific ideas have developed over time ¹ recognises the applications of specific scientific ideas ² .
	Planning	sets up simple practical enquiries, comparative and fair tests begins to make decisions about what observations to make and how long to make them for
Equipment	begins to choose the type of simple equipment that might be used from a reasonable range uses appropriate equipment and measurements with reasonable accuracy	chooses the most appropriate equipment to make measurements explains how to use the equipment accurately
Variables	recognises when a simple fair test is needed with help, decides how to set up a fair test and control variables	recognises when and how to set up comparative and fair tests recognises and controls variables where necessary (e.g. explains which variables need to be controlled and why)
Observing and Presenting Evidence		
Observing and measuring	makes systematic and careful observations	takes measurements, in standard units, using a range of scientific equipment, with increasing accuracy and precision ⁴ .
	makes accurate measurements using standard units (e.g. cm, m, °C, N, g, Kg, ml) using a range of equipment, e.g. data loggers and thermometers	takes repeat readings when appropriate
Secondary sources	recognises when and how secondary sources (e.g. books, internet, experts, diagrams) might help answer questions that cannot be answered through practical investigations	recognises which secondary sources will be most useful to research their ideas begins to separate opinion from fact
Recording information and data	gathers and records data in a variety of ways to help in answering questions prepares own format for recording data makes decisions about how to record and analyse the data	records data and results of increasing complexity decides how to record data from a choice of familiar approaches calculates mean value where appropriate
	Presenting Evidence	records and presents findings using drawings, labelled diagrams, keys, tally charts, Carroll diagrams, Venn diagrams, bar charts and tables reports on findings from enquiries, in simple scientific language, using oral and written explanations, displays or presentations of results and conclusions
Considering and Evaluating Evidence		
Looking for patterns	uses observable and other criteria to group, sort and classify in different ways (including simple keys and branching databases) identifies differences, similarities or changes related to simple scientific ideas and processes with help, looks for changes, patterns, and relationships in their data	uses and develops keys and other information to identify, classify and describe living things and materials identifies conclusions, causal relationships and patterns ⁵ .
	Explaining results	with help, uses results to draw simple conclusions and answers questions using appropriate level of knowledge and their own experiences uses straightforward scientific evidence to answer questions or to support their findings
Communication	uses relevant scientific language to discuss their ideas and communicate their findings	uses relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas
Evaluating	with support, uses results to suggest improvements to what they have done	makes practical suggestions about how their working method could be improved (e.g. the effect of sample size on reliability)
	with support, raises further questions (e.g. arising from the data)	uses results to identify when further tests and observations might be needed
	with support, makes predictions for new values within or beyond the data collected	uses test results to make predictions and to set up further comparative and fair tests

Implementation

Science is taught discreetly in class but also plays an important part in whole school activities, for example, during our annual science fair, our scientific careers fayre and regular science-based assemblies.

The science curriculum is taught in a way that ignites the children's interest, curiosity and passion for the subject. The children are signposted to the future opportunities that science can bring, and we particularly focus on building the confidence of girls in the subject.

We recognise that the key vocabulary, listed at the beginning of each subject area of the curriculum, need to be explicitly taught in order for the children to have the necessary tools to access the Science curriculum.

Enrichment activities linked to the year group curriculum

School Science Fair

Every June we hold a school science fair where children get to share a special investigation they have carried out. The whole school pay a visit to the fair, but also parents, even grandparents get to visit and the children get to show off all they have done.

Visits:

Year 4 and 5 – Royal Institute – L’Oreal Lab for Chemistry of Cosmetics.

Visitors:

Year 5 – The Astronomy Roadshow and Minister of Chocolate.

STEM Parents: A host of parents that work in STEM industries came into school to talk to children about their world.

Collins Aerospace: A team of engineers came into school to carry out a range of activities with the children, demonstrating science in action.

Impact

- Our children are inquisitive about the natural and scientific world, and are confident to ask questions
- Our children have the skills and understanding to formulate hypotheses based on evidence
- KS2 results are consistently above national and Hertfordshire measures
- The school is consistently graded as outstanding by our Hertfordshire Improvement Partner
- Anecdotal evidence suggests that our past pupils do well at GCSE and A level, and are highly valued by secondary colleagues
- There is a large percentage of children each year who gain places at high performing secondary schools, both in the state and private sector

We evaluate the impact of what we teach by...

- Carefully monitoring and reporting on the progress and attainment of individual children and groups of children, and ensuring that staff have access to this information to inform their planning
- Identifying gaps between disadvantaged children and other children, and ways to address gaps if they occur
- Regularly consulting with children
- Working in partnership with parents

This process of evaluation results in a continuous and relentless striving for marginal gains improvement.