Inspiring Children to shine

'Walk as children of light'

Science at Hardwicke Parochial Primary Academy

Purpose of study

At Hardwicke, we recognise that 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 in Key Stage 1 and Key Stage 2

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.

Scientific knowledge and conceptual understanding

The programmes of study describe a sequence of knowledge and concepts. While it is important that pupils make progress, it is also vitally important that they develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage. Insecure, superficial understanding will not allow genuine progression: pupils may struggle at key points of transition (such as between primary and secondary school), build up serious misconceptions, and/or have significant difficulties in understanding higher-order content. Pupils should be able to describe associated processes and key characteristics in common language, but they should also be familiar with, and use, technical terminology accurately and precisely. They should build up an extended specialist vocabulary. They should also apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data. The social and economic implications of science are important but, generally, they are taught most appropriately within the wider school curriculum: teachers will wish to use different contexts to maximise their pupils' engagement with and motivation to study science.

The nature, processes and methods of science

'Working scientifically' specifies the understanding of the nature, processes and methods of science for each year group. It should not be taught as a separate strand. The notes and guidance give examples of how 'working scientifically' might be embedded within the content of biology, chemistry and physics, focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions. These types of scientific enquiry should include: observing over time; pattern seeking; identifying, classifying and grouping; comparative and fair testing (controlled investigations); and researching using secondary sources. Pupils should seek answers to questions through collecting, analysing and presenting data. 'Working scientifically' will be developed further at key stages 3 and 4, once pupils have built up sufficient understanding of science to engage meaningfully in more sophisticated discussion of experimental design and control.

Spoken language

The national curriculum for science reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. They must be assisted in making their thinking clear, both to themselves and others, and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

EYFS

The Natural World Children at the expected level of development will:

- Explore the natural world around them, making observations and drawing pictures of animals and plants;
- Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class;
- Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.

Progression of skills

<table>
<tr><td rowspan="6">Biology</td><td>YR</td><td colspan="3">Understanding the World
Three & Four Year-Olds
Use all their senses in hands-on exploration of natural materials.
Explore collections of materials with similar and/or different properties.
Talk about what they see, using a wide vocabulary.
Begin to make sense of their own life-story and family’s history.
Explore how things work.
Plant seeds and care for growing plants.
Understand the key features of the life cycle of a plant and an animal.
Begin to understand the need to respect and care for the natural environment and all living things.
Explore and talk about different forces they can feel.
Talk about the differences between materials and changes they notice.
Reception
Explore the natural world around them.
Describe what they see, hear and feel while they are outside.
Recognise some environments that are different to the one in which they live.
Understand the effect of changing seasons on the natural world around them.
ELG
Explore the natural world around them, making observations and drawing pictures of animals and plants.
Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.
Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.</td></tr>
<tr><td>Key Vocabulary</td><td colspan="3">Science, experiment, test, fair, find out, explain, reason, why, record, senses, sight, hearing, touch, taste, smell, summer, winter, autumn, spring, life cycle, petal, leaf, root, seed, shoot, bulb, changing states e.g. rotting, ice, melting,</td></tr>
<tr><td></td><td>Animals including Humans</td><td>Animals including Humans</td><td>Plants</td></tr>
<tr><td></td><td>• Name common animals
• Carnivores, etc</td><td>• Human body and senses</td><td>• Common plants
• Plant structure</td></tr>
<tr><td>Year 1</td><td>Know how to classify a range of animals by amphibian, reptile, mammal, fish and birds
Know and classify animals by what they eat (carnivore, herbivore and omnivore)
Know how to sort by living and non- living things

Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets).</td><td>Know the name of parts of the human body that can be seen and say which part of the body is associated with each sense.</td><td>Know and name a variety of common wild and garden plants including deciduous and evergreen
Know and name the petals, stem, leaves and root of a plant
Know and name the roots, trunk, branches and leaves of a tree</td></tr>
</table>

	Key Vocabulary	amphibian, reptile, mammal, fish and birds, classify, animal, carnivore, herbivore and omnivore, living, non-living, sort, similar, different, structure, vertebrae, invertebrate, human, skeleton, bones, 5 senses, skin, common plant names, deciduous, evergreen, petals, stem, root, trunk, seed Leaves, soil,		
		All living things and their habitats	**Animals including Humans**	**Plants**
		• *Alive or dead* • *Habitats* • *Adaptations* • *Food chains*	• Animal reproduction • Healthy living • Basic needs	• Plant and seed growth • Plant reproduction • Keeping plants healthy
	Year 2	Classify things by living, dead or never lived Know how a specific habitat provides for the basic needs of things living there (plants and animals) Match living things to their habitat Name some different sources of food for animals Know about and explain a simple food chain	Know the basic stages in a life cycle for animals, (including humans) Know why exercise, a balanced diet and good hygiene are important for humans Find out about and describe the basic needs of animals, including humans, for survival (water, food and air).	Know and explain how seeds and bulbs grow into plants Know what plants need in order to grow and stay healthy (water, light & suitable temperature)
	Key Vocabulary	Revise Y1: omnivore, carnivore, herbivore, predator, prey Introduce: Alive, living, dead, never alive, habitat, MRS GREN, Movement, Respiration, Sense, Growth, Reproduction, Excretion, Nutrition, food chain, basic needs,	Life cycle, exercise, balanced diet, hygiene, basic needs, survival	Seed, stem, flower, leaf, light, soil, nutrition, fruit, bulb, healthy, temperature
		Animals, including humans	**Plants**	**Plants**
		• *Skeleton and muscles* • *Nutrition* • *Exercise and health*	• *Plant life* • *Basic structure and functions*	• *Life cycle* • *Water transportation*
	Year 3	Know about the importance of a nutritious, balanced diet Know how nutrients, water and oxygen are transported within animals and humans Know about the skeletal and muscular system of a human	Know the function of different parts of flowing plants and trees (roots, stem, trunk, leaves, flowers)t 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	Know how water is transported within plants Know the plant life cycle, especially the importance of flowers Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal

	Key Vocabulary	Balanced diet, carbohydrate, protein, sugar, carnivore, omnivore, herbivore, nutrients, blood, circulation, oxygen, muscle, skeleton roots, stem, trunk, leaves, flowers) light, water, soil, cycle, pollination, seed dispersal	
		Animals including humans	**All living things and their habitat**
		• *Digestive system* • *Teeth* • *Food chains*	• *Grouping living things* • *Classification keys* • *Adaptation of living things*
	Year 4	Identify and name the parts of the human digestive system Know the functions of the organs in the human digestive system Identify and know the different types of human teeth Know the functions of different human teeth Use and construct food chains to identify producers, predators and prey	Use classification keys to group, identify and name living things Know how changes to an environment could endanger living things
	Key Vocabulary	Mouth, oesophagus, stomach, liver, large intestine, small intestine, rectum Incisor, canine, molar, premolar Producer, predator, prey, carnivore, omnivore, herbivore Mammals, reptiles, birds, amphibians, fish, insects, vertebrate, invertebrate	
		All living things and their habitats	**Animals including humans**
		• *Life cycles – plants and animals* • *Reproductive processes* • *Famous naturalists*	• *Changes as humans develop from birth to old age*
	Year 5	Know the life cycle of different living things e.g. mammal, amphibian, insect and bird Know the differences between different life cycles Know the process of reproduction in plants Know the process of reproduction in animals	Create a timeline to indicate stages of growth in humans
	Key Vocabulary	David Attenborough, natural sciences, documentary, naturalist, lecture, Jane Goodall, chimpanzee, primatologist, primate, endangered, fertilisation, genes, sexual reproduction, pollination, pollen, unborn, egg, hatch, fledgling, mammary gland, metamorphosis, larva, pupa, tadpole, butterfly, asexual, plantlet, bulb, tuba, bacteria	Reproduce, adult, foetus, embryo, puberty, egg, sperm, ovary, testes, fertilisation, time period, breeding, gestation, growth spurt, childhood, motor skills, milk teeth, labour, adolescence, blood stream, hormone, growth, appetite, cataracts, cardio vascular, plasticity, memory, neuro-degenerative

		Animals including humans	**All living things and their habitat**	**Evolution and Inheritance**
		• *The circulatory system* • *Water transportation* • *Impact of exercise on body*	• *Classification of living things and the reasons for it*	• *Identical and non identical off-spring* • *Fossil evidence and evolution* • *Adaptation and evolution*
	Year 6	Identify and name the main parts of the human circulatory system Know the function of the heart, blood vessels and blood	Classify living things into broad groups according to observable characteristics and based on similarities and differences	Know how the Earth and living things have changed over time Know how fossils can be used to find out about the past

		Know the impact of diet, exercise, drugs and lifestyle on health Know the ways in which nutrients and water are transported in animals, including humans	Know how living things have been classified Give reasons for classifying plants and animals in a specific way	Know about reproduction and offspring (recognising that offspring normally vary and are not identical to their parents) • Know how animals and plants are adapted to suit their environment • Link adaptation over time to evolution • Know about evolution and can explain what it is
	Key Vocabulary	Blood vessels, circulatory system, oxygenated, capillary, heart rate, addiction, nutrients, balanced diet. **Blood and Transportation** - Transfusion, plasma, pancreas, diabetes, transportation, spleen, alveoli, bacteria.	Classify, prokaryote, species, vertebrate, invertebrate, microorganism, fungi, kingdom.	Evolution, inheritance, DNA, natural selection, ancestor, husbandry, generation, fossilisation.
		Everyday materials		
		• *Properties of materials* • *Grouping materials*		
	Year 1	Know the name of the materials an object is made from Know about the properties of everyday materials Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. Compare and group together a variety of everyday materials on the basis of their simple physical properties.		
	Key Vocabulary	Materials**,** wood, plastic, glass, metal, water, and rock, properties, waterproof, transparent, opaque, identify, hard, soft, similar, different, sort, physical		
		Everyday materials		
		• *Identify different materials* • *Name everyday materials* • *Properties of materials* • *Compare the use of different materials* • *Compare movement on different surfaces*		
	Year 2	Know how materials can be changed by squashing, bending, twisting and stretching Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. Know why a material might or might not be used for a specific job		
	Key Vocabulary	Wood, glass, plastic, paper, cardboard, card, tissue, metal, rock, brick Squash, twist, bend, stretch Opaque, transparent, soft, hard, flexible, stiff, absorbent, waterproof, smooth, rough.		
		Rocks		
		• *Fossil formation* • *Compare and group rocks* • *Soil*		
	Year 3	Compare and group rocks based on their appearance and physical properties, giving reasons Know how soil is made and how fossils are formed		

		Know about and explain the difference between sedimentary, metamorphic and igneous rock	
	Key Vocabulary	Rocks, soil, sedimentary, metamorphic, igneous clay, fossil	
		States of matter	
		• *Compare and group materials* • *Solids, liquids and gases* • *Changing state* • *Water cycle*	
	Year 4	Know the temperature at which materials change state Know about and explore how some materials can change state Know the part played by evaporation and condensation in the water cycle Group materials based on their state of matter (solid, liquid or gas)	
	Key Vocabulary	Particles, freeze, melt, evaporate, condensation Water cycle, precipitation, solid, liquid, gas	
		Properties and changes in materials	
		• *Compare properties of everyday materials* • *Soluble/ dissolving* • *Reversible and irreversible substances*	
	Year 5	Compare and group materials based on their properties (e.g. hardness, solubility, transparency, conductivity, [electrical & thermal], and response to magnets Know and explain how a material dissolves to form a solution Know and show how to recover a substance from a solution Know and demonstrate how some materials can be separated (e.g. through filtering, sieving and evaporating) Know and demonstrate that some changes are reversible and some are not Know how some changes result in the formation of a new material and that this is usually irreversible	
	Key Vocabulary	Elastic, durable, absorbency, waterproof, flexibility, hardness, transparency, conductive, magnetic, solubility, bridge, tamp, damp, unmould, cotton, adhesive, resistant, roof, resource, non-renewable, sustainable, over exploited, renewable, conduction, Kelvin, insulation, thermal conductivity. Separating, method, filter, sieve, evaporate, solution, dissolve, solute, saturated, solvent, bicarbonate of soda, irreversible, reversible, permanent, burning, activate, bond, molecule, product, reaction, atom, physical change, chemical change, rust, iron oxide, properties, compound, element, mixture, helium, methane	
		Seasonal change	
		• *The four seasons* • *Seasonal weather*	
	Year 1	Name the seasons and know about the type of weather in each season Observe and describe weather associated with the seasons and how day length varies.	
	Key Vocabulary	Autumn, Winter, Spring, Summer, Weather, similar, different, season, Months, Year, observe, change	
		Forces	**Light**
		• *Different Forces* • *Magnets*	• *Reflections* • *Shadows*
	Year 3	Know about and describe how objects move on different surfaces	Know that dark is the absence of light

		Know how a simple pulley works and use to on to lift an object Know how some forces require contact and some do not, giving examples Know about and explain how magnets attract and repel Predict whether magnets will attract or repel and give a reason	Know that light is needed in order to see and is reflected from a surface Know and demonstrate how a shadow is formed and explain how a shadow changes shape Know about the danger of direct sunlight and describe how to keep protected
	Key Vocabulary	**Friction, pulleys, force, attract, repel,** **Shadow, opaque, transparent, translucent, shadow, light source**	
		Electricity	**Sound**
		• *Uses of electricity* • *Simple circuits and switches* • *Conductors and insulators*	• *How sounds are made* • *Sound vibrations* • *Pitch and Volume*
	Year 4	Identify and name appliances that require electricity to function Construct a series circuit Identify and name the components in a series circuit (including cells, wires, bulbs, switches and buzzers) Predict and test whether a lamp will light within a circuit Know the function of a switch Know the difference between a conductor and an insulator; giving examples of each	Know how sound is made, associating some of them with vibrating Know how sound travels from a source to our ears Know the correlation between pitch and the object producing a sound Know the correlation between the volume of a sound and the strength of the vibrations that produced it Know what happens to a sound as it travels away from its source
	Key Vocabulary	Electricity, appliance, circuit, series circuit, mains, battery, wire, cell, bulb, buzzer, motor, switch, conductor, insulator Sound, vibrate, sound waves, volume, pitch	
		Forces	**Earth and Space**
		• *Gravity* • *Friction* • *Forces and motion of mechanical devices*	• *Movement of the Earth and the planets* • *Movement of the Moon* • *Night and day*
	Year 5	Know what gravity is and its impact on our lives Identify and know the effect of air and water resistance Identify and know the effect of friction Explain how levers, pulleys and gears allow a smaller force to have a greater effect	Know about and explain the movement of the Earth and other planets relative to the Sun Know about and explain the movement of the Moon relative to the Earth Know and demonstrate how night and day are created Describe the Sun, Earth and Moon (using the term spherical)
	Key Vocabulary	Sir Isaac Newton, prism, gravity, theory, curved mirror, parachute, paragliding, skydiving, drag, brake, water resistance, streamlined, paddle, friction, load, effort, lever, pivot, fulcrum, gear, sinking, floating, mass, volume, buoyant	Heliocentric, geocentric, Nicholaus Copernicus, orbit, Ptolemy, axis, season, poles, eclipse, hemisphere, rocky planets, gas planets, dwarf planets, moon, solar system, astronomy, universe, milky way, expand, big bang theory, ocean tides, gravitational force, black hole, mass, celestial, phase, illuminate, waxing, waning, ellipsis, elliptical
		Electricity	**Light**
		• *Electrical components* • *Simple circuits* • *Fuses and voltage*	• *How light travels* • *Reflection* • *Ray models of light*

	Year 6	*Compare and give reasons for why components work and do not work in a circuit* *Draw circuit diagrams using correct symbols* *Know how the number and voltage of cells in a circuit links to the brightness of a lamp or the volume of a buzzer*	*Know how light travels* *Know and demonstrate how we see objects* *Know why shadows have the same shape as the object that casts them* *Know how simple optical instruments work e.g. periscope, telescope, binoculars, mirror, magnifying glass etc.*
	Key Vocabulary	Static electricity, filament, voltage, insulator, conductor, fuse, component, variable resistor.	Transparent, opaque, translucent, magnify, angle of incidence, angle of reflection, lens, refraction.