Primary School Curriculum

Curaclam na Bunscoile

Science

Social, Environmental and Scientific Education

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Science

Social, Environmental and Scientific Education

Curriculum

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Introduction

Social, environmental and scientific education

Social, environmental and scientific education (SESE) provides opportunities for the child to explore, investigate and develop an understanding of the natural, human, social and cultural dimensions of local and wider environments; to learn and practise a wide range of skills; and to acquire open, critical and responsible attitudes. SESE enables the child to live as an informed and caring member of local, national, European and global communities.

SESE takes place within, and contributes to, many areas of the curriculum. It thus contributes significantly to many aspects of the child's development. Within this curriculum, SESE is presented under three subject headings: history, geography and science. Each of these areas has a distinctive role to play in enabling the child to explore and understand the natural, human, social and cultural environments in which he/she lives.

The SESE curriculum

Understanding the term 'environment'

An agreed definition of the term 'environment' is fundamental to an understanding of the nature of social, environmental and scientific education. The word 'environment' is used in this curriculum to denote the surroundings or external conditions with which an individual (human or other living organism) or community interacts.

Environments may be categorised in two broad groupings. *Natural environments* are formed largely through the interaction of the Earth's physical features and processes, its flora and fauna. A tropical rainforest, a peatland or a rocky seashore may be examples of natural environments.

In Ireland, human activity over thousands of years has shaped and changed the landscape considerably. Environments that have been modified in this way are termed *human environments*. Areas that have been altered by the presence of people, farming activities, the extraction of resources, the provision of roads and other communication links and the construction of buildings are all examples of human environments.

Some human environments, such as urban areas, are predominantly the constructions of people and are termed *built environments*. Other human environments result from social and cultural activities and are entirely human creations. As people live and work together, social patterns,

relationships, systems and institutions are evolved, while human experience, knowledge, values and beliefs are expressed, developed and perpetuated through a range of cultural activities. Patterns of human behaviour, the social institutions developed by people and the political and economic systems that they utilise are aspects of *social environments*; artistic, religious, scientific, technological and recreational activities are aspects of *cultural environments*.

Exploration and investigation

A key characteristic of learning within SESE is the involvement of the child in the active exploration and investigation of all these environments.

Science education enhances children's knowledge and understanding of themselves and the world in which they live. It involves children in the active construction of their own understanding. This understanding changes in response to the children's broadening experience. A scientific approach to investigations fosters the development of important skills, concepts and knowledge through which children can observe, question, investigate, understand and think logically about living things and their environments, materials, forces, everyday events and problems. The knowledge and skills acquired may be applied in designing and making activities in which children perceive a need to create or modify elements of their environments.

In geographical education, children explore and learn about features in the natural and human environments, especially those in the immediate locality. They investigate the processes that create, sustain or change physical features and the interactions of people with each other and their environments in the locality and wider contexts.

Historical education enables children to investigate and critically examine significant events in their own immediate past, the past of their families and local communities and the histories of people in Ireland and other parts of the world. History develops an understanding of the actions, beliefs and motivations of people in the past and is fundamental to an informed appreciation of contemporary society and environments.

Values, attitudes and responsibilities

SESE is also concerned with the cultivation of important values and attitudes. It fosters an appreciation of the interrelationships of all living things and their environments and encourages children to become active agents in the conservation of environments for future generations. Through their investigations, children develop informed, critical and scientific perspectives that acknowledge the importance of founding judgements on a respect for facts, accuracy and reason. SESE seeks to generate an appreciation of cultural and historical inheritance, and cultivates an atmosphere of equality and opportunity where cultural diversity, minorities and special needs are respected and valued. Prejudice and discrimination are challenged, while respect and mutual understanding are promoted.

Integration

Throughout the primary school years, the environments of the child, particularly those of a local nature, provide ideal contexts and a compelling impetus for the integration of learning. The subject headings **history**, **geography** and **science** are used to aid presentation of the curriculum, and an awareness of them is an important part of the child's cultural and intellectual inheritance. Each subject offers a distinctive perspective on the world and equips children with a particular range of skills. However, the use of subject divisions must not negate the effective implementation of an integrated curriculum. The use of well-planned integrated approaches, both within SESE and between SESE and other curricular areas, will have an important part to play in the teaching of the primary curriculum at all levels. Systematically planned integrated topics can provide contexts in which knowledge and skills may be developed in a range of areas. Many elements from the history, science and geography curricula may be explored concurrently, and much of the work involved will contribute to the development of the child's oral language, literacy, numeracy and communication skills.

A number of features have been incorporated in the curriculum in order to facilitate effective integration. SESE is best approached in a holistic manner with younger children as this respects the wholeness of their view of the world. Accordingly, a considerable degree of overlap and similarity has been embodied within the content suggested in the strands and strand units of the three curricular statements for the infant and

junior classes. Further suggestions for integrated studies are included in the accompanying guidelines for teachers.

As children grow older they begin to recognise that there are different ways or modes of looking at the world and of organising human knowledge, so teaching strategies may vary to include a holistic approach, some cross-curricular integration and a subject-centred focus. Possible cross-curricular links and integrated studies are noted within the content of the curricular statements for third to sixth classes. These should be regarded as suggestions only: people and their activities, other living things, features, materials, events and processes to be found in local and wider environments provide many other opportunities for a unified approach to learning. Such an approach utilises teaching and learning time efficiently and acknowledges that the social, emotional, attitudinal and moral development of the child is interwoven with the acquisition of knowledge and skills.

Aims

The aims of social, environmental and scientific education are:

- to enable the child to acquire knowledge, skills and attitudes so as to develop an informed and critical understanding of social, environmental and scientific issues
- to reinforce and stimulate curiosity and imagination about local and wider environments
- to enable the child to play a responsible role as an individual, as a family member and as a member of local, regional, national, European and global communities
- to foster an understanding of, and concern for, the total interdependence of all humans, all living things and the Earth on which they live
- to foster a sense of responsibility for the long-term care of the environment and a commitment to promote the sustainable use of the Earth's resources through personal life-style and participation in collective environmental decision-making
- to cultivate humane and responsible attitudes and an appreciation of the world in accordance with beliefs and values.

Science

Science encompasses knowledge and understanding of the biological and physical aspects of the world and the processes through which such knowledge and understanding are developed.

Through science education, children construct, modify and develop a broad range of scientific concepts and ideas. Working scientifically involves them in observation, questioning, discussion, prediction, analysis, exploration, investigation, and experimentation, while the knowledge and skills they acquire may be applied in designing and making tasks. Thus, science education equips children to live in a world that is increasingly scientifically and technologically oriented.

Science education fosters a respect for the evidence of scientific enquiry, while the collaborative nature of its activities can also help children to acquire social and co-operative skills. Investigations and problem-solving tasks nurture the inventive and creative capacities of children. Science education plays a key role in promoting a sensitivity to, and a personal sense of responsibility for, local and wider environments. It helps to develop an appreciation of the interdependence of all living things and the Earth on which they live. It encourages the adoption of responsible attitudes and patterns of behaviour towards the environment and so fosters the concept of people as custodians of the Earth for future generations.

The science curriculum

Primary science involves helping children develop basic scientific ideas and understanding, which will enable them to explore and investigate their world. In well-planned, practical investigations children's natural curiosity is channelled and they are equipped with the strategies and processes to develop scientific ideas and concepts.

The teaching of science in the primary curriculum involves the development of two types of understanding: *conceptual understanding* and *procedural understanding*. Children's *conceptual understanding* is concerned with the development of scientific knowledge and with their deepening understanding of fundamental scientific ideas. The four strands of the science programme are *Living things*, *Materials*, *Energy and forces*, and *Environmental awareness and care*. These outline the knowledge and understanding that children acquire and describe the scientific ideas that they will encounter.

Knowledge of the scientific process is sometimes referred to as *procedural understanding*. The section of the science curriculum entitled 'Working

scientifically' outlines how children may engage in scientific enquiry. It is a procedural model of how scientists work and includes statements of the various component skills that contribute to this methodology.

Children's conceptual understanding and their procedural understanding are not developed independently: pupils' understanding and application of the scientific process enable them to construct and refine their own framework of fundamental ideas and concepts in science.

Learning in science

The development of children's ideas is central to science education. Young children come to science activities with ideas that they have formed from previous experiences. They use these ideas to make sense of the things that happen around them. These ideas tend to be limited to concrete, observable features and may be inconsistent with the formal theories of conventional science.

The focus of science education will be on helping children to modify their ideas and to develop more scientific understandings. As well as planning science lessons on the basis of knowledge, skills and understanding, it is essential to consider the children's ideas as the starting points for science activities and education. To change these alternative ideas or misconceptions it is necessary for pupils to become consciously aware of their ideas and then to have these ideas challenged and debated. Meaningful learning occurs when the pupils construct their understanding by modifying their existing ideas in the light of new insights gained from scientific investigations. Thus, science may be seen as the active process of the personal construction of meaning and understanding.

Environmental awareness and care

The environment provides the context for learning for primary pupils. The curriculum area of SESE is specifically founded on the pupils' relationship and interaction with the world around them. The environment, in its broadest sense, is the springboard for learning, and pupils' classroom experience will be deepened and extended by direct experience of their own surroundings. The locality will provide the starting points for environmental education, and as children's knowledge and understanding grow and develop they will encompass other places and direct pupils to Irish, European and global dimensions.

Pupils should develop a broad and balanced view of the environment. They should appreciate the ways in which science and technology can help people to use the Earth's resources for the social, cultural and economic benefits of humanity. Environmental education through science will enable pupils to understand the interdependence of all life. It will help them to understand the positive and negative repercussions of human action on local and global environments. Pupils will develop and apply scientific knowledge and skills in protecting, conserving and improving their environments. They will appreciate that they can apply their scientific and technological knowledge and methods of working in promoting positive and responsible attitudes to the use of the Earth's resources and in contributing actively to human development and to the shaping of the environment of the future.

Science and technology: designing and making

The process of practical problem-solving provides children with a context in which to use their aesthetic and inventive capacities to design and make models and artefacts. Designing and making encourages the creative and imaginative aspects of the scientific process. Many teachers are actively involved in encouraging their classes to make models and systems: for example, having spent some time on the topic of weather many children will have designed and made their own rain gauge and instruments for recording wind direction and strength. These skills of exploring, planning, designing and making enable children to apply their scientific knowledge and understanding to devising a method or solution, carrying it out practically and evaluating the final product. The skills involved will be developed progressively through the primary school as children tackle open-ended problem-solving tasks.

The subject matter of designing and making relates to all aspects of experience, such as energy, force, transport, homes, materials, industry and food. The focus of a design and make curriculum can come from any response to a human need. Involvement in designing and making activities should awaken an interest in how processes are applied in everyday situations and how common tools, objects, appliances and machines work. Designing and making is a process which draws on the whole curriculum and should be developed in association with and through visual arts, science and mathematics.

Science, SESE and the integrated curriculum

While science makes an important and distinctive contribution to the development of the child, scientific education complements the growth of the child's learning in geography and history. All three contribute to the wider social, environmental and scientific education of the child, and their complementary roles will be reflected in the organisation of learning. Throughout the primary school, and in the early years especially, much learning in science, geography and history will take place through the integrated themes or topics that teachers use to organise their work. Many of these topics will arise out of the child's need to explore and understand his/her immediate environment and local community. The curriculum and its accompanying guidelines suggest how the development of valuable scientific skills, concepts and knowledge will be achieved as these topics are explored.

Information and communication technologies

Information and communication technologies are an important resource and tool for learning in science. Children's investigations and explorations can be enhanced by using information and communication technologies in recording and analysing information, in simulating investigations and tests that support scientific topics, in communicating their scientific information and findings, in collaborating with children in other schools in science investigations and in accessing a range of sources of scientific and technological information.

Assessment

Assessment is an integral part of teaching and learning in science, as in other areas of the curriculum. The section on assessment outlines how a range of informal and more formal assessment techniques can assist in enriching the learning experience of the child and provide useful information for pupils, teachers, parents and others.

Language and science

Language is such a pervasive influence in the teaching and learning process that particular examples of the integration of science with language are not delineated in the curriculum statement. Much of the child's learning in science takes place in the interaction between language, whether Irish or English, and experience. Through discussing their ideas and the results of their scientific investigations children will develop their scientific understandings. Through language children name and classify things, express and modify ideas, formulate questions and hypotheses, and report conclusions. In this way language contributes to the expansion of the child's conceptual development.

Language is the principal means of communication in every aspect of the learning process. The teacher uses language to question, to explain, to suggest, to prompt, and to stimulate the child to think. The children are encouraged to describe, discuss, predict, explain, hypothesise and analyse ideas. Language is important, too, in helping children to access and to retrieve information and to record and communicate ideas. The extent, therefore, to which language is an integral part of the teaching and learning process should be a consistent concern in the planning and implementation of the curriculum in science.

Aims

The aims of science education are:

- to develop knowledge and understanding of scientific and technological concepts through the exploration of human, natural and physical aspects of the environment
- to develop a scientific approach to problem-solving which emphasises understanding and constructive thinking
- to encourage the child to explore, develop and apply scientific ideas and concepts through designing and making activities
- to foster the child's natural curiosity, so encouraging independent enquiry and creative action
- to help the child to appreciate the contribution of science and technology to the social, economic, cultural and other dimensions of society
- to cultivate an appreciation and respect for the diversity of living and non-living things, their interdependence and interactions
- to encourage the child to behave responsibly to protect, improve and cherish the environment and to become involved in the identification, discussion, resolution and avoidance of environmental problems and so promote sustainable development
- to enable the child to communicate ideas, present work and report findings using a variety of media.

Broad objectives

When due account is taken of intrinsic abilities and varying circumstances, the science curriculum should enable the child to

- develop an interest in and curiosity about the world through the exploration and study of living and non-living things
- develop a knowledge and understanding of scientific ideas through the study of living things and the environments in which they live, energy and forces, materials and processes of change
- observe, ask questions, discern patterns, hypothesise, plan, experiment, design, make, measure, discuss, analyse and evaluate results and so develop a scientific approach to problem-solving
- develop and apply constructive thinking in scientific investigations
- understand the application of some basic scientific ideas and concepts in everyday situations
- apply and use scientific knowledge, skills and resources in designing and making tasks
- explore and appreciate the influence that scientific and technological developments have on societies, life-styles, economic activities and the environment
- communicate and record observations, evidence and results of experiments and investigations using a variety of oral, written and graphical forms and other media
- explore the environmental repercussions of human actions on physical, natural and human environments
- understand the interdependence of a wide variety of living things and their environments, recognise the importance of conserving habitats and environments, and begin to understand that all life now and in the future depends on the sustainable development of the planet
- become actively involved in the discussion, exploration and resolution of environmental issues
- understand and apply a safety code in scientific and technological investigations and activities.

Infant classes

Overview

infant classes

Skills development

Working scientifically	• Questioning • Observing • Predicting • Investigating and experimenting • Estimating and measuring • Analysing *Sorting and classifying* • Recording and communicating
Designing and making	• Exploring • Planning • Making • Evaluating

The science skills above will be developed as work is completed on the strands and strand units of the curriculum outlined below.

Strands	*Strand units*
Living things	• Myself • Plants and animals
Energy and forces	• Light • Sound • Heat • Magnetism and electricity • Forces
Materials	• Properties and characteristics of materials • Materials and change
Environmental awareness and care	• Caring for my locality

Planning

Structure

The content of the science curriculum for infant classes is presented in two sections:

- a *skills* section, which describes the science process skills that children should develop as they encounter topics in the curriculum
- a number of *strands,* which outline the topics that may be included in the science programme. The topics within each strand are referred to as strand units. Examples and suggestions are shown in italic type throughout the content sections.

The presentation of content in these two sections is intended to help teachers in planning for the development of important skills and attitudes as knowledge and understanding of scientific concepts are acquired.

Skills in science

The science skills outlined at this level are arranged under two headings:

- *Working scientifically* describes the science skills that children should develop through their scientific investigations
- *Designing and making* skills will involve pupils in exploring materials, planning designs and making models that will provide solutions to practical problems.

As children work scientifically throughout these strands, a broad range of skills will be nurtured and developed in conjunction with the framework of ideas explored in each content area of science.

Strands for infant classes

The strands of the curriculum present the science topics that children will explore. Content in science for the infant classes is presented in four strands:

- *Living things*, which is concerned with the study of people, animals and plants and their life processes
- *Energy and forces*, which describes the different forms of energy such as light, sound and heat and the exploration of different forces that the children encounter through structured play with water and toys
- *Materials,* which involves the exploration of different everyday materials and the investigation of their characteristics

- *Environmental awareness and care*, which outlines how science and geography can foster the child's appreciation of environments and his/her responsibility for their conservation and enhancement. Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

A spiral approach

The curriculum is based on a spiral approach, in which some aspects of the biological and physical environment may be explored at each class level. The titles of the strands and the strand units are almost identical at each class level. However, the knowledge and understanding presented and the range of process skills that children are encouraged to use in scientific investigations will be developed and extended at each class level.

It is not intended that all the strand units will be taught in each class. Some units will be treated during junior infants only, some will be taught in the senior infants year only, while others could be profitably taught in each class, with the more complex details, concepts and methods of investigation and treatment reserved for the senior infants class. The suggestions are not intended to be prescriptive or exclusive, and the units may be supplemented by additional enrichment units, as identified in school planning or at the discretion of the teacher.

Planning

Efficient planning for science in the school will ensure that children experience a broad and balanced curriculum in which undue repetition and significant gaps are avoided. The units selected by the school and the teacher should

- be based on the environment, and all pupils should have the opportunity to explore and investigate the environment systematically and thoroughly at each class level; scientific concepts and skills should be developed through explorations in the immediate environment whenever possible
- ensure that pupils have access to a comprehensive and balanced range of scientific ideas while providing opportunities for the development of skills and concepts through practical investigations.

Breadth and balance—a menu curriculum

A broad and balanced programme will ensure that pupils have access to scientific concepts from each of the strands. Within each strand unit it is not expected that children should cover each objective. Instead, teachers at individual school level will select from the content objectives and exemplars outlined in each strand unit while ensuring that pupils apply and develop their scientific skills in a broad range of contexts.

Linkage and integration

Much of the work suggested in the curriculum might be delivered through the integrated themes or topics that are commonly used to organise learning in infant classes. For example, objectives in the strand units 'Myself' and 'Plants and animals' might be achieved as children examine these themes in SPHE or religious education. Similarly, many of the skills used in mathematics, such as measuring, estimating and problem-solving, will provide opportunities for the development of similar scientific skills.

Within the content sections, notes below strand units suggest some of the instances where linkage (i.e. integration within the science curriculum) and integration (i.e. cross-curricular connections) might be established.

Skills development for infant classes

Working scientifically

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Questioning

- ask questions about animals and plants, familiar objects and events in the immediate environment

  What is it? Where does it live?

  What do you hear, see or smell?

  How does it move? What helps these plants to grow?

  How many marbles can this toy boat carry?

  Which material will make the best umbrella?

Observing

- use the senses to observe animals, plants, objects and events in the immediate environment
- observe characteristics such as the shape, size, colour, pattern, texture, sound and smell of familiar things in the local environment
- observe differences and similarities

  hot/cold, wet/dry, heavy/light

Predicting

- guess and suggest what will happen next in structured situations

  What will happen to the ruler if we place it in water?

  I think it will float/I think it will sink

Investigating and experimenting

- carry out simple investigations set by the teacher, make observations and collect data

Estimating and measuring

- describe mass and length using non-standard units and informal language
- compare and estimate

  is bigger than, is heavier than
- match objects of equal length

Analysing

Sorting and classifying

- sort and group objects according to observable features

  set of red objects, set of floaters, set of heavy things

Recording and communicating

- describe his/her observations orally using an increasing vocabulary
- represent findings pictorially and in other media

  models, friezes

  information and communication technologies.

Integration

Activities in the mathematics curriculum will inform and complement this unit.

Mass and weight

In everyday speech the term 'weight' is used to describe mass and weight. However, weight is not the same as mass. The mass of an object is the amount of material or matter it contains; the weight of an object is the amount of force being exerted on it by the pull of gravity. Most children, during the primary years, will not have developed the ability to grasp the distinction between mass and weight. However, by the end of the senior classes they could be encouraged to use the term 'mass'.

Designing and making

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Exploring

- handle and manipulate a range of materials in structured and unstructured situations
- observe, investigate and describe familiar objects

  state what he/she likes or dislikes about objects

  discuss why people have a need for them

Planning

- imagine and suggest a possible object to be made
- choose appropriate materials from a given limited range
- talk about the plan and communicate it to others

  through discussion

  through drawing pictures

  through modelling materials such as sand, Plasticine and Duplo

Making

- make simple objects

  understand that materials can be linked together
- develop craft-handling skills and techniques needed to carry out the plan

  cutting and tearing, assembling, sticking, moulding or modelling, tying knots, folding
- use a range of tools

  scissors, pencils, hole-punch, ruler (for tearing)
- *use a range of materials*

  reclaimable domestic 'waste', Plasticine, adhesives, construction kits, string, cardboard, straws, paper fasteners, paper clips, adhesive tape, pipe cleaners, clay, fabric, papier m ch

Evaluating

- talk about own work during design and making tasks
- report to others on what has been done
- discuss the work of peers in a positive way.

Integration

Activities throughout the strands of the visual arts curriculum will complement this unit and provide opportunities to apply these designing and making skills.

Mathematics: Space and shape

Geography: Human environments—Living in the local community

Strand: Living things

Strand unit Myself

The child should be enabled to

Variety and characteristics of humans

- identify parts of the male and female body
- recognise and measure physical similarities and differences between people

  Se n is smaller than Jan

  both Robert and Sin ad have blue eyes

Human life processes

- become aware of some changes that occur as children grow and mature

  height, foot size

  design and make a slipper or shoe for self or an imaginary character

- become aware that people have a variety of needs for growth (exercise, food, clothing, shelter)
- develop an awareness of human birth

  that a baby grows and is nurtured in the mother's womb until ready to be born

- use all the senses (touch, smell, sight, taste, hearing) to become aware of and explore environments

  examine a muesli, identify and taste the ingredients, what else could be in a cereal?

  design a tasty cereal from a base of oatflakes and/or wheatflakes.

Strand unit Plants and animals

The child should be enabled to

Variety and characteristics of living things

- observe, discuss and identify a variety of plants and animals in different habitats in the immediate environment

  common trees and other plants

  common birds and other animals

  in habitats such as ponds, trees, hedges, grass, rocks, soil

- become aware of animals and plants of other environments
- sort and group living things into sets

  flowers, leaves, trees, birds, fruit and vegetables

- recognise and identify the external parts of living things

  flower, leaf, stem, root

  tail, leg, beak, feathers

Processes of life

- observe growth and change in some living things
- explore conditions for growth of bulbs and seeds

  in soil, damp moss, wet paper

- become aware that animals and plants undergo seasonal change in appearance or behaviour

  colour change, leaf fall, appearance of buds and shoots, hibernation.

Integration

SPHE: Myself

History: Local studies

Strand: Energy and forces

Strand unit Light

The child should be enabled to

- identify and name different colours
- sort objects into sets according to colour
- observe colours in the local environment

  at school, in the home, in the street, in animal and plant life

- explore dark and bright colours and become aware of different shades of colour

  colour tables, coloured light

- discuss differences between day and night, light and shade
- explore how shadows are formed.

Strand unit Sound

The child should be enabled to

- recognise and identify a variety of sounds in the environment
- identify and differentiate between high and low sounds, loud and soft sounds
- explore ways of making different sounds using a variety of materials

  tins, metals, bottles and paper.

Integration

Music: Exploring sounds

Strand unit Heat

The child should be enabled to

- recognise the difference between hot and cold in terms of weather, food, water and the body
- identify ways of keeping objects and substances warm and cold

  wrapping and covering (e.g. cosy on teapot, cool-box, clothes, shade from sunlight)

  design and make a suitable cover to keep a hot drink warm.

Linkage

Materials—Materials and change

Integration

Geography: Natural environments—Weather

Strand unit Magnetism and electricity

The child should be enabled to

- use magnets of different shapes and sizes in purposeful play to explore their effects on different materials
- investigate the fact that magnets attract certain materials

  design and make a container (incorporating a magnet) that will keep all teacher's paper clips together
- become aware of the uses of electricity in school and at home
- identify some household appliances that use electricity
- become aware of the dangers of electricity.

Strand unit Forces

The child should be enabled to

- explore, through informal activity with toys, forces such as pushing and pulling
- explore how the shape of objects can be changed by squashing, pulling and other forces
- investigate how forces act on objects

  through experimenting with different materials

  group objects that will float or sink

  push objects into water.

Strand: Materials

Strand unit Properties and characteristics of materials

The child should be enabled to

- observe and investigate a range of familiar materials in the immediate environment

  water, wood, textiles, food, plastic, metal, rock
- describe and compare materials, noting the differences in the colour, shape and texture
- know about some everyday uses of common materials
- group materials according to certain criteria

  strength, colour, texture, flexibility
- investigate materials for different properties, for example

  materials that are attracted by magnets

  materials that keep us warm

  materials that absorb water and those that are waterproof.

Strand unit Materials and change

The child should be enabled to

- explore the effects of water on a variety of materials
- observe and describe materials when they are wet and when they are dry

  soil and paper
- identify some materials that are waterproof

  raincoat, umbrella, boot, feather, skin

  suggest materials suitable for rainy days

  design and make a waterproof outfit for a toy character or doll
- explore the effects of heating and cooling on everyday objects, materials and substances

  ice-cream, butter, chocolate, water.

Integration

Geography: Natural environments; Human environments

Strand: Environmental awareness and care

Strand unit Caring for my locality

The child should be enabled to

- observe, discuss and appreciate the attributes of the local environment
  - *beauty and diversity of plants and animals in a variety of habitats*
  - *attractive elements of physical, natural and human features*
- appreciate that people share the environment with plant and animal life
- develop a sense of responsibility for taking care of and improving the environment
- identify, discuss and implement simple strategies for improving and caring for the environment
  - *things I can do*
    - *caring for clothes, toys and other possessions*
    - *keeping home, garden, classroom and street clean and tidy*
    - *caring for living and non-living things in the locality*
  - *things we can do together*
    - *keeping classroom, school and play spaces clean, tidy and safe*
    - *disposing of litter appropriately*
    - *collecting paper or cans for recycling*
    - *caring for living and non-living things in the locality.*

Linkage

Many of the objectives of this strand will be achieved as children complete work in other strands of the science curriculum.

Integration

Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

SPHE: Myself and the wider world—Environmental care

First and second classes

Overview

first and second classes

Skills development

Working scientifically

- Questioning
- Observing
- Predicting
- Investigating and experimenting
- Estimating and measuring
- Analysing
  - *Sorting and classifying*
  - *Recognising patterns*
  - *Interpreting*
- Recording and communicating

Designing and making

- Exploring
- Planning
- Making
- Evaluating

The science skills above will be developed as work is completed on the strands and strand units of the curriculum outlined below.

Strands	*Strand units*
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Environmental awareness and care	• Caring for my locality

Planning

Structure

The content of the science curriculum for first and second classes is presented in two sections:

- a *skills* section, which describes the science process skills that children should develop as they encounter topics in the curriculum
- a number of *strands*, which outline the topics that may be included in the science programme. The topics within each strand are referred to as strand units. Examples and suggestions are shown in italic type throughout the content sections.

The presentation of content in these two sections is intended to help teachers in planning for the development of important skills and attitudes as knowledge and understanding of scientific concepts are acquired.

Skills in science

The science skills outlined at this level are arranged under two headings:

- *Working scientifically* describes the science skills that children should develop through their scientific investigations
- *Designing and making* skills will involve pupils in exploring materials, planning designs and making models which will provide solutions to practical problems.

As children work scientifically throughout these strands a broad range of skills will be nurtured and developed in conjunction with the framework of ideas explored in each content area of science.

Strands for first and second classes

The strands of the curriculum present the science topics which children will explore. Content in science for first and second classes is presented in four strands:

- *Living things*, which is concerned with the study of people, animals and plants and their life processes
- *Energy and forces*, which describes the different forms of energy such as light, sound and heat and the exploration of different forces that the children encounter through structured play with water and toys
- *Materials*, which involves the exploration of different everyday materials and the investigation of their characteristics

- *Environmental awareness and care*, which outlines how science and geography can foster the child's appreciation of environments and his/her responsibility for their conservation and enhancement. Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

The range of units within these strands provides considerable flexibility for schools and teachers in the selection of content.

A spiral approach

The curriculum is based on a spiral approach, in which some aspects of the biological and physical environment may be explored at each class level. The titles of the strands and the strand units are almost identical at each class level. However, the knowledge and understanding presented and the range of process skills that children are encouraged to use in scientific investigations will be developed and extended at each class level.

It is not intended that all the strand units will be taught in each class. Some units will be treated during first class only, some will be taught in second class only, while others could be profitably taught in each class, with the more complex details, concepts and methods of investigation and treatment reserved for second class. The suggestions are not intended to be prescriptive or exclusive, and the units may be supplemented by additional enrichment units, as identified in school planning or at the discretion of the teacher.

Planning

Efficient planning for science in the school will ensure that children experience a broad and balanced curriculum in which undue repetition and significant gaps are avoided. The units selected by the school and the teacher should

- be based on the environment, and all pupils should have the opportunity to explore and investigate the environment systematically and thoroughly at each class level; scientific concepts and skills should be developed through explorations in the immediate environment whenever possible
- ensure that pupils have access to a comprehensive and balanced range of scientific ideas while providing opportunities for the development of skills and concepts through practical investigations.

Breadth and balance—a menu curriculum

A broad and balanced programme will ensure that pupils have access to scientific concepts from each of the strands. Within each strand unit it is not expected that children should cover each objective. Instead, teachers at individual school level will select from the content objectives and exemplars outlined in each strand unit while ensuring that pupils apply and develop their scientific skills in a broad range of contexts.

Linkage and integration

Much of the work suggested in the curriculum might be delivered through the integrated themes or topics that are commonly used to organise learning in first and second classes. For example, many of the objectives in *Materials* and *Designing and making* might be achieved as children explore strands of the visual arts and mathematics curricula. Similarly, a broad range of scientific skills will be developed through geographical work.

Within the content sections, notes below strand units suggest some of the instances where linkage (i.e. integration within the science curriculum) and integration (i.e. cross-curricular connections) might be established.

Skills development for first and second classes

Working scientifically

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Questioning

- ask questions about animals, plants, objects and events in the immediate environment

  What is it?

  What animals and plants are here?

  How heavy/long/wide/far can it move in a minute?

  How many cabbage leaves will this snail eat in one day?

  Which food type is the woodlouse's favourite?

  Which material is the best for bouncing?

- ask questions that may lead to investigations

  What will happen if we add water?

  How will we move the box?

  Will the ball bounce better on the carpet or on the tarmac?

Observing

- observe accurately both inside and outside the classroom
- use all the senses, separately or in combination, to explore living things, objects and events in the immediate environment
- observe differences and similarities in the environment

  different plants and animals in contrasting environments

- observe gradual changes in living things and familiar objects and events over a period

  growth of seed

  weather diary

  evaporation of puddles in the yard

Predicting

- suggest outcomes of an investigation, based on observations

  suggest outcomes in the course of an activity (e.g. I think the object will move faster on a rough surface)

  suggest outcomes over a longer period (e.g. I think that more seeds will germinate by next week in tray A than tray B)

Investigating and experimenting

- carry out simple investigations where the problem, materials and method are suggested by the teacher

  explore how to make a paper bridge stronger

- begin to suggest approaches and methods of solving problems
- begin to identify one or two variables with guidance from the teacher

  that heat and water are necessary for growth

Estimating and measuring

- begin to use simple methods to estimate, measure and compare observations

  use non-standard units and some standard units to measure length, mass, time and temperature

- compare and identify differences in measurements

  fast/slow, heavy/light

- appreciate the need for standard units

Analysing

Sorting and classifying

- sort and group objects according to observable features

  colour, shape, size

- appreciate that there are different criteria for sorting and suggest more than one way of sorting a number of items

  a group of animals could be sorted by number of legs or by the food they eat

Recognising patterns

- begin to look for and recognise patterns and relationships in observations

  falling leaves and seasonal change

Interpreting

- draw conclusions from simple investigations

Recording and communicating

- describe and discuss observations orally using an increasing vocabulary
- represent findings using pictures, models and other methods

  simple charts or pictograms
  annotated drawings
  simple written or word-processed accounts.

Integration

Activities in the mathematics curriculum will inform and complement this unit.

Mass and weight

In everyday speech the term 'weight' is used to describe mass and weight. However, weight is not the same as mass. The mass of an object is the amount of material or matter it contains; the weight of an object is the amount of force being exerted on it by the pull of gravity. Most children, during the primary years, will not have developed the ability to grasp the distinction between mass and weight. However, by the end of the senior classes they could be encouraged to use the term 'mass'.

Designing and making

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Exploring

- handle and manipulate a range of materials and objects
- observe, investigate and describe familiar objects

  investigate how objects work

  state what he/she likes or dislikes about objects

  discuss why people have a need for them
- recognise that people like certain characteristics of objects but not others and investigate the reasons for these preferences

  preferences in shape, colour, texture, structure, material

Planning

- identify a need for new or revised designs; imagine and suggest a possible object to be made
- discuss, using appropriate vocabulary, what he/she would like to design or make
- clarify and communicate through pictures or simple modelling the materials and structures required to build the object
- choose materials, from a given range, to comply with the design idea
- talk about and communicate a plan of action using appropriate vocabulary

  oral, written or other media

  information and communication technologies

Making

- make simple objects
- develop craft-handling skills

  marking out, cutting curved edges

  cutting a variety of materials (e.g. paper, card, fabric, string)
- use a variety of simple tools

  scissors, single-hole punch, stapler
- use a range of materials

  reclaimable domestic waste, general-purpose adhesives, string, Lego, various thicknesses of cardboard, balloons, wooden dowelling, lollipop sticks, matchsticks, thread spools, adhesive tape, pipe cleaners, fabric, clay, straws, fasteners (hair-clips, paper clips, Bulldog clips, pegs)
- understand that these materials can be linked in simple ways to allow movement

  make a wheel and axle using a pencil and thread spools; a paper fastener joining two pieces of card allows a 'card wheel' to rotate

Evaluating

- evaluate design ideas as these develop in the making process
- evaluate own work and suggest possible modifications to the designing and making task

  suitability of materials chosen, aesthetic outcomes, the extent to which objects fulfil needs identified earlier
- evaluate the work of peers and propose positive modifications.

Integration

Activities throughout the strands of the visual arts curriculum will complement this unit and provide opportunities to apply these designing and making skills.

Mathematics: Space and shape

Geography: Picturing places; Human environments

Strand: Living things

Strand unit Myself

The child should be enabled to

Variety and characteristics of living things

- name and identify external parts of the male and female body and their associated functions or senses
- become aware of the role of each sense in detecting information about the environment and in protecting the body
- recognise and/or measure physical similarities and differences between individuals

  height, colour of hair, eye colour

  design and make a measuring chart of heights, including a 'pointer' to show and record heights

Human life processes

- recognise that all living things grow and change
- recognise that physical growth has taken place since birth

  differences between milk teeth and permanent teeth

  physical size

  in a range of abilities and skills
- identify some requirements for growth and development in the human

  food, sleep, exercise
- begin to identify the main phases of the human life cycle
- use all the senses to become aware of and explore environments.

Integration

SPHE: Myself

History: Local studies

Strand unit — Plants and animals

The child should be enabled to

Variety and characteristics of living things

- observe, identify and explore a variety of living things in local habitats and environments

  identify

  common trees and other plants

  common birds and other animals

  common insects and minibeasts of habitats such as

  forest, waste ground, hedge, pond, rocks, stream, seashore

- develop some awareness of plants and animals from wider environments
- recognise and describe the parts of some living things

  root, leaf, stem of plants

  trunk and branches of trees

  head, leg, wing, tail, skin covering of animal

- recognise that trees are plants
- group and sort living things into sets according to certain characteristics

  hibernation

  migration

  farm animals

  animals and plants that provide food

Processes of life

- appreciate that living things have essential needs for growth
- explore, through the growing of seeds, the need of plants for water and heat

  design, make or adapt a suitable container for growing seeds

- investigate how plants respond to light
- understand that seasonal changes occur in living things and examine the changes in plant and animal life during the different seasons
- become familiar with the life cycles of common plants and animals.

Integration

Geography: Natural environments

Strand: Energy and forces

Strand unit Light

The child should be enabled to

- recognise that light comes from different sources
- recognise that light is needed in order to see
- investigate the relationship between light and materials

  sort materials according to whether or not they allow light through (transparent/ opaque)

  explore materials that do not allow light to pass through (opaque) and thus form shadows

  design and make a model glasshouse using a plastic bottle that will allow light to pass through

  design and make a pair of shades using different combinations of coloured film or plastic
- recognise that the sun gives us heat and light, without which we could not survive
- become aware of the dangers of looking directly at the sun.

Strand unit Sound

The child should be enabled to

- recognise and identify a variety of sounds in the environment
- identify and differentiate between high and low sounds, loud and soft sounds
- explore ways of making different sounds using a variety of materials

  tins, metals, bottles, paper
- design and make a range of simple percussion instruments

  investigate how changes in materials, volume and beaters affect the sound produced.

Integration

Music: Exploring sounds

Strand unit Heat

The child should be enabled to

- become aware of different sources of heat energy

  sun, fire, radiator

- learn that temperature is a measurement of how hot something is
- measure and compare temperatures in different places in the classroom, school and environment.

Linkage

Materials—Materials and change

Integration

Geography: Natural environments—Weather

Strand unit Magnetism and electricity

The child should be enabled to

- use magnets of different shapes and sizes in purposeful play to explore their effects on different materials

  design and make a fishing game using a magnet

- investigate that magnets attract magnetic materials, such as iron and steel
- investigate that magnets attract certain materials through other materials

  magnets attracting materials through water, glass, plastic

- explore the effects of static electricity
- become aware of the uses of electricity in school and at home
- identify some household appliances that use electricity
- become aware of the dangers of electricity.

Strand unit Forces

The child should be enabled to

- explore how objects may be moved by pushing and pulling
- become aware of and explore how moving water and moving air can make things move

  design and make a land yacht that can be used for carrying toys for a set distance
- observe and investigate the movement of objects such as toys on various materials and surfaces

  level and inclined surfaces

  rough and smooth surfaces
- investigate how forces act on objects

  investigate floating and sinking with a wide range of materials and objects

  make and test predictions about objects that will sink or float

  group objects that will sink or float

  investigate how some objects may be made to float by hollowing them out.

Strand: Materials

Strand unit Properties and characteristics of materials

The child should be enabled to

- identify and investigate a range of common materials used in the immediate environment

  food and its ingredients

  materials used to construct buildings

  materials used to make furniture

  materials used to make clothes

  materials used to make tools

  materials used to make toys, school equipment
- describe and compare materials, noting the differences in colour, shape and texture
- begin to distinguish between natural and manufactured materials
- group materials according to their properties

  flexibility, transparency, magnetism, strength
- identify and investigate materials that absorb water and those that are waterproof

  investigate the absorbency factor of various fabrics and materials and design and make a new kitchen cloth or roll
- begin to explore how different materials may be used in the construction of homes suited to their environments

  homes, homes of animals, models, structures.

Strand unit Materials and change

The child should be enabled to

Heating and cooling

- explore the effects of heating and cooling on a range of liquids and solids

  water, toffee, syrup, Blu-tack
- become aware of and investigate the suitability of different kinds of clothes for variations in temperature

  recognise that some fabrics keep us warmer than others

  design and make or assemble an outfit for someone who is going on holiday to a very warm or cold place
- explore ways in which liquids and solids may be kept hot or cold

  effect of wrapping or covering using different materials, such as paper, fabrics, foil

  use of vacuum flasks.

Integration

Geography: Natural environments—Weather

Mixing and other changes

- begin to investigate how materials may be changed by mixing

  mixing paints to make new colours

  mixing water and sugar or salt

  ingredients mixed in baking a cake or making biscuits

  design and make different varieties of chocolate buns using mixing, heating or cooling (e.g. cereal and chocolate buns)

- investigate the characteristics of different materials when wet and dry.

Linkage

The strands Living things and Energy and forces will complement this unit.

Integration

Geography: Human environments

Strand: Environmental awareness and care

Strand unit Caring for my locality

The child should be enabled to

- identify, discuss and appreciate the natural and human features of the local environment
- observe and develop an awareness of living things in a range of habitats in local and wider environments
- observe similarities and differences among plants and animals in different local habitats
- develop an awareness that air, water, soil, living and non-living things are essential to the environment
- begin to recognise that people, animals and plants depend on one another
- realise that there is both an individual and a community responsibility for taking care of the environment
- identify, discuss and implement simple strategies for improving and caring for the environment

  caring for clothes, toys and other possessions

  caring for living things in the locality

  keeping home, classroom, school and play spaces clean, tidy and safe
- identify and help to implement simple strategies for protecting, conserving and enhancing the environment

  planting trees, flowers

  developing a school garden

  engaging in anti-litter campaigns
- become aware of ways in which the environment can be polluted or harmed

  litter, pollution, vandalism.

Linkage

Many of the objectives of this strand will be achieved as children complete work in other strands of the science curriculum.

Integration

Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

SPHE: Myself and the wider world—Environmental care

Third and fourth classes

Overview

third and fourth classes

Skills development

Working scientifically	• Questioning • Observing • Predicting • Investigating and experimenting • Estimating and measuring • Analysing *Sorting and classifying* *Recognising patterns* *Interpreting* • Recording and communicating
Designing and making	• Exploring • Planning • Making • Evaluating

The science skills above will be developed as work is completed on the strands and strand units of the curriculum outlined below.

Strands	*Strand units*
Living things	• Human life • Plants and animals
Energy and forces	• Light • Sound • Heat • Magnetism and electricity • Forces
Materials	• Properties and characteristics of materials • Materials and change
Environmental awareness and care	• Environmental awareness • Science and the environment • Caring for the environment

Planning

Structure

The content of the science curriculum for third and fourth classes is presented in two sections:

- a *skills* section, which describes the science process skills that children should develop as they encounter topics in the curriculum
- a number of *strands,* which outline the topics that may be included in the science programme. The topics within each strand are referred to as strand units. Examples and suggestions are shown in italic type throughout the content sections.

The presentation of content in these two sections is intended to help teachers in planning for the development of important skills and attitudes as knowledge and understanding of scientific concepts are acquired.

Skills in science

The science skills outlined at this level are arranged under two headings:

- *Working scientifically* describes the science skills that children should develop through their scientific investigations
- *Designing and making* skills will involve pupils in exploring materials, planning designs and making models that will provide solutions to practical problems.

As children work scientifically throughout these strands a broad range of skills will be nurtured and developed in conjunction with the framework of ideas explored in each content area of science.

Strands for third and fourth classes

The strands of the curriculum present the science topics that children will explore. Content in science for third and fourth classes is presented in four strands:

- *Living things*, which is concerned with the child's developing knowledge of people, animals and plants, their life processes and their interrelationships
- *Energy and forces*, which describes the different forms of energy such as light, sound and heat and the exploration of different forces that the children encounter through the investigation of different materials and through designing and making activities

- *Materials*, which involves the exploration of different everyday materials, their characteristics and the processes by which materials are changed
- *Environmental awareness and care*, which outlines how science and geography can foster the child's appreciation of environments and his/her responsibility for their conservation and enhancement. Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

The range of units within these strands provides considerable flexibility for schools and teachers in the selection of content.

A spiral approach

The curriculum is based on a spiral approach, in which some aspects of the natural and physical environment may be explored at each class level. The titles of the strands and the strand units are almost identical at each class level. However, the knowledge and understanding presented and the range of process skills that children are encouraged to use in scientific investigations will be developed and extended at each class level.

It is not intended that all the strand units will be taught in each class. Some units will be treated during third class only, some will be taught in fourth class only, while others could be profitably taught in each class, with the more complex details, concepts and methods of investigation and treatment reserved for fourth class. The suggestions are not intended to be prescriptive or exclusive, and the units may be supplemented by additional enrichment units, as identified in school planning or at the discretion of the teacher.

Planning

Efficient planning for science in the school will ensure that children experience a broad and balanced curriculum in which undue repetition and significant gaps are avoided. The units selected by the school and the teacher should

- be based on the environment, and all pupils should have the opportunity to explore and investigate the environment systematically and thoroughly at each class level; scientific concepts and skills should be developed through explorations in the immediate environment whenever possible

- ensure that pupils have access to a comprehensive and balanced range of scientific ideas while providing opportunities for the development of skills and concepts through practical investigations.

Breadth and balance—a menu curriculum

A broad and balanced programme will ensure that pupils have access to scientific concepts from each of the strands. Within each strand unit it is not expected that children should cover each objective. Instead, teachers at individual school level will select from the content objectives and exemplars outlined in each strand unit while ensuring that pupils apply and develop their scientific skills in a broad range of contexts.

Linkage and integration

Opportunities for the use of an integrated approach exist at all levels in the science curriculum. The study of the properties and characteristics of materials will integrate with the topics of water and air as described in the strand *Natural environments* in the geography curriculum. It should also be remembered that the strands and units of the science curriculum are not discrete; work on a science topic or investigation may incorporate objectives from a number of units.

Within the content sections, notes below strand units suggest some of the instances where linkage (i.e. integration within the science curriculum) and integration (i.e. cross-curricular connections) might be established.

Skills development for third and fourth classes

Working scientifically

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Questioning

- ask questions about animals, plants, objects and events in the immediate environment and their relationships

  What animals and plants live here?

  How can we find out what snails like to eat?

  How do the plants and animals depend on each other?

  Are there any signs of animals eating plants or smaller animals in this area?

- ask questions that will identify problems to be solved

  Do birds like all red berries?

  Are all materials waterproof?

- ask questions that will help in drawing conclusions and interpreting information

  Did the type of soil make any difference to the way the seeds grew?

Observing

- observe and describe natural and human elements and processes in the immediate environment

  variety of flora and fauna to be found in a range of environments

  effects of heating and cooling on a variety of substances

- observe and describe characteristics such as the shape, size, colour, pattern, texture and interrelationships of elements in the local environment

  describe weight, lengths and capacity

  use lenses, scales, timers and rulers to aid observations

Predicting

- offer suggestions (hypotheses) based on observations about the likely results of the investigation

  make suggestions based on observations over a period

  suggest what effects a cause will produce

Investigating and experimenting

- collect information and data from a variety of sources, including observations in the environment, classroom observations and experiments, photographs, books, maps and information and communication technologies
- design, plan and carry out simple investigations
- identify one or two obvious variables relevant to the investigation
- realise that an experiment is unfair if relevant variables are not controlled

  each tray of seeds must be given an equal amount of water

  temperature must be recorded at the same site each day to enable reliable comparisons to be made

Estimating and measuring

- measure, compare and record mass, weight, capacity, time and temperature using appropriate standard units of measurement and simple equipment

  rulers, rain gauges, thermometers, scales

Analysing

Sorting and classifying

- sort and group data on people, events and natural phenomena using a range of appropriate criteria

  animals observed in varying habitats

  test objects that sink or float

  test materials that will or will not conduct electricity
- sort and present data in sets and subsets

Recognising patterns

- look for and recognise relationships when making observations

  relationships between the length, thickness, tension and type of material used in making musical instruments and the sounds produced
- select appropriate observations that fit a pattern

Interpreting

- interpret information and offer explanations
- draw conclusions from suitable aspects of the evidence collected

Recording and communicating

- record and present findings and conclusions using a variety of methods

  oral and written accounts

  charts, graphs and diagrams

  presentations using information and communication technologies.

Integration

Activities in the mathematics curriculum will inform and complement this unit.

Mass and weight

In everyday speech the term 'weight' is used to describe mass and weight. However, weight is not the same as mass. The mass of an object is the amount of material or matter it contains; the weight of an object is the amount of force being exerted on it by the pull of gravity. Most children, during the primary years, will not have developed the ability to grasp the distinction between mass and weight. However, by the end of the senior classes they could be encouraged to use the term 'mass'.

Designing and making

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Exploring

- explore a wide range of everyday objects and how they work

  hinges on a door

  egg-beater

  paper punch

  screw-caps on bottles, jars, tubes

- explore freely how a range of shapes, objects and other constructions could be made using a variety of materials
- explore how some objects might be improved or adapted

  add struts to a bridge

  change materials

- recognise that people like certain characteristics of objects but not others and investigate the reasons for these preferences

  preferences in shape, colour, texture, structure, material

Planning

- recognise a need to adapt or change an object or surroundings
- become aware that new designs may create an interest and perceived need among others

  the creation of a better or more attractive pencil case may stimulate an interest and need in others for similar objects

- work collaboratively to create a design proposal
- communicate and evaluate the design plan using sketches, models and information and communication technologies

  use small models and/or sketches showing measurements and materials required

  list the equipment needed

  consider the resources available

Making

- make a range of simple objects to solve practical problems *(hold door open)*, to fulfil a need or preference (*colour/texture/weight/shape*) and to express creative ideas (*make a dragon, mask*)
- develop craft-handling skills and techniques

  tying knots, marking and cutting, joining and fastening, making holes, weaving and plaiting, strengthening structures using struts, linking objects with adhesives, simple card hinge
- use appropriate tools

  friction (e.g. sandpaper and files)

  joining and fastening (e.g. needle and thread, adhesive, stapler, bolts, nuts and spanners)

  cutting and punching (e.g. scissors, single-hole punch)
- use a range of materials including

  soft strip wood, lollipop sticks, various thicknesses of card, basic electrical equipment, adhesive, paper clips, Bulldog clips

Evaluating

- recognise that modifications to the plan may have to be made throughout the task
- evaluate the effectiveness of the new product and suggest modifications to the designing and making task

  suitability of materials chosen, aesthetic outcomes, the extent to which objects fulfil needs identified earlier
- evaluate the work of peers and propose positive modifications.

Integration

Activities throughout the strands of the visual arts curriculum will complement this unit and provide opportunities to apply these designing and making skills.

Mathematics: Space and shape

Geography: Maps, globes and graphical skills; Human environments

Strand: Living things

Strand unit — Human life

The child should be enabled to

Variety and characteristics of humans

- become aware of the names and structure of some of the body's major external and internal organs

Human life processes

- develop an awareness of the importance of food for energy and growth

  need for a balanced and healthy diet

  structure and function of teeth

  design and make a nutritious sandwich for lunch

  design and make a clay model of a set of teeth (or part of a set of teeth)
- understand the physical changes taking place in both male and female during growth to adulthood
- become aware of and investigate breathing

  appreciate the need for oxygen from the air

  understand that air is drawn in through mouth and nose and passes through windpipe to lungs

  investigate breathing rate before and after exercise

  recognise dangers of smoking and air pollution
- explore and investigate how people move

  body supported by a skeleton

  actions of muscles, bones and joints.

Integration

SPHE: Myself

History: Local studies

Strand unit — Plant and animal life

The child should be enabled to

Variety and characteristics of living things

- observe, identify and investigate the animals and plants that live in local environments

  local stream, river or pond, seashore

  aspect of a local rural landscape (e.g. road or laneway verge, hedgerow, peatland, field)

  aspect of a local urban area (e.g. areas around school, park, waste ground)

- develop an increasing awareness of plants and animals from wider environments
- observe and explore some ways in which plant and animal behaviour is influenced by, or adapted to, environmental conditions

  suitability of plants for shaded/damp/dry/wet conditions

  use of colour and camouflage by animals

- sort and group living things into sets according to observable features

  animals that have fur, feathers, scales

  flowering and non-flowering plants

- use simple keys to identify common species of plants and animals
- understand that plants use light energy from the sun
- come to appreciate that animals depend on plants and indirectly on the sun for food
- discuss simple food chains

Processes of life

- become aware of some of the basic life processes in animals

  feeding, breathing, growing, moving, reproducing (life cycles), using their senses

  design and make an animal home that provides for growth, exercise, feeding of the animal

- investigate the factors that affect plant growth

  water, light, types of soil, temperature.

Integration

Geography: Natural environments

Strand: Energy and forces

Strand unit Light

The child should be enabled to

- learn that light is a form of energy
- recognise that light comes from different natural and artificial sources
- investigate that light can be broken up into many different colours

  use prism to create spectrum
- investigate the relationships between light and materials

  sort materials according to the degree to which they allow light through (i.e. transparent, translucent, opaque)

  explore materials that do not allow light to pass through (opaque) and thus form shadows

  design and make a light shade for bedroom
- investigate how mirrors and other shiny surfaces are good reflectors of light

  effects of flat shiny surface, curved shiny surface
- recognise that the sun gives us heat and light, without which people and animals could not survive
- be aware of the dangers of looking directly at the sun.

Integration

Geography: Human environments

Strand unit Sound

The child should be enabled to

- learn that sound is a form of energy
- recognise and identify a variety of sounds in the environment
- understand and explore how different sounds may be made by making a variety of materials vibrate

  skin of drum, plastic ruler on table, string of an instrument, 'seed' in referee's whistle
- design and make a range of simple string instruments using an increasing variety of tools and materials

  investigate how changes in length, tension, thickness and types of materials affect sound produced
- explore the fact that sound travels through materials

  air, water, wood, metal.

Integration

Music: Exploring sounds

Strand unit Heat

The child should be enabled to

- learn that heat can be transferred
- recognise that temperature is a measurement of how hot something is
- measure changes in temperature using a thermometer
- measure and compare temperatures in different places in the classroom, school and environment and explore reasons for variations
- understand that the sun is the Earth's most important heat source
- identify ways in which homes, buildings and materials are heated

  cookers, kettles, electric radiators.

Integration

Geography: Natural environments—Weather; Human environments

Strand unit Magnetism and electricity

The child should be enabled to

- learn that magnets can push or pull magnetic materials
- explore how magnets have poles and investigate how these poles attract and repel each other
- explore the relationship between magnets and compasses
- examine and classify objects and materials as magnetic and non-magnetic
- investigate that magnets attract certain materials through other materials

  magnets attracting materials through water, glass, plastic
- explore the effects of static electricity

  plastic ruler, comb, glass rod
- observe the effects of static electricity on everyday things in the environment

  use of lightning conductor on buildings

  use of earthing strips for cars
- learn about electrical energy
- investigate current electricity by constructing simple circuits

  use wire, bulbs and batteries

  experiment with simple switches

  design and make a marine warning system (e.g. buoy with light or buzzer, lighthouse)
- examine and group materials as conductors (those that conduct electricity) and insulators (those that do not allow electricity to pass through)
- become aware of the dangers of electricity.

Integration

Geography: Human environment

Strand unit Forces

The child should be enabled to

- explore how objects may be moved

  by pushing and pulling

  by twisting and stretching

  by machines (e.g. rollers, wheels, pulleys)

  design and make a pulley system to help a Norman builder to carry stone to the top of a castle

- explore how some moving objects may be slowed down

  a bicycle wheel by a brake

  a falling object by a parachute

  design and make a parachute to help transport a small object (e.g. marble, square of chocolate, matchbox)

- explore the effect of friction on movement through experimenting with toys and objects on various surfaces

  tiled surface, carpet, concrete, grass, table-top

- investigate falling objects

- explore how levers may be used to help lift different objects

  design and make safe see-saws

- investigate the pushing force of water

  compare floating and sinking in fresh and salty water

  design and make a boat or raft using an increasing variety of materials, tools and craft-handling skills.

Strand: Materials

Strand unit Properties and characteristics of materials

The child should be enabled to

- identify and investigate a range of common materials in the immediate environment

  water, air, rock, fabrics, paper, metal, wood, plastic, food
- recognise that materials can be solid, liquid or gaseous
- describe and compare materials, noting the differences in colour, shape and texture
- distinguish between raw and manufactured materials
- group materials according to their properties

  flexibility, transparency, magnetism, conductivity or insulation properties, strength, shape, ability to muffle sounds, perishable and non-perishable, solubility
- investigate how materials may be used in construction

  homes and other buildings, furniture, models, structures, everyday appliances.

Strand unit Materials and change

The child should be enabled to

Heating and cooling

- explore the effects of heating and cooling on a range of liquids, solids and gases

  the effects of heating and cooling on water

  heat causing air to rise

  design, make and flavour ice-cream
- investigate the suitability of different kinds of clothes for variations in temperature

  recognise that some fabrics keep us warmer than others
- experiment to establish which materials are conductors of heat or insulators

  explore ways in which liquids and objects may be kept hot or cold

  design and make a tea-cosy or a cover for a hot-water bottle.

Integration

Geography: Natural environments—Weather

Mixing and other changes

- investigate how materials may be changed by mixing

  mixing and dissolving materials in water

  design and make suitable refreshments for guests at a concert (e.g. iced tea, lemonade, adding fruit juices to water)

- investigate the characteristics of different materials when wet and dry

  experiment with papier m ch

- examine the changes that take place in materials when physical forces are applied

  when materials are beaten, whisked, mixed, squashed, pulled or bent

- explore some simple ways in which materials may be separated

  using sieves of varying meshes

  using magnet

  using ruler charged with static electricity

  allowing sediment to settle in a jar of liquid

  separating water and salt through evaporation.

Linkage

Aspects of the work in this strand will be covered as work is completed in the strands Living things and Energy and forces in this science curriculum.

Integration

Geography: Natural environments; Human environments

Strand: Environmental awareness and care

Strand unit — Environmental awareness

The child should be enabled to

- identify positive aspects of natural and built environments through observation, discussion and recording
  - *colours, textures and shapes in rural and urban areas*
  - *diversity of plant and animal life*
  - *range of materials, buildings, walls and other features*
  - *places that people enjoy and the reasons for these preferences*
- identify the interrelationship of the living and non-living elements of local and other environments
  - *plants, animals, water, air and soil in habitats*
- become aware of the importance of the Earth's renewable and non-renewable resources
- recognise how the actions of people may impact upon environments
  - *planting and felling trees*
  - *removing hedgerows*
  - *draining marshes*
  - *constructing buildings, roads and bridges*
- come to appreciate the need to conserve resources
  - *recycling of materials, use of paper packaging in contrast to some plastic packaging, identifying materials which can be used for a variety of purposes, turning off lights, reducing the amounts of water used.*

Linkage

Many of the objectives of this unit may be achieved as children complete work in other strands of the science curriculum.

Integration

Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

SPHE: Myself and the wider world—Environmental care

Visual arts: an awareness of colours and textures in the environment will complement the work in this unit.

Strand unit Science and the environment

The child should be enabled to

- begin to explore and appreciate the application of science and technology in familiar contexts

  at home: cooking, heating, vacuum cleaners, refrigerators, washing machines, toasters

  at school: design of computer desks, chairs, pens, calculators

  in shops: design of trolleys, use of conveyor belts in counters, ways of preserving foods, packaging foods

  in designing and making activities

- identify some ways in which science and technology contributes positively to society

  transport, buildings, bridges, roads, information and communication technologies, insulation of houses, tools and appliances, toys, farming, medicine

- recognise and investigate human activities which have positive or adverse effects on local and wider environments

  enhance the built environment

  protect flora and fauna, e.g. by creating and maintaining a school garden

  produce biodegradable and non-biodegradable waste

  affect the quality of air, water and soil.

Strand unit — Caring for the environment

The child should be enabled to

- examine a number of ways in which the local environment could be improved or enhanced

  recycling campaigns

  helping in anti-litter campaign

- identify and discuss a local, national or global environmental issue

  such as

  litter in area

  an incident of pollution

  changes in flora and fauna

  new roads, buildings

  need to protect a habitat and its flora and fauna

  proposals for enhancing the environment (e.g. need for cycleways near school)

  investigate the causes of the issue

  appreciate the roles and different views of people involved

  suggest and discuss possible actions and consider the effects of these on people and the environment

- realise that there is a personal and community responsibility for taking care of the environment.

Fifth and sixth classes

Overview

fifth and sixth classes

Skills development

Working scientifically	• Questioning • Observing • Predicting • Investigating and experimenting • Estimating and measuring • Analysing *Sorting and classifying* *Recognising patterns* *Interpreting* • Recording and communicating
Designing and making	• Exploring • Planning • Making • Evaluating

The science skills above will be developed as work is completed on the strands and strand units of the curriculum outlined below.

Strands	*Strand units*
Living things	• Human life • Plant and animal life
Energy and forces	• Light • Sound • Heat • Magnetism and electricity • Forces
Materials	• Properties and characteristics of materials • Materials and change
Environmental awareness and care	• Environmental awareness • Science and the environment • Caring for the environment

Planning

Structure

The content of the science curriculum for fifth and sixth classes is presented in two sections:

- a *skills* section, which describes the science process skills that children should develop as they encounter topics in the curriculum
- a number of *strands,* which outline the topics that may be included in the science programme. The topics within each strand are referred to as strand units. Examples and suggestions are shown in italic type throughout the content sections.

The presentation of content in these two sections is intended to help teachers in planning for the development of important skills and attitudes, as knowledge and understanding of scientific concepts are acquired.

Skills in science

The science skills outlined at this level are arranged under two headings:

- *Working scientifically* describes the science skills that children should develop through their scientific investigations
- *Designing and making* skills will involve pupils in exploring materials, planning designs and making models that will provide solutions to practical problems.

As children work scientifically throughout these strands a broad range of skills will be nurtured and developed in conjunction with the framework of ideas explored in each content area of science.

Strands for fifth and sixth classes

The strands of the curriculum present the science topics that children will explore. Content in science for fifth and sixth classes is presented in four strands:

- *Living things*, which is concerned with the child's developing knowledge of people, animals and plants, their life processes and their interrelationships
- *Energy and forces*, which describes the different forms of energy such as light, sound and heat and the exploration of different forces that the children encounter through the investigation of different materials and through designing and making activities

- *Materials,* which involves the exploration of different everyday materials, their characteristics and the processes by which materials are changed
- *Environmental awareness and care*, which outlines how science and geography can foster the child's appreciation of environments and his/her responsibility for their conservation and enhancement. Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

The range of units within these strands provides considerable flexibility for schools and teachers in the selection of content.

A spiral approach

The curriculum is based on a spiral approach, in which some aspects of the natural and physical environment may be explored at each class level. The titles of the strands and the strand units are almost identical at each class level. However, the knowledge and understanding presented and the range of process skills that children are encouraged to use in scientific investigations will be developed and extended at each class level.

It is not intended that all the strand units will be taught in each class. Some units will be treated during fifth class only, some will be taught in sixth class only, while others could be profitably taught in each class with the more complex details, concepts and methods of investigation and treatment reserved for sixth class. The suggestions are not intended to be prescriptive or exclusive, and the units may be supplemented by additional enrichment units, as identified in school planning or at the discretion of the teacher.

Planning

Efficient planning for science in the school will ensure that children experience a broad and balanced curriculum in which undue repetition and significant gaps are avoided. The units selected by the school and the teacher should

- be based on the environment, and all pupils should have the opportunity to explore and investigate the environment systematically and thoroughly at each class level; scientific concepts and skills should be developed through explorations in the immediate environment whenever possible

- ensure that pupils have access to a comprehensive and balanced range of scientific ideas while providing opportunities for the development of skills and concepts through practical investigations.

Breadth and balance—a menu curriculum

A broad and balanced programme will ensure that pupils have access to scientific concepts from each of the strands. Within each strand unit it is not expected that children should cover each objective. Instead, teachers at individual school level will select from the content objectives and exemplars outlined in each strand unit while ensuring that pupils apply and develop their scientific skills in a broad range of contexts.

Linkage and integration

Opportunities for the use of an integrated approach exist at all levels in the science curriculum. The study of the properties and characteristics of materials will integrate with the topics of water and air as described in the strand *Natural environments* in the geography curriculum. It should also be remembered that the strands and units of the science curriculum are not discrete; work on a science topic or investigation may incorporate objectives from a number of units.

Within the content sections, notes below strand units suggest some of the instances where *linkage* (i.e. integration within the science curriculum) and *integration* (i.e. cross-curricular connections) might be established.

Skills development for fifth and sixth classes

Working scientifically

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Questioning

- ask questions about animals, plants, objects and events in the immediate environment and their relationships
- ask questions that will identify problems to be solved

  Does light travel in straight lines?

  How can this be tested?
- ask questions that will help in drawing conclusions and interpreting information

Observing

- observe, describe and discuss physical, natural and human elements and processes in the immediate environment

  colour of water in stream

  types of materials used in building construction

  flora and fauna to be found in a range of environments

  effect of forces on a variety of materials
- recognise and describe pattern and sequences in observations

  patterns observed in the adaptation of animals to their habitats

  sequences in seasonal changes
- distinguish between the significant and less significant observations

Predicting

- offer suggestions (hypotheses) based on a number of observations and data available about the likely results of the investigations
- make inferences based on suggestions and observations
- propose ideas or simple theories that may be tested by experimentation

Investigating and experimenting

- collect information and data from a variety of sources, including

  observations in the environment, classroom observations and experiments, photographs, books, maps, CD-ROM and computer database

- design, plan and carry out simple experiments, having regard to one or two variables and their control and the need to sequence tasks and tests
- realise that an experiment is unfair if relevant variables are not controlled
- appreciate the importance of repeating tests and experiments
- identify (with guidance) different ways of looking at a problem and compare results of different investigations

Estimating and measuring

- use appropriate simple instruments and techniques to collect and record data on length, weight, mass, capacity, time and temperature

  thermometers, rulers, scales, stop-watches, measuring jugs

  record sheets, spring balances and forcemeters

- estimate and use appropriate standard units of measurement
- decide what should be measured and the degree of accuracy required

Analysing

Sorting and classifying

- sort and group data on people, events, natural phenomena, materials and physical processes using a range of appropriate criteria
- sort and present data in sets and sub-sets

Recognising patterns

- look for and recognise patterns and relationships when making observations

  relationship between the amount of sugar that can be dissolved and the temperature of the water

- identify other instances that fit an observed pattern
- use observed patterns to make predictions

Interpreting

- interpret information and offer explanations
- draw conclusions from suitable aspects of the evidence collected

Recording and communicating

- record and present findings and conclusions using a variety of methods

  oral and written accounts

  charts, graphs and diagrams

  presentations using wordprocessing or publishing programs

Evaluating

- review the methods used in investigations and assess their usefulness.

Integration

Activities in the mathematics curriculum will inform and complement this unit.

Mass and weight

In everyday speech the term 'weight' is used to describe mass and weight. However, weight is not the same as mass. The mass of an object is the amount of material or matter it contains; the weight of an object is the amount of force being exerted on it by the pull of gravity. Most children, during the primary years, will not have developed the ability to grasp the distinction between mass and weight. However by the end of the senior classes they could be encouraged to use the term 'mass'.

Designing and making

Throughout their science investigations children should be aware of and encouraged to adopt **safe practices**. *They should observe* **safety procedures** *in designing and making tasks, particularly when they are using tools and materials.*

Through completing the strand units of the science curriculum the child should be enabled to

Exploring

- explore a wide range of everyday objects and how they work

  tools and domestic equipment

  walls and their construction

  gates and hinges

  wheelbarrows

- explore freely how a range of shapes, objects and other constructions could be made using a variety of materials
- explore how some objects might be improved or adapted
- recognise that people like certain characteristics of objects but not others and investigate the reasons for these preferences

  preferences in shape, colour, texture, structure, material, practicality

Planning

- use knowledge and the result of investigations to identify needs and/or opportunities to improve an object or environments in familiar contexts

  knowledge that plants need water could initiate design of watering device; the results of a litter survey could prompt design of new litter bins

- understand that while the change may be desirable it may result in problems

  too difficult to make, not pleasing to look at

- develop the ability to draw designs showing different perspectives of proposed objects

  side, top, front elevations

- communicate their design plan using sketches, models and other media including information and communication technologies
- organise work, taking account of constraints and resources
- present design proposal on a 'design sheet'

  simple elevations, measurements (scale), equipment required, aesthetic features (e.g. colour)

- evaluate the feasibility of the design proposal and possible modifications to it, bearing in mind the resources available

Making

- make objects, applying knowledge that

  structures have distinctive characteristics, including form and stability

  materials can be permanently linked to allow maximum stability

- identify problems with, or undesirable effects of, a design during construction; propose and implement alterations as the object is made
- develop craft-handling skills and techniques

  tying knots, marking and cutting, joining and fastening, making holes, weaving and plaiting, strengthening structures using struts, linking objects with adhesives, simple card hinges, triangular joining, dowel joints, cut a variety of materials with different tools

- use a range of tools

  hammer, G clamp, hand drill, junior hacksaws, measuring devices, rotary cutter, simple paper clip and drawing pin switch for electric currents

- use a range of material

  wood, lollipop sticks, clothes pegs, various thicknesses of card, sheet plastic, dowels, matchsticks, Lego Technic, Meccano, fabrics, fibres and plastics

Evaluating

- evaluate the positive and negative impact of design on surroundings and others
- discuss stability and form of other made objects and evaluate the effectiveness of the group product in the light of this investigation

  compare the joints in a range of objects with those in own design

- justify the ideas, materials, joins, procedures and techniques used and indicate possible improvements

  why a loose dowel joint was used for axle movement and not a tight dowel joint

- discuss and justify modifications that would improve the overall quality and stability of the outcome
- appraise results against group's initial plan and intentions.

Integration

Activities throughout the strands of the visual arts curriculum will complement this unit and provide opportunities to apply these designing and making skills.

Mathematics: Space and shape

Geography: Maps, globes and graphical skills; Human environments

Strand: Living things

Strand unit Human life

The child should be enabled to

Variety and characteristics of humans

- develop a simple understanding of the structure of some of the body's major internal and external organs

Human life processes

- develop a simple understanding of food and nutrition

  structure, function and care of teeth

  the importance of food for energy and growth

  importance of a balanced and healthy diet

  design and make a balanced and nutritious lunch menu for self or younger child

- develop an understanding of the reproductive systems of both male and female and of the physical changes taking place in both male and female during growth to adulthood

- become aware of and investigate breathing

  appreciate the need for oxygen from the air

  understand structure and function of nose, windpipe and lungs

  recognise the dangers of smoking and air pollution

  investigate and/or design and make facial anti-dust mask

- identify and understand ways in which the body protects itself against disease and infection

  role of external organs: nose and skin.

Integration

SPHE: Myself

Strand unit — Plant and animal life

The child should be enabled to

Variety and characteristics of living things

- observe, identify and examine the animals and plants that live in local habitats and environments

  local stream, river or pond, rock pool, seashore

  aspect of a local rural landscape (e.g. soil, hedgerow, forest, peatland, field); aspect of a local urban area (e.g. areas around school, park, waste ground)
- develop an increasing awareness of plants and animals from wider environments
- identify the interrelationships and interdependence between plants and animals in local and other habitats

  plants and animals depend on, and compete with, each other

  concept of food chains and food webs
- become aware of the sun as a source of energy for plants through photosynthesis
- observe and explore some ways in which plant and animal behaviour is influenced by, or adapted to, environmental conditions

  location factors for plant and animal habitats, including food supply and physical conditions

  use of colour and camouflage by animals
- recognise that there is a great diversity of plants and animals in different regions and environments
- group and compare living things into sets according to their similarities and differences

  similarities and differences between members of the same groups or species
- become familiar with the characteristics of some major groups of living things

  mammals, insects, arachnids, amphibians, fish, birds, reptiles

  *flowering and non-flowering plants, fungi and bacteria**
- construct and use simple keys to identify locally occurring species of plants and animals

Processes of life

- become aware of some of the basic life processes in animals and plants

  animals: nutrition, breathing, growth, movement, reproduction (life cycles), use of their senses

  plants: nutrition, reproduction, movement in response to light, use of oxygen and carbon dioxide
- investigate the factors that affect plant growth

  water, light, soil, temperature

  design and make a suitable growth environment for a plant that requires some specialised care (e.g. a bottle garden for plants that require much heat and humidity)
- understand some ways in which plants reproduce

  flowering plants and seeds

  non-flowering plants, spores

  vegetatively: runners, tubers, bulbs.

*Fungi and bacteria are not considered to be part of the animal or plant kingdoms.

Strand: Energy and forces

Strand unit Light

The child should be enabled to

- learn that light is a form of energy
- know that light travels from a source
- investigate the splitting and mixing of light
  - *use prism to create spectrum*
  - *mix coloured light using filters*
- investigate the refraction of light
- investigate how mirrors and other shiny surfaces are good reflectors of light
  - *effects of flat shiny surface, curved shiny surface*
  - *design and make model periscopes*
- explore how objects may be magnified using simple lens or magnifier
  - *investigate use of lens*
  - *design and make model telescopes*
- appreciate the importance of sight
- understand the role of sunlight in photosynthesis and appreciate that the sun gives us heat and light without which people and animals could not survive
- be aware of the dangers of excessive sunlight
  - *dangers of looking directly at the sun*
  - *effect of the sun's rays on skin*
  - *design and make a sun canopy or umbrella for toys such as dolls and models.*

Strand unit Sound

The child should be enabled to

- learn that sound is a form of energy
- recognise and identify a variety of sounds in the environment and appreciate the importance of noise control
- understand and explore how different sounds may be made by making a variety of materials vibrate
  - *skin of drum, plastic ruler on table, string of an instrument*
- design and make simple woodwind instruments
  - *investigate how the length, thickness, diameter and type of materials used will influence the sound produced*
- explore how sound travels through materials
  - *air, water and solids*
  - *identify materials that muffle sounds*
  - *design and make a pair of ear muffs*
- appreciate the importance of hearing.

Integration

Music: Exploring sounds

Strand unit Heat

The child should be enabled to

- experiment with a range of materials to establish that heat may be transferred in different ways
  - *through water, metals or air*
- recognise a variety of sources of heat
  - *renewable sources (e.g. solar energy, heat from burning of bio-mass)*
  - *non-renewable sources (e.g. heat from burning of fossil fuels)*
  - *friction in mechanical movement*
- know that heat energy can be transferred
  - *in solids (conduction)*
  - *in water and air (convection)*
  - *from the sun (radiation)*
- measure and record temperature using thermometer.

Integration

Geography: Natural environments—Weather; Human environments

Strand unit Magnetism and electricity

The child should be enabled to

- learn that magnets can push or pull magnetic materials
- investigate how magnets may be made
  - *stroking a piece of iron or steel with a magnet*
  - *passing electricity through a coil around a piece of iron or steel (electromagnet)*
- explore the use of magnets to lift and hold objects
  - *how magnets can be used in cranes, door catches*
  - *how magnets may be used to sort materials*
- learn about electrical energy
- investigate current electricity by constructing simple circuits
  - *use wire, bulbs, motors and batteries*
  - *use more than one bulb in a circuit*
  - *use more than one battery in a circuit*
  - *experiment with simple switches*
  - *design and make set of traffic lights using a simple circuit and switch*
- become aware of how some common electrical appliances work
- become aware of and understand the dangers of electricity
  - *dangers of mains electricity in the home and at work*
  - *the importance of fuses and circuit breakers for safety.*

Integration

Geography: Human environments

Strand unit Forces

The child should be enabled to

- identify and explore how objects and materials may be moved
  - *by pushing and pulling*
  - *by machines using rollers, wheels, axles, gear wheels, chains and belts*
  - *by pouring and pumping*
  - *using trapped air pressure (pneumatics)*
  - *using trapped liquid under pressure (hydraulics)*
  - *using wind energy*
  - *harnessing energy of moving water*
  - *design and make a lifting device that uses levers and gears*
  - *design and make a windmill, water wheel or wind turbine to spin a coloured disk or turn a flywheel*
- explore the effect of friction on movement and how it may be used to slow or stop moving objects
  - *a bicycle wheel by a brake*
  - *a falling object by a parachute*
  - *air resistance, streamlining*
- explore how friction can generate heat
  - *rubbing hands*
- come to appreciate that gravity is a force
- become aware that objects have weight because of the pull of gravity
  - *design and make a spring balance*
- explore how levers may be used to help lift different objects
  - *design and make a toy using a lever.*

Strand: Materials

Strand unit Properties and characteristics of materials

The child should be enabled to

- recognise that materials can be in solid, liquid or gas form
- identify and investigate a widening range of common materials in the immediate environment

  water, air, rock, fabric, paper, metal, wood, plastic, food
- explore the origins of these materials

  identify natural and manufactured materials

  understand how some of these materials are processed or made
- group materials according to their properties and/or composition

  properties (e.g. flexibility, transparency, magnetism, conductivity, insulation, strength, shape, perishable or non-perishable foods, solubility)

  composition (e.g. foods containing proteins, carbohydrates and/or fats; soil containing clay, silt, sand and/or gravel)
- identify how materials are used

  relate the properties of the material to its use

  examine how shape affects the strength of structures

  design and make a bridge that takes account of flexibility, form, stability and strength
- recognise that a gas, such as air, occupies space, has mass* and exerts pressure

  investigate evidence for atmospheric pressure

  explore the effect of air resistance

  design and make a glider
- recognise that some materials decay naturally while others survive a long time in the environment

  biodegradable and non-biodegradable waste

  environmental problems caused by non-biodegradable waste

  materials that may be recycled
- become aware that air is composed of different gases

  including oxygen and carbon dioxide
- become aware of some of the practical applications of these gases in everyday life

  use of carbon dioxide in fizzy drinks and in fire extinguishers.

*See reference to weight and mass on page 80 of this document.

Strand unit Materials and change

The child should be enabled to

Heating and cooling

- explore the effects of heating and cooling on a range of solids, liquids and gases

  temporary changes (e.g. from solid to liquid to gas)

  expansion of water on freezing

  evaporation of water on heating

  permanent changes (e.g. those caused by baking bread in an oven)
- experiment to establish which materials are good conductors of heat or good insulators

  explore ways in which liquids and solids may be kept hot or cold
- identify ways in which homes and buildings are heated and insulated
- recognise how heating and cooling can be used to preserve food

Mixing, separating and other changes

- investigate how a wide range of materials may be changed by mixing

  mixing and dissolving materials in water solutions

  exploring liquids that will not mix
- investigate the effects of light, air and water on materials

  discoloration and fading

  rusting of iron and steel

  investigate how rusting can be controlled

  characteristics of materials when wet and dry
- examine the changes that take place in materials when physical forces are applied

  when materials are beaten, whisked, mixed, squashed, pulled, bent
- recognise that oxygen is required for burning
- explore some simple ways in which materials may be separated

  using sieves of varying meshes

  using a magnet

  using ruler charged with static electricity

  allowing sediment to settle in a jar of liquid

  separation of salt and water by evaporation

  separation of water and soil using simple sieves (filtration).

Integration

Geography: Natural environments—Weather; Human environments

Strand: Environmental awareness and care

Strand unit — Environmental awareness

The child should be enabled to

- identify positive aspects of natural and built environments through observation, discussion and recording
  - *colours, textures and shapes in rural and urban areas*
  - *diversity of plant and animal life*
  - *range of materials, buildings, walls and other features*
  - *places that people enjoy and the reasons for these preferences*
- explore some examples of the interrelationship of living and non-living aspects of local and other environments
  - *ecosystem of tree, hedgerow, stream*
  - *boglands, mountains, lowlands, river*
  - *rainforest, grasslands, desert, tundra*
- become aware of the importance of the Earth's renewable and non-renewable resources
- foster an appreciation of the ways in which people use the Earth's resources
  - *mining, fishing, forestry, agriculture*
  - *using wind, water, fossil fuels or nuclear energy to generate power*
  - *processing raw materials for manufacturing*
  - *using the environment for leisure activities*
- come to appreciate the need to conserve resources
  - *recycling of materials, use of paper packaging in contrast to some plastic packaging, identifying materials that can be used for a variety of purposes, turning off lights, reducing the amounts of water used.*

Strand unit Science and the environment

The child should be enabled to

- appreciate the application of science and technology in familiar contexts

  at home: microwave oven, cooker, dustbin, coffee maker

  at school: photocopier, projector, information and communication technologies

  in the work-place: conveyor belts and pulleys in a factory; pneumatic drill, cement mixer and crane on a building site

  in hospitals: stethoscope, X-ray, radium treatment

  in designing and making activities

- examine some ways that science and technology have contributed positively to the use of the Earth's resources

  purifying water, mixing materials to produce new materials, medicines, processing food, preserving food, generating electricity, using fertilisers for increased agricultural yields

- recognise the contribution of scientists to society

  work of scientists in the past and present

- recognise and investigate aspects of human activities that may have positive or adverse effects on environments

  activities that

  protect flora and fauna, such as creating a wildlife area and planting trees

  enhance built environments

  affect the quality of air, soil, water and the built environment.

Strand unit — Caring for the environment

The child should be enabled to

- participate in activities that contribute to the enhancement of the environment
  - *organise collection of paper, aluminium cans or other materials for recycling*
  - *become aware of the need to use energy wisely in school and at home*
  - *compost waste for garden*
- identify and discuss a local, national or global environmental issue
  - *such as*
    - *effect of building a new factory, new roads, buildings*
    - *farming practices*
    - *traffic congestion, road safety*
    - *suggestions for environmental enhancement*
    - *an incident of pollution, deforestation,*
    - *ozone depletion, nuclear energy, global warming*
  - *investigate the causes of the issue*
  - *appreciate the roles and different views of people involved*
  - *identify and use ways of assessing or measuring the extent of the problem*
  - *suggest possible actions and consider the effect of these on people and the environment*
  - *participate in the resolution of the issue, if possible*
- come to appreciate individual, community and national responsibility for environmental care
  - *explore concept of custodianship and its practical implications*
  - *become familiar with the concept of sustainable development*
  - *appreciate the need to protect environments for present and future inhabitants.*

Linkage

Many of the objectives of this unit may be achieved as children complete work in other strands of the science curriculum.

Integration

Environmental awareness and care is a cross-curricular strand common to the science and geography curricula.

SPHE: Myself and the wider world—Environmental care

Visual arts: an awareness of colours and textures in the environment will complement the work in this unit.

Assessment

Assessment in Social, environmental and scientific education

Assessment: an integral part of teaching and learning

The assessment of children's learning is an essential and on-going part of the teaching and learning process in SESE: in some form it will be part of every lesson in science, geography and history. Teachers are constantly making judgements about their pupils' learning as they plan how to introduce new areas of knowledge, concepts and skills, consolidate earlier lessons, assess the progress of individual pupils, identify difficulties, and praise and encourage learners.

Assessment enhances the teacher's awareness of each individual's learning, provides accurate information about the child's understanding and skills, and creates a picture of the child's holistic development throughout the broad range of curricular areas. It provides the basis for decisions about the pupil's further learning needs, assists in planning better educational experiences and is a natural element of a progressive child-centred curriculum.

Roles of assessment: Why assess in SESE?

Assessment enhances teaching and learning in a number of ways. *Primarily, assessment in SESE, as in other areas of the curriculum, should assist in planning and supporting future learning for the child.* Assessment should indicate the positive achievements of each pupil as he/she is engaged in the study of scientific, historical and geographical topics and should indicate possible areas of development in the child's learning. Used in this way, assessment plays a constructive, *formative* role in the child's education. Information gained about the child's learning will be used primarily by the teacher but it will also involve the pupil in self-evaluation and in the setting of personal learning targets.

Assessment will also indicate areas of learning difficulty encountered by the child. The learning difficulties identified in SESE may include weaknesses in the child's understanding, gaps in his/her knowledge or a lack of certain skills. As assessment fulfils this *diagnostic* role, it should help the teacher to identify approaches or learning experiences that could help to improve the child's learning. At times learning difficulties may be identified in one aspect of the child's scientific, historical or geographical development, but on other occasions a weakness encountered in one area of SESE will reveal information about the child's learning in the other SESE curricula. Many teaching and learning experiences in science, geography and history draw on and use a wide

range of skills and concepts, so SESE may also provide valuable opportunities to gain evidence of a child's progress in areas such as mathematics, language and social development.

Assessment should provide an indication of the child's overall achievement in a systematic way at regular intervals. Assessment may be used to fulfil this *summative* role when teachers seek to establish the outcomes of learning following completion of a unit of work or when they report to audiences beyond the child, for example when they communicate with parents or other teachers about the child's progress.

Assessment can also help the teacher to evaluate the suitability of the SESE programme selected by the teacher and school for a particular age group and can assist the teacher in assessing the effectiveness of the educational resources, methodologies and approaches deployed. Used in this *evaluative* role, assessment can help to identify how the learning experience could be improved for the child.

Assessment in science

To fulfil these various functions successfully, assessment must be valid and must seek to measure and report on the child's progress and achievements throughout all aspects of the science curriculum. The assessment techniques in science must focus on knowledge objectives, understanding of scientific concepts, competence in the application of experimental and investigative skills and the cultivation of important attitudes.

Strands and strand units

The strands and strand units of the science curriculum outline the knowledge areas of the curriculum and suggest ways in which scientific skills may be developed as these units of work are completed. The objectives and italicised exemplars indicate the range of knowledge that may be expected at each level, and the section 'Planning a unit of work' in the accompanying teacher guidelines illustrates how these may be used to form the basis of teaching and learning activities. The knowledge objectives outlined in these units should form one aspect of assessment.

Schools and teachers have considerable flexibility in the selection of appropriate topics for the science programme. Side by side with this flexibility is the requirement of achieving a balance between the four strands, i.e. *Living things, Materials, Energy and forces* and *Environmental awareness and care*. The strand *Environmental awareness and care* is a major cross-curricular link and has been designed so that it will be delivered through the science and the geography curricula. Many strand units of the geography and science curricula integrate with each other and a co-ordinated approach in the teaching of both these areas within SESE will be required. The flexibility offered by the curriculum and the requirement that children study units from different strands makes comprehensive planning, effective summative assessment and record-keeping essential within the school.

Working scientifically

Science is about understanding certain aspects of the physical world around us, and it involves testing and changing ideas about how natural and manufactured things work. Practical investigation is central to scientific activity of all kinds. Children begin from their ideas and change and develop these ideas by testing them in practical investigations. The development of knowledge, concepts and skills is interdependent, and the

assessment of both these aspects of the scientific process is of equal importance. At each class level of the curriculum the sections 'Working scientifically' and 'Designing and making' outline the specific skills that will enable children to develop ideas and make sense of the world around them. The objectives listed in these sections indicate the degree of skill that should be expected of children working at each level.

The skills outlined in 'Working scientifically', which include questioning, observing, predicting, investigating and experimenting, estimating, measuring and analysing, mirror those included in the geography curriculum under the heading 'Geographical investigation skills'. Their inclusion in the geography curriculum indicates that an investigative approach should inform children's explorations of the environment and that significant aims of the science curriculum can be achieved through geographical topics. Opportunities for the application of science investigation skills arise both in geography and science, and assessment techniques will therefore have to take cognisance of the wide range of units within which skills can be assessed.

The assessment of skills is a complex activity. Process skills of science are concerned with activity and application and are therefore less readily assessed by techniques that rely on a written or other product. The performance of some process skills has to be observed in action so that the teacher can be confident that they have been used and can judge the level of operation. The ability with which a primary child applies process skills is demonstrated best in practical investigations, where the concepts being developed are discussed and tested and approaches to solving problems in real contexts are explored. Thus if assessment is to be a valid indicator of the children's scientific understanding it must seek to record and acknowledge the ability that pupils demonstrate in a variety of practical learning situations.

Values, attitudes and responsibilities

Assessment in science will also be concerned with values and attitudes that are developed in the child as he/she is engaged in the study of scientific topics. Through science education children will develop attitudes of curiosity to try new experiences, to find out how things work, to explore and to discover more about the things around them. Through their scientific investigations children develop informed critical and scientific perspectives, which acknowledge the importance of founding judgements on a respect for evidence. This involves the child in

developing attitudes of open-mindedness to the ideas of others and a willingness to consider conflicting evidence and ideas. Helping children to understand that scientific ideas are tentative should encourage the development of attitudes of flexibility and the ability to modify their ideas in the light of new evidence.

This growth in skills of enquiry and concepts should be accompanied by a development of sensitivity towards living things and the cultivation of a personal sense of responsibility towards local and wider environments. Science investigations based on the strands *Living things* and *Environmental awareness and care* will encourage children to become active agents in the conservation of environments and to adopt responsible attitudes and behaviour that will promote more sustainable use of the Earth's resources. The development of these attitudes is fostered by a balanced curriculum of scientific topics based in local and wider environments. The provision of opportunities for children to work scientifically in the outdoor environment will make a significant contribution to the cultivation of positive attitudes. Assessment of the child's attitudes in science will rely strongly on the teacher's observations and his/her professional judgement of the child's approach to scientific investigations. Field trips, working in the school garden, tending the bird table and nature walks and trails are examples of opportunities for the teacher to observe the child's patterns of behaviour towards the environment.

Assessment tools: how to assess

Assessment in science is concerned with the children's mastery of knowledge and understanding of the strands of the science programme and the development of skills and attitudes. Consequently a broad range of assessment tools and approaches will be necessary. The assessment techniques employed will arise naturally out of teaching and learning, and their effectiveness will be dependent on teacher skills of observation, listening, interacting with pupils and scrutinising the outcomes of learning tasks used in science. Reliable judgements of pupils' performance need to take into account the capacity of children to achieve in a variety of contexts. Thus assessment will be a continuous process and will be part of the normal teaching and learning situations.

The following are among the assessment tools that schools will find most useful in science:

teacher observation

teacher-designed tasks and tests

concept-mapping

work samples, portfolios and projects

curriculum profiles.

It should be understood that it may be neither practicable nor desirable to use all these tools in every learning situation or within a particular time span.

Teacher observation

Observations made by the teacher during practical science tasks provide opportunities to assess the development of process skills and attitudes and to establish the extent to which children have mastered the knowledge aspects of the science programme. Teachers should take into account criteria outlined in the school plan, the skills and knowledge objectives of the science curriculum and the levels of maturation of the pupils when forming judgements based on their observations of children's practical tasks. These knowledge and skill objectives might form the basis for guidelines for describing children's progress at different class levels. Check-lists of specific items related to particular tasks might be devised. For example, for children in first and second classes such a check-list might include such questions as:

- Had the child a clear idea about the purpose of the investigation?
- Did the child ask questions that related to the problem?
- Did the child make observations using more than one sense?

Informal observation of practical tasks in science will involve the teacher in taking an active role in the learning situation. Through open-ended questions the teacher can gain an insight into the children's conceptual understanding, attitudes to scientific investigations and use of process skills. During these observation periods the teacher may make written notes so that further work for an individual or group can be planned and a record kept for future reference.

Other observations of children's learning and activity may be planned and structured. In these observations the teacher will generally concentrate on seeking evidence of one or two process skills, for example on the extent to which pupils plan experiments during one lesson and ask questions during the next. The teacher will watch the children as they work and listen to their interactions so as to obtain evidence of skills or scientific ideas.

Observation in the science lesson will focus on:

- individual discussion
- how a child carries out an investigation as part of a group
- the group, and the interaction of individuals within the group
- the responses the child makes to the teacher's questions and suggestions
- the participation of the child at different stages of investigation, for example planning, identifying variables and evaluating
- the way the child reacts to tasks and to the identification and solution of problems in a variety of environments.

The assessment of practical tasks in science takes a wide variety of forms. Written records, drawings and reports of investigations provide children with a record of their own work. However, they rarely supply the teacher with the information required about the level of skill used and the way in which children work. Teacher observation, discussion and questioning of children during practical tasks allow assessment of the performance of skills.

Practical tasks may focus on

- a specific practical skill or process skill, for example the ability to use measuring instruments in a scientific investigation or the ability to make observations
- a number of skills being used at the same time
- open-ended investigations, for example the ability of the child to identify and control variables
- model-making in problem-solving contexts
- explorations and investigations in the outdoor environment.

Teacher-designed tasks and tests

Throughout the units of the science curriculum teachers will identify opportunities for children to engage in a range of tasks. These will have a number of purposes. Some will be designed to engage the child in asking questions and thinking about scientific concepts and knowledge, while others will promote a range of scientific and technological skills. Some representational record, whether written, drawn, sculpted or modelled, that can be used to convey the children's ideas, questions and discoveries is necessary to build up a precise picture of the child's achievements in a variety of contexts. Children's reactions to these tasks will indicate their progress in science.

A wide variety of tasks should be provided for children, including:

- observing both inside and outside the classroom
- recognising patterns in observations and evidence
- analysing objects and processes and hypothesising about how models and systems work or are made
- predicting outcomes of an investigation
- collecting information from sources such as direct observation in the environment and in the classroom using books and other materials
- asking questions
- providing oral, written and pictorial accounts of investigations or stages of investigations and experiments
- completing and displaying projects and reports of topic work
- using workcards or activity sheets that guide children to apply process skills
- designing, making and evaluating models and structures that provide solutions to problems
- evaluating the evidence generated by an investigation
- using interactive multimedia computer programs that enable the child to explore scientific themes and topics and complete a range of tasks and problems
- exploring and engaging in practical investigations in the environment
- completing teacher-designed revision tests on a unit or units of work

- evaluating the outcomes of design-and-make activities
- displaying and reporting project work in progress or when completed
- estimating, measuring or comparing
- making drawings of the evidence of visual observations, plans for investigations or methods to be used in investigations. The value of expressing ideas through drawing with labels is greatly increased if the teacher discusses the drawing with the child and annotates it as a result of asking questions.

Concept-mapping

One of the primary principles on which the science curriculum is based is the recognition that children come to school with preconceived ideas about the biological and physical world. The child's initial ideas must be explored and taken seriously if they are to form the starting point for learning. Concept-mapping helps children to record and discuss their ideas as the starting point for learning. Concept maps are schematic representations of relationships between concepts. A list of concept words that are known and that can be linked together is drawn up in discussion with the children, who are then asked to draw lines and write joining words between the different words. The results can be analysed to give an insight into the relationships that children see between things. They provide the teacher with information about the ideas children commonly hold and about how they can explore and respond to the ideas of their own pupils.

Work samples, portfolios and projects

The compilation of a range of samples of a child's work to form a science portfolio provides a systematic means whereby progress can be documented and assessed over a term, a year or a longer period. Products arising at all stages of an investigation will indicate the children's ideas. The shape used for a boat, the way a tower is constructed to support something, or how Plasticine is moulded to make it float provide teachers with an understanding of how children are thinking and of the ideas they are developing. The portfolios should contain samples of work in progress or what the individual child considers to be 'best samples' of finished pieces together with the teacher's comments. The samples included in the portfolios should demonstrate the children's achievement in a range of areas. Several samples of work in one area may be included to show the progression and development of children's ideas and process skills.

Written accounts or drawings, photographs of stages of an investigation, graphs, samples of worksheets or audio tapes of children's reports of investigations might also be enclosed.

Reviewing the contents of the portfolio with the pupil can encourage the child in self-assessment and the setting of new learning targets. It also provides an excellent basis for the reporting of pupils' achievements to teachers, parents and others, and can allow weaknesses to be identified. In addition, the systematic analysis of science portfolios can allow the teacher to evaluate the content, methodologies and approaches he/she has used over a term or year.

Curriculum profiles

Teachers may find curriculum profiles useful for the systematic observation and recording of children's progress and achievements while work is being done in science. The profile consists of descriptions of the range of knowledge, skills and attitudes that might be expected of children at different stages of development. These descriptions, sometimes written in the form of short paragraphs, are indicators of behaviours or abilities that children may demonstrate. Teachers seek to match their observations of pupils to the indicators in the profiles as work on units is in progress or is completed and at other regular intervals. Where aspects of paragraphs are marked or highlighted in line with pupil achievement, profiles can also serve recording and reporting functions.

The indicators relating to scientific skills should be based on the sections 'Working scientifically' and "Designing and making', while the other indicators should be based on the knowledge content of those strand units that are included in a school's science programme and on the attitudes that are described in the aims and broad objectives of this curriculum statement. The emphasis placed on the local environment and the close links which the strand units and skills sections of the science curriculum have with the geography curriculum should also be borne in mind.

The discussion of curriculum profiles by teachers from clusters of schools would enhance their reliability as assessment tools. Such discussion would have the added advantage of contributing to increased expertise in the organisation of activities in science for pupils.

A balanced approach to assessment in SESE

The primary aim of all assessment is to enhance the learning experiences of the child, and it will be important that the assessment techniques employed in science and in other areas of SESE should not detract from teaching time. The school's policy for science should guide teachers in using assessment tools in a manageable and reliable way that is closely integrated with teaching and learning. The development and use of common approaches to recording teacher observations, the outcomes of learning experiences and the compilation of portfolios and curriculum profiles will facilitate a balanced and practical approach to assessment in the school.

Recording and communicating

Teacher observations, teacher-designed tasks and tests and work samples and portfolios, together with curriculum profiles and pupil profile cards, constitute a comprehensive system of assessing and recording each child's progress and achievements in the science programme. The pooling and discussion of this information among the teaching staff can enable teachers to share expertise and develop a common understanding of pupil progress and assessment in SESE (in a process referred to as *moderation*). Such co-operation can help to ensure continuity and reliability in the use of the assessment tools.

The range of assessment tools in SESE should provide essential information about the child's learning for pupils, teachers, schools, parents and other professionals and so facilitate future decisions about the child's learning. Teacher-parent discussions will provide opportunities for parental feedback and will enhance the overall assessment of the child.

Pupil profile card

The recording and communication of this information about the child's progress will be facilitated by the use of a pupil profile card. The pupil's profile card, which may be developed for use in all primary schools, should contain a summative assessment of the child's progress in all curricular areas and of other aspects of his/her development.

The teacher's professional judgement of the child's development in science, based on the outcomes of teaching, learning and assessment throughout the year, will form one aspect of the profile card. The section

of the profile card for SESE should be sufficiently flexible to allow for the highly integrated nature of the area in infant, first and second classes. As the profile card should provide a basis for the planning of the child's future in another class or school, it should include, or be accompanied by, information regarding the selection of science topics that the child has explored.

The possibilities and advantages offered by information technology in facilitating the recording, storage and transfer of pupil profile records should be explored and if possible used in the compilation of any widely used pupil profiling system.

Appendix

Glossary

air-resistance	a frictional force that opposes the movement of an object through the air
amphibian	a type of animal that spends part of its life cycle in water and part on land; cold-blooded, with a backbone
animal	a type of living organism that moves about in search of food and is not a plant; single-celled organisms (as seen under a microscope) are not considered animals
battery	two or more electric cells that produce electricity; this happens when the chemicals within the battery react together; the voltage of a battery depends on the number of cells it contains: more cells mean greater voltage
biodegradable	capable of being broken down by bacteria or fungi
blood	the fluid that flows through the heart, veins and arteries of animals; it carries oxygen as well as other substances in the arteries and carries waste products in the veins
breathing	the process of taking in oxygen from the air and releasing carbon dioxide to the air through the lungs, gills or other structures
buoyancy	the upward thrust experienced by objects when they are placed in a liquid
carbohydrates	substances such as sugar and starches; green plants make carbohydrates through the process of photosynthesis
carnivore	an animal that eats meat or flesh
chemical change	a change in materials that produces a new substance; the change is permanent
chlorophyll	the green pigment in plants, necessary for photosynthesis
circuit	the complete path of an electric current around a series of wires and connections; if there is a break in the circuit the current will not flow
classification	the grouping together of plants, animals, rocks or other objects that have similar characteristics

community	all the organisms that live together in a habitat
competition	the struggle among organisms for a resource that is in short supply, such as food, water, oxygen, space or mates
condensation	the change of a gas into a liquid by cooling: for example, vapour from a boiling kettle hitting a cold kitchen wall condenses into liquid
conduction	the movement of energy through a substance
conductor	a material that transmits heat, electrical or other kinds of energy
control	see *experiment*
current (electric)	a flow of charge; electrons are the charge carriers; a current in a metal consists of a flow of electrons (electricity) from the negative terminal of the battery to the positive terminal; however, we usually say that current flows from positive to negative; measured in amperes or 'amps' (A)
decomposer	organisms such as bacteria and fungi; they break down the dead remains of organisms into simpler substances, which are returned to the soil
diaphragm	a sheet-like muscle that separates the chest cavity from the abdomen in mammals, important in breathing
digestion	the process by which large food particles are broken down and made soluble with the help of enzymes and our teeth
dissolving	the mixing of a substance with a solvent, for example sugar mixed with water, to form a solution; children sometimes confuse the terms 'melt' and 'dissolve'
ear	the organ of hearing; the external part of the ear leads to a canal, at the end of which is the ear drum; the ear drum is connected to three bones, which in turn are connected to an oval window; the ear is connected to the brain by the auditory nerve
ecology	the study of ecosystems
ecosystem	a community of organisms and their relationships with each other and with their environment

egg	a female reproductive cell in an organism
electromagnet	a magnetic material, surrounded by coiled wire, that acts as a magnet when an electric current passes through the wire
electron	one of the particles of which an atom is made up; electrons are negatively charged
energy	the ability to do work; light energy, electrical energy and sound energy are all different forms
evaporation	the changing of a liquid into a (gas) vapour by using heat or moving air, for example boiling a solution and driving the water off as steam, or a puddle being changed into vapour by the wind
excretion	the release of waste materials from an organism
experiment	a procedure causing a change in what is being tested together with an identical untested control
explorations	all activities that relate to an investigation, including unstructured, unplanned preliminary activities, such as play
eye	the organ of sight; the visible parts include the clear outer cornea, the coloured iris and the pupil; the eye also contains a lens, and the back of the eye is covered by the retina
fair test	a test in which everything about the things being tested is equal, except the item being tested
fertilisation	the joining together of a male and female reproductive cell to form a new organism
filter	an object such as a sieve or a strainer that will separate an insoluble solid from a liquid when the mixture is passed through it, or a transparent material that allows some light to pass through it
filtration	a technique for separating a solid or solids from a liquid in a mixture by passing it through a filter, for example tea being strained through a strainer
floating	the tendency of an object to remain on the surface of a liquid; an object will float if its density is less than that of the liquid; the weight of a floating body is equal to the weight of fluid displaced; the force up and the force down on the body are equal

flower	the reproductive part of flowering plants, which contain the sex organs of the plant, i.e. the carpel (female) and the stamen (male); the carpel consists of the stigma, style and ovary; the stamen consists of the anther and the filament; petals, which are usually brightly coloured, help to attract insects to pollinate the flower; sepals, which are usually green, lie outside the petals and protect the flower in the bud stage
food chain	the transfer of energy from one organism to another within a habitat or ecosystem; shows the feeding relationships between organisms; a simple food chain is grass ⟶ rabbit ⟶ fox
food web	a linked series of food chains
force	anything that causes a change in the velocity of an object; force is loosely understood as being a push or a pull; it can make an object speed up, slow down, stop, change shape or change direction or can hold an object in place
fossil fuel	fuel formed from the remains of living organisms millions of years ago, for example coal, oil and natural gas
friction	a force that opposes movement
fuse	a device to prevent too large an electric current passing through a circuit; consists of a piece of thin wire that melts if it becomes heated; this breaks the circuit and acts as a safety device
germination	the process that occurs when a seed or spore begins to grow into a mature plant; germination requires moisture, oxygen and a suitable temperature
gravity	a force of attraction between all bodies in the universe; the force of attraction between objects depends on their mass; the greater the mass of an object the greater the force of attraction
habitat	the place where an organism lives; it provides a particular set of conditions for life; it may be large (a field) or small (a leaf)

heart	an organ that pumps blood around the body; in the adult human the heart rate is about 70 beats per minute, but in a baby it will be much faster; blood travels by means of a network of vessels; blood leaves the heart through arteries and returns to the heart in veins
heat transfer	the way in which heat is moved: in solids by conduction, in liquids and gases by convection, and from a hot object like the sun or a stove by radiation
herbivore	a type of animal that eats plants only
humus	a brown or black fibrous material formed from the remains of dead plants and animals; it helps soil particles to stick together and is important in soil fertility
hydraulics	the pressure of liquids that can make something work
hypothesis	an idea that can be tested: a supposition put forward in explanation of observed facts; the prediction is qualified by a tentative explanation
insulator	a material or substance that will not allow heat to pass through it or one that will not allow electricity to flow through it
investigations	activities where ideas, predictions or hypotheses are tested and conclusions are drawn in response to a question or problem
joint	a connection formed where one bone meets another; in most cases the bones can move freely, for example hip, shoulder and elbow
key	a series of questions that leads to the identification of organisms or other unknown items
lens	a piece of glass or transparent material that causes light to change direction as it passes through it; lenses can be different shapes, for example, concave and convex lenses
lever	a rigid bar that can be turned freely about a fixed point; levers are simple machines, because they make work easier

light	a form of energy that travels in rays; it travels at approximately 300,000 km/s; white light is a mixture of light of every wavelength, that is, of all colours
luminous	giving out its own light, for example the sun and other stars
lungs	the respiratory organs in humans and many other animals; the respiratory system includes the nasal passages and mouth, pharynx, larynx (voice box), trachea (wind-pipe) and bronchi
machine	a device that takes in some form of energy and changes it into another form that is more suitable for the desired purpose or work, for example an electric motor lifting a weight; electrical energy changes to kinetic energy
magnet	a material that produces a magnetic field around itself; can be shown by sprinkling iron filings around the magnet; there are poles at the ends of magnets: these are the north-seeking and south-seeking poles; like poles repel each other, whereas unlike poles attract; magnets are made in a variety of shapes and sizes; most materials are non-magnetic, but metals such as iron, nickel, cobalt or alloys of these, such as steel, are magnetic; a compass is a free-swinging magnet
mammal	a warm-blooded animal with a backbone (vertebrate), usually with a covering of hair or fur, that produces live young and feeds them on milk; the duck-billed platypus and the spiny ant-eater are exceptions, as they lay eggs
mass	the amount of matter in an object; measured in grams (g)
material	matter from which other things can be made; materials can be classified in many different ways, for example natural, such as wood, or synthetic, such as plastics, polyester or stainless steel; materials can be classified according to their uses or their properties, such as metals, plastics, textiles and others

matter	anything that takes up space and has mass; all substances and materials can be called matter; solid, liquid and gas are the terms used to describe the three states of matter; it is possible to convert one state into another by either heating or cooling
micro-organism	a living organism that can only be seen under a microscope
mineral	inorganic chemicals needed in small amounts by plants and animals, for example calcium, iron and copper; can also refer to anything extracted by mining, for example copper and gold
mixture	a substance formed when two or more substances are added together, for example salt and water; the substances are not chemically combined and may be separated again
newton	see *weight*
non-renewable energy sources	energy sources that are not continuous and cannot be renewed naturally; examples are fossil fuels (gas, coal, oil, turf)
nuclear energy	energy released during the splitting (fission) or joining (fusion) of the nuclei of some atoms
observation	using the senses to obtain information about objects and events
organ	a part of the body, such as the heart or stomach, made of several different tissues, all working together to perform a specific function
organism	a living animal, plant, fungus or micro-organism
opaque	not letting light pass through: neither transparent nor translucent
photosynthesis	the process by which green plants manufacture their own food from carbon dioxide and water, using the sun's energy, which is trapped by the green pigment (chlorophyll) in the plant
physical change	a change in which no new substance is formed; the change can be in shape, form or state, for example wood being cut or ice melting

pitch	highness or lowness of a note; sound is caused by vibrations: the pitch of a note is a measure of the frequency of vibration of the source producing the note
plant	an organism made up of many cells; the cells have a wall and a nucleus; they manufacture their own food by photosynthesis; plants respire, grow, reproduce and respond to stimuli just like animals but do not move from place to place
plastic	a synthetic material; raw material is usually derived from oil; can be moulded into shape when heated and sets hard when cooled
pole	the point of a magnet where the magnetic force is strongest; every magnet has a north and a south pole
pollen	grains, usually yellow or orange, produced by the anther; contains the male reproductive cells of flowering or coniferous plants
pollination	transfer of pollen from the anther of a stamen to the stigma of a carpel; self-pollination is when this happens within the same plant; cross-pollination is more common and is when the pollen comes from another plant of the same species; pollination is usually effected by insects or wind
pooter	a device used to collect insects and other small animals from the bark of trees and shrubs and from leaves; consists of a jar from which two plastic tubes emerge
population	the total number of organisms of a species within a particular habitat, for example the daisy population of a field
power	the rate at which work is done, that is, the amount of work done per second; the unit of power is the watt (W)
primary colour	the primary colours of light are red, green and blue; white light is obtained by mixing all three in equal proportions; mixing two primary colours gives one of the secondary colours, yellow, cyan or magenta; the primary colours of paint are red, yellow and blue

prism	a triangular block made of glass or plastic; can be used to change the direction of light or to split light into the colours of the spectrum
protein	one of the major types of food; used for growth and repair in the body; body-building material
quadrat	a small area, generally about 1 metre square, that shows all the plants growing in that area; can be made from pieces of wire, string or wood
reflection	a ray of light that hits off something and bounces back; all objects reflect light to some extent, some better than others; a mirror reflects light very well; sound can also be reflected, and a common example of this is an echo
refraction	the change of direction of light when it passes from one medium to another, for example from air to glass, water or plastic
renewable energy	energy from sources such as tide, wave and biomass
reproduction	the formation of new individuals; sexual reproduction involves the joining (fusion) of two sex cells; only one organism is involved in asexual reproduction; taking cuttings of plants is an example of asexual reproduction
resistance	a measurement of the ability of a substance to reduce the flow of current through it; measured in ohms
resistor	a device that controls the current flowing in a circuit; resistors are used in radios, record players and televisions
respiration	the process by which living things obtain energy from food; all living things respire
respiratory system	in humans consists of windpipe, bronchi, lungs, diaphragm and nose
rusting	a chemical reaction that occurs in iron or steel when both air and water are present; the general term is corrosion; can be prevented by methods such as painting, oiling and greasing

shadow	a dark area formed when light strikes an opaque object
soil	a substance composed of particles of different size, formed by weathering of rock; contains water, humus, air, minerals and living organisms
solution	a mixture of a solute and a solvent, for example a sugar and water solution, where the solute is the sugar and the solvent is the water
sound	a form of energy; all sounds come from something that is vibrating; travels through air, solids and liquids; the speed of sound in air is about 344 m/s
species	a set of organisms that share many characteristics in common; they can breed with each other to produce fertile offspring; example of species are humans, dogs, cats, buttercups and daffodils
spectrum (visible)	the range of colours produced when light is passed through a prism; colours can be seen when white light is split by droplets of water; forms only a small part of the whole electromagnetic spectrum; this spectrum includes radio waves, microwaves, X-rays and gamma rays, among others
spore	a microscopic reproductive cell; produced by fungi, mosses, ferns and in general plants that do not have seeds
static electricity	an electric charge that builds up on the surface of a material; this build-up can happen by rubbing one material against another; electrons are rubbed off one of the materials, which then becomes positively charged, while the other material, which gains the electrons, becomes negatively charged; the two materials then attract each other; thunderstorms are caused by static electricity
switch	a device used to make or break circuits; it stops the flow of electricity in a circuit
temperature	a measure of how hot it is; thermometers are used to measure temperature and are usually marked in degrees Celsius (°C)
theory	a set of general statements that provide feasible explanations for certain phenomena; can be used to predict the occurrence of certain events

transect	a line of string or some other material along which vegetation or animals are studied
translucent	a material that allows some light through it; objects cannot be seen clearly through such material; frosted glass is an example of a translucent material
transparent	material through which light passes and allows an object to be seen clearly
variable	the characteristic in an investigation that the investigator decides to change systematically
variation	the difference in characteristics that appear within a species: for example, humans have different-coloured hair, eyes, and skin and different size
vertebrate	animals with a backbone and a brain enclosed in a skull
voltage	potential difference; measured in volts (V)
water vapour	water in the gaseous or vapour state
watts	a unit of power; 1 kW = 1,000 W
weight	the downward force acting on a body due to the effect of gravitational force; measured in newtons (N)

Membership of the Curriculum Committee for Social, Environmental and Scientific Education

This curriculum has been prepared by the Curriculum Committee for Social, Environmental and Scientific Education established by the National Council for Curriculum and Assessment.

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