Rewarding Learning

NOTE

CCEA will NOT be accepting entries from English centres for GCSE courses that begin in or after September 2012

CCEA GCSE Specification in Science (Single Award)

For first teaching from February 2011

For first assessment from Summer 2012
For first award in Summer 2013

Subject Code: 1310

science

single award

Version 4 04 July 2012

Foreword

This booklet contains CCEA's General Certificate of Secondary Education (GCSE) Single Award Science for first teaching from September 2011. We have designed this specification to meet the requirements of the following:

- GCSE Subject Criteria for Science;
- GCSE Qualifications Criteria;
- Common Criteria for all Qualifications;
- GCSE Controlled Assessment Regulations for Science; and
- GCSE Controlled Assessment Generic Regulations.

We will make the first full award based on this specification in summer 2013.

We will continue to offer this specification as a unitised course. There are four units. The first assessment for the following units will be available in February 2012:

- Unit 1: Biology;
- Unit 2: Chemistry; and
- Unit 3: Physics.

We will notify centres in writing of any major changes to this specification. We will also publish changes on our website at www.ccea.org.uk

The version on our website is the most up-to-date version. Please note that the web version may be different from printed versions.

Centres in England

CCEA will not be accepting entries from English centres for GCSE courses starting September 2012 onwards.

Final awarding for English centres currently following this specification will be in Summer 2013.

A final resit opportunity for candidates from English centres will be available in Summer 2014.

Subject Code	1310
QAN*	600/6851/6

You may download further copies of this publication from www.ccea.org.uk

* Please note the QAN for candidates completing this course in Summer 2013 is 600/1354/0

Version 4 04 July 2012

Contents

1 Introduction

This specification sets out the content and assessment details for our GCSE Single Award Science course. First teaching begins from September 2011, and we will make the first awards for this specification in summer 2013. You can view and download the latest version of this specification on our website at www.ccea.org.uk

The specification builds on the broad objectives of the Northern Ireland Curriculum. It is also relevant to key curriculum concerns in Wales.

1.1 Aims and learning outcomes

This specification encourages students to be inspired, motivated and challenged by following a broad, coherent, practical, satisfying and worthwhile course of study. It encourages them to develop their curiosity about the living, material and physical worlds and provides insight into and experience of how science works. It enables students to engage with science and to make informed decisions both about further study in science and related subjects and about their careers.

This specification aims to enable students to:

- develop their knowledge and understanding of the material, physical and living worlds;
- develop their understanding of the nature of science and its applications and the interrelationships between science and society;
- develop an understanding of the importance of scale in science;
- develop and apply their knowledge and understanding of the scientific process through hypotheses, theories and concepts;
- develop their understanding of the relationships between hypotheses, evidence, theories and explanations;
- develop their awareness of risk and the ability to assess potential risk in the context of potential benefits;
- develop and apply their observational, practical, enquiry and problem-solving skills and understanding in laboratory, field and other learning environments;
- develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions; and
- develop their skills in communication, mathematics and the use of technology in scientific contexts.

1.2 Key features

The key features of the specification appear below:

- The specification incorporates the skills, knowledge and understanding of how science works.
- The specification is divided into four units.
- Units 1, 2 and 3 are each assessed by a written examination either at Foundation Tier (grades C–G) or Higher Tier (grades A*–D/E).
- We set the controlled assessment tasks for Unit 4: Practical Skills. Students must complete one task. Teachers supervise it and mark students according to our mark scheme, and we moderate the results.
- Students can resit each unit once.
- Students achieving a GCSE in Single Award Science can progress to further education, training or employment. (Please note that an award in this science subject alone will not be sufficient to progress to GCE in chemistry, physics or biology.)
- There is a range of support available for both teachers and students, including specimen papers, mark schemes and schemes of work. You can download these from our website at www.ccea.org.uk

1.3 Prior attainment

This specification builds on the knowledge, skills and understanding developed through the Northern Ireland curriculum for science at Key Stage 3. There is no particular level of attainment required; however, before studying this specification, we expect students to have a level of skills in science, numeracy, literacy and communication that is commensurate with having studied science to Key Stage 3.

1.4 Classification codes and subject combinations

Every specification is assigned a national classification code that indicates the subject area to which it belongs. The classification code for this qualification is 1310.

Progression to another school/college

Should a student take two qualifications with the same classification code, schools and colleges that they apply to may take the view that they have achieved only one of the two GCSEs. The same view may be taken if students take two GCSE qualifications that have different classification codes but have content that overlaps significantly. Students who have any doubts about their subject combinations should check with the schools and colleges that they wish to attend before embarking on their planned study.

1.5 How science works

Section 3 of our specification includes learning outcomes that allow students to develop the specific skills, knowledge and understanding of how science works.

The skills, knowledge and understanding of how science works are:

(i) **data evidence, theories and explanations:**

- (a) the collection and analysis of scientific data;
- (b) the interpretation of data, using creative thought, to provide evidence for testing ideas and developing theories;
- (c) many phenomena can be explained by developing and using scientific theories, models and ideas; and
- (d) there are some questions that science cannot currently answer and some that science cannot address;

(ii) **practical and enquiry skills:**

- (a) planning to test a scientific idea, answer a scientific question or solve a scientific problem;
- (b) collecting data from primary or secondary sources, including the use of ICT sources and tools;
- (c) working accurately and safely, individually and with others, when collecting first-hand data; and
- (d) evaluating methods of data collection and considering their validity and reliability as evidence;

(iii) **communication skills:**

- (a) recalling, analysing, interpreting, applying and questioning scientific information or ideas;
- (b) using both qualitative and quantitative approaches; and
- (c) presenting information, developing an argument and drawing a conclusion, using scientific, technical and mathematical language, conventions and symbols, and using ICT tools;

(iv) **applications and implications of science:**

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

2 Specification at a Glance

The table below summarises the structure of this GCSE course:

Content	Assessment	Weighting	Availability
Unit 1: Biology **Section A: Staying Alive** **Section B: Human Activity and Health**	An externally assessed written examination consisting of a number of compulsory structured questions that provide opportunities for short answers, extended writing and calculations Foundation Tier: 1 hour Higher Tier: 1 hour 15 mins	25%	February, Summer and November from 2013 **(February and November only in 2012)**
Unit 2: Chemistry **Section A: Chemical Patterns and Our Environment** **Section B: Materials and Their Management**	An externally assessed written examination consisting of a number of compulsory structured questions that provide opportunities for short answers, extended writing and calculations Foundation Tier: 1 hour Higher Tier: 1 hour 15 mins	25%	February, Summer and November from 2013 **(February and November only in 2012)**
Unit 3: Physics **Section A: Electricity, Waves and Communication** **Section B: Fossil Fuels, Road Transport and Safety, Radioactivity, and Earth in Space**	An externally assessed written examination consisting of a number of compulsory structured questions that provide opportunities for short answers, extended writing and calculations Foundation Tier: 1 hour Higher Tier: 1 hour 15 mins	25%	February, Summer and November from 2013 **(February and November only in 2012)**
Unit 4: Practical Skills	Controlled assessment Students complete one controlled assessment task from a choice of two. Teachers mark the task and we moderate the results.	25%	From September (beginning in 2011) (submitted every May beginning 2013)

At least 40 percent of the assessment (based on unit weightings) must be taken at the end of the course as terminal assessment.

3 Subject Content

We have divided the course into four units. Three units are subdivided into Section A and Section B. The examination for each unit assesses the content of both Section A and Section B. The fourth unit addresses practical skills, and this unit is assessed through controlled assessment. The respective learning outcomes of all units appear below.

Content for the **Higher Tier only** is in ***bold italics***.
Questions in Higher Tier papers may be set on **any** content in the specification

Content for the Foundation Tier is in normal type.
Questions in Foundation Tier papers will be set **only** on this content.

Students should have opportunities to experiment and carry out their own investigations throughout their course of study.

3.1 Unit 1: Biology (Section A) – Staying Alive

In this section of the unit, students explore the wider issues around food, diet and exercise. They learn about living processes and how they are interrelated, how living organisms respond to change, how living organisms regulate their internal environment, and the human reproductive system and contraception. They examine the nature of energy flow and the ways in which organisms function as a result of their genes. They also evaluate our ability to alter and test genes, as well as the ethical issues associated with this ability.

Food and Diet

Students investigate food composition and health issues associated with our approach to food and exercise, photosynthesis and respiration as interrelated key processes, and the nature of energy flow through the biosphere.

Content	Learning Outcomes
Food and Diet **Food and Energy**	In the context of how science works, students should be able to: 1.1 describe food as a source of chemical energy in humans; 1.2 investigate the energy content of different foods; and 1.3 explore and evaluate how the energy required by individuals is different depending on age, gender and activity.

Content	Learning Outcomes
Food Content	In the context of how science works, students should be able to: 1.4 examine food content: – protein, fats and carbohydrates and their functions; – the food tests for starch, sugars, protein and fat; – the sources and functions of vitamins C and D; – the sources and functions of the minerals calcium and iron; – water as a solvent and a medium for chemical reactions; and – the importance of fibre in preventing constipation and reducing bowel cancer;
Food and Health	1.5 examine and evaluate the relationship between health and diet, obesity, heart disease and strokes, and recognise why many people in society are slow to accept these links or fail to adapt their lifestyle, with reference to: – the eating problems anorexia and bulimia; and – the ways in which the risk of heart disease and strokes may be reduced: lifestyle – increasing exercise, reducing stress and stopping smoking; and diet – low salt, low saturated fats and low cholesterol;
Costs to Society	1.6 evaluate the costs to society of circulatory diseases (medical and wider costs, such as the effect on families);
Exercise	1.7 assess the effect of exercise on the heart rate; 1.8 ***explain how the circulatory system benefits from regular exercise, including how regular exercise strengthens the heart muscle and increases its output when not exercising; and***
Photosynthesis and Respiration	1.9 examine photosynthesis and respiration as interrelated key processes that ensure the energy flow through the biosphere: – knowing the word equations for photosynthesis and respiration; – showing practically that light is needed for photosynthesis and that starch is produced; and – ***explaining how palisade cells are adapted for photosynthesis.***

Content	Learning Outcomes
Interdependence of Living Organisms	In the context of how science works, students should be able to: 1.10 discuss the interdependence of organisms through analysis of food chains and food webs, including: – the Sun as the primary source of energy; – producers; – consumers (primary, secondary and tertiary); and – the nature of energy flow.

Chromosomes and Genes

The ways in which organisms function are related to the genes in their cells. Scientists are now able to alter genes in an organism. This provides many exciting possibilities, but it also raises many ethical issues.

Content	Learning Outcomes
Chromosomes	In the context of how science works, students should be able to: 1.11 recognise chromosomes as genetic structures in the nucleus;
Genes	1.12 explain that genes are sections of chromosomes that operate as functional units to control characteristics;
DNA and Its Structure	1.13 recognise DNA as the core component of genes and chromosomes; 1.14 recognise the double helix structure of DNA; 1.15 ***recognise DNA bases, understand base pairing and appreciate the unique nature of an individual's DNA;***
Production of Amino Acids	1.16 ***explain the link between the DNA code and the building up of amino acids in the correct sequence to form protein (the base triplet hypothesis); and***
Discovery of the Structure of DNA	1.17 ***describe how the theory of the structure of DNA was developed, with each stage building on prior knowledge (to include the work of Chargaff on the quantitative analysis of bases, Franklin and Wilkins on X-ray diffraction, and Watson and Crick on modelling).***

Content	Learning Outcomes
Discovery of the Structure of DNA (cont.)	In the context of how science works, students should be able to: 1.18 ***recognise that the development of the scientific theory of the structure of DNA is an example of the collaborative nature of science, that many scientific theories are developed in stages using different lines of evidence, and how new scientific knowledge is validated (for example peer review);***
Genetic Terminology	1.19 explore the transfer of genes across generations: – chromosomes occurring as functional pairs (except for sperm and ova); – genetic diagrams consisting of a single characteristic controlled by a single gene with two alleles; – dominant and recessive alleles; – genotype, phenotype, gamete and offspring ratios; and – homozygous and heterozygous genotypes;
Inherited Conditions	1.20 recall cystic fibrosis as an example of an inherited disease (symptoms and causes not required); 1.21 evaluate ethical issues relating to the diagnosis of foetal abnormalities in the womb and decisions relating to termination of pregnancy; 1.22 ***interpret pedigree diagrams;***
Genetic Screening	1.23 ***explore genetic screening and evaluate associated ethical issues, to include:*** – ***the dilemma for carriers of genetic conditions in becoming pregnant;*** – ***making genetic information available to wider society, for example insurance companies; and*** – ***gene therapy, to include the potential benefits and limitations of current techniques in relation to cystic fibrosis;***
Asexual and Sexual Reproduction	1.24 explain asexual and sexual reproduction in terms of producing identical offspring and variation respectively; and
Genetic Engineering	1.25 ***describe GM crops as an example of genetic engineering – evaluating the advantages and disadvantages.***

Nervous System and Hormones

Students investigate how animals respond to internal changes, how animals and plants respond to external changes and how animals regulate internal systems. They also investigate the nervous system, the hormones that allow us to respond to change both inside and outside the body, and the role of insulin in maintaining blood glucose levels. They study tropism in plants, study the human reproductive system and evaluate the different types of contraception.

Content	Learning Outcomes
Nervous System and Hormones **Central Nervous System**	In the context of how science works, students should be able to: 1.26 describe and explain the basic structure and function of the nervous system in responding to the senses and in controlling movement: – the brain and spinal cord together form the central nervous system; and – the brain as the control centre receives impulses from the senses and responds, if necessary, by sending impulses to effectors (limited to muscles);
Voluntary and Reflex Actions	1.27 describe and explain the two main types of actions available: voluntary and reflex action;
Phototropism	1.28 assess how plants respond to external changes – phototropism as a growth movement controlled by hormones in response to light;
Male and Female Reproductive Systems	1.29 analyse the structure and function of the male reproductive system: the testes, urethra, scrotum, penis, sperm tube and prostate gland; 1.30 analyse the structure and function of the female reproductive system: the ovaries, oviducts, uterus, cervix and vagina; 1.31 ***consider the role of the hormones oestrogen and progesterone in the control of the menstrual cycle; and***
Contraception	1.32 evaluate the advantages and disadvantages of different types of contraception: – being aware that contraception can raise ethical issues for some people; – explaining how the contraceptive pill changes hormone levels and stops development of an ovum; and – knowing that condoms act as a barrier preventing the passage of sperm and also help prevent sexually transmitted diseases.

Content	Learning Outcomes
Contraception (cont.)	In the context of how science works, students should be able to: 1.33 explain male sterilisation (vasectomy) as the cutting of sperm ducts to prevent the passage of sperm into the penis; 1.34 explain female sterilisation as the cutting of oviducts to prevent the ova from reaching the uterus and being fertilised;
Hormones	1.35 examine hormones as chemical messengers that travel in the blood to a target organ, where they act;
Insulin	1.36 know and understand that insulin is a hormone produced by the pancreas when blood sugar levels are high, which results in lower glucose levels in the blood because more glucose is converted to glycogen;
Diabetes	1.37 examine the difference between Type 1 and Type 2 diabetes; 1.38 describe the symptoms of diabetes, its treatment and possible long-term effects, to include damage to eyesight, kidney failure, heart disease and strokes; 1.39 evaluate why the number of people with diabetes in the population is rising; and
Development of Scientific Theories	1.40 ***outline the general principle that many scientific theories are developed in stages using different lines of evidence, having an awareness of the collaborative nature of science and the way new scientific knowledge is validated (for example peer review).***

3.2 Unit 1 Biology (Section B) – Human Activity and Health

This section of the unit investigates variation in living organisms and its causes and effects. Students investigate human health, including the main mechanisms by which we defend ourselves against disease, and analyse the impact of human activity on the environment and strategies to reduce the harm caused.

Variation and Adaptation

Students investigate the fact that all organisms vary and this can make some better adapted for survival than others.

Content	Learning Outcomes
Variation and Adaptation **Types of Variation**	In the context of how science works, students should be able to: 2.1 explain that variation can be observed in living things: – height in humans as an example of continuous variation; and – tongue rolling as an example of discontinuous variation;
Mutations	2.2 explain that variation in living organisms can be due to mutations – random changes in the structure or number of chromosomes or genes – and can be triggered by environmental factors (UV light causing skin cancer); 2.3 understand that cancer is uncontrolled cell division; 2.4 evaluate the use of tanning as a health aid or harmful factor; 2.5 describe Down Syndrome as a condition caused by having an extra chromosome – identification of Down Syndrome from karyotypes; and
Natural Selection, Evolution and Extinction	2.6 discuss how living organisms are adapted to their environment and how variation and selection may lead to evolution or extinction, including: – natural selection as variation within phenotypes, which often leads to differential survival; – ***the relationship between natural selection and evolution as a continuing process;*** – ***why Darwin's theory of evolution has taken so long to be accepted by a few in the scientific community and why it may never be accepted by all;*** – extinction of species; and – the role of human activity in bringing about extinction of species and in creating conditions for the continued survival of endangered species.

Content	Learning Outcomes
Keys **Classification**	In the context of how science works, students should be able to: 2.7 use and apply keys, using observable features to assign organisms to groups; and 2.8 explain the rationale for the scientific classification of living organisms.

Disease and Body Defences

Diseases are often caused by microorganisms. The body has a range of natural defences against microorganisms, and we are continually making technological advances to aid the body's defence mechanisms.

Content	Learning Outcomes
Disease and Body Defences **Pasteur**	In the context of how science works, students should be able to: 2.9 discuss Pasteur's work, which showed that contamination is caused by microorganisms;
Types of Microorganisms	2.10 understand that microorganisms can cause disease: – bacterial diseases: gonorrhoea, chlamydia, salmonella and tuberculosis; – viral diseases: HIV leading to AIDS, cold and flu, polio, chickenpox and rubella; – fungal diseases: athlete's foot and thrush; and – ***the consequences of mutations of bacteria and viruses in relation to epidemics and pandemics;***
Body's Defence Mechanisms	2.11 discuss how the body defends itself from microorganisms: – the skin, mucous membranes and blood clotting; – the production of antibodies in response to antigens and the role of antibodies in defence against disease; – the mechanism of phagocytosis; and – active and passive immunity;
Vaccinations	2.12 explain that vaccines work by using modified disease-causing organisms to produce elevated antibody levels in the blood; and 2.13 examine issues surrounding vaccination uptake (the MMR controversy).

Content	Learning Outcomes
Antibiotics **Antibiotic-Resistant Bacteria** **Development of Medicines** **Alcohol, Tobacco and Drugs**	In the context of how science works, students should be able to: 2.14 explain how antibiotics can be used to treat bacterial diseases; 2.15 explain bacterial resistance to antibiotics; 2.16 understand the importance of hygiene in preventing the spread of microorganisms in hospitals, including an awareness of MRSA; 2.17 discuss how medicines are developed, including Fleming's role in the discovery of penicillin; 2.18 evaluate issues involved in developing treatments, to include the role of the following in providing valid and reliable evidence: – in-vitro testing; – animal testing; – species difference and side effects; and – clinical trials and licensing; and 2.19 consider how drugs may be used or misused: – alcohol and its effects on the individual and society, including binge drinking; – reasons why people drink, evaluating strategies for reducing alcohol intake; – tobacco smoke: tar can cause cancer, bronchitis and emphysema, nicotine is addictive and affects heart rate, and carbon monoxide reduces the oxygen-carrying capacity of the blood; and – cannabis and cocaine, and the effects of both.

Human Activity on Earth

Human activity has had a significant effect on the world. There is a growing awareness of the harmful effects that people's direct and indirect activities are having, and strategies are being developed to reduce or reverse the damage to the environment.

Content	Learning Outcomes
Human Activity on Earth **Effects of Population and Economic Growth**	In the context of how science works, students should be able to: 2.20 describe and evaluate how aspects of human activity affect the world, exploring the balance and potential conflict between population/economic growth and conservation: – human population growth; – the use of resources (sustainability of fish stocks and strategies used to conserve stocks); and – pollution: air (CO_2 and acid rain), land (household refuse) and water (nitrate levels due to sewage and slurry effluent);
	2.21 discuss strategies for limiting the effects of pollution (see examples of pollution in 2.20);
Global Warming	2.22 discuss global warming as the consequence of an unbalanced carbon cycle;
	2.23 evaluate the evidence for global warming and understand why global warming has only recently become widely accepted as a serious environmental issue, including causes of global warming, its effects and possible remedial action;
History of Earth's Atmosphere	2.24 understand that the atmosphere has changed throughout the history of the Earth, in particular that it was the process of photosynthesis that caused oxygen levels to rise high enough to promote the evolution of animals;
Monitoring Environmental Changes	2.25 evaluate methods of monitoring changes in the environment: – abiotic factors – CO_2 levels, decreasing ice fields, water levels and changing climates; and – biotic factors – lichens as pollution monitors; and
Nitrogen Cycle	2.26 ***analyse the nitrogen cycle as an example of a nutrient cycle, to include the roles of microorganisms in the processes of decay and nitrification (the processes of nitrogen fixation and denitrification are not required).***

Content	Learning Outcomes
Competition	In the context of how science works, students should be able to: 2.27 discuss the concept of competition between living things, including: – the effect of planting density on plant seedlings; and – the influence that humans have on the normal balance of competition in nature; and – the introduction of competitive invasive species: grey squirrels and rhododendron; and
Conservation	2.28 explore conservation issues, including: – the concept of sustainable development and an awareness of some examples, to include the planting of willow for biofuel; and – strategies for maintaining biodiversity, including the role of nature reserves.

3.3 Unit 2: Chemistry (Section A) – Chemical Patterns and Our Environment

In this section of the unit, students study the world about us (including rock types, movement of plates, earthquakes and volcanoes) and acids and bases in the home. They investigate elements and compounds (including particle theory, periodic patterns and their development, and atomic structure) and basic chemical reactions.

Acids and Bases

Acids and bases have many uses and can be identified using indicators. Students investigate how to make indicators, how some practical neutralisation reactions are used in the home and kitchen, and practical uses and applications of baking soda.

Content	Learning Outcomes
Acids and Bases	In the context of how science works, students should be able to:
Household Examples	3.1 discuss the uses of the following acids and bases in the home: citric acid (in lemon juice), ethanoic acid (in vinegar), baking soda, ammonia solution (in cleaning products), magnesium hydroxide (Milk of Magnesia), and sodium hydroxide (oven cleaners or drain cleaners);
Hazard Symbols	3.2 explore the use of the GHS/CLP international chemical hazard labelling on household and industrial items to alert users to their dangers, and recognise the symbols representing the following hazards: corrosive, toxic, explosive and flammable;
Indicators	3.3 obtain indicators from natural dyes that can be extracted from plants, such as red cabbage, beetroot or blackcurrant, and test an indicator on a range of solutions from pH 1 to pH 14;
Universal Indicator	3.4 explore the use of universal indicator to determine the pH of solutions and understand that pH values can be used to classify a range of solutions as acidic, alkaline or neutral;
Neutralisation	3.5 follow a neutralisation reaction using pH sensors, dataloggers and chemical indicators, and compare and evaluate data collected using these methods; 3.6 explore neutralisation in everyday contexts, for example curing indigestion with baking soda, and liming soil; 3.7 explain acid indigestion as a condition caused by excess hydrochloric acid in the stomach; and 3.8 investigate how indigestion can be cured by taking indigestion tablets, which contain weak bases such as oxides and hydroxides or carbonates.

Content	Learning Outcomes
Neutralisation (cont.) **Release of Carbon Dioxide from Carbonates**	In the context of how science works, students should be able to: 3.9 write a word equation ***and a symbol equation*** to show the chemical reaction that takes place when indigestion is cured using sodium hydrogencarbonate; 3.10 explain why farmers add limestone to soil; 3.11 identify carbon dioxide gas using limewater; 3.12 examine the use of baking powder (a mixture of sodium hydrogencarbonate and tartaric acid) in cake mixtures to generate carbon dioxide gas so that the mixture rises and has a lighter texture, including: – the effect of heat on sodium hydrogencarbonate/ baking soda (thermal decomposition) to produce sodium carbonate, carbon dioxide and water; – the addition of acid to sodium hydrogencarbonate (compare with removing indigestion); and – writing word equations ***and symbol equations*** to show the effect of heat on sodium hydrogencarbonate; 3.13 discuss sherbet (a mixture of sodium hydrogencarbonate, sugar and citric acid) and note the sensation caused by the generation of carbon dioxide as a fizzing feeling when moistened in the mouth; and 3.14 understand and write word equations to show how baking soda reacts with citric acid and tartaric acid.

The World about Us

Students look at the rock types that make up the outer surface of the Earth's crust and how these can be used to determine the age of the Earth. They examine how movements of tectonic plates can cause earthquakes, volcanoes and tsunamis. They examine how different theories arose, were questioned and achieved general acceptance. The concept that science cannot answer all questions with complete authority is also raised.

Content	Learning Outcomes
The World about Us **Types of Rocks**	In the context of how science works, students should be able to: 3.15 analyse the three different types of rock as igneous, sedimentary and metamorphic, for example granite/basalt, limestone/sandstone, and slate/marble.

Content	Learning Outcomes
Fossils	In the context of how science works, students should be able to:
	3.16 explain what fossils are and understand that their location demonstrates there have been changes in the Earth over time;
Age and Structure of the Earth	3.17 ***explain the concept of deep time;***
	3.18 ***explain how rocks provide evidence for the Earth's age;***
	3.19 ***evaluate Archbishop Ussher's ideas on the age of the Earth and compare them with the modern method of dating rocks using radiometric dating;***
	3.20 ***identify that the Earth is considered to be 4,500 million years old;***
	3.21 ***understand Wegener's theory of continental drift and give evidence for its presentation and rejection;***
	3.22 recall the size and understand the structure of the Earth;
Tectonic Plates, Volcanoes and Earthquakes	3.23 explain the theory of plate tectonics as a unifying theory that covers a large range of Earth processes;
	3.24 explain that volcanoes and mountain building are likely to occur at the edge of tectonic plates;
	3.25 explain that earthquakes occur when tectonic plates move past each other;
	3.26 interpret the intensity of earthquakes by using measurements on the Richter scale;
	3.27 recognise that no theory has been advanced that accurately predicts when a volcano will erupt or when an earthquake will happen; and
	3.28 analyse the process of volcanic eruption.

Elements and Compounds

Students investigate how the Periodic Table developed through the work of Newlands and Mendeleev, and they study trends in the Periodic Table. They investigate some chemical reactions, learn that elements form compounds by chemically joining together, and write formulae and equations.

Content	Learning Outcomes
Elements and Compounds **Structure of the Atom**	In the context of how science works, students should be able to: 3.29 examine atoms as particles that have a nucleus surrounded by moving electrons and know the relative charge and relative mass of a proton, electron and neutron; 3.30 examine the structure of atoms in terms of protons, neutrons and electrons (elements 1–20) and use of the terms atomic number and mass number;
The Periodic Table and Its Development	3.31 evaluate the work of Newlands and Mendeleev in the development of the Periodic Table and the role of careful observation in formulating their periodic theory; 3.32 ***examine how the reasons for rejection of Newlands' theory were overcome by Mendeleev, whose theory became gradually accepted, and examine how the Greek concept of four elements changed over time with increasing knowledge;*** 3.33 discuss the relationship between the electronic structure of the first twenty elements and their position in the periodic table; 3.34 explore how the periodic table groups together elements with similar properties, for example alkali metals, alkaline earth metals, halogens and gases known as the noble gases; 3.35 assess how the metallic character of elements decreases on moving across the periodic table from left to right; 3.36 recall that helium, neon and argon are chemically inert gases known as the noble gases; and
Formulae	3.37 understand and write formulae of simple ***and more complex*** compounds using the Periodic Table and Data Leaflet, for example NaCl, MgO, Na_2SO_4 and CH_4.

Content	Learning Outcomes
Equations	In the context of how science works, students should be able to: 3.38 give simple word equations to describe the range of reactions in this unit ***and represent the reactions covered in this unit by balanced symbol equations***;
Alkali Metals	3.39 examine how the alkali metals react with water; 3.40 understand the relationship between the rate at which the alkali metals react and their position in the Periodic Table;
Reactivity Series	3.41 examine how the metals magnesium, zinc, iron and copper can be put into a reactivity series based on their reactions with dilute acid, and predict where an unfamiliar element should be placed in the series based on comparative information;
Displacement Reaction	3.42 examine how a more reactive metal can displace a less reactive metal to form a solution of its salt;
Compounds	3.43 explain a compound as a substance that contains two or more different elements chemically joined together;
Bonding	3.44 explain how when elements react their atoms join with other atoms to form compounds by giving, taking or sharing electrons and forming bonds that hold the atoms together, for example NaCl, MgO, ***H_2O and H_2***; and
Oxidation and Reduction	3.45 describe oxidation as the addition of oxygen to a substance and reduction as the removal of oxygen from a substance, for example the formation of magnesium oxide and the reduction of copper oxide.

3.4 Unit 2: Chemistry (Section B) – Materials and Their Management

In this section of the unit, students explore the wider issues around oils, polymers and materials, the extraction of chemicals, and the properties of some simple organic compounds. They investigate the difference between natural and synthetic materials and study electrolysis to help them understand the industrial production of aluminium. They also learn about hard water and the role of recycling in conserving the Earth's resources. The use of forensic science in investigating crime is also covered.

Oils, Polymers and Materials

Students examine the importance of oil to the chemical industry, the formation of new substances by polymerisation and the properties of some simple organic compounds. They study the properties of different materials (including composites) and the reason for their current uses. They also learn about how electrolysis can be used in industry to make aluminium.

Content	Learning Outcomes
Oils, Polymers and Materials **Fossil Fuels**	In the context of how science works, students should be able to: 4.1 explain that coal is mainly carbon, while crude oil and natural gas are hydrocarbons;
Crude Oil	4.2 explain that crude oil is a liquid mixture containing many hundreds of different substances, including dissolved gases and solids; 4.3 examine data on organic chemicals that come from oil and their place in the modern chemical industry;
Fractional Distillation	4.4 describe and understand the separation of crude oil by fractional distillation to collect the various fractions: petrol, naphtha, paraffin, lubricating oil and bitumen; 4.5 explain that each fraction contains hydrocarbons with a similar number of carbon atoms;
Alkanes	4.6 ***draw the structural formulae of alkanes (C_1–C_4);*** 4.7 know the uses of the different fractions of crude oil; and
Combustion	4.8 explain that when fuels burn, atoms of carbon and hydrogen from the fuel combine with atoms of oxygen from the air to produce carbon dioxide, water and heat energy.

Content	Learning Outcomes
Combustion (cont.)	In the context of how science works, students should be able to:
	4.9 write word equations ***and symbol equations*** to show the combustion of alkanes;
Polymerisation	4.10 describe how some small molecules, for example ethene or propene, can join together to make very long molecules called polymers and that this process is called polymerisation;
	4.11 ***understand and write balanced symbol equations for the polymerisation of ethene, propene and vinyl chloride;***
Plastics	4.12 know that there are two types of plastic and that this make plastics difficult to recycle if they are mixed together;
Natural Materials	4.13 know that materials can be obtained from living things, for example cotton, wool and silk;
	4.14 explain why modern materials have replaced some traditional ones because of their superior properties;
	4.15 evaluate the implications for manufacturers of traditional materials as their use declines, for example the linen industry in Northern Ireland;
Properties of Materials	4.16 examine how solid materials differ with respect to their melting points, strength, conductivity, density and hardness and relate these properties to the general uses of metals, plastics, fibres and ceramics;
	4.17 evaluate and interpret data about the properties of metals, plastics, fibres and ceramics to assess their suitability for particular purposes;
Composite Materials	4.18 explain a composite material as one that combines the properties of more than one material to produce a more useful material for particular purposes; and
	4.19 evaluate the relative advantages and disadvantages of composite materials, including glass fibre (boats, car bodies), reinforced glass (windows), reinforced concrete (beams), glass-reinforced plastic, and bone.

Content	Learning Outcomes
Nanotechnology	In the context of how science works, students should be able to:
	4.20 explore how nanotechnology (the reduction of the size of a particle to nano-scale) can produce new properties in a material, including the use of nano-sized particles of silver in sterilising sprays and wound dressings;
Smart Materials	4.21 explain that a smart material is one whose properties alter with a change in the surrounding conditions (such as light and temperature), for example thermochromic and photochromic paint;
Electrolysis	4.22 explain the meaning of the terms electrolysis, anode and cathode and give a simple explanation of electrolysis in terms of ions moving and carrying charge (for example obtaining aluminium from aluminium oxide); and
Extraction of Aluminium	4.23 discuss the processes involved in the commercial extraction of aluminium ***and write an ionic equation for the reaction at the cathode only.***

Hard Water

Students recognise and investigate the causes of different types of hard water, the problems that hard water causes, and how it can be treated. They also investigate the characteristics of hard water areas.

Content	Learning Outcomes
Hard Water	In the context of how science works, students should be able to:
Investigating Hard Water	4.24 explain that hard water is water which is difficult to lather with soap, and investigate the hardness of water using soap solution;
Calcium and Magnesium Compounds	4.25 deduce that calcium and magnesium compounds are present in hard water and that these compounds form a scum with soap;
	4.26 explain that hard water forms undesirable deposits of calcium carbonate or magnesium carbonate in kettles and hot water pipes, and describe their formation using word equations; and
	4.27 ***understand and write balanced symbol equations for the formation of 'fur' (or calcium carbonate) in pipes.***

Content	Learning Outcomes
Temporary and Permanent Hardness	In the context of how science works, students should be able to: 4.28 explain the differences between temporary and permanent hardness; 4.29 understand and write word equations ***and symbol equations*** for the carbonates of calcium and magnesium reacting with hydrochloric acid;
Methods of Softening Water	4.30 examine methods of softening water, to include thermal decomposition, ***precipitation (using washing soda)***, distillation and ion exchange;
Advantages and Disadvantages of Hard Water	4.31 evaluate the advantages (to include better taste, making beer, and stronger bones and teeth) and disadvantages (to include stains on washing, clogging water pipes, and fur in kettles) of living in a hard water area; and 4.32 explain that a hard water area, for example Fermanagh, can have caves (Marble Arch Caves) that can be exploited for tourism.

Recycling and Exploitation of Earth's Resources

Students examine the reasons for recycling and how various materials are recycled. They investigate the difference between different types of waste and the problems involved in recycling. They also study the exploitation of natural resources and the problems that this can cause.

Content	Learning Outcomes
Recycling and Exploitation of Earth's Resources	In the context of how science works, students should be able to: 4.33 know that materials can be recycled;
Recycling	4.34 discuss the process of glass recycling;
Biodegradable and Non-Biodegradable	4.35 understand the difference between biodegradable and non-biodegradable waste; 4.36 evaluate the problems with disposal of plastics and how some plastics are being developed that are more biodegradable; and 4.37 examine how a hard, biodegradable polymer can be made from starch powder.

Content	Learning Outcomes
Reduce, Reuse and Recycle **Benefits of Recycling** **Laws Relating to Recycling**	In the context of how science works, students should be able to: 4.38 explain the terms reuse, reduce and recycle; 4.39 explore the benefits of recycling, for example saving energy and raw materials and reducing landfill sites; and 4.40 explore how laws are in place that require local authorities to recycle waste and reduce landfill sites or face fines and what councils are doing to encourage recycling, including: – providing several bins for household refuse; – separating metal/iron/steel from general waste; – producing mulch from garden waste; and – charging businesses for placing waste in landfill sites.

Using Materials to Fight Crime

Students investigate crime-fighting materials and techniques, use their powers of observation and inference to examine fingerprints, identify metal ions, develop responsibilities in protecting their belongings, and learn what steps retailers can take to identify forgeries.

Content	Learning Outcomes
Using Materials to Fight Crime **Fingerprints** **Preventing Forgery of Bank Notes**	In the context of how science works, students should be able to: 4.41 explain that fingerprints can be taken in a variety of situations and recognise the variety of types: arch, loop, whorl and composite; 4.42 examine how fingerprints can be taken from different surfaces and used for identification purposes; 4.43 examine the different properties of materials that make them suitable for taking fingerprints, for example colour and particle size; 4.44 examine how fingerprint evidence is treated in the court system; and 4.45 explore how retail outlets check for forged notes (UV only) and the characteristics of a banknote (bar, watermarks and paper).

Content	Learning Outcomes
Fibres	In the context of how science works, students should be able to: 4.46 examine the different properties of fibres and understand that these can be used to identify them, including appearance of nylon, wool, cotton and human hair;
Metal Ions	4.47 examine how different metal ions produce different colours when heated in a flame (Li^+, K^+, Na^+ Ca^{2+}, Pb^{2+}, Cu^{2+}) and that these can be used to identify their presence in a given sample from a crime scene ***(using emission spectroscopy – no details required)***; and
Genetic Fingerprinting	4.48 ***examine what genetic fingerprinting is and how genetic fingerprinting is used to identify criminals***.

3.5 Unit 3: Physics (Section A) – Electricity, Waves and Communication

In this unit, students investigate electrical circuits (series and parallel), Ohm's law, the concept of electrical power and the kilowatt hour as the unit of electrical energy. They also examine the production, distribution and safe use of mains electricity, and they discuss both renewable and non-renewable sources of energy and their environmental implications.

Students also examine wave types and their uses, including ultrasound and the electromagnetic spectrum. They evaluate and discuss health issues, study the use of electromagnetic waves in communications and examine the technology associated with mobile phone networks. They investigate lenses and study the use of different lenses in the correction of long sightedness and short sightedness.

Electrical Circuits

Students investigate electrical circuits.

Content	Learning Outcomes
Electrical Circuits **Series and Parallel Circuits** **Current Flow** **Resistance**	In the context of how science works, students should be able to: 5.1 plan and carry out investigations on how current and voltage vary in simple series and parallel circuits, and draw diagrams of these types of circuits using the appropriate circuit symbols; 5.2 ***appreciate the convention that current flows from positive to negative potential while electrons flow in the opposite direction;*** 5.3 calculate resistance from measurements of current and voltage using the formula V = IR; and 5.4 examine how the length ***and thickness*** of a wire (for example nichrome and constantan) affect its resistance ***and examine how variable resistors can control current in a circuit***.

Household Electricity

Students are introduced to the concept of electrical power and how it is generated, transmitted and used safely.

Content	Learning Outcomes
Household Electricity **Power**	In the context of how science works, students should be able to: 5.5 apply knowledge of the formula power = voltage × current to choose the correct size of fuse;
Fuses	5.6 evaluate the consequences of incorrect fuses in common electrical appliances;
Kilowatt Hour	5.7 ***recall that the unit of electrical consumption is kWh;*** 5.8 use meter readings to calculate the cost of household electricity and investigate the factors that increase or reduce these bills; 5.9 ***use the formula*** ***energy (kWh) = power (kW) × time (hr)*** ***to calculate the cost of using appliances for varying amounts of time;***
Protection from Electrical Shock	5.10 explore the various measures that protect users from electrical shock, including: – the wiring and design features of the three pin plug; – the importance of fitting the correct fuse; – earthing; – double insulation; and – residual circuit breakers;
Electricity Generation	5.11 examine the principle of electricity generation (for example that electricity is generated when a magnet is moved near conducting coils);
Power Stations	5.12 interpret, from a block diagram, the component parts (and their functions) of power stations;
Transformers	5.13 describe the distribution of electricity across the grid, ***including the use of step up and step down transformers and the reasons for their use;*** and
Energy Transfers	5.14 ***apply their knowledge of energy transfers to those that take place within power stations.***

Content	Learning Outcomes
Energy Transfers (cont.)	In the context of how science works, students should be able to: 5.15 deduce that electricity is the most useful energy type (as it is easily transferred into heat, movement, sound and light), and name devices in the home that use these energy transfers;
Renewable Sources of Energy	5.16 evaluate the environmental issues surrounding the use of renewable energy sources that can drive turbine generators directly; and 5.17 explain why the emphasis on developing alternative renewable fuels has increased in recent years.

Waves

Students investigate different types of waves and their features, uses and possible dangers.

Content	Learning Outcomes
Waves **Properties of Waves**	In the context of how science works, students should be able to: 5.18 recognise that waves are caused by vibrations and that they transport energy; 5.19 examine the difference between transverse and longitudinal waves; 5.20 analyse the main features of a transverse wave (amplitude, frequency and wavelength), and explain transverse wave propagation in terms of particle movement; 5.21 use the wave equation speed = frequency × wavelength
Speed of Sound	5.22 ***examine how to measure the speed of sound using the flash-bang method;*** 5.23 explain how sound can be reflected and recall that this is known as an echo and what steps are taken in auditoria to counteract this problem; and 5.24 carry out simple calculations involving the echo method.

Content	Learning Outcomes
Human Audible Range	In the context of how science works, students should be able to: 5.25 know and understand that a human's audible range is from 20 Hz to 20 kHz and that ultrasound has a frequency greater than 20 kHz;
Ultrasound	5.26 illustrate how ultrasound can be used for depth measurement (including locating fish) and in medicine to scan the internal structure of the body and that ultrasound scanning is safer than X-rays;
Electromagnetic Spectrum	5.27 examine the make-up of the electromagnetic spectrum, from gamma rays to radio waves; 5.28 explain that electromagnetic radiation travels as waves and that these waves travel at the same speed in a vacuum;
Effects of Electromagnetic Radiation on Living Cells	5.29 appreciate that different wavelengths of electromagnetic radiation have different effects on living cells, ***explain these effects in terms of increasing frequency*** and explore the dangers associated with: – overexposure to sunlight (UV rays); – the damaging effect of X-rays on tissues; and – using gamma rays in industry and medicine; and
Microwaves	5.30 ***explain the microwave heating effect in terms of energy absorption and molecular behaviour.***

Communications

Students investigate the use of electromagnetic waves in communications and the associated health issues.

Content	Learning Outcomes
Communications **Electromagnetic Waves in Communication**	In the context of how science works, students should be able to: 5.31 outline the use of electromagnetic waves in communications: – radio waves for television and radio; – microwaves for satellite and mobile phones; and – infra red and visible light in telephone networks using optical fibres.

Content	Learning Outcomes
Mobile Phones	In the context of how science works, students should be able to: 5.32 examine how mobile phones work by passing messages from one cell to another, that this requires phone masts to act as repeater stations, and that telephone messages may also be sent across wires or through fibre optic cables; and 5.33 examine the use of microwaves in mobile phone communications, considering possible health risks.

Vision

Students investigate the eye, lenses and the use of lenses to correct vision defects.

Content	Learning Outcomes
Vision **Ray Diagrams** **The Eye** **Long Sight** **Short Sight** **Correction of Long and Short Sightedness**	In the context of how science works, students should be able to: 5.34 draw ray diagrams to illustrate the different ways in which converging and diverging lenses refract rays of light parallel to the principal axis; 5.35 explain the part refraction of light plays in the formation of an image on the retina and that most of the refraction takes place as the light passes from air through the cornea; 5.36 explain that the function of the lens in the human eye is to further converge light rays onto the retina to produce a sharp image; 5.37 explain that in long sight a person's lens is too weak to converge the light and the focal point is behind the retina, so the image gets blurred; 5.38 explain that in short sight a person's lens is too strong, so the image is formed in front of the retina; and 5.39 explain how short sight and long sight are corrected and draw ray diagrams to show how long sight is corrected with a converging lens and short sight is corrected with a diverging lens.

3.6 Unit 3: Physics (Section B) – Fossil Fuels, Road Transport and Safety, Radioactivity, and Earth in Space

In this section, students examine the importance of fossil fuels in transport and the consequences that increasing use of such fuels have on our planet. They investigate the factors governing the stopping distances of road vehicles and explore the dangers involved in road transport and how they can be reduced. They study the nature and properties of alpha, beta and gamma radiation. The terms background and half life are introduced. Students discuss the damaging effect that nuclear radiations have on our bodies and study the Solar System, star formation, galaxies and the expansion of the Universe. They discuss the difficulties of space travel and the creation of the Universe and examine the Big Bang model.

Fossil Fuels, Road Transport and Safety

Students investigate the use of fossil fuels and the importance of energy efficiency. They explore factors relating to stopping distances and aspects of road safety.

Content	Learning Outcomes
Fossil Fuels, Road Transport and Safety **Fossil Fuels**	In the context of how science works, students should be able to: 6.1 explain that fossil fuels are the remains of dead plant and animal matter buried in the Earth for millions of years and that the major world energy resources are oil, gas and coal; 6.2 explain that global sources of all fossil fuels are finite and appreciate why energy resources should be used efficiently;
Reducing Reliance on Fossil Fuels	6.3 examine data on the use of fossil fuels and discuss and evaluate the attempts being made to minimise reliance on fossil fuels ***by using substitutes (such as biodiesel from oil-bearing seeds and hydrogen) and extenders (such as alcohol);*** 6.4 ***explore strategies that car manufacturers are currently developing to reduce reliance on fossil fuels (such as the use of regenerative, hybrid systems and fuel cells based on methanol);***
Efficiency	6.5 use the equation below to calculate the efficiency of a device: $\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$
Conservation of Energy	6.6 explain that energy cannot be created or destroyed; it can only be transformed from one form to another.

Content	Learning Outcomes
Conservation of Energy (cont.)	In the context of how science works, students should be able to:
	6.7 explain that both wasted energy and the energy that is usefully transferred/transformed are eventually transferred to their surroundings, which become warmer;
Thinking, Braking and Stopping Distances	6.8 apply the terms thinking distance, braking distance and stopping distance in relation to the drivers of road vehicles;
	6.9 explain the meaning of reaction time and describe a simple experiment to measure it;
	6.10 investigate how thinking distance changes with speed and appreciate that it may increase when the driver has taken alcohol, prescribed medicines or illegal drugs;
	6.11 describe how braking distance increases with speed and investigate factors that affect braking distance, for example the state of a road's surface, the weather and the condition of the tyres and brakes;
Friction	6.12 explain that friction is the name given to the force which opposes motion and understand the role it plays when a vehicle brakes;
	6.13 examine factors that can affect frictional force on a moving object;
Safety in Cars	6.14 evaluate how the use of seatbelts, airbags, crumple zones and a rigid passenger cell reduce the risk of serious injury to people;
Road Safety	6.15 assess how speed restrictions, speed bumps and traffic cameras contribute to road safety;
Speed Calculations	6.16 use the equation below to calculate average speed: $$\text{average speed} = \frac{\text{total distance travelled}}{\text{time taken}}$$
	6.17 examine motion on a trolley using dataloggers;
	6.18 produce and interpret straight line graphs of distance against time; and
	6.19 ***discuss the difference between instantaneous speed and average speed.***

Content	Learning Outcomes
Momentum	In the context of how science works, students should be able to:
	6.20 ***explain that any moving object has momentum and that in a collision there is a momentum transfer that causes a force;***
	6.21 ***use the following equation:*** ***momentum = mass × velocity***
	6.22 ***explore how vehicles are designed to absorb energy in collisions to reduce injury to passengers;***
Balanced Forces	6.23 ***explain that when forces on an object are balanced, the object will move at a steady speed in a straight line or remain at rest; and***
Resultant Force	6.24 ***explain the meaning of resultant force and appreciate that a resultant force will cause an acceleration.***

Radioactivity

Students investigate the nature, properties, effects and uses of alpha, beta and gamma radiation.

Content	Learning Outcomes
Radioactivity	In the context of how science works, students should be able to:
	6.25 recognise that some combinations of neutrons and protons are unstable and disintegrate, and that such nuclei are described as radioactive;
Alpha, Beta and Gamma Radiation	6.26 explain that radioactive nuclei emit alpha, beta and gamma radiation;
	6.27 analyse the properties of alpha, beta and gamma radiation and how they can be stopped;
Background Radioactivity	6.28 evaluate background radioactivity and its sources; and
Half-Life	6.29 explain the meaning of the term half-life, carry out simple calculations involving half-life, and link the concepts of half-life and background activity to the time taken for a radioactive source to become safe.

Content	Learning Outcomes
Ionising Radiation	In the context of how science works, students should be able to: 6.30 explain radioactivity as the emission of ionising radiation and that this can damage or kill living cells or cause them to become cancerous; and 6.31 give uses and reasons why ionising radiation can be used to treat cancer, sterilise surgical instruments and extend the shelf-life of perishable food.

Earth in Space

Students investigate the Solar System, star formation and the Big Bang theory.

Content	Learning Outcomes
Earth in Space **The Solar System**	In the context of how science works, students should be able to: 6.32 explain the meaning of heliocentric and geocentric models of our Solar System, and explore the evidence and reasons that led to the heliocentric model superceding the geocentric; 6.33 discuss the structure of our Solar System;
Gravitational Force	6.34 investigate how gravitational force varies on different planets and how this can affect weight;
Asteroid Strikes	6.35 deduce that there is the possibility of the Earth being struck by an asteroid, that such events have taken place in the past and that evidence for this exists;
Stars	6.36 explain: – that stars are formed from clouds of hydrogen gas; – the processes that bring about star formation; and – that nuclear fusion is the energy source of a star; and
Galaxies	6.37 explain that galaxies are huge collections of stars and that: – our galaxy is called the Milky Way; – the distances between the stars and the galaxies are enormous; – a light year is the distance that light travels in a year; and – the galaxies are moving away from each other.
Huge Distances	In the context of how science works, students should be able to:

Content	Learning Outcomes
in Space **Expanding Universe**	6.38 discuss the difficulties of space travel between the stars; 6.39 ***explain that the further away the galaxies are, the faster they are moving apart, and that space is expanding;*** 6.40 ***explain that there is a red-shift in light observed from most distant galaxies and that the further away galaxies are, the bigger the red-shift; and*** 6.41 ***evaluate data that suggests that the expanding Universe began with a Big Bang some 14 billion years ago, and be aware that other theories may exist or co-exist (for example the Steady State theory).***

3.7 Unit 4: Practical Skills

This controlled assessment unit makes up 25 percent of the qualification. The acquisition and development of the skills needed for controlled assessment should form part of normal classroom teaching and learning. They should be an integral part of teachers' schemes of work.

We set three controlled assessment tasks for each cohort of students. We renew these each year. **Students may attempt one or more of the tasks.** If they attempt more than one task, they will achieve the highest of their marks as their overall mark for the unit.

Teachers may assess students' performance in the controlled assessment task at any time during the course. At the centre's discretion, assessment may occur as part of normal class routine or in a set time block. It is not necessary to assess all students at the same time, even if they are carrying out the same controlled assessment task.

Although teachers can give students feedback on the results of assessments, they should inform the students that their marks may change as a result of moderation.

Each controlled assessment task has three parts:

- Part A – Planning and Risk Assessment
- Part B – Data Collection
- Part C – Processing, Analysis and Evaluation.

Part A – Planning and Risk Assessment

In Part A of the controlled assessment task, students develop a hypothesis and plan an experimental method to investigate that hypothesis. They draw a blank results table to record and process their evidence, and they carry out a risk assessment. Students should complete this part of the task in **Candidate Response Booklet A**.

Students carry out Part A under a **medium (informal)** level of control, and teachers assess it using generic marking criteria that we provide (see Section 6). The maximum mark is 18.

Before beginning this part of the controlled assessment task, teachers must refer to the controlled assessment task and our teacher guidance notes.

Content	Learning Outcomes
Planning and Risk Assessment	Students should be able to: • develop a hypothesis that they are going to investigate; • plan a practical experiment to test the hypothesis, including a risk assessment; and • draw a blank results table for recording and processing their data or observations.

Part B – Data Collection

In Part B, students are required to collect data safely while managing any risks they identified in Part A. They record the data in the blank results table they drew in Candidate Response Booklet A.

Because the acquisition and development of the skills that students need for this stage should form part of normal classroom teaching and learning, students taking the controlled assessment task should have had ample opportunity to practise the safe use of scientific techniques for collecting data.

Students carry out this part of the task under a **low (limited)** level of control; there is no assessment.

Content	Learning Outcomes
Data Collection	Students should be able to: • carry out the experimental part of an investigation safely; and • collect sufficient data to complete a blank results table.

Part C – Processing, Analysis and Evaluation

In Part C, students must answer a number of compulsory questions that relate directly to their own work and to secondary data supplied.

The questions appear in **Candidate Response Booklet B**, and students must complete all their answers in this booklet. Extra lined paper and graph paper can be made available on request.

There is a **high (formal)** level of control for this stage of the controlled assessment task: it is assessed. The maximum mark is 27.

Content	Learning Outcomes
Processing, Analysis and Evaluation	Students should be able to: • answer a number of compulsory questions relating directly to their own work and to secondary data supplied; • demonstrate their scientific knowledge and understanding; and • process, analyse and evaluate the work they have completed, the data they recorded in Candidate Response Booklet A, and secondary data supplied.

3.8 Mathematical Content

Students need to be familiar with and competent in, the following areas of mathematics in order to develop their skills, knowledge and understanding in science (Single Award).

Students should be able to:

- understand number, size and scale and the quantitative relationship between units;
- understand when and how to use estimation;
- carry out calculations involving +, - , ×, ÷, either singly or in combination, decimals, fractions, percentages and positive whole number powers;
- provide answers to calculations to an appropriate number of significant figures;
- understand and use the symbols =, <, >, ~ ;
- understand and use direct proportion and simple ratios;
- calculate arithmetic means;
- understand and use common measures and simple compound measures such as speed;
- plot and draw graphs (line graphs, bar charts, pie charts, scatter graphs, histograms) selecting appropriate scales for the axes;
- substitute numerical values into simple formulae and equations using appropriate units;
- translate information between graphical and numeric form;
- extract and interpret information from charts, graphs and tables;
- understand the idea of probability; and
- calculate area, perimeters and volumes of simple shapes.

In addition, **Higher Tier** students should be able to:

- ***interpret, order and calculate with numbers written in standard form;***
- ***carry out calculations involving negative powers (only -1 for rate);***
- ***change the subject of an equation;***
- ***understand and use inverse proportion; and***
- ***understand and use percentiles and deciles.***

Students can use calculators in all assessments.

Students are expected to know and use the appropriate units for all the quantities specified. However, they will not necessarily gain credit for the appropriate use of units in assessment questions.

4 Scheme of Assessment

4.1 Assessment opportunities

The availability of examinations and controlled assessment appears in Section 2 of this specification.

Candidates studying unitised GCSE qualifications must complete at least 40 percent of the overall assessment requirements as terminal assessment.

Candidates may resit each individual assessment unit once. If candidates resit a unit, they are free to count the better of the two marks they achieve **unless** the resit makes up part of their 40 percent terminal assessment. If the resit **does** make up part of the terminal assessment, the resit mark will count towards the final grade, even if there is a better score for an earlier attempt.

Please note that for this specification, Unit 4 (controlled assessment) counts towards the 40 percent terminal requirement.

Results for individual assessment units remain available to count towards a GCSE qualification until we withdraw the specification.

4.2 Assessment objectives

Below are the assessment objectives for this specification. Candidates must:

AO1	Recall, select and communicate their knowledge and understanding of science
AO2	Apply skills, knowledge and understanding of science in practical and other contexts
AO3	Analyse and evaluate evidence, make reasoned judgements and draw conclusions based on evidence.

4.3 Assessment objective weightings

The table below sets out the assessment objective weightings for each examination component and the overall GCSE qualification:

Assessment Component	Nature of Assessment	Assessment Objectives			Component Weighting
		AO1	AO2	AO3	
Unit 1	External	11–12%	8–9%	4–6%	25%
Unit 2	External	11–12%	8–9%	4–6%	25%
Unit 3	External	11–12%	8–9%	4–6%	25%
Unit 4	Internal Controlled assessment	–	12%	13%	25%
Total		33–36%	36–39%	25–31%	100%

4.4 Quality of written communication

In GCSE Single Award Science, candidates must demonstrate their quality of written communication (QWC). In particular, they must:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- select and use a form and style of writing appropriate to their purpose and to complex subject matter; and
- organise information clearly and coherently, using specialist vocabulary where appropriate.

Examiners and teachers assess the quality of candidates' written communication in their responses to questions or tasks that require extended writing.

4.5 Reporting and grading

We award GCSE qualifications on an eight grade scale A*–G, with A* being the highest. For candidates who fail to attain a grade G, we report their results as unclassified (U).

We report the results of individual assessment units on a uniform mark scale that reflects the assessment weighting of each unit. The maximum uniform marks available to candidates entered for the Higher Tier of a unit will be the maximum uniform mark available for that unit. The maximum marks available to candidates entered for the Foundation Tier of a unit will be the maximum uniform mark available for the notional grade C on that unit (the notional grade B minus one uniform mark).

We determine the grades awarded by aggregating the uniform marks obtained on individual assessment units.

The grades we award match the grade descriptions published by the regulatory authorities (see Section 5).

Unit results

For each of Unit 1, Unit 2 and Unit 3, there are 60 raw marks available at Foundation Tier and 75 at Higher Tier. For the Controlled Assessment unit, there are 45 raw marks available.

The **maximum** uniform mark for each unit is 100. The **minimum** uniform mark required for each grade is as follows:

A*	A	B	C	D	E	F	G
90	80	70	60	50	40	30	20

Candidates entering for Foundation Tier can achieve a maximum uniform mark score of 69 in these units.

Unit 4 (Controlled assessment)

The **maximum** uniform mark for Unit 4 is 100. The **minimum** uniform mark required for each grade is as follows:

A*	A	B	C	D	E	F	G
90	80	70	60	50	40	30	20

Qualification results

The **maximum** uniform mark for the final award is 400. The **minimum** uniform mark required for each final grade is as follows:

A*	A	B	C	D	E	F	G
360	320	280	240	200	160	120	80

5 Grade Descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content in the specification; they are not designed to define that content.

The grade awarded depends in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of candidates' performance in the assessment may be balanced by better performances in others.

Grade	Description
A	Candidates recall, select and communicate precise knowledge and detailed understanding of science. They demonstrate a comprehensive understanding of the nature of science, its laws, its applications and the influences of society on science and science on society. They understand the relationships between scientific advances, their ethical implications and the benefits and risks associated with them. They use scientific and technical knowledge, terminology and conventions appropriately and consistently, showing a detailed understanding of scale in terms of time, size and space. They apply appropriate skills, including communication, mathematical and technological skills, knowledge and understanding effectively in a wide range of practical and other contexts. They show a comprehensive understanding of the relationships between hypotheses, evidence, theories and explanations and make effective use of models to explain phenomena, events and processes. They use a wide range of appropriate methods, sources of information and data consistently, applying relevant skills to address scientific questions, solve problems and test hypotheses. Candidates analyse, interpret and critically evaluate a broad range of quantitative and qualitative data and information. They evaluate information systematically to develop arguments and explanations, taking account of the limitations of the available evidence. They make reasoned judgements consistently and draw detailed, evidence-based conclusions.

Grade	Description
C	Candidates recall, select and communicate secure knowledge and understanding of science. They demonstrate understanding of the nature of science, its laws, its applications and the influences of society on science and science on society. They understand how scientific advances may have ethical implications, benefits and risks. They use scientific and technical knowledge, terminology and conventions appropriately, showing understanding of scale in terms of time, size and space. They apply appropriate skills, including communication, mathematical and technological skills, knowledge and understanding in a range of practical and other contexts. They recognise, understand and use straightforward links between hypotheses, evidence, theories and explanations. They use models to explain phenomena, events and processes. Using appropriate methods, sources of information and data, they apply their skills to answer scientific questions, solve problems and test hypotheses. Candidates analyse, interpret and evaluate a range of quantitative and qualitative data and information. They understand the limitations of evidence and develop arguments with supporting explanations. They draw conclusions consistent with the available evidence.
F	Candidates recall, select and communicate their limited knowledge and understanding of science. They recognise simple inter-relationships between science and society. They have a limited understanding that advances in science may have ethical implications, benefits and risks. They use limited scientific and technical knowledge, terminology and conventions, showing some understanding of scale in terms of time, size and space. They apply skills, including limited communication, mathematical and technological skills, knowledge and understanding in practical and some other contexts. They show limited understanding of the nature of science and its applications. They can explain straightforward models of phenomena, events and processes. Using a limited range of skills and techniques, they answer scientific questions, solve straightforward problems and test ideas. Candidates interpret and evaluate some qualitative and quantitative data and information from a limited range of sources. They can draw elementary conclusions having collected limited evidence.

6 Guidance on Controlled Assessment

6.1 Controlled assessment review

We replace our controlled assessment tasks every year to ensure that they continue to set appropriate challenges and at the same time remain valid, relevant and stimulating to encourage candidates to achieve their true potential.

6.2 Skills assessed by controlled assessment

The controlled assessment tasks draw on candidates' ability to:

- develop hypotheses and plan practical ways to test them, including risk assessment;
- collect data while managing any associated risks;
- process, analyse and interpret primary and secondary data;
- draw evidence-based conclusions;
- review and evaluate methods of data collection and the quality of the resulting data; and
- review hypotheses in light of outcomes.

6.3 Levels of control

The rules for controlled assessment in GCSE Sciences are defined for the three stages of the assessment:

- Task setting;
- Task taking; and
- Task marking.

The purpose of the controls is to ensure the validity and reliability of the assessment and to enable teachers to confidently authenticate candidates' work.

6.4 Task setting

The level of control for task setting is **high**. We set three comparable tasks for each cohort of students. We renew these each year. Candidates may sit one or more of the controlled assessment tasks. However, they cannot take a specific task more than once.

We supply the controlled assessment tasks, along with teacher guidance notes, in September each year. Centres must keep these in a secure place, for example a locked metal filing cabinet. Even when candidates' work is under way, they must not be allowed to take their Candidate Response Booklets with them after class; these must be stored securely at all times.

A centre may choose to contextualise the task that we have set if, for example, the centre lacks availability and access to the resources required. However, this must not change the nature of the task; all candidates must carry out the task that we have set.

6.5 Task taking

Part A – Planning and Risk Assessment

This part of the controlled assessment task is carried out under a **medium (informal)** level of control. Teachers assess it using marking criteria that we provide.

Area of Control	Detail of Control
Authenticity	Candidates must complete their Planning and Risk Assessment under medium (informal) supervision. **They must complete all work that is to be submitted in Candidate Response Booklet A.** They must not remove work that they have completed in Candidate Response Booklet A from the classroom. If a candidate fails to complete all sections of the booklet in one sitting, the teacher should collect the work, store it in a secure place and return it to the candidate at the beginning of the next session.
Feedback	Teachers may discuss aspects of the task in general terms with the candidates. This discussion should not be too specific, as candidates must make their own planning decisions. Teachers may also discuss with candidates, in general terms, the skills required to reach maximum marks in each of the bands in the generic mark schemes for planning and risk assessment. Candidates may also carry out a trial of their proposed method using any apparatus they might need.
Time Limit	There is no time limit for the planning and risk assessment phase of the task.
Collaboration	Before documenting their planning and risk assessment activities in Candidate Response Booklet A, candidates may discuss aspects of the task as a class and/or in small groups (of up to three). Candidates can also carry out trials with any apparatus/ equipment individually or in small groups of up to three. However, when completing their work in Candidate Response Booklet A, candidates must work individually. It is the responsibility of the teacher to ensure that any assessable outcomes can be attributed to individual candidates.

Area of Control	Detail of Control
Resources	When carrying out a trial of their investigation, candidates may have access to any practical apparatus/equipment available to the centre. Teachers must guide and supervise them to ensure that they comply with the necessary health and safety requirements. Candidates may have access to their notes, textbooks and the internet during the planning and risk assessment stage of the task. As QWC is assessed in this part of the controlled assessment task, they are not allowed access to dictionaries, spell checks and grammar facilities on a computer or otherwise.

Part B – Data Collection

There is a **low (limited)** level of control for this stage of the controlled assessment task; it is not assessed.

Area of Control	Detail of Control
Authenticity	Candidates must complete this stage of the controlled assessment task under limited supervision. Teachers must supervise to ensure that candidates comply with the necessary health and safety requirements.
Feedback	Significant teacher guidance is permitted during the data collection stage: teachers can give help to candidates just as they would during any teaching and learning situation. However, they must avoid giving answers to questions that appear in the assessed Processing, Analysis and Evaluation stage of the assessment (Part C).
Time Limit	There is no time limit for the data collection part of the assessment.
Collaboration	As the work of individual candidates can be informed by working with others, candidates may carry out their data collection either individually or in small groups of up to three (ideally groups of two). It is a requirement that each individual candidate makes an active contribution to carrying out the experiment and collecting data. If one candidate in a group refuses to participate in the data collection process, that candidate should not be permitted to take the assessed Part C of the task.

Area of Control	Detail of Control
Resources	Candidates must have access to their Candidate Response Booklet A containing: • their plan and risk assessment; and • the blank results table they need to record their data. Candidates may have access to any practical apparatus/ equipment available to the centre. Teachers must supervise them to ensure that they comply with the necessary health and safety requirements.

Part C – Processing, Analysis and Evaluation

There is a **high (formal)** level of control for this stage of the controlled assessment task.

Area of Control	Detail of Control
Authenticity	This stage of the controlled assessment task must take place under formal supervision. Candidates must complete all work under the direct supervision of a teacher. All work must be completed in Candidate Response Booklet B.
Feedback	Teachers must not give any assistance during this stage.
Time Limit	The maximum time allowed for the completion of Part C is **1 hour**, and **candidates must complete it in one sitting**.
Collaboration	Candidates must work independently. They must not communicate with each other during this phase.
Resources	Candidates must have access to the work they completed in their Candidate Response Booklet A. They must not use other pre-prepared materials or have access to the internet, email or portable memory devices. They may, however, use calculators.

6.6 Task marking

The level of control for task marking is **medium**.

A candidate's final mark must be based on only one controlled assessment task. **If a candidate has attempted both of the tasks we set, their overall mark for the unit is the mark they achieved in the higher scoring task.**

Candidates must not attempt a controlled assessment task more than once.

Part A – Planning and Risk Assessment

Teachers mark the candidates' planning and risk assessment work using the generic marking criteria shown in this section.

They must view the planning and risk assessment work submitted in Candidate Response Booklet A as candidates' **final** piece of work and mark it accordingly. **Teachers must not return this work to candidates for redrafting.**

Generic Marking Criteria for Part A: Planning

Band	Descriptor	Increasing complexity of method
(0 marks)	A mark of **zero** must be awarded for work not worthy of credit.	↓
Band 1 **(1–4 marks)**	Making little or no use of appropriate specialist terms, candidates state simply what they hope to find out in the investigation. They develop a simple plan to collect and record a limited amount of appropriate evidence. They identify a key factor to vary and select suitable equipment/apparatus. They identify an area in the investigation that could reduce the reliability of the data/evidence collected. The form, style, spelling, grammar and punctuation are of a limited standard.	
Band 2 **(5–8 marks)**	Using some appropriate specialist terms, candidates develop a hypothesis, with scientific reasoning, as to the outcomes of the investigation. They develop a plan, with some degree of complexity, to collect and record a significant amount of appropriate evidence. They identify key factors to investigate and measure/observe and select suitable equipment/apparatus. They identify areas in the investigation that could affect the reliability of the data/evidence collected and explain the steps taken to ensure its reliability. The form, style, spelling, grammar and punctuation are of a satisfactory standard.	
Band 3 **(9–12 marks)**	Using appropriate specialist terms throughout, candidates develop a hypothesis, with detailed scientific reasoning, as to the outcomes of the investigation. They develop a complex plan to collect and record a wide range of appropriate evidence. They identify key factors to investigate, measure/observe and control and select suitable equipment/apparatus. They discuss in detail areas of the investigation that could affect the reliability of the data/evidence collected and the steps taken to ensure its reliability. They explain their strategies to deal with anomalous results/observations. The form, style, spelling, grammar and punctuation are of a high standard.	

Generic Marking Criteria for Part A: Risk Assessment

Band	Descriptor
(0 marks)	A mark of **zero** must be awarded for work not worthy of credit.
Band 1 **(1–2 marks)**	Candidates state a safety hazard specific to the investigation and state briefly the hazardous outcomes that may result.
Band 2 **(3–4 marks)**	Candidates identify some of the safety hazards specific to the chosen investigation and explain the hazardous outcomes. They state the steps needed to minimise these risks.
Band 3 **(5–6 marks)**	Candidates identify all the safety hazards specific to the chosen investigation and explain in detail both the hazardous outcomes and the steps needed to minimise risk.

It is up to the **professional judgement** of the teacher to decide which mark descriptors best apply and hence what mark to award for a particular skill.

Teachers should award zero marks only in the unlikely event of a candidate's work not being worthy of any credit.

Teachers should lightly annotate candidates' work to assist moderation. The annotation should be brief but must highlight any aspects of the work that meet the key requirements of a particular mark band.

After marking the candidates' planning and risk assessment work, the teacher has three options to allow the candidate to move forward in the investigation:

Scenario	Action by Teacher
1 **The candidate's plan and risk assessment are deemed to be appropriate.**	Instruct the candidate to use their proposed plan and risk assessment to collect the required data/evidence.
2 **The candidate's plan and risk assessment are, with some minor amendment suggested by the teacher, deemed to be appropriate.**	Amend the candidate's plan and risk assessment, and return it to the candidate. Relay any amendments to them both verbally and in writing. Then instruct the candidate to collect the required data/evidence using the amended plan and risk assessment.
3 **The candidate's plan and risk assessment are deemed to be unsuitable and inappropriate.**	Give an alternative plan and risk assessment to the candidate, and instruct them to collect the required data/evidence using this teacher's plan.

Teachers must ensure that the work they are marking is the candidate's own. They must sign a declaration on their Candidate Response Booklet A certifying that all of the work the candidate has submitted for assessment is their own and has been done in accordance with our controlled assessment regulations. Candidates must also sign the front of their Candidate Response Booklet A.

Part C – Processing, Analysis and Evaluation

Teachers mark candidates' work in Part C, adhering closely to the marking guidelines that we supply. They should use red ink to place marks in the right-hand margin of each Candidate Response Booklet B, then transfer the total for each question to the front cover.

Teacher judgement is sometimes necessary to determine if a candidate deserves a mark. If at a particular point it is not clear why they have awarded a mark, they should add a brief note to explain. This will show the external moderator why the teacher felt the candidate had earned the mark.

Teachers must ensure that the work they are marking is the candidate's own. They must sign a declaration on the Candidate Response Booklet B certifying that all of the work the candidate has submitted for assessment is their own and has been done in accordance with our controlled assessment regulations. Candidates must also sign the front of the Candidate Response Booklet B.

For up-to-date advice on plagiarism or any other incident in which candidate malpractice is suspected, please refer to the Joint Council for Qualifications' *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* on the JCQ website at www.jcq.org.uk

Recording assessment

Centres should complete the Candidate Record Sheet (CRS) for each candidate, including:

- the title of the controlled assessment task;
- a short description of the method used; and
- the overall mark for the highest scoring controlled assessment task for that candidate.

The teacher and candidate declaration on each form must be signed.

Agreement trials and support

We conduct agreement trials each year, where we brief teachers on how to apply the marking guidelines and they engage in trial marking.

We also issue supplementary training materials to all centres in the form of advice on assessment and exemplar materials.

6.7 Internal standardisation

Centres in which **two or more** teachers are involved in the marking process must conduct internal standardisation to ensure they apply the marking guidelines consistently. They should select the work of several candidates across teaching groups. Teachers should mark each candidate's work independently, then use the marking guidelines provided to reach agreement on the marks to award. Centres must complete the appropriate documentation (TAC2 form) to confirm that internal standardisation has taken place. The Head of Department must sign the TAC2 form.

6.8 Moderation

Centres must submit their marks and samples to us by May in any year. We may adjust centres' marking. This is to bring the assessment of the candidates' work into line with our agreed standards.

We issue full instructions well in advance of submission on:

- the details of moderation procedures;
- the nature of sampling; and
- the dates by which centres have to submit marks and samples to us.

For each candidate we randomly select for moderation, centres must submit the following documentation:

- the candidate's completed Candidate Response Booklets, A and B (both booklets must be dated and signed by both the teacher and the candidate); and
- the CCEA Candidate Record Sheet (attached to the candidate's work).

We issue blank copies of all of the above documents, along with the controlled assessment tasks and guidance notes for teachers, in September each year.

Teachers and centre staff may contact us at any stage if they require advice, assistance or support regarding any aspect of controlled assessment.

7 Links

7.1 Support

We provide the following resources to support this specification:

- our website;
- a subject microsite within our website;
- specimen papers and mark schemes; and
- a specimen controlled assessment task.

Some support material from the previous specification may also remain useful.

We intend to expand our range of support to include the following:

- past papers;
- mark schemes;
- Chief Examiner's reports;
- Principal Moderator's reports;
- schemes of work;
- Topic Tracker*;
- controlled assessment guidance for teachers;
- student guides;
- centre support visits;
- support days for teachers;
- agreement trials; and
- exemplification of examination performance.

* Topic Tracker allows teachers to produce their own test papers using past paper examination questions, and a mark scheme is generated to match.

You can find our annual support programme of events and materials for Single Award Science on our website at www.ccea.org.uk

7.2 Curriculum objectives

This specification addresses and builds upon the broad curriculum objectives for Northern Ireland and Wales. In particular it enables students to:

- develop as individuals and contributors to society, the economy and the environment through the study of:
  - diet and health;
  - our impact on the environment including sustainable development;
  - chemistry in everyday life;
  - electricity, waves and communication;
  - road safety; and
  - our position in the wider universe;
- further develop the following Cross-Curricular Skills:
  - Communication;
  - Using Mathematics; and
  - Using ICT;

- enhance their Thinking Skills and Personal Capabilities, to include:
  - managing information, self-management, problem-solving and decision-making through the study of subject content; and
  - being creative and working with others through practical opportunities;
- further develop the knowledge, understanding and skills of the Key Stage 3 science curriculum;
- develop an awareness of the role of science in society, its potential and limitations and develop STEM-related skills;
- be able to critically evaluate scientific information, be aware of some current ethical considerations, and make informed decisions that affect health and well-being of self and the environment; and
- increase their scientific literacy in general.

7.3 Key Skills

All four units in this specification provide opportunities for students to develop and generate evidence for assessing the following nationally recognised Key Skills:

- Application of Number
- Communication
- Improving Own Learning and Performance
- Information and Communication Technology
- Problem-Solving
- Working with Others.

You can find details of the current standards and guidance for each of these skills on the CCEA website at www.ccea.org.uk

7.4 Examination entries

Entry codes for this subject and details on how to make entries are available on our Qualifications Administration Handbook microsite, which you can access at www.ccea.org.uk

Alternatively, you can telephone our Examination Entries, Results and Certification team using the contact details provided in this section.

7.5 Equality and inclusion

We have considered the requirements of equalities legislation in developing this specification.

GCSE qualifications often require the assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare students for a wide range of occupations and higher level courses.

The revised GCSE and qualification criteria were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any students with disabilities. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability and equality groups and with people with disabilities.

During the development process, we carried out an equality impact assessment. This was to ensure that we identified any additional potential barriers to equality and inclusion. Where appropriate, we have given consideration to measures to support access and mitigate against barriers.

Reasonable adjustments are made for students with disabilities in order to reduce barriers to accessing assessments. For this reason, very few students will have a complete barrier to any part of the assessment. Students with physical impairment may instruct a practical assistant to set up equipment but may have difficulty in making observations and in manipulating the equipment to carry out the experiment.

Students with a visual impairment may find elements of the assessment difficult, but technology may help visually impaired students to take readings and make observations. Therefore the assessments should not pose a difficulty for these learners.

It is important to note that where access arrangements are permitted, they must not be used in any way that undermines the integrity of the assessment. You can find information on reasonable adjustments in the Joint Council for Qualifications' document *Access Arrangements and Special Consideration: Regulations and Guidance Relating to Candidates Who Are Eligible for Adjustments in Examinations.*

7.6 Contact details

The following list provides contact details for relevant staff members and departments:

- Specification Support Officer: Nuala Braniff
  (telephone: (028) 9026 1200, extension 2292, email: nbraniff@ccea.org.uk)

- Officer with Subject Responsibility: Patricia Quinn
  (telephone: (028) 9026 1200, email: pquinn@ccea.org.uk)

- Examination Entries, Results and Certification
  (telephone: (028) 9026 1262, email: entriesandresults@ccea.org.uk)

- Examiner Recruitment
  (telephone: (028) 9026 1243, email: appointments@ccea.org.uk)

- Distribution (past papers and support materials)
  (telephone: (028) 9026 1242, email: cceadistribution@ccea.org.uk)

- Support Events Administration
  (telephone: (028) 9026 1401, email: events@ccea.org.uk)

- Information Section (including Freedom of Information requests)
  (telephone: (028) 9026 1200, email: info@ccea.org.uk)

- Business Assurance (appeals)
  (telephone: (028) 9026 1244, email: appealsmanager@ccea.org.uk).

Appendix 1

Glossary of Terms for Controlled Assessment Regulations

Term	Definition
Component	A discrete, assessable element within a controlled assessment/qualification that is not itself formally reported and for which the awarding body records the marks May contain one or more tasks
Controlled assessment	A form of internal assessment where the control levels are set for each stage of the assessment process: task setting, task taking, and task marking
External assessment	A form of independent assessment in which question papers, assignments and tasks are set by the awarding body, taken under specified conditions (including detailed supervision and duration) and marked by the awarding body
Formal supervision (High level of control)	The candidate must be in direct sight of the supervisor at all times. Use of resources and interaction with other candidates is tightly prescribed.
Informal supervision (Medium level of control)	Questions/tasks are outlined, the use of resources is not tightly prescribed and assessable outcomes may be informed by group work. Supervision is confined to: • ensuring that the contributions of individual candidates are recorded accurately; and • ensuring that plagiarism does not take place. The supervisor may provide limited guidance to candidates.
Limited supervision (Low level of control)	Requirements are clearly specified, but some work may be completed without direct supervision and will not contribute directly to assessable outcomes.

Term	Definition
Mark scheme	A scheme detailing how credit is to be awarded in relation to a particular unit, component or task Normally characterises acceptable answers or levels of response to questions/tasks or parts of questions/tasks and identifies the amount of credit each attracts May also include information about unacceptable answers
Task	A discrete element of external or controlled assessment that may include examinations, assignments, practical activities and projects
Task marking	Specifies the way in which credit is awarded for candidates' outcomes Involves the use of mark schemes and/or marking criteria produced by the awarding body
Task setting	The specification of the assessment requirements Tasks may be set by awarding bodies and/or teachers, as defined by subject-specific regulations. Teacher-set tasks must be developed in line with awarding body specified requirements.
Task taking	The conditions for candidate support and supervision, and the authentication of candidates' work Task taking may involve different parameters from those used in traditional written examinations. For example, candidates may be allowed supervised access to sources such as the internet.
Unit	The smallest part of a qualification that is formally reported and can be separately certificated May comprise separately assessed components

Revision History Number	Date of Change	Page Number	Change Made
Version 2	30 August 2011	51	Deletion and addition of words in descriptor section.
Version 3	01 June 2012	18	Deletion of paragraph 3.2 from table and addition of new paragraph 3.2.
Version 4	04 July 2012	Inner Foreword Throughout document	New QAN added for courses starting September 2012 Statement added in relation to entries from English centres Removal of references to England