
The National Curriculum for England: science

Jointly published by

Department for Education and Employment
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First published in 1999

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[The importance of science

Science stimulates and excites pupils' curiosity about phenomena and events in the world around them. It also satisfies this curiosity with knowledge. Because science links direct practical experience with ideas, it can engage learners at many levels. Scientific method is about developing and evaluating explanations through experimental evidence and modelling. This is a spur to critical and creative thought. Through science, pupils understand how major scientific ideas contribute to technological change - impacting on industry, business and medicine and improving quality of life. Pupils recognise the cultural significance of science and trace its worldwide development. They learn to question and discuss science-based issues that may affect their own lives, the direction of society and the future of the world.]

Programme of study: science

Key stage 1

[During key stage 1 pupils observe, explore and ask questions about living things, materials and phenomena. They begin to work together to collect evidence to help them answer questions and to link this to simple scientific ideas. They evaluate evidence and consider whether tests or comparisons are fair. They use reference materials to find out more about scientific ideas. They share their ideas and communicate them using scientific language, drawings, charts and tables.]

Knowledge, skills and understanding

Teaching should ensure that scientific enquiry is taught through contexts taken from the sections on life processes and living things, materials and their properties and physical processes.

Scl Scientific enquiry

Ideas and evidence in science

1. Pupils should be taught that it is important to collect evidence by making observations and measurements when trying to answer a question.

Investigative skills

2. Pupils should be taught to:

Planning

- a) ask questions [for example, 'How?', 'Why?', 'What will happen if ...?'] and decide how they might find answers to them
- b) use first-hand experience and simple information sources to answer questions
- c) think about what might happen before deciding what to do
- d) recognise when a test or comparison is unfair

Obtaining and presenting evidence

- e) follow simple instructions to control the risks to themselves and to others
- f) explore, using the senses of sight, hearing, smell, touch and taste as appropriate, and make and record observations and measurements
- g) communicate what happened in a variety of ways, including using ICT [for example, in speech and writing, by drawings, tables, block graphs and pictograms]

Considering evidence and evaluating

- h) make simple comparisons [for example, hand span, shoe size] and identify simple patterns or associations

- i) compare what happened with what they expected would happen, and try to explain it, drawing on their knowledge and understanding
- j) review their work and explain what they did to others.

Sc2 Life processes and living things

Life processes

1. Pupils should be taught:
 - a) the differences between things that are living and things that have never been alive
 - b) that animals, including humans, move, feed, grow, use their senses and reproduce
 - c) to relate life processes to animals and plants found in the local environment.

Humans and other animals

2. Pupils should be taught:
 - a) to recognise and compare the main external parts of the bodies of humans and other animals
 - b) that humans and other animals need food and water to stay alive
 - c) that taking exercise and eating the right types and amounts of food help humans to keep healthy
 - d) about the role of drugs as medicines
 - e) how to treat animals with care and sensitivity
 - f) that humans and other animals can produce offspring and that these offspring grow into adults
 - g) about the senses that enable humans and other animals to be aware of the world around them.

Green plants

3. Pupils should be taught:
 - a) to recognise that plants need light and water to grow
 - b) to recognise and name the leaf, flower, stem and root of flowering plants
 - c) that seeds grow into flowering plants.

Variation and classification

4. Pupils should be taught to:
 - a) recognise similarities and differences between themselves and others, and to treat others with sensitivity
 - b) group living things according to observable similarities and differences.

Living things in their environment

5. Pupils should be taught to:
 - a) find out about the different kinds of plants and animals in the local environment
 - b) identify similarities and differences between local environments and ways in which these affect animals and plants that are found there
 - c) care for the environment.

Sc3 Materials and their properties

Grouping materials

1. Pupils should be taught to:
 - a) use their senses to explore and recognise the similarities and differences between materials
 - b) sort objects into groups on the basis of simple material properties [for example, roughness, hardness, shininess, ability to float, transparency and whether they are magnetic or non-magnetic]
 - c) recognise and name common types of material [for example, metal, plastic, wood, paper, rock] and recognise that some of them are found naturally
 - d) find out about the uses of a variety of materials [for example, glass, wood, wool] and how these are chosen for specific uses on the basis of their simple properties.

Changing materials

2. Pupils should be taught to:
 - a) find out how the shapes of objects made from some materials can be changed by some processes, including squashing, bending, twisting and stretching
 - b) explore and describe the way some everyday materials [for example, water, chocolate, bread, clay] change when they are heated or cooled.

Sc4 Physical processes

Electricity

1. Pupils should be taught:
 - a) about everyday appliances that use electricity
 - b) about simple series circuits involving batteries, wires, bulbs and other components [for example, buzzers, motors]
 - c) how a switch can be used to break a circuit.

Forces and motion

2. Pupils should be taught:
 - a) to find out about, and describe the movement of, familiar things [for example, cars going faster, slowing down, changing direction]
 - b) that both pushes and pulls are examples of forces
 - c) to recognise that when things speed up, slow down or change direction, there is a cause [for example, a push or a pull].

Light and sound

3. Pupils should be taught:

Light and dark

- a) to identify different light sources, including the Sun
- b) that darkness is the absence of light

Making and detecting sounds

- c) that there are many kinds of sound and sources of sound
- d) that sounds travel away from sources, getting fainter as they do so, and that they are heard when they enter the ear.

Breadth of study

1. During the key stage, pupils should be taught the Knowledge, skills and understanding through:
 - a) a range of domestic and environmental contexts that are familiar and of interest to them
 - b) looking at the part science has played in the development of many useful things
 - c) using a range of sources of information and data, including ICT-based sources
 - d) using first-hand and secondary data to carry out a range of scientific investigations, including complete investigations.

2. During the key stage, pupils should be taught to:

Communication

- a) use simple scientific language to communicate ideas and to name and describe living things, materials, phenomena and processes

Health and safety

- b) recognise that there are hazards in living things, materials and physical processes, and assess risks and take action to reduce risks to themselves and others.

Key stage 2

[During key stage 2 pupils learn about a wider range of living things, materials and phenomena. They begin to make links between ideas and to explain things using simple models and theories. They apply their knowledge and understanding of scientific ideas to familiar phenomena, everyday things and their personal health. They begin to think about the positive and negative effects of scientific and technological developments on the environment and in other contexts. They carry out more systematic investigations, working on their own and with others. They use a range of reference sources in their work. They talk about their work and its significance, and communicate ideas using a wide range of scientific language, conventional diagrams, charts and graphs.]

Knowledge, skills and understanding

Teaching should ensure that scientific enquiry is taught through contexts taken from the sections on life processes and living things, materials and their properties and physical processes.

Sc1 Scientific enquiry

Ideas and evidence in science

1. Pupils should be taught:
 - a) that science is about thinking creatively to try to explain how living and non-living things work, and to establish links between causes and effects [for example, Jenner's vaccination work]
 - b) that it is important to test ideas using evidence from observation and measurement.

Investigative skills

2. Pupils should be taught to:

Planning

- a) ask questions that can be investigated scientifically and decide how to find answers
- b) consider what sources of information, including first-hand experience and a range of other sources, they will use to answer questions
- c) think about what might happen or try things out when deciding what to do, what kind of evidence to collect, and what equipment and materials to use
- d) make a fair test or comparison by changing one factor and observing or measuring the effect while keeping other factors the same

Obtaining and presenting evidence

- e) use simple equipment and materials appropriately and take action to control risks
- f) make systematic observations and measurements, including the use of ICT for datalogging
- g) check observations and measurements by repeating them where appropriate

h) use a wide range of methods, including diagrams, drawings, tables, bar charts, line graphs and ICT, to communicate data in an appropriate and systematic manner

Considering evidence and evaluating

i) make comparisons and identify simple patterns or associations in their own observations and measurements or other data

j) use observations, measurements or other data to draw conclusions

k) decide whether these conclusions agree with any prediction made and/or whether they enable further predictions to be made

l) use their scientific knowledge and understanding to explain observations, measurements or other data or conclusions

m) review their work and the work of others and describe its significance and limitations.

Sc2 Life processes and living things

Life processes

1. Pupils should be taught:

- a) that the life processes common to humans and other animals include nutrition, movement, growth and reproduction
- b) that the life processes common to plants include growth, nutrition and reproduction
- c) to make links between life processes in familiar animals and plants and the environments in which they are found.

Humans and other animals

2. Pupils should be taught:

Nutrition

- a) about the functions and care of teeth
- b) about the need for food for activity and growth, and about the importance of an adequate and varied diet for health

Circulation

- c) that the heart acts as a pump to circulate the blood through vessels around the body, including through the lungs
- d) about the effect of exercise and rest on pulse rate

Movement

- e) that humans and some other animals have skeletons and muscles to support and protect their bodies and to help them to move

Growth and reproduction

- f) about the main stages of the human life cycle

Health

- g) about the effects on the human body of tobacco, alcohol and other drugs, and how these relate to their personal health
- h) about the importance of exercise for good health.

Green plants

3. Pupils should be taught:

Growth and nutrition

- a) the effect of light, air, water and temperature on plant growth
- b) the role of the leaf in producing new material for growth
- c) that the root anchors the plant, and that water and minerals are taken in through the root and transported through the stem to other parts of the plant

Reproduction

- d) about the parts of the flower [for example, stigma, stamen, petal, sepal] and their role in the life cycle of flowering plants, including pollination, seed formation, seed dispersal and germination.

Variation and classification

4. Pupils should be taught:

- a) to make and use keys
- b) how locally occurring animals and plants can be identified and assigned to groups
- c) that the variety of plants and animals makes it important to identify them and assign them to groups.

Living things in their environment

5. Pupils should be taught:

- a) about ways in which living things and the environment need protection

Adaptation

- b) about the different plants and animals found in different habitats
- c) how animals and plants in two different habitats are suited to their environment

Feeding relationships

- d) to use food chains to show feeding relationships in a habitat
- e) about how nearly all food chains start with a green plant

Micro-organisms

- f) that micro-organisms are living organisms that are often too small to be seen, and that they may be beneficial [for example, in the breakdown of waste, in making bread] or harmful [for example, in causing disease, in causing food to go mouldy].

Sc3 Materials and their properties

Grouping and classifying materials

1. Pupils should be taught:
 - a) to compare everyday materials and objects on the basis of their material properties, including hardness, strength, flexibility and magnetic behaviour, and to relate these properties to everyday uses of the materials
 - b) that some materials are better thermal insulators than others
 - c) that some materials are better electrical conductors than others
 - d) to describe and group rocks and soils on the basis of their characteristics, including appearance, texture and permeability
 - e) to recognise differences between solids, liquids and gases, in terms of ease of flow and maintenance of shape and volume.

Changing materials

2. Pupils should be taught:
 - a) to describe changes that occur when materials are mixed [for example, adding salt to water]
 - b) to describe changes that occur when materials [for example, water, clay, dough] are heated or cooled
 - c) that temperature is a measure of how hot or cold things are
 - d) about reversible changes, including dissolving, melting, boiling, condensing, freezing and evaporating
 - e) the part played by evaporation and condensation in the water cycle
 - f) that non-reversible changes [for example, vinegar reacting with bicarbonate of soda, plaster of Paris with water] result in the formation of new materials that may be useful
 - g) that burning materials [for example, wood, wax, natural gas] results in the formation of new materials and that this change is not usually reversible.

Separating mixtures of materials

3. Pupils should be taught:
 - a) how to separate solid particles of different sizes by sieving [for example, those in soil]
 - b) that some solids [for example, salt, sugar] dissolve in water to give solutions but some [for example, sand, chalk] do not
 - c) how to separate insoluble solids from liquids by filtering
 - d) how to recover dissolved solids by evaporating the liquid from the solution
 - e) to use knowledge of solids, liquids and gases to decide how mixtures might be separated.

Sc4 Physical processes

Electricity

1. Pupils should be taught:

Simple circuits

- a) to construct circuits, incorporating a battery or power supply and a range of switches, to make electrical devices work [for example, buzzers, motors]
- b) how changing the number or type of components [for example, batteries, bulbs, wires] in a series circuit can make bulbs brighter or dimmer
- c) how to represent series circuits by drawings and conventional symbols, and how to construct series circuits on the basis of drawings and diagrams using conventional symbols.

Forces and motion

2. Pupils should be taught:

Types of force

- a) about the forces of attraction and repulsion between magnets, and about the forces of attraction between magnets and magnetic materials
- b) that objects are pulled downwards because of the gravitational attraction between them and the Earth
- c) about friction, including air resistance, as a force that slows moving objects and may prevent objects from starting to move
- d) that when objects [for example, a spring, a table] are pushed or pulled, an opposing pull or push can be felt
- e) how to measure forces and identify the direction in which they act.

Light and sound

3. Pupils should be taught:

Everyday effects of light

- a) that light travels from a source
- b) that light cannot pass through some materials, and how this leads to the formation of shadows
- c) that light is reflected from surfaces [for example, mirrors, polished metals]

Seeing

- d) that we see things only when light from them enters our eyes

Vibration and sound

- e) that sounds are made when objects [for example, strings on musical instruments] vibrate but that vibrations are not always directly visible
- f) how to change the pitch and loudness of sounds produced by some vibrating objects [for example, a drum skin, a plucked string]
- g) that vibrations from sound sources require a medium [for example, metal, wood, glass, air] through which to travel to the ear.

The Earth and beyond

4. Pupils should be taught:

The Sun, Earth and Moon

a) that the Sun, Earth and Moon are approximately spherical

Periodic changes

b) how the position of the Sun appears to change during the day, and how shadows change as this happens

c) how day and night are related to the spin of the Earth on its own axis

d) that the Earth orbits the Sun once each year, and that the Moon takes approximately 28 days to orbit the Earth.

Breadth of study

1. During the key stage, pupils should be taught the Knowledge, skills and understanding through:

a) a range of domestic and environmental contexts that are familiar and of interest to them

b) looking at the part science has played in the development of many useful things

c) using a range of sources of information and data, including ICT-based sources

d) using first-hand and secondary data to carry out a range of scientific investigations, including complete investigations.

2. During the key stage, pupils should be taught to:

Communication

a) use appropriate scientific language and terms, including SI units of measurement [for example, metre, newton], to communicate ideas and explain the behaviour of living things, materials, phenomena and processes

Health and safety

b) recognise that there are hazards in living things, materials and physical processes, and assess risks and take action to reduce risks to themselves and others.