

Programme of study: science

Key stage 4

Knowledge, skills and understanding

Teachers should ensure that the **Knowledge, skills and understanding** of how science works are integrated into the teaching of the **Breadth of study**.

How science works

Data, evidence, theories and explanations

- 1 Pupils should be taught:
 - a how scientific data can be collected and analysed
 - b how interpretation of data, using creative thought, provides evidence to test ideas and develop theories
 - c how explanations of many phenomena can be developed using scientific theories, models and ideas
 - d that there are some questions that science cannot currently answer, and some that science cannot address.

Practical and enquiry skills

- 2 Pupils should be taught to:
 - a plan to test a scientific idea, answer a scientific question, or solve a scientific problem
 - b collect data from primary or secondary sources, including using ICT sources and tools
 - c work accurately and safely, individually and with others, when collecting first-hand data
 - d evaluate methods of collection of data and consider their validity and reliability as evidence.

Communication skills

- 3 Pupils should be taught to:
 - a recall, analyse, interpret, apply and question scientific information or ideas
 - b use both qualitative and quantitative approaches
 - c present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools.

Applications and implications of science

- 4 Pupils should be taught:
 - a about the use of contemporary scientific and technological developments and their benefits, drawbacks and risks
 - b to consider how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions
 - c how uncertainties in scientific knowledge and scientific ideas change over time and about the role of the scientific community in validating these changes.

During key stage 4, pupils learn about the way science and scientists work within society. They consider the relationships between data, evidence, theories and explanations, and develop their practical, problem-solving and enquiry skills, working individually and in groups. They evaluate enquiry methods and conclusions both qualitatively and quantitatively, and communicate their ideas with clarity and precision.

All pupils develop their ability to relate their understanding of science to their own and others' decisions about lifestyles, and to scientific and technological developments in society.

Most pupils also develop their understanding and skills in ways that provide the basis for further studies in science and related areas.

Note

The general teaching requirement for health and safety applies in this subject.

2 → links to other subjects

These requirements build on En1/10, Ma4/3a,3b, ICT/1a,1b.

2b → ICT opportunity

Pupils could use data-handling software to analyse data from fieldwork and use datalogging equipment to collect data.

3 → links to other subjects

This requirement builds on En1/1 and En3/1i.

3b → links to other subjects

This requirement builds on Ma3/4a and Ma4/4.

3c → links to other subjects

This requirement builds on En3/9,10, Ma2/1e–1i, Ma4/5, ICT/3a,3b.

5a → ICT opportunity

Pupils could use simulations/spreadsheets to model the effects of competition and predation.

5e → ICT opportunity

Pupils could use the internet to find out about current developments and issues.

6a → ICT opportunity

Pupils could use simulations/spreadsheets to explore models of atomic and molecular arrangements.

6c → ICT opportunity

Pupils could use the internet to find out about products and processes.

6d → ICT opportunity

Pupils could use a database of material properties to explore uses.

7a → links to other subjects

This requirement builds on Ma2/4b, 5a.

7a,7b → ICT opportunity

Pupils could use simulations/spreadsheets to model the supply of electrical power and energy loss in a house.

8a → ICT opportunity

Pupils could use simulations/spreadsheets to explore environmental effects.

8c → ICT opportunity

Pupils could use a CD-ROM to explore the origin of the solar system.

Breadth of study

During the key stage, pupils should be taught the **Knowledge, skills and understanding** of how science works through the study of organisms and health, chemical and material behaviour, energy, electricity and radiations, and the environment, Earth and universe.

Organisms and health

- 5 In their study of science, the following should be covered:
- organisms are interdependent and adapted to their environments
 - variation within species can lead to evolutionary changes and similarities and differences between species can be measured and classified
 - the ways in which organisms function are related to the genes in their cells
 - chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state
 - human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments.

Chemical and material behaviour

- 6 In their study of science, the following should be covered:
- chemical change takes place by the rearrangement of atoms in substances
 - there are patterns in the chemical reactions between substances
 - new materials are made from natural resources by chemical reactions
 - the properties of a material determine its uses.

Energy, electricity and radiations

- 7 In their study of science, the following should be covered:
- energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use
 - electrical power is readily transferred and controlled, and can be used in a range of different situations
 - radiations, including ionising radiations, can transfer energy
 - radiations in the form of waves can be used for communication.

Environment, Earth and universe

- 8 In their study of science, the following should be covered:
- the effects of human activity on the environment can be assessed using living and non-living indicators
 - the surface and the atmosphere of the Earth have changed since the Earth's origin and are changing at present
 - the solar system is part of the universe, which has changed since its origin and continues to show long-term changes.