

Skills and learning

Science in the national curriculum for Wales

This document highlights those statements or sections in the programmes of study for science that provide explicit opportunities for

- developing thinking
- developing communication
- developing ICT
- developing number

and promoting

- Curriculum Cymreig and Wales Europe and the world
- personal and social education
- careers and the world of work.

The number and context of such opportunities are for schools to determine within their curriculum overview/curriculum planning.



## **Developing thinking**

Schools should provide opportunities, where appropriate, for learners to develop and apply their thinking across the curriculum through the processes of planning, developing and reflecting.

In science, learners follow the processes of planning, developing and reflecting in all areas of Enquiry, through which the Range is taught. Focused paired/group work allows such processes to be articulated within lessons so that learning and thinking strategies can be developed and applied to new situations leading to high quality outcomes.

In science, opportunities to develop thinking apply throughout the Skills and Range sections of the programmes of study for Key Stages 2, 3 and 4.



## **Developing communication**

Schools should provide opportunities, where appropriate, for learners to develop and apply their communication skills across the curriculum through the skills of oracy, reading, writing and wider communication.

In science, learners communicate ideas, information and data in a variety of ways depending on the nature of the task, audience, purpose and the learners' own preferences. Communication can take a wide variety of forms, including the use of IT at times, and with increasing maturity should show progression in the use of scientific terminology, symbols and conventions and a more logical, systematic approach.

In science, opportunities to develop communication apply throughout the Skills and Range sections of the programmes of study for Key Stages 2, 3 and 4.



## Developing ICT

Schools should provide opportunities, where appropriate, for learners to develop and apply their ICT skills across the curriculum by finding, developing, creating and presenting information and ideas and by using a wide range of equipment and software.

In science, learners use ICT for a number of purposes. They search for, access, collect, process and analyse relevant scientific evidence, information, ideas and data. They use ICT to present their evidence, information, ideas and data in the most appropriate form.

### Key Stage 2

#### Skills

##### *Communication*

Pupils should be given opportunities to:

1. search for, access and select relevant scientific information, from a range of sources, including ICT
2. communicate clearly by speech, writing, drawings, diagrams, charts, tables, bar charts, line graphs, videos, and ICT packages, using relevant scientific vocabulary.

##### *Enquiry*

##### *Developing*

Pupils should be given opportunities to carry out different types of enquiry, e.g. pattern-seeking, exploring, classifying and identifying, making things, fair testing, using and applying models, by following the planned approach/method, revising it where necessary, and where appropriate:

2. make careful observations and accurate measurements, using digital and ICT equipment at times.

### Key Stage 3

#### Skills

##### *Communication*

Pupils should be given opportunities to:

1. search systematically for, process and analyse information for a specific purpose, including ICT as appropriate

2. communicate logically by speech, writing, drawings, diagrams, charts, tables, bar charts, line graphs, videos and ICT packages using a wide range of scientific vocabulary, terms, symbols and conventions.

### *Enquiry*

### *Developing*

Pupils should be given opportunities to carry out different types of enquiry, e.g. pattern-seeking, exploring, classifying and identifying, making things, fair testing, using and applying models, by following the planned approach/method, revising it where necessary, and where appropriate:

2. make sufficient relevant observations and accurate measurements, using ICT as appropriate, to a degree of precision appropriate to the enquiry.

## **Key Stage4**

### Skills

### *Enquiry and practical skills*

Pupils should be given opportunities to:

2. collect data from primary or secondary sources, including using ICT sources and tools.



## Developing number

Schools should provide opportunities, where appropriate, for learners to develop and apply their number skills across the curriculum by using mathematical information, calculating, and interpreting and presenting findings.

In science, learners work quantitatively to estimate and measure using non-standard and then standard measures, recording the latter with appropriate S.I. units. They use tables, charts and graphs to record and present information. With increasing maturity they draw lines of best fit on line graphs, use some quantitative definitions and perform scientific calculations.

### Key Stage 2

#### Skills

##### *Communication*

Pupils should be given opportunities to:

3. use standard measures and S.I. units, e.g. kg, s, N, m.

##### *Enquiry*

##### *Developing*

Pupils should be given opportunities to carry out different types of enquiry, e.g. pattern-seeking, exploring, classifying and identifying, making things, fair testing, using and applying models, by following the planned approach/method, revising it where necessary, and where appropriate:

2. make careful observations and accurate measurements, using digital and ICT equipment at times
3. check observations and measurements by repeating them in order to collect reliable data.

#### Range

##### *How things work*

Pupils should use and develop their skills, knowledge and understanding by investigating the science behind everyday things, e.g. toys, musical instruments and electrical devices, the way they are constructed and work.

They should be given opportunities to study:

3. the ways in which forces can affect movement and how forces can be compared.

## **Key Stage 3**

### Skills

#### *Communication*

Pupils should be given opportunities to:

3. work quantitatively, using appropriate mathematical conventions and using S.I. units appropriate to their work, e.g. kg, s, N, m, J, w.

#### *Enquiry*

Pupils should be given opportunities to carry out different types of enquiry, e.g. pattern-seeking, exploring, classifying and identifying, making things, fair testing, using and applying models, by:

#### *Planning*

deciding on the most suitable type of enquiry to carry out and outlining the planned approach/method, recognising, deciding upon and justifying each of the following when appropriate:

5. the number of observations or measurements that need to be made and their range and values to ensure reliability of evidence.

#### *Developing*

following the planned approach/method, revising it where necessary, and where appropriate:

2. make sufficient relevant observations and accurate measurements, using ICT as appropriate, to a degree of precision appropriate to the enquiry.

### Range

#### *How things work*

Pupils should use and develop their skills, knowledge and understanding by investigating the science involved in a range of contemporary devices/machines and evaluate different energy resources and possibilities.

They should be given opportunities to study:

4. the forces in devices and their relationship to work done and power.

## **Key Stage 4**

### Skills

#### *Enquiry and practical skills*

Pupils should be given opportunities to:

4. evaluate methods of collection of data and consider their validity and reliability as evidence.



*Data, evidence, theories and explanations – links between ideas and information in science*

Pupils should be given opportunities to:

1. explore how scientific data can be collected and analysed, and how interpretation of data, using creative thought, provides evidence to test ideas and develop theories.

Range

Pupils should build on their previous experiences and be taught within the context of the skills section. They should have particular regard to:

- scientific enquiry
- scientific and technological developments, their benefits, drawbacks and risks
- ethical, social, economic and environmental issues and their interaction with science.

*Energy, electricity and radiations*

1. Energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use.



## **Curriculum Cymreig (7–14) and Wales, Europe and the World (14–19)**

Schools should provide opportunities, where appropriate, for learners aged 7–14 to develop and apply knowledge and understanding of the cultural, economic, environmental, historical and linguistic characteristics of Wales. Learners aged 14–19 should have opportunities for active engagement in understanding the political, social, economic and cultural aspects of Wales as part of the world as a whole.

Science contributes to the Curriculum Cymreig by the use of contexts that are relevant to learners' lives in Wales. The rich and varied environment around learners gives the basis for fieldwork. Learners have the opportunity to study recycling, sustainability and the impact of humans within their locality and further afield.

### **Key Stage 2**

#### Range

##### *Interdependence of organisms*

Pupils should use and develop their skills, knowledge and understanding by investigating how animals and plants are independent yet rely on each other or survival. They should be given opportunities to study:

4. through fieldwork, the plants and animals found in two contrasting local environments, e.g. identification, nutrition, life cycles, place in environment
5. the interdependence of living organisms in those two environments and their representation as food chains
6. the environmental factors that affect what grows and lives in those two environments, e.g. sunlight, water availability, temperature
7. how humans affect the local environment, e.g. litter, water pollution, noise pollution.

##### *The sustainable Earth*

Pupils should use and develop their skills, knowledge and understanding by comparing the Earth with other planets, investigating materials around them and considering the importance of recycling.

They should be given opportunities to study:

6. a consideration of what waste is and what happens to local waste that can be recycled and that which cannot be recycled.



## **Personal and social education**

Schools should provide opportunities, where appropriate, for learners to promote their health and emotional well-being and moral and spiritual development; to become active citizens and promote sustainable development and global citizenship; and to prepare for lifelong learning.

Science contributes to learners' personal and social education by helping them to make sense of issues within their lives and others' lives. It gives background evidence to health and well-being, sex and relationships, recycling and the sustainability of both materials and energy. With increasing maturity learners compare their lives with that in developing countries and review the impact of humans on the Earth.

### **Key Stage 2**

#### Skills

##### *Enquiry*

Pupils should be given opportunities to carry out different types of enquiry, e.g. pattern-seeking, exploring, classifying and identifying, making things, fair testing, using and applying models, by:

##### *Planning*

Pupils turn ideas suggested to them, and their own ideas, into a form that can be investigated. They outline the planned approach/method recognising, deciding upon and giving some justification for each of the following when appropriate:

7. any hazards and risks to themselves and others.

#### Range

##### *Interdependence of organisms*

Pupils should use and develop their skills, knowledge and understanding by investigating how animals and plants are independent yet rely on each other for survival. They should be given opportunities to study:

2. the need for a variety of foods and exercise for human good health
3. the effect on the human body of some drugs, e.g. alcohol, solvents, tobacco
7. how humans affect the local environment, e.g. litter, water pollution, noise pollution.

### *The sustainable Earth*

Pupils should use and develop their skills, knowledge and understanding by comparing the Earth with other planets, investigating materials around them and considering the importance of recycling.

They should be given opportunities to study:

6. a consideration of what waste is and what happens to local waste that can be recycled and that which cannot be recycled.

## **Key Stage 3**

### Skills

#### *Developing*

Pupils follow the planned approach/method, revise it where necessary, and where appropriate:

1. use a range of apparatus and equipment safely and with skill, taking action to control the risks to themselves and others.

### Range

#### *Interdependence of organisms*

Pupils use and develop their skills, knowledge and understanding by investigating how humans are independent yet rely on other organisms for survival, applying this to life in countries with different levels of economic development.

They should be given opportunities to study:

2. how food is used by the body as fuel during respiration and why the components of a balanced diet are needed for good health
3. the beneficial and detrimental effects of some drugs on the organs of the human body and other consequences of their use, e.g. insulin, steroids, paracetamol, caffeine
6. how human activity affects the global environment, e.g. acid rain, greenhouse effect, and the measures taken to minimise any negative effects and monitor them, e.g. by Earth observation satellites.

### *The sustainable Earth*

Pupils use and develop their skills, knowledge and understanding by investigating the materials in the Earth and its atmosphere and how they can change, and apply this in contemporary contexts.

They should be given opportunities to study:

5. the properties of sustainable materials and how these are related to their uses in everyday life, e.g. in the construction and manufacturing industries, and the importance of sustainability.

### *How things work*

Pupils should use and develop their skills, knowledge and understanding by investigating the science involved in a range of contemporary devices /machines and evaluate different energy resources and possibilities.

They should be given opportunities to study:

5. how renewable and non-renewable energy resources are used to generate electricity and the implications of decisions made about their use
6. technologies under development, which may lead to more efficient use of energy resources or using them in new ways, e.g. hydrogen-powered cars, using cooking oil/gasohol, as replacements for diesel/petrol.

## **Key Stage 4**

### Range

Pupils should build on their previous experiences and be taught within the context of the skills section. They should have particular regard to:

- scientific enquiry
- scientific and technological developments, their benefits, drawbacks and risks
- ethical, social, economic and environmental issues and their interaction with science.

### *Organisms and health*

5. Human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments.



## **Careers and the world of work**

Schools should provide opportunities, where appropriate, for learners aged 11–19 to develop their awareness of careers and the world of work and how their studies contribute to their readiness for a working life.

Science contributes to careers and the world of work by enabling learners to study a range of applications of science, medicine and technology in their everyday life and in the wider world. This gives learners insight into how scientists work and also develops experimental and generic skills needed for the world of work.

In science, there are no explicit references to careers and the world of work.