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The Cayman Islands

National Curriculum
2008

Science, design and technology
Programme of study and attainment targets for
Key Stage 2

Acknowledgements

The overview document sets out the guiding philosophy and principles of the new Cayman Islands curriculum. It guides all the subject documents and approaches to teaching and learning in the revised curriculum.

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Aims

Learning in and about science, design and technology contributes to achievement of the curriculum aims for all young people (the 'Educated Caymanian') to become:

- Enthusiastic and motivated about learning, and willing to continue to extend his/her knowledge and skills after leaving school
- Well rounded, good at finding solutions to problems, flexible and adaptable to changing circumstances and demands
- Literate, numerate and adept at using information and communication technology
- Aware of global issues affecting life in the 21st century
- Confident individuals who are able to live safe, healthy and fulfilling lives
- Responsible citizens who make a positive contribution to society

The programme of study for science, design and technology aims to help students develop a number of important attitudes, in particular: curiosity, safety awareness, creativity, integrity, open-mindedness, cooperation, perseverance, commitment, initiative, critical thinking, scientific and technical reasoning, confidence, interest, and an appreciation of the contribution of science, design and technology to everyday life.

Overview

The Cayman Islands national curriculum integrates the disciplines of science, design and technology for students in the primary years. The subjects are recognised as fundamental areas of the curriculum, but share an approach that involves solving practical problems through experimentation and investigation.

Science exists because it serves an innate human desire to make sense of the world. Science is a collection of theories and knowledge about the physical and natural world and a system of inquiry involving a variety of investigative skills.

Technology is a creative, purposeful activity aimed at meeting needs and opportunities through the development of products, systems, or environments. Knowledge, skills, and resources are combined to help solve practical problems. Technological practice takes place within, and is influenced by, social contexts. People have always adapted resources to meet their needs, from such fundamental, far-reaching innovation and invention as the development of the wheel, to innumerable and equally significant uses of resources such as shaping bone to create a hook for fishing, pressing wool fibres into felt, or applying heat to make foods more edible. In the context of our islands the need to 'turn a hand' to a variety of tasks, to be creative and adaptable in using what is available continues to be a significant feature of the Caymanian spirit.

Learning about and through science, design and technology should help children to make sense of and interact with their increasingly technological world. Technology affects our environment, our standard of living, and quality of life. Students need to start considering the ethical and social issues to which the advance of science, design and technology gives rise.

Learning in this subject will develop attitudes, skills and knowledge that will help students solve problems and be more prepared for life, further study and future careers in this rapidly changing world. Tomorrow's citizens will need special knowledge and skills if they are to evaluate and deal with this change. The subject will also encourage students to seek scientific explanations of natural phenomena, build their confidence and ability to effect changes and improvements in their environment and most importantly develop their critical thinking ability.

How teachers should use the programme of study and attainment targets

The programme of study identifies the experiences and opportunities that students must be given to enable them to achieve the knowledge, skills and understanding specified in the attainment targets.

The strands

The programme for science, design and technology is divided into four strands:

i. Investigating, designing, carrying out and making
ii. Living things
iii. Materials
iv. Physical processes

This division into strands is a convenient way of emphasising the outcomes for science, design and technology education in schools. It does not mean that learning in each strand has to be developed independently. In Key Stage 2, students should mainly be taught the knowledge and ideas of the subject through a practical, hands-on, process-approach. As their ideas evolve, they should be acquiring an understanding of the nature of science and its relationship to technology. Consequently, when planning and implementing a science, design and technology programme, the first strand of investigating, designing, carrying out and making should be interwoven within the other three strands.

Progression in this subject requires students to develop skills in investigating, designing, carrying out and making alongside the development of knowledge and understanding. They should start with activities linked to themselves and their immediate environment and move on to less familiar situations and contexts.

Each strand has been divided into a number of sub-headings. It should not be felt, however, that this sub-division should dictate the way teachers should plan their teaching schemes.

Design and technology – Elements of technology in strand i are identified by the use of (T). These elements should be integrated with work in science. When planning activities, teachers should identify opportunities for design and technology from strands ii, iii and iv. There should be opportunities for science investigations to develop into design and technology activities.

During the key stage, **students should be offered opportunities** to enhance their learning, understanding and enjoyment of the subject, through:

- Researching, experimenting, discussing and developing arguments
- Independent inquiry or research into aspects of science, design and technology of personal interest
- Relating their learning to everyday, real life examples
- Studying science, design and technology in local, national and global contexts and appreciate the connections between these
- Experiencing science, design and technology outside the school environment including in the workplace, where possible
- Using creativity and innovation in science, design and technology and appreciate their importance in enterprise
- Recognising the importance of sustainability in scientific and technological developments and their design
- Exploring contemporary and historical scientific, design and technological developments and how they have been communicated
- Making links between science, design and technology and other subjects and areas of the curriculum

Progression in this subject requires students to develop their skills in investigating, designing, carrying out and making, living things, materials and physical processes. They should start with activities linked to themselves and their immediate environment and move on to less familiar situations and contexts.

The attainment targets specify the knowledge, understanding and skills that students should acquire through the key stage. More detail is given about how to interpret them in appendix 1. Exceptionally gifted students will need to be given work from the Key Stage 3 programme of study so they can access levels 6 and above.

Science, design and technology programme of study for Key Stage 2

Introduction

Building on experiences gained in Key Stage 1, students should continue to be given opportunities to develop their skills, understanding and knowledge of science, design and technology. They should build on the working vocabulary that has been developed in Key Stage 1 and be encouraged to communicate with other students and their teachers through group and class discussions.

Students should be given opportunities to increase their awareness of the importance of science, design and technology in everyday life. This understanding may arise from everyday experiences in school, at home and in the local environment.

Students should develop an awareness and an understanding of the need to conserve the natural environment. They should appreciate the need for the sensitive collection and care of living things that are used as the subject of any study of the environment. Activities and experiences in science, design and technology may sometimes link into themes and topics incorporating other areas of the curriculum, and may be integrated with them, where appropriate.

It is important in science, design and technology that **students are given opportunities to:**

- Solve problems
- Carry out investigations
- Make observations
- Ask and answer questions
- Present their ideas
- Plan independently
- Record observations
- Work methodically
- Interpret evidence
- Construct, using a wide variety of materials
- Plan and adapt as they work
- Evaluate and revise their work
- Make suggestions for improvement
- Develop oral, written and graphic communication skills

i Investigating, designing, carrying out and making

Activities in this strand should be introduced through the other strands of the programme of study. Students should be encouraged to adopt safe practices when undertaking science, design and technology activities. They should be made aware of potential hazards and the appropriate actions necessary to avoid risks.

Investigating and designing

Students should have opportunities to participate in practical activities that involve talking to the teacher and each other about ideas, predictions and solutions to problems and planning what to make.

Students should be given opportunities to:

- Recognise a fair test and the factors that need to be kept constant, *for example, know that when testing the bounce of balls they must keep some factors (variables) constant, such as the height and/or surface*
- Suggest ideas that can be investigated and make predictions, *for example, find out which material is best for keeping ice cubes solid*
- Choose appropriate materials and components when planning what to make, f*or example, choose cartons, doweling, wheels and tape when planning how to make a toy vehicle (T)*
- Suggest how to carry out a fair test, for *example, know that when changing one factor and observing or measuring the effect of this change the other factors must be kept the same*
- Plan what they are going to make and talk about the materials and components they could use, f*or example, discuss ideas and decide how to construct a working model of a lighthouse taking into consideration the properties of the materials, the components to be used and the need for safe working procedures* (T)
- Design a fair test, *for example, in an investigation find out which kitchen roll is best at soaking up water*

Carrying out and making

Students should have opportunities to participate in practical activities that involve exploring familiar objects and materials in their immediate environment and recording what they have done.

Students should be given opportunities to:

- Start to use standard measures for measuring, *for example, use a ruler to measure the distance travelled by a toy car*
- Develop manipulative skills using a range of materials and tools, *for example, use small hand saw to cut and shape plywood (T)*
- Record what they have done or observed in tables they have designed themselves
- Make decisions about what, when and how to measure, *for example, decide when comparing which is the best paper helicopter, either to measure the time taken for it to fall or to observe the direction of spin*
- Make observations and measurements, taking account of the need for care and accuracy, f*or example, know that when comparing how substances dissolve in water it is necessary to measure the amount of substance and water accurately*
- Develop competence in the safe use of appropriate tools and techniques to cut, shape and join materials, *for example, use a low temperature glue gun to join wood (T)*
- Record findings choosing appropriate methods, f*or example, use a computer database to record the height of students*
- Construct working models that incorporate an energy source and which can be controlled, *for example, use syringes and tubing to make a working 'Jack in the Box', use a balloon to power a buggy, or use information technology to control a model they have made (T)*
- Carry out a fair test that they have designed and record results systematically in tables, *for example, testing plant growth under different conditions*

Evaluating and reporting

Students should participate in practical activities that provide them with opportunities to develop skills in reporting, presenting and interpreting results and evaluating what they have made.

Students should be given opportunities to:

- Present their findings using appropriate methods, including block graphs, bar charts and simple line graphs
- Relate what happened to what they predicted
- Talk about what they have made in terms of materials, colour, size or shape and make suggestions for improvement, *for example, talk to the teacher about how well their model vehicle moves and suggest how it might be improved by changing the size of the wheels (T)*
- Choose appropriate methods to present results and make a record of their conclusions, *for example, bar charts, graphs, database mapping diagrams or a written record which presents their own ideas*
- Use results to draw conclusions or make comparisons, *for example, state that the warmer the water, the faster the sugar will dissolve*
- Evaluate what they have made, in terms of appearance and fitness for purpose, and suggest improvements, *for example, suggest how they might improve a model windmill they have made (T)*
- Use results to identify patterns, f*or example, state that Kitchen Roll A is best, followed by Kitchen Roll B, followed by Kitchen Roll C*
- Evaluate a model that they have made bearing in mind their original intentions, *for example, test if a balloon powered buggy can travel the required distance (T)*

ii Living things

Ourselves

Students should be given opportunities to:

- Find out about themselves, including how they grow, move and use their senses
- Identify major organs, including brain, heart, lungs, stomach, liver, bladder, small and large intestines, kidneys, and place these organs on an outline of the human body
- Learn about factors that contribute to good health including diet, exercise, hygiene and develop an awareness of the safe use of medicines and the harmful effects of tobacco, alcohol and other substances
- Develop an awareness of puberty-related changes, through discussion with the teacher or other professionals, *for example, discuss with the teacher the changes that occur in their bodies during puberty*
- Investigate how basic life processes including circulation, simple respiration and digestion relate in order to maintain healthy bodies, *for example, compare breathing and pulse rates before and after exercise*
- Understand that humans have skeletons and muscles to support their bodies and help them move, *for example, make a hinged cardboard model of their joints (T)*

Animals and plants

Students should be given opportunities to:

- Find out about other animals, including how they grow, feed, move and use their senses
- Observe similarities and differences among animals and among plants
- Discuss the use of colour in the natural environment, *for example, in camouflage, talk about how animals adapt to their surroundings*
- Find out ways in which animal and plant behaviour is influenced by seasonal changes, *for example, find out about some trees losing their leaves in the dry season, or the migration by some North American birds to The Cayman Islands in winter*
- Investigate a local habitat, including the relationship between the animals and plants found there, and develop skills in classifying animals and plants by observing external features, *for example, classify minibeasts by observing the number of legs and note the conditions in which they were found*
- Find out about the main stages in the life cycle of some animals including a butterfly and a frog, *for example, sequence pictures of the main stages of growth*
- Investigate the conditions necessary for the growth of familiar plants including light, heat and water, *for example, place plants in different environments, varying the light, water and temperature and observe the results*
- Learn about the life cycle of a flowering plant including how pollen is taken from the stamen into the stigma, fertilised in the ovule and a seed produced which is dispersed in a variety of ways
- Order living things in a simple food chain and understand the dependency of one on the other, *for example, construct a food chain, such as grass/cow/human*

iii Materials

Properties

Students should be given opportunities to:

- Find out about the origins of materials and learn that some are natural and others are manufactured, *for example, find out that wood is natural and plastic is manufactured*
- Investigate the properties of materials and how these relate to their uses, *for example, investigate the strength of paper, or describe the different materials used in building a house*
- Investigate the distinctive properties of solids, liquids and gases as exemplified by water, *for example, learn that solids have a definite shape and volume, that liquids have a definite volume but take the shape of containers and that gas will occupy the space available*

Change

Students should be given opportunities to:

- Know that when materials are changed this may be desirable or undesirable, for example, *find out that the change brought about by baking is desirable whereas the change brought about by rusting is undesirable*
- Investigate the changes of state brought about by heating and cooling everyday substances, *for example, investigate the effect of heat on ice and water and the reverse process*
- Understand that when new materials are formed, change is permanent, *for example, learn that plastics are made from oil, paper is made from wood and that these changes are permanent*
- Investigate how rusting can be controlled, *for example, observe that the use of paints and oils (grease) will prevent rusting and protect iron*

Environment

Students should be given opportunities to:

- Find out how human activities create a variety of waste products, *for example, match waste products to the activity that created them*
- Find out that some materials decay naturally while others do not, *for example, find out that fruit and leaves decay while aluminium cans and glass do not*
- Understand that some waste materials can be recycled and that this can be of benefit to the environment, *for example, discuss the recycling of bottles, cans and paper*

Geological changes

Students should have opportunities to:

- Learn about the structure of the earth
- Describe and group rocks and soils on the basis of their characteristics, including appearance, texture and permeability
- Learn about fossils and how they are formed

iv Physical processes

Forces and energy

Students should be given opportunities to:

- Find out about the range of energy sources used in school and at home*, for example, create a class database of methods used to cook food in their homes*
- Identify the sources of energy in a variety of models and machines, f*or example, in a flashlight, yacht or waterwheel, or make a model that incorporates an energy source*
- Investigate how forces can affect the movement and shape of objects, *for example, describe what happens when different weights are placed on sponges*
- Investigate the effect of friction on the movement of objects, *for example, carry out grip tests with shoes or blocks on a variety of surfaces*
- Understand the differences between renewable and non-renewable energy resources and the need for fuel economy

Electricity

Students should be given opportunities to:

- Know about the safe use of mains electricity and its associated dangers
- Construct simple series circuits using components, such as switches, bulbs and batteries, *for example, light a bulb using two wires and a battery*
- Investigate materials as to whether they are insulators or conductors, *for example, identify materials that can be used to complete a circuit*
- Investigate the effects of varying current in a series circuit to make bulbs brighter or dimmer, *for example, use two bulbs or two batteries to observe changes in brightness*

Sound

Students should be given opportunities to:

- Investigate how sounds are produced when objects vibrate, *for example, find out that vibrations caused by plucking an elastic band make sounds, or make instruments which produce sounds*
- Investigate that sound travels through a variety of materials, for example, recognise that sound travels through string in a string telephone and through metal when tapping pipes

Light

Students should be given opportunities to:

- Find out that when light travelling from a source does not pass through materials, shadows are formed, *for example, draw an object and the shadows formed when the light shines from different positions*
- Investigate the reflection of light from mirrors and other shiny surfaces, *for example, observe images formed by a range of objects with reflective surfaces*

Earth in space

Students should be given opportunities to:

- Investigate the key characteristics of the sun, moon, earth and solar system.
- Learn that day and night can be explained in terms of the rotation of the earth on its axis and that year length can be explained in terms of the movement of the earth round the sun

Appendix 1 Attainment targets

The learning outcomes or attainment targets are expressed at eight levels of increasing difficulty. These levels are the same for all key stages and are not age or year-group-dependent, which will make it easier to see how a student progresses as he/she moves up the year groups and from primary to secondary school.

Students learn at different rates and, therefore, individual students or groups of students of the same age could be working towards different levels within and across the key stage boundaries. By the end of a key stage, **most** students should be performing at the **'expected'** level, but some will be above this level and others will be below.

The range of levels covered by the key stage and the 'expected' levels for the end of each key stage are given in the table below:

Key Stage	Year Groups	Range of levels covered by the programme of study	Expected level at end of the Key Stage
1	1 - 3	1-3	2
2	4 - 6	2-5	4
3	7 - 9	3-7	5 or 6

Teachers will be expected to make judgements about the levels attained by each of their students, particularly at the end of a key stage. In deciding on a student's level of attainment, teachers should judge which description in the attainment targets best fits the student's performance. When doing so, each description should be considered alongside those for adjacent levels. It is not necessary for a student to have satisfied the entire range of a particular level to be awarded it.

It can be helpful to divide levels into three sub-levels to support tracking of progress and target setting.

For example:

- 3a – Represents a performance that demonstrates a good understanding of all the descriptors in level 3
- 3b – Represents understanding of the majority of level 3 descriptors
- 3c– Represents understanding at level 2a (ie the full understanding of the previous level) plus an understanding of some of the descriptors at level 3

Appendix 2 The design and technology process

The design and technology process, as shown on the next page, is cyclical. Often the reporting phase will give rise to new problems or projects that will allow the process to begin again.

Students should become skilled in moving through the process within each of the strands. The process can be applied sequentially, where students move directly from investigating to designing, producing and evaluating. Alternatively, students might have to return to any of the phases in order to solve a problem: for example, students continually evaluate during each phase and therefore will often have to return to a preceding phase, as they apply their learning to real world problems and projects, generated by teachers and students.

In implementing the science, design and technology curriculum, students should be encouraged to engage in the process fully and teachers should try to use all of the outcomes relevant to a strand in planning a design and technology learning experience.

The strand organisers are illustrated in the diagram on the next page and described below.

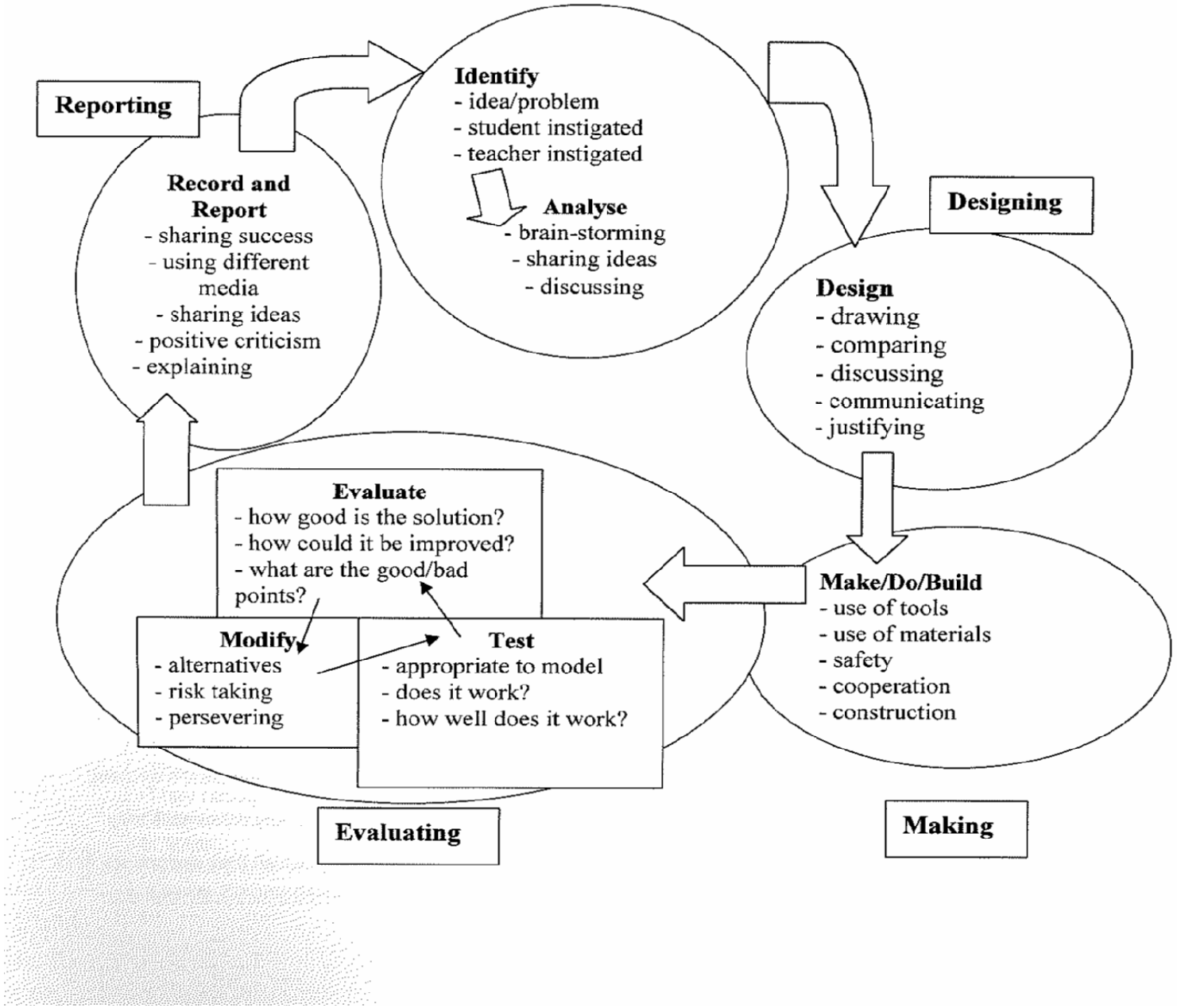
Investigating - Investigation involves the identification of a particular problem and the broad analysis of a variety of possible solutions. Often the analysis calls for further exploration to gain knowledge about materials, information or systems required to analyse possible solutions to the problem.

Designing - This phase results in the completion of a design brief, which gives a direction for the remainder of the process. A design brief should describe simply and clearly what is to be designed. The design brief involves assessment of design alternatives and decisions about resources and equipment. A design brief may be presented using a combination of text and graphics.

Making - Making is the physical manifestation of the design brief. Here students develop skills through a variety of techniques using a range of equipment. Students learn to work cooperatively and discover appropriate levels of safety.

Evaluating- Evaluation is a process of testing and modification in which the end result is measured against the original problem. This testing and modification process can continue through several cycles until the students believe that, within the constraints of the resources available, no further improvements can be made. Students learn to assist others in making evaluations.

Reporting - Reporting involves sharing with others the information that has been gathered during the design and technology process. Students may demonstrate their work, report on their success or failure, or outline the reasons for their design choices or modifications. Reporting and recording may use a variety of different approaches and media.


Reporting
Identify
- idea/problem
- student instigated
- teacher instigated
Analyse
- brain-storming
- sharing ideas
- discussing
Designing
Record and Report
- sharing success
- using different media
- sharing ideas
- positive criticism
- explaining
Design
- drawing
- comparing
- discussing
- communicating
- justifying
Evaluate
- how good is the solution?
- how could it be improved?
- what are the good/bad points?
Modify
- alternatives
- risk taking
- persevering
Test
- appropriate to model
- does it work?
- how well does it work?
Make/Do/Build
- use of tools
- use of materials
- safety
- cooperation
- construction
Evaluating
Making

Appendix 3 Attainment targets for Key Stage 2 science, design and technology

Strand i Investigating, designing, carrying out and making

Level 1	Level 2	Level 3	Level 4
•Students observe and describe simple features of objects, products, living things and events. •They communicate their plans and findings in simple ways, such as by talking about their work and what they will do and use, often using drawings or simple charts. •They use tools and equipment with help, where needed. •They describe in simple language how something works and can talk about their own and other people's design products in simple terms.	•Students respond to suggestions of how to find things out, and, with help, make their own suggestions. •They use models, pictures and words to describe their designs and can explain the tools, techniques and materials used. •They use equipment provided to investigate, assemble, join and combine materials and components in a variety of ways. •They compare objects, living things and events they observe. •They make and describe observations related to their task and record them using simple tables where it is appropriate to do so. •They say whether what happened was what they expected, recognise what they have done well as their work progresses, and suggest things they could do better in the future.	•Students respond to suggestions, put forward their own ideas, and, where appropriate, make simple predictions. •They recognise that their designs have to meet a range of different needs and make realistic plans for achieving their aims, thinking ahead about the order of work, choosing appropriate tools, equipment, materials, components and techniques. •They clarify ideas when asked and use words, labelled sketches and models to communicate the details of their designs. •They make relevant observations and measure quantities, such as length, mass or weight, using a range of simple equipment and with some help they carry out a fair test, recognising and explaining why it is fair. •They use tools and equipment with some accuracy to cut and shape materials and to put together components and are aware of safety precautions taken while carrying out experiments. •They record their observations in a variety of ways and provide explanations for observations, recognising, simple patterns where they occur. •They say what they have found out from their work and where evaluation of the design and make process has led to improvements.	•Students generate ideas by collecting and using information, where appropriate, they make predictions. •They take users' views into account, producing step by step plans and can communicate alternative ideas using words, labelled sketches and models. •They recognise the need for fair tests, describing, or showing in the way they perform their task, how to change one variable while keeping the others the same. •They select and work with a range of suitable equipment to use and make a series of observations and measurements that are adequate for the task. •They work with a variety of materials and components with some accuracy, paying attention to function and the quality of finished product. •They present their observations and measurements clearly by using tables, bar charts and simple graphs. They use these graphs to point out and interpret patterns or trends in their data. •They take account of these patterns when they draw conclusions, and begin to relate their conclusions to scientific knowledge and understanding. •They reflect on their experiments and designs as they develop and identify what is working well and what could be improved.

Level 5	Level 6	Level 7	Level 8
•Students identify the variables they need to change or keep constant, where experiments involve only a few variables. •They make predictions based on their scientific knowledge and understanding and draw upon various sources of information in producing their designs. •They use their understanding of the characteristics of familiar objects when developing and communicating their own ideas and can clarify their thoughts through discussion, drawing and modelling. •They work from their own detailed plans, checking their work as it develops and modifying their approach in the light of progress. •They work with a range of tools, materials, equipment, components and processes and select apparatus for a range of tasks. They work with precision and care, exercising appropriate safety precautions. •They make and systematically record series of observations and measurements, presenting data as line graphs and offering simple explanations for any differences they encounter. They draw conclusions that are consistent with the evidence and begin to relate these to scientific knowledge and understanding. •They test and evaluate their experiment or products, and the value of the information sources used, showing that they understand the situations in which their designs will have to function, and showing awareness of constraints.	•Students apply the scientific knowledge they have gained from comparable situations to prepare plans in which they identify key factors that need to be considered. •They make predictions for their own investigations. •They use data from other sources, such as database packages. •They describe procedures, using scientific vocabulary, and make measurements and observations appropriate to the task. •They demonstrate a competence in practical skills, such as in the selection of appropriate apparatus and the precision with which they make their observations and measurements. •They use sensors to monitor or respond to changes occurring during their investigations. •They decide on the most appropriate ways to record and present their results and draw valid conclusions from these results. •They explain these conclusions in terms of the evidence obtained and their knowledge and understanding of science.	•With guidance, students prepare systematic plans for investigations in which they identify key factors that need to be considered. •They make use of their scientific knowledge and understanding to make predictions. •They make decisions about the type, range and precision of observations and measurements to be taken. •They identify when they need to repeat measurements and observations in order to obtain reliable data. •They present qualitative observations clearly and concisely. •They present quantitative data in graphs and use, where appropriate, lines of best fit. •They draw valid conclusions and explain these using scientific knowledge and understanding, including relevant data from other sources. •They begin to critically evaluate their scientific procedures and suggest ways of improving their investigations.	•Students apply their knowledge and understanding in a range of contexts, including unfamiliar situations. •They recognise that investigations of different kinds can require different approaches. •They select a strategy or strategies appropriate to the specific investigation. •Unaided, they prepare systematic and precise plans for their investigations including a strategy for dealing with results. •They offer detailed and precise predictions based on reasoned scientific models. •They decide on the observations and measurements that need to be taken and the degree of accuracy that is required. •They set up and use scientific apparatus with precision and skill. •They repeat observations and measurements and identify and explain anomalies in their results, allowing for these when they represent their results graphically. •They evaluate the designs of their investigations and produce systematic and structured reports.

Strand ii Living things

Level 1	Level 2	Level 3	Level 4
•Students recognise and name simple internal and external parts of the body, *such as heart, lungs, brain, head, arm, and of plants, using words such as leaf or flower.* •They observe and describe a range of animals and plants in terms of features *such as colour of coat, or size of leaf.* •They recognise and identify a range of common animals, *using terms such as fly, goldfish, or parrot.*	•Students use their knowledge about living things to describe basic conditions, *such as a supply of food, water, air, light or shelter, that animals or plants need in order to survive.* •They recognise that living things grow and reproduce. •They sort living things into groups, using simple features. •They describe the basis for their groupings in terms such as number of legs or shape of leaf. •They recognise that different living things are found in different places, *such as ponds or woods.*	•Students use their knowledge of basic life processes, such as growth or reproduction, when they describe differences between living and non-living things. •They provide simple explanations for changes in living things, *such as diet affecting the health of humans or other animals, lack of light or water altering plant growth, or seasons.* •They identify ways in which an animal is suited to its environment, *such as a fish having fins to help it swim.* •They identify ways in which humans interact with their environment. •They describe the conditions necessary to keep healthy.	•Students, through first hand experiences and using a range of resources, identify and classify locally occurring species of animals and plants using observable features. •They relate them to the location in which they were found and describe the conditions necessary for their growth. •They sequence the main stages of a life cycle, *such as that of a butterfly or a flowering plant.* •They name the major organs of the human body, *such as brain, heart or lungs,* and identify the position of these organs in the human body. •They recognise that living things are made up of cells. •They identify organs, such as petal, stamen or stigma, of different plants they observe. •They describe feeding relationships between plants and animals in a habitat, using food chains and terms *such as predator and prey.* •They are able to describe ways in which humans can affect or change the environment

Level 5	Level 6	Level 7	Level 8
•Students assign organisms to their major groups and understand the main stages in a life cycle. •They explain, in simple terms, the process of photosynthesis in green plants. •They know the functions of food, the roles of nutrients in the diet and the reasons for maintaining a healthy diet. •They describe, in simple terms, the parts and basic functions of the major organ systems in humans. •They describe the ways by which human activity, *such as de-forestation,* can change the environment and affect the plants and animals living there, and suggest suitable conservation strategies. •They describe the reproductive parts in both plants and humans. •They explain the requirements to maintain a healthy body and identify the health issues which are associated with diet, drugs and the need for responsible attitudes to sexual behaviour.	•Students explain the differences between plant and animal cells. •They describe ways that living organisms show variation. •They explain how cells become specialised in multicellular organisms, leading to varying levels of organisation in plants and animals. •They explain why food chains and food webs exist in the environment. •They explain that the distribution and abundance of organisms in habitats are affected by environmental factors, such as the availability of light or water. •They explain the circulatory digestive and respiratory systems in humans, using appropriate scientific terminology. •They explain pollination and fertilization in plants, leading to germination and dispersal. •They discuss the requirements to maintain a healthy body and a healthy baby during pregnancy, and the needs of young children in the early stages of their development.	•Students show an increasing knowledge of cell structure that incorporates an understanding that genetic information is carried in the form of chromosomes and genes. •They explain how cells are adapted to their function. •They explain the processes of cell respiration and photosynthesis in terms of the main underlying chemical changes. •They explain the need for additional elements in plants for healthy growth. •They compare the energy content of different foods and explain how energy requirements vary according to age, gender and activity. •They explain the processes of human fertilization, the role of the placenta and the process of birth. •They discuss the physical and emotional changes which occur during adolescence and of contraception and sexually transmitted diseases.	• Students demonstrate an extensive knowledge and understanding of life processes and living things drawn from the Key Stage 3 programme of study, in explaining how biological systems function. •They use their knowledge of the cellular structure of organs to explain the associated life processes, *such as the absorption of food in the digestive system or gas exchange in the lungs.* •They recognise, predict and explain changes in biological systems, *such as the effect of increased carbon dioxide concentration on the growth of greenhouse crops, or the consequences of smoking for organ systems.* •They explain how characteristics can be inherited by individuals and apply their knowledge to contexts such as selective breeding. •They predict the short-term and long-term effects of environmental change on ecosystems and use their understanding of such systems to justify their predictions.

Strand iii Materials

Level 1	Level 2	Level 3	Level 4
•Students know about a range of properties, such as texture or appearance, and they describe materials they observe in terms of these properties,	•Students identify a range of common materials and know about some of their properties, •They describe similarities and differences between materials •They sort materials into groups and describe in everyday terms, *such as shininess, hardness, or smoothness, the basis for their groupings.* •They describe ways in which some materials are changed by heating or cooling, or by processes such as bending or stretching.	•Students use their knowledge and understanding of materials when they describe a variety of ways of sorting them into groups according to their properties. •They describe how some materials are particularly suitable for specific purposes, *such as a metal for making electrical cables, or aluminium cans for recycling.* •They recognise that some changes, such as the freezing of water, can be reversed, and some, *such as the baking of clay, cannot, and they classify changes in this way.*	•Students demonstrate knowledge and understanding of aspects of materials and their properties drawn from the Key Stage 2 or Key Stage 3 programme of study. •They describe differences between the properties of different materials and explain how these differences are used to classify substances as solids, liquids and gases. •They can distinguish between elements and compounds. •They describe some methods, such as filtration, that are used to separate simple mixtures. •They use scientific terms, such as evaporation or condensation, to describe changes of state. •They use knowledge about some reversible and irreversible changes to make simple predictions about whether other changes are reversible or not.

Level 5	Level 6	Level 7	Level 8
•Students understand the physical properties of gases and relate these to everyday uses. •They know how to prepare and identify common gases. •They use the pH scale when classifying solutions as acidic, alkaline or neutral. •They understand that when new materials are formed, the change is permanent. •They explain rusting in terms of oxidation and know how rusting can be controlled. •They understand that there are limited amounts of raw materials in the environment. •They discuss the positive and negative effects of obtaining and using the raw materials from the earth. •They relate changes in state to the water cycle.	•Students use their knowledge and understanding of the nature and behaviour of materials to explain chemical and physical changes and how new materials can be made. •They use their knowledge and understanding of particles to explain the differences in the three states of matter. •They extend their knowledge of classification to explain the differences between elements, compounds and mixtures. •They describe some methods of separation to obtain pure substances from mixtures. •They recover a solvent from solution using simple distillation. •They know about the methods of monitoring water purity. •They explain what happens in a range of chemical reactions and relate these to everyday contexts giving word equations where appropriate. •They use the reactivity series to make predictions about reactions of metals.	•Students use their knowledge and understanding to relate the properties and uses of everyday materials. •They apply their knowledge of particles to explain changes of state, diffusion and dissolving. •They recognise the Periodic Table as a means of arranging elements and describe the physical and chemical properties of elements in terms of their position. •They explain the differences between mixtures and compounds in terms of their physical and chemical properties. •They explain the effects of corrosive gas pollutants. •They discuss the positive and negative effects of the exploitation of raw materials.	•Students describe and explain the physical and chemical properties of metals and non-metals and their compounds. •They extend their understanding of the Periodic Table to explain the atomic structure of the first twenty elements. •They recognise and classify a range of chemical reactions, *such as reduction or thermal decomposition.* •They apply their knowledge of patterns in a chemical reaction to explain how substances, such as salts, could be made. •They explain the applications of chemical reactions in everyday contexts, *such as the extraction of iron in the blast furnace.* •They explain the differences between exothermic and endothermic chemical reactions.

Strand iv Physical processes

Level 1	Level 2	Level 3	Level 4
•Students describe the changes that result from actions such as pushing or pulling objects. •They recognise that sound and light come from a variety of sources and name some of these sources.	•Students describe and compare the way in which devices, such as bulbs, work in different electrical circuits. •They compare the effects of similar phenomena, *such as the brightness or colour of lights, or the loudness or pitch of sounds.* •They compare the movement of different objects in terms of speed or direction.	•Students know that there are different sources of fuels for energy *such as oil, gas or coal.* •They outline the dangers of the misuse of mains electricity and know how to use electrical appliances safely. •They describe how sounds are produced by vibrations. They know that light does not pass through all materials.	•Students describe how forces can affect the movement and shape of objects. •They identify a range of energy sources, *such as a battery for a flashlight.* •They describe how to construct simple series circuits using terms *such as switches, bulbs or batteries,* and identify whether materials are electrical insulators or conductors. •They know how shadows are formed and what makes them longer or shorter. •They describe the relative movement of the sun and planets within the solar system.

Level 5	Level 6	Level 7	Level 8
•Students identify a variety of energy sources and explain the difference between renewable and non-renewable sources. •They explain the effect of friction on moving objects. •They know the properties of magnets and the magnetic field pattern produced by a bar magnet. •They describe how light is reflected from plane surfaces in simple terms, the relationship between the angle of incidence and the angle of reflection. •They explain the relationship between loudness and amplitude, and pitch and frequency of a sound. •They describe the affect of changing current in an electric circuit and explain what happens in series and parallel circuits. •They use models to explain the changing phases of the Moon and to describe how day, night and year length are caused by the movement of the earth.	•Students understand the relationship between applied force, the area over which it acts and the resulting pressure. •They calculate average speed from measurements made of distance and time. •They distinguish between temperature and thermal energy and know their units . •They explain energy conversions in terms of the principle of the conservation of energy. •They explain how light is reflected from plane surfaces and that white light can be dispersed to give a range of colours. •They explain the need to control noise levels in the environment. •They know the properties of electromagnets and can explain them in simple applications. •They explain changes in day length, seasonal changes and changes in the elevation of the sun.	•Students use models to describe and explain phenomena, *such as the flow of charge in parallel circuits.* •They know and can apply the principle of moments in practical situations. •They explain the process of energy transfer by conduction, convection and radiation. •They know that global resources are limited and discuss why energy should be used efficiently. •They describe common electrostatic phenomena and can explain that electric current is a flow of charge. •They give detailed interpretations of graphs, *such as speed/time graphs.* •They apply science concepts in explanations of a range of physical phenomena *(for example, the appearance of objects in different colours of light, the relationship between the frequency of vibration and the pitch of a sound, the role of gravitational attraction in determining the motion of bodies in the solar system, the dissipation of energy during energy transfers).*	•Students consider physical phenomena from different perspectives, *such as relating the dissipation of energy during energy transfer to the need to conserve limited energy resources.* •They apply their understanding of the principle of moments to situations involving stability. •They explain the heating effect of a current in terms of vibration of particles. •They consider ways of obtaining data *(for example, of the solar system)* and they use their knowledge of physical processes to explain patterns that they find. •They use quantitative relationships between physical quantities in calculations that may involve more than one step.