

Science – Subject Overview

From The National Curriculum in England – framework document 2013...

Purpose of study

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.

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.

Attainment targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

Key stage 1

The principal focus of science teaching in key stage 1 is to enable pupils to experience and observe phenomena, looking more closely at the natural and humanly-constructed world around them. They should be encouraged to be curious and ask questions about what they notice. They should be helped to develop their understanding of scientific ideas by using different types of scientific enquiry to answer their own questions, including observing changes over a period of time, noticing patterns, grouping and classifying things, carrying out simple comparative tests, and finding things out using secondary sources of information. They should begin to use simple scientific language to talk about what they have found out and communicate their ideas to a range of audiences in a variety of ways. Most of the learning about science should be done through the use of first-hand practical experiences, but there should also be some use of appropriate secondary sources, such as books, photographs and videos.

'Working scientifically' is described separately in the programme of study, but must **always** be taught through and clearly related to the teaching of substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

Working Scientifically

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking simple questions and recognising that they can be answered in different ways
- observing closely, using simple equipment
- performing simple tests
- identifying and classifying
- using their observations and ideas to suggest answers to questions
- gathering and recording data to help in answering questions.

Areas of Study

Plants

Pupils should be taught to:

- 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.

Animals, including Humans

Pupils should be taught to:

- 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.

Everyday materials

Pupils should be taught to:

- 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.

Seasonal Changes

Pupils should be taught to:

- observe changes across the four seasons
- observe and describe weather associated with the seasons and how day length varies.

Key stage 2

Lower Key Stage 2 – Years 3 & 4

The principal focus of science teaching in lower key stage 2 is to enable pupils to broaden their scientific view of the world around them. They should do this through exploring, talking about, testing and developing ideas about everyday phenomena and the relationships between living things and familiar environments, and by beginning to develop their ideas about functions, relationships and interactions. They should ask their own questions about what they observe and make some decisions about which types of scientific enquiry are likely to be the best ways of answering them, including observing changes over time, noticing patterns, grouping and classifying things, carrying out simple comparative and fair tests and finding things out using secondary sources of information. They should draw simple conclusions and use some scientific language, first, to talk about and, later, to write about what they have found out.

'Working scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read and spell scientific vocabulary correctly and with confidence, using their growing word reading and spelling knowledge.

Working Scientifically

During years 3 and 4, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- asking relevant questions and using different types of scientific enquiries to answer them
- setting up simple practical enquiries, comparative and fair tests
- making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers
- gathering, recording, classifying and presenting data in a variety of ways to help in answering questions
- recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables
- reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions
- using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions
- identifying differences, similarities or changes related to simple scientific ideas and processes
- using straightforward scientific evidence to answer questions or to support their findings.

Areas of Study

Year 3

Plants

Pupils should be taught to:

- identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers
- explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant
- investigate the way in which water is transported within plants
- explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

Animals, including humans

Pupils should be taught to:

- 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.

Rocks

Pupils should be taught to:

- compare and group together different kinds of rocks on the basis of their appearance and simple physical properties

- describe in simple terms how fossils are formed when things that have lived are trapped within rock
- recognise that soils are made from rocks and organic matter.

Light

Pupils should be taught to:

- recognise that they need light in order to see things and that dark is the absence of light
- notice that light is reflected from surfaces
- recognise that light from the sun can be dangerous and that there are ways to protect their eyes
- recognise that shadows are formed when the light from a light source is blocked by a solid object
- find patterns in the way that the size of shadows change.

Forces and magnets

Pupils should be taught to:

- compare how things move on different surfaces
- notice that some forces need contact between two objects, but magnetic forces can act at a distance
- observe how magnets attract or repel each other and attract some materials and not others
- compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
- describe magnets as having two poles
- predict whether two magnets will attract or repel each other, depending on which poles are facing.

Year 4

Living things and their habitats

Pupils should be taught to:

- 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.

Animals, including humans

Pupils should be taught to:

- 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
- construct and interpret a variety of food chains, identifying producers, predators and prey.

States of matter

Pupils should be taught to:

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius ($^{\circ}\text{C}$)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Sound

Pupils should be taught to:

- identify how sounds are made, associating some of them with something vibrating
- recognise that vibrations from sounds travel through a medium to the ear
- find patterns between the pitch of a sound and features of the object that produced it
- find patterns between the volume of a sound and the strength of the vibrations that produced it
- recognise that sounds get fainter as the distance from the sound source increases.

Electricity

Pupils should be taught to:

- identify common appliances that run on electricity
- construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers
- identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery
- recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit
- recognise some common conductors and insulators, and associate metals with being good conductors.

Upper Key Stage 2 – Years 5&6

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

'Working and thinking scientifically' is described separately at the beginning of the programme of study, but must **always** be taught through and clearly related to substantive science content in the programme of study. Throughout the notes and guidance, examples show how scientific methods and skills might be linked to specific elements of the content.

Pupils should read, spell and pronounce scientific vocabulary correctly.

Working Scientifically

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- using test results to make predictions to set up further comparative and fair tests
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments.

Areas of Study

Year 5

Living things and their habitats

Pupils should be taught to:

- 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.

Animals, including humans

Pupils should be taught to:

- describe the changes as humans develop to old age.

Properties and changes of materials

Pupils should be taught to:

- compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Earth and space

Pupils should be taught to:

- describe the movement of the Earth, and other planets, relative to the Sun in the solar system
- describe the movement of the Moon relative to the Earth
- describe the Sun, Earth and Moon as approximately spherical bodies
- use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Forces

Pupils should be taught to:

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Year 6

Living things and their habitats

Pupils should be taught to:

- 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.

Animals including humans

Pupils should be taught to:

- 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.

Evolution and inheritance

Pupils should be taught to:

- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago
- recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
- identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Light

Pupils should be taught to:

- recognise that light appears to travel in straight lines
- use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye
- explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
- use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

Electricity

Pupils should be taught to:

- associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- use recognised symbols when representing a simple circuit in a diagram.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 1	Ongoing Learning Unit	What's the weather like today?	Seasonal Changes			
	Why do we play...? <i>Everday Materials</i> <i>Animals including humans</i> When I was a baby Name body parts and their purpose Investigation – using the senses Comparing similarities and differences Keeping healthy	Hello I'm new here. <i>Plants</i> <i>Animals including humans</i> <i>Seasonal changes</i> Plants near our school	What can learn about our world from stories? <i>Everyday materials</i> <i>Seasonal changes</i> Sorting materials for puppets Sorting materials (floating & sinking) Mixing and changing materials Making shadows	Starry Night <i>Seasonal change</i> Light and light sources Telescopes Shooting stars Star constellations	Why is water so precious? <i>Plants</i> <i>Animals including Humans</i> <i>Seasonal Changes</i> Growing <ul style="list-style-type: none"> • Exploring seeds • Class seed diary • What do plants need to grow? • My results Pond life <ul style="list-style-type: none"> • Visit pond • Frog spawn • Review investigation How the environment affects plants & animals Food that keeps us healthy Open ended questions Review investigation Growing/Pond life <ul style="list-style-type: none"> • Grouping plants • Alive or not? • Review of investigation Caring for the environment <ul style="list-style-type: none"> • Walk around school • Research in their gardens • - Review investigation • 	Where could we go for a great day out? <i>Animals including humans</i> What kind of animals live in rivers?

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 2	<p>Can Party Food be Healthy? <i>Everyday Materials</i> <i>Animals, including humans</i> Healthy Eating Sorting and classifying materials Properties of materials Use of materials on basis of properties Changing the shapes of materials Exercise</p>	<p>Pride in Place <i>Plants</i> <i>Seasonal changes</i> Identifying common plants and trees Labelling drawings of plants and trees</p>	<p>What is the best way for Mrs Armitage travel? <i>Everyday Materials</i> <i>Seasonal changes</i> Investigating materials Which materials make the best wheels? Which materials are waterproof Test the vehicles</p>	<p>Where do bong trees grow? <i>Animals, including humans</i> Example using local resources o Local bee keeper o Honey tasting o Bee life cycle o Pollination o Make honey biscuits</p>	<p>What makes us like other animals? <i>Animals, including humans</i> <i>Plants</i> <i>Living things and their habitats (KS2)</i> Is it Living? Nature detective Categorisation Observational drawings Human impact on the environment. Animal and Human Care Egg pet Caring for creatures Keeping the world healthy Looking after ourselves Life Stories Parent and young Animal and human life stories. Animal Families How are animals the same? Habitats and Humans What is a habitat? Human senses Animal senses What's in our air?</p>	<p>How did families have fun in the past? <i>Everyday materials</i> <i>Seasonal changes</i> <i>Rocks(KS2)</i> Classification Sorting natural and manmade materials and objects Fossils</p>

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 3	<p>How does electricity work? <i>Electricity</i> <i>Forces & Magnets</i> I wonder...? Lighting up a bulb Electrical conductors Switches Lighting up a picture Concept map magnets Magnetic materials Static electricity Finding out about magnets Memorise Science 'Killer Facts'</p>	<p>Who were the greatest builders...? <i>Plants</i> <i>Forces</i> Germinating and growing Testing bricks Moving heavy objects Memorise Science 'Killer Facts'</p>	<p>Let's go on an adventure. Would we like to visit Guatemala? <i>Forces & Friction</i> <i>Measuring forces</i> <i>Pulling objects</i> <i>(Air resistance Y5)</i> Pushes and pulls 'Magically' make an object move Friction Measuring forces Air resistance Memorise Science 'Killer Facts'</p>	<p>The Games Children Play</p>	<p>Are Bugs important? <i>Plants</i> <i>Animals including humans</i> <i>Living things and their habitats</i> What is a plant/animal? Is it alive? Intro to ant farm Investigation assessment – What do plants need? Where does the water go? What are roots for? Habitats/Habitats in the school grounds Seed dispersal Life cycle of an ant/butterfly Food chains Memorise Killer Facts</p>	<p>How can we make living here better for everyone? <i>Rocks</i> Investigating materials Memorise Science 'Killer Facts'</p>

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 4	<p>How do I see? How do I hear? <i>Light</i> <i>Sound</i> I wonder...? Investigating materials How do we see? Shadows Reflection Challenges using mirrors Sounds are made when objects vibrate Seeing vibrations Feeling vibrations Vibrations from sound sources travel through medium Sound insulation Pitch and loudness Exploring refraction, reflection, colour Memorise Science 'Killer Facts'</p>	<p>Why do we speak English at school? <i>Forces</i> Sail power Memorise Science 'Killer Facts'</p>	<p>Should we stop eating chocolate? <i>States of matter</i> Dissolving investigation Food value of chocolate bar How does the chocolate become fuel/energy for our bodies? Which sugar dissolves first? Should we continue to eat chocolate as far as our teeth are concerned? Changes occur when materials are heated or cooled* Temperature is a measure of hot and cold Heating solid materials can cause irreversible changes* Burning materials results in irreversible changes* Memorise Science 'Killer Facts'</p>	<p>From a Railway Carriage</p>	<p>What happens inside us? <i>Animals, including humans</i> Concept of living How do our bodies feel after exercise? The heart and pulse Science investigation – how exercise affects our bodies Organs of the body Skin, skeleton and muscles Jigsaw activity Digestive system Sorting food Healthy eating The Brown family Food labels Teeth Tooth decay Dental care Revisit science investigation Quiz Memorise science 'Killer Facts'</p>	<p>European Regional Study <i>Seasonal changes(KS1)</i> Measuring air temperature Making and using temperature records Memorise Science 'Killer Facts'</p>

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 5	What's it made of? <i>Properties and changes to materials</i> Quiz (part1) Trainee Materials Scientists Key terms Classifying materials Problem – sustainable carrier bags Dissolving Separating insolubles Evaporation Recovering sugar Evaporating perfumes Solids, liquids, gases Cornflour slime Gases Keeping it cool Non-reversible changes Big separation problem Quiz (part 1 and 2) Memorise Science 'Killer Facts'	Why would someone build a castle...? <i>Forces</i> Catapult investigation	Fairgrounds <i>Electricity</i> <i>Light</i> <i>Forces</i> Electrical circuits Forces Light Sound Memorise Science 'Killer Facts'	The Highwayman	Do we make the most of what is right on our doorstep? <i>Living things and their habitats</i> <i>Animals including humans</i> Plant search Plant classification Grow your own salad Life cycle of a plant Parts of a plant and functions Pollination Investigation – germination Seed dispersal The dandelion seed Parachute investigation Food chains Pond visit Memorise science 'Killer Facts'	Who are we? Why do I live here? UK and Duluth USA <i>Rocks</i> Fossils and the Great Lakes Memorise Science 'Killer Facts'

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 6	What's out there? <i>Earth & space</i> <i>(Light</i> <i>States of matter</i> <i>Rocks)</i> I wonder...? Enough water Investigating evaporation and condensation Water cleaning Position of the Sun Day and night Earth's orbit Moon's orbit Role Play Moon shapes Relative sizes of planets Gravity Names of planets Investigating insulation Rocks and soils Memorise Science 'Killer Facts'	Has there ever been a better time...? Discrete Science review and revisit according to need – See Let's Go Round Again - Memorise Killer facts	Why do some creatures no longer exist? <i>Evolution & inheritance</i> <i>(Living things and their habitats</i> <i>Seasonal changes)</i> Biography in a Bag We are naturalists Carl Linnaeus – optional The Chimp report Natural selection activity Darwin's finches Telling the story – population graphs Creating something new Plants Animals What do we know about fossils Memorise Science 'Killer Facts' So, why do some creatures no longer exist? Review of Learning Memorise killer facts Presenting our learning	The Lady of Shalott Discrete Science review and revisit according to need – See Let's Go Round Again - Memorise Killer facts	The Great UK Geographical Challenge Discrete Science review and revisit according to need – See Let's Go Round Again - Memorise Killer facts	How successful are we as entrepreneurs?
EYFS-Y6	The Ancient Greeks – Whole School Learning Unit (suggested use Olympics year i.e. every four years) Further opportunities to explore and provide experiences in this subject area					
	The Global Dimension – Whole School Learning Unit (can be used at your discretion. You may choose to revisit every 3-4 years) This is intended to provide a launch pad for adding a global dimension to your existing curriculum. Further opportunities to explore and provide experiences in this subject area					



Subject Leaders plan for and layer on school's own:

- Entitlement and simple progression
- Sig individuals artists/architects/scientist/historical – **in bold**
- Also see **The *Subjectness* of Subjects** in the **Teacher and Subject Leader Handbook**, the **Science Guidance** booklet, and **Let's Go Round Again** Y6 Learning Unit