

Programme of study: Science (Key stage 3)

Curriculum aims

Learning and undertaking activities in science contribute to achievement of the curriculum aims for all young people to become:

- successful learners who enjoy learning, make progress and achieve
- confident individuals who are able to live safe, healthy and fulfilling lives
- responsible citizens who make a positive contribution to society.

The importance of science

The study of science fires pupils' curiosity about phenomena in the world around them and offers opportunities to find explanations. It engages learners at many levels, linking direct practical experience with scientific ideas. Experimentation and modelling are used to develop and evaluate explanations, encouraging critical and creative thought, and to show how knowledge and understanding in science are rooted in evidence. Pupils discover how scientific ideas contribute to technological change – affecting industry, business and medicine and improving quality of life. They trace the development of science worldwide and recognise its cultural significance. They learn to question and discuss issues that may affect their own lives, the directions of societies and the future of the world.

Key concepts

There are a number of key concepts that underpin the study of science and how science works. Pupils need to understand these concepts in order to deepen and broaden their knowledge, skills and understanding.

Scientific thinking

- Using ideas and models to [explain phenomena](#) and developing them to generate and test theories.
- Critically analysing and evaluating evidence from observations and experiments.

Applications and implications of science

- Applying scientific ideas brings about technological developments and consequent changes in the way people think and behave.
- Exploring the [ethical and moral implications](#) of using and applying science.

Cultural understanding

- Recognising that modern science has its roots in many different societies and cultures and draws on a variety of valid approaches to scientific practice.

Collaboration

- [Sharing developments and common understanding](#) across disciplines and boundaries.

Explain phenomena

Science is not yet able to explain all phenomena but the process of developing scientific understanding constantly generates new and sometimes conflicting evidence. This in turn gives rise to new explanations and ideas.

Ethical and moral implications

Scientists, individuals and society need to think about the balance between the advantages and disadvantages of new developments before making decisions. For example examining issues relating to in vitro fertilisation and stem cell research, the production of potentially hazardous chemicals and the use of nuclear energy. This could also include exploring how developments are achieved, for example experiments on animals to produce drugs that may prolong human life.

Sharing developments and common understanding

Scientists of all disciplines communicate scientific ideas and understanding using mathematics and internationally recognised conventions and terminology. Scientific investigation is predominantly undertaken by groups of scientists with different specialisms working in collaboration.

Key processes

These are the essential skills and processes in science that pupils need to learn to make progress.

Pupils should be able to:

- use a range of scientific methods and techniques to develop and test ideas and explanations
- assess risk and work safely in the laboratory, field and workplace
- carry out practical and investigative activities, both individually and in groups
- obtain, record and analyse data from a [wide range of primary and secondary sources](#), including ICT sources, and use their findings to provide evidence for scientific explanations
- evaluate scientific evidence and working methods
- [use appropriate methods, including ICT, to communicate scientific information](#) and contribute to presentations and discussions about scientific issues.

Wide range of primary and secondary sources

Primary sources such as data logging and secondary sources such as the internet are essential aspects of pupils' experience of science.

Use appropriate methods, including ICT, to communicate scientific information

For example digital photography, video or podcasting as alternatives to text-based approaches.

Range and content

This section outlines the breadth of the subject on which teachers should draw when teaching the key concepts and key processes.

The study of science should include:

Energy, electricity and forces

- energy can be transferred usefully, stored, or wasted, but cannot be created or destroyed
- forces are interactions between objects and can affect their shape and motion
- electricity in circuits can produce a variety of effects

Chemical and material behaviour

- the particle model provides explanations for the different physical properties and behaviour of matter
- elements consist of atoms that combine together in chemical reactions to form compounds
- elements and compounds show characteristic chemical properties and patterns in their behaviour

Organisms, behaviour and health

- life processes are supported by the organisation of cells into tissues, organs and body systems
- the human reproductive cycle includes adolescence, fertilisation and foetal development
- conception, growth, development, behaviour and health can be affected by diet, drugs and disease
- all living things show variation, can be classified and are interdependent, interacting with each other and their environment
- behaviour is influenced by internal and external factors and can be investigated and measured

Energy

This includes the properties and behaviour of light and sound, renewable energy resources and emerging technologies such as fuel cells.

Shape and motion

This includes pressure effects, linear motion and moments.

Electricity

This includes current and voltage in series and parallel circuits.

Variety of effects

This includes energy transfer in a variety of electrical devices, and magnetic effects.

Elements

This includes the development and organisation of elements within the Periodic Table.

Compounds

This includes the different properties of compounds due to the number and type of atoms and their arrangement.

Characteristic chemical properties and patterns

This can be exemplified by the reactions of metals, acids and bases.

Diet, drugs and disease

This includes the importance of healthy eating complemented by regular exercise, and the effect of drugs such as alcohol, tobacco and marijuana on mental and physical health. This also includes the effects of bacteria and viruses, such as those associated with sexually transmitted diseases.

Variation

This includes inherited and environmental variation and variation through genetic engineering and selective breeding.

Behaviour

This includes human and animal behaviour (psychology and ethology).

The environment, Earth and universe

- [geological events](#) are a combination of chemical and physical processes
- astronomy and space science provide insight into the [nature and observed motions](#) of the Sun, Moon, stars, planets and other celestial bodies
- human activity and natural processes can lead to changes in the environment.

Geological events

This includes rock formation and weathering.

Nature and observed motions

This includes consideration of historical misconceptions due to insufficient scientific evidence.

Curriculum opportunities

During the key stage pupils should be offered the following opportunities that are integral to their learning and enhance their engagement with the concepts, processes and content of the subject.

The curriculum should provide opportunities for pupils to:

- research, experiment, discuss and develop arguments
- pursue an [independent enquiry](#) into an aspect of science of personal interest
- use real life examples which put science into context as a basis for finding out about science
- study science in local, national and global contexts and appreciate the connections between these
- experience science outside the school environment including in the workplace, where possible
- use [creativity and innovation](#) in science, and appreciate their importance in enterprise
- recognise the importance of [sustainability](#) in scientific and technological developments
- explore [contemporary and historical](#) scientific developments and how they have been [communicated](#)
- prepare to specialise in a range of science subjects at key stage 4 and consider [career opportunities](#) that are provided by science qualifications both within science and in other areas
- consider how knowledge and understanding of science informs personal and collective decisions, including those on [substance abuse](#) and [sexual health](#)
- make links between science and other subjects and areas of the curriculum.

Independent enquiry

This could include using primary sources from experimental work or using secondary sources from desk-based research.

Creativity and innovation

Creativity is an important part of the scientific process and scientific experimentation can generate new ideas that may not otherwise have been considered, leading to novel discoveries and applications.

Sustainability

This relates to the continuity of economic, social, institutional and environmental aspects of human society, as well as the non-human environment. It also incorporates sustainable development: meeting the needs of the present generation without compromising the ability of future generations to meet their needs. It could include examining issues surrounding the availability of finite resources, waste reduction and recycling, energy conservation and renewable energy resources, and environmental pollution.

Contemporary and historical

This should include an appreciation of the global and the diverse cultural nature of science and the contributions made by men and women.

Communicated

This should include an appreciation of how science is represented and sometimes misrepresented in the media and by scientists themselves.

Career opportunities

The skills, understanding and knowledge developed through the study of science are highly regarded by employers. Many career pathways require qualifications in science, but science qualifications do not necessarily lead to lab-based occupations.

Substance abuse

This includes the abuse of alcohol, tobacco, solvents and other drugs (see explanatory text in range and content section).

Sexual health

This includes issues related to pregnancy, contraception and sexually transmitted diseases (see explanatory text in range and content section).