

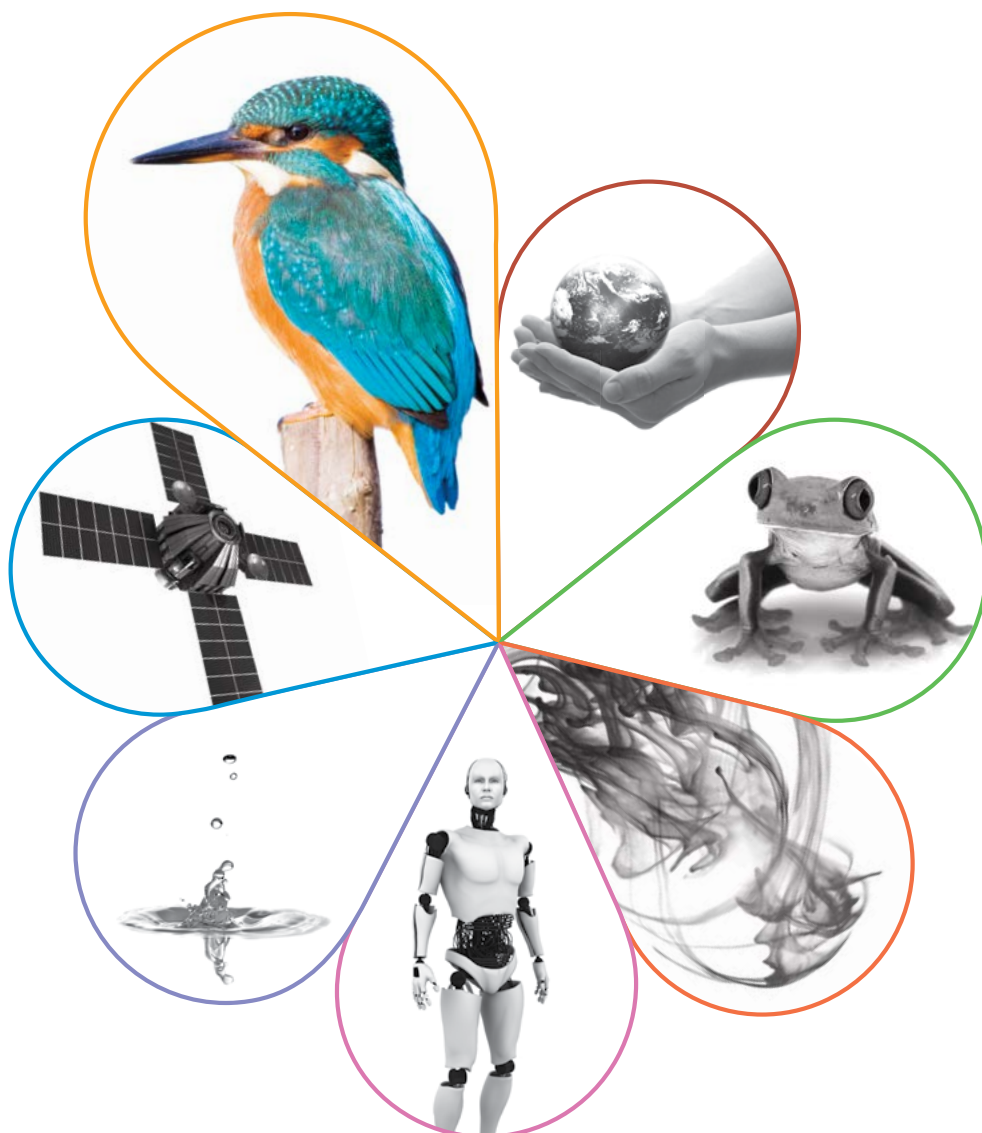
ENTRY LEVEL CERTIFICATE SCIENCE

(5960)

Specification

For teaching from September 2016 onwards
For ELC certification in 2017 onwards

Version 1.2 8 December 2016



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Are you using the latest version of this specification?

- You will always find the most up-to-date version of this specification on our website at [aqa.org.uk/5960](https://www.aqa.org.uk/5960)
- We will write to you if there are significant changes to this specification.

1 Introduction

1.1 Why choose AQA for ELC Science

We design qualifications to enable students to engage, explore, enjoy and succeed in science. By putting students at the heart of everything we do, our aim is to help teachers shape success in science for every student.

Entry Level Certificates (ELCs) are nationally recognised qualifications which give students the opportunity to achieve a certificated award. The ELC Science specification is co-teachable with our GCSE Combined Sciences to suit students who are studying both qualifications. The assessment is on demand so your students can complete assignments when they are ready, helping to keep them motivated. Like all of our science qualifications, we use straightforward language in our tests to allow students to focus on the science and achieve the results they deserve.

Progression

As an approved Entry Level qualification, the ELC Science specification provides excellent progression to GCSE studies particularly in GCSE Combined Science: Trilogy and GCSE Combined Science: Synergy.

The ELC provides flexibility, but on a clear progression pathway. It equips students with skills and knowledge transferable to both educational and career settings, and provides a worthwhile course for students of various ages and from diverse backgrounds in terms of general education and lifelong learning.

You can find out about all our science qualifications at [aqa.org.uk/science](https://www.aqa.org.uk/science)

1.2 Support and resources to help you teach

We've worked with experienced teachers to provide you with a range of resources that will help you confidently plan, teach and prepare for exams.

Teaching resources

Visit [aqa.org.uk/5960](https://www.aqa.org.uk/5960) to see all our teaching resources. They include:

- teachers guide to provide additional information and support for non-science specialists
- worksheets to cover all components in this specification to use for classwork assessment or as teaching resources
- support from coursework advisers
- training courses to help you deliver AQA science qualifications, including teacher online standardisation
- subject expertise courses for all teachers, from newly qualified teachers who are just getting started to experienced teachers looking for fresh inspiration.

Keep your skills up-to-date with professional development

Wherever you are in your career, there's always something new to learn. As well as subject specific training, we offer a range of courses to help boost your skills.

- Improve your teaching skills in areas including differentiation, teaching literacy and meeting Ofsted requirements.
- Prepare for a new role with our leadership and management courses.

You can attend a course at venues around the country, in your school or online – whatever suits your needs and availability. Find out more at coursesandevents.aqa.org.uk

Get help and support

Visit our website for information, guidance, support and resources at [aqa.org.uk/5960](https://www.aqa.org.uk/5960)

If you'd like us to share news and information about this qualification, sign up for emails and updates at [aqa.org.uk/keepinformedscience](https://www.aqa.org.uk/keepinformedscience)

Alternatively, you can call or email our subject team direct.

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2 Specification at a glance

This qualification is linear. Linear means that students submit all components that form the assessment at the end of the course.

Two Entry Level Certificate Science qualifications are available.

- Entry Level Certificate (Single Award)
- Entry Level Certificate (Double Award)

Students will be entered for either ELC Science – Single Award or ELC Science – Double Award using the appropriate entry code. Students will submit a *Portfolio of work* containing the appropriate number of externally set assignments (ESAs) and teacher devised assignments (TDAs).

There are three levels of award available: Entry 1, Entry 2 and Entry 3. Entry 3 is the most demanding.

2.1 Subject content

The specification comprises six components. Each component has two assessments: one externally set and one internally set.

Biology

1. [Component 1 – Biology: The human body](#)
2. [Component 2 – Biology: Environment, evolution and inheritance](#)

Chemistry

3. [Component 3 – Chemistry: Elements, mixtures and compounds](#)
4. [Component 4 – Chemistry: Chemistry in our world](#)

Physics

5. [Component 5 – Physics: Energy, forces and the structure of matter](#)
6. [Component 6 – Physics: Electricity, magnetism and waves](#)

2.2 Assessments

There are two different types of assessment.

1. Externally set assignments (ESAs) consist of a short written test.
2. Teacher devised assignments (TDAs) consist of a short piece of practical work.

2.2.1 Single award

The six components meet the Programme of study Key Stage 4 requirements, but students need only submit evidence for **three** teacher devised assignments plus **three** externally set assignments. These do not need to be from the same components.

Externally set assignments (ESA)	+ Teacher devised assignments (TDA)
<p>What's assessed</p> <p>Students should submit evidence from at least three of the six components. At least one each from biology, chemistry and physics.</p>	<p>What's assessed</p> <p>Students must submit evidence for three components. They are not required to be the same components as the ESAs. These are assessments of practical tasks set by the teacher and marked against the marking criteria provided in the Scheme of assessment.</p>
<p>How it's assessed</p> <ul style="list-style-type: none"> • Externally set assignment: 45 minutes • Each test is worth 20 marks • Weighting 57% 	<p>How it's assessed</p> <ul style="list-style-type: none"> • Teacher devised assignments • Each piece of coursework is worth 15 marks • Weighting 43%
<p>These assignments are set by AQA and marked by the teacher using a mark scheme provided by AQA. ESAs and mark schemes are accessible via e-AQA.</p>	

2.2.2 Double award

Students studying all six components meet the Programme of study Key Stage 4 requirements. Students certificating in Entry Level Certificate Science – Double Award must submit evidence for **six** teacher devised assignments plus **six** externally set assignments.

Externally set assignments (ESA)	+ Teacher devised assignments (TDA)
<p>What's assessed</p> <p>Students should submit evidence from all six components.</p>	<p>What's assessed</p> <p>Students must submit evidence for all six components. These are assessments of practical tasks set by the teacher and marked against the marking criteria provided in the Scheme of assessment.</p>
<p>How it's assessed</p> <ul style="list-style-type: none"> • Externally set assignment: 45 minutes • Each test is worth 20 marks • Weighting 57% 	<p>How it's assessed</p> <ul style="list-style-type: none"> • Teacher devised assignment • Each piece of practical work is worth 15 marks • Weighting 43%
<p>These assignments are set by AQA and marked by the teacher using a mark scheme provided by AQA. ESAs and mark schemes are accessible via e-AQA.</p>	

3 Subject content

We recognise that a GCSE in science is too demanding for some students. ELC Science gives students who are unlikely to achieve a grade in GCSE science the opportunity to achieve a certificated award. It also prepares students for GCSE and can be used to monitor their progress.

The specification has been developed to meet the requirements of the Programme of study for Key Stage 4 Science. It can be used in conjunction with GCSE Combined Science specifications, and we have included specification references to facilitate co-teaching of the two different levels.

The component based structure of the ELC provides students with the opportunity to work in short programmes. This gives the student a sense of achievement throughout the course and enables their progress to be monitored. It also enables teachers gauge whether entry for both ELC Science and GCSE Combined Science is a reasonable expectation.

3.1 Component 1 – Biology: The human body

The human body is composed of structures called organs, which are organised into organ systems that carry out all of the key processes of life. These systems all require energy, which is contained in food and released in the cell by respiration. The organ systems are responsible for delivering food and oxygen to the cells and taking away waste.

All these key processes, including reproduction, are coordinated by the nervous system and a hormone system.

A healthy body can be maintained by a balanced diet, exercise and a healthy lifestyle. Health can be damaged by microbes, which can cause infectious diseases. The body can defend itself against most diseases but will sometimes need drugs in order to alleviate the symptoms and speed recovery.

3.1.1 What is the body made of?

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
Cells are the basic building blocks of all living organisms.		4.2.1.1	4.1.3.2

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
<p>Most human cells are like most other animal cells and have the following parts:</p> <ol style="list-style-type: none"> 1. nucleus – controls the activities of the cells and contains the genetic material 2. cytoplasm – where most chemical reactions take place 3. cell membrane – controls the passage of substances in and out of cells. <p>Cells may be specialised to carry out a particular function, eg sperm cells, nerve cells and muscle cells.</p> <p>Students should be able, when provided with appropriate information, to explain how the structure of different types of cell relates to their function.</p>	<p>Details of sub-cellular structures are not needed.</p>	4.1.1.2	4.1.3.2
Outcome 2			
<p>A tissue is a group of cells with a similar structure and function.</p> <p>Students should develop some understanding of size and scale in relation to cells, tissues, organs and systems.</p>		4.2.1.1	4.2.1.2
<p>Organs are aggregations of tissues performing similar functions.</p> <p>Organs are organised into organ systems which work together.</p> <p>Students should be able to identify the position of the major organs in the human body such as the brain, heart, liver, lungs, kidneys and reproductive organs.</p> <p>Students should be able to identify the function of the main organ systems.</p>	<p>Diagram in support booklet (human hair to cell).</p>	4.2.2.1	4.2.1.2
<p>The human circulatory system consists of the heart, which pumps blood around the body (in a dual circulatory system) and blood, which transports oxygen, proteins and other chemical substances around the body.</p> <p>Students should be able to recognise the different types of blood cell from a photograph or diagram.</p>			4.2.1.3

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 3			
<p>The human digestive system contains a variety of organs:</p> <ul style="list-style-type: none"> • salivary glands • stomach • liver • gall bladder • pancreas • small intestine • large intestine. <p>Students should be able to identify the position of these organs on a diagram of the digestive system.</p> <p>Enzymes are used to convert food into soluble substances that can be absorbed into the bloodstream.</p>	<p>Details of specific enzyme reactions are not required.</p>	4.2.2.1	4.2.1.5

3.1.2 How the body works

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 4			
<p>Respiration releases the energy needed for living processes and is represented by the equation:</p> <p>glucose + oxygen → carbon dioxide + water (+ energy)</p> <p>Students should know the word equation for respiration.</p> <p>Students should know that glucose is derived from the diet and that carbon dioxide and oxygen gases are exchanged through the lungs.</p>	<p>Details of aerobic/ anaerobic respiration are not needed.</p>	4.4.2.1	4.2.1.1

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
<p>Lifestyle can have an effect on people's health eg diet and exercise are linked to obesity; smoking to cancer; alcohol to liver and brain function.</p> <p>A healthy diet contains the right balance of the different foods you need and the right amount of energy.</p>	<p>Suggested activity for TDA Compare the energy released by burning a 'low fat' crisp (or rice cake) with a normal one.</p> <p>No knowledge of deficiency diseases is required.</p> <p>Knowledge of the effects of an unbalanced diet is limited to a person being underweight or overweight and includes the link with Type 2 diabetes.</p>	4.2.2.8	4.3.1.2
<p>People who exercise regularly are usually fitter than people who take little exercise.</p>	<p>The concept of fitness is limited to the rate at which the pulse rate returns to normal for a person after exercise.</p> <p>Suggested activity for TDA Investigate the effect of exercise on pulse rate.</p> <p>Suggested activity for TDA Investigate the effect of caffeine drinks on pulse rate.</p>		

3.1.3 How the body fights disease

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 5			
Infectious (communicable) diseases are caused by microorganisms called pathogens.	Types of pathogen limited to bacteria and viruses.	4.3.1.1	4.3.3.1
These may reproduce rapidly inside the body and may produce poisons (toxins) that make us feel ill.	No recall of specific illnesses is required.		
Viruses damage cells in which they reproduce.			
Outcome 6			
White blood cells help to defend against bacteria by ingesting them.		4.3.1.6	4.2.1.4
Vaccination involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies so that if the same pathogen re-enters the body, antibodies can be produced rapidly.		4.3.1.7	4.3.3.5
Students should be able to explain the use of vaccination in the prevention of disease.			
Outcome 7			
Medical drugs are developed and tested before being used to relieve illness or disease. Drugs change the chemical processes in people's bodies. People may become dependent or addicted to the drugs and suffer withdrawal symptoms without them.		4.3.1.9	4.3.3.7
Antibiotics, including penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body, but cannot be used to kill viruses.	The names of any antibiotics other than penicillin are not required. Suggested activity for TDA Use pre-inoculated agar in Petri dishes to evaluate the effect of disinfectants and antibiotics.	4.3.1.8	4.3.3.6

3.1.4 How the body is coordinated

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 8			
The human body has automatic control systems, which may involve nervous responses or chemical responses coordinated by hormones.		4.5.2.1	4.3.1.4
Reflex actions are automatic and rapid. Examples include the response of the pupil in the eyes to bright light, and the knee jerk reaction.	Knowledge of the reflex arc is not required. Suggested activity for TDA Compare the speed of the catching reflex of two people.		
Outcome 9			
Hormones are secreted by glands and are transported to their target organs by the bloodstream.	Knowledge of the names of specific hormones is not required.	4.5.3.4	4.2.1.7
Several hormones are involved in the menstrual cycle of a woman, including some that are involved in promoting the release of an egg. Students should be familiar with a diagram of the menstrual cycle.		4.5.3.4	4.3.1.6
Outcome 10			
The uses of hormones in controlling fertility include: <ul style="list-style-type: none"> giving oral contraceptives that contain hormones to inhibit eggs from maturing giving 'fertility drugs' to stimulate eggs to mature. 	The names of the hormones involved and the mechanism by which they work are not required.	4.4.3.2	4.3.1.8
Students should be able to evaluate the benefits of, and the problems that may arise from, the use of hormones to control fertility.		4.4.3.3	4.3.1.8

3.2 Component 2 – Biology: Environment, evolution and inheritance

Life on earth is dependent on photosynthesis to fix carbon dioxide and produce the organic molecules used as the fuels for respiration and life processes.

Living organisms interact with one another and their environment in many different ways. Human behaviours may have beneficial or detrimental effects on natural populations and the environment. The chemicals in the environment are continually cycling through the natural world.

Life on earth has evolved over time by natural selection, which accounts for biodiversity and how organisms are related. The characteristics of living things depend on both their environment and their genome.

Humans can now use genetic engineering to modify organisms.

3.2.1 What are the feeding relationships between living organisms?

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
Radiation from the Sun is the source of energy for living organisms.		4.4.1.1	4.4.1.3
Green plants and algae absorb a small amount of the light that reaches them and make glucose by photosynthesis. These organisms are called producers. Carbon dioxide + water → glucose + oxygen Students should know the word equation for photosynthesis.	Suggested activity for TDA Investigate the rate of photosynthesis in pond weed.	4.4.1.1	4.4.1.1

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 2			
Animals and plants may be adapted for survival in the conditions where they normally live.	Students should be able to explain how organisms are adapted to live in their natural environment given appropriate information in image or prose format. Examples may include polar bears in the Arctic, or cacti in deserts. Suggested activity for TDA Investigate the use of choice chambers, eg with woodlice or maggots.	4.7.1.4	
Outcome 3			
Feeding relationships within a community can be represented by a food chain. All food chains begin with a producer. A food web can be used to understand the interdependence of species within an ecosystem in terms of food resources.		4.7.2.1	4.4.2.1
Outcome 4			
All materials in the living world are recycled to provide the building blocks for future organisms.		4.7.2.2	4.4.1.2
Decay of dead plants and animals by microorganisms returns carbon to the atmosphere as carbon dioxide to be used by plants in photosynthesis.	The names of particular microorganisms are not required. Suggested activity for TDA Investigate the change in temperature as grass cuttings decay.		

3.2.2 What determines where particular species live?

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 5			
Plants often compete with each other for light and space, and for water and nutrients from the soil.	<p>Students will not be required to recall any specific examples of nutrients.</p> <p>Suggested activity for TDA Investigate the link between seed size and plant size.</p> <p>Suggested activity for TDA Compare the growth of plants when seeds are planted at different densities.</p>	4.7.1.1	4.4.2.2
Animals often compete with each other for food, mates and territory.		4.7.1.2	4.4.2.2
Outcome 6			
Animals and plants are subjected to environmental changes. Such changes may be caused by non-living or living factors.	<p>An example of a non-living factor is a change in the average temperature or rainfall.</p> <p>An example of a living factor is the introduction of a competitor or predator.</p> <p>Suggested activity for TDA Compare the distribution of plants in a trodden and non-trodden area (using a transect line/quadrat).</p>	4.7.1.3	4.4.2.3

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 7			
<p>Pollution of the environment can occur:</p> <ul style="list-style-type: none"> in water, from sewage, fertiliser or toxic chemicals in air, from smoke and gases such as sulfur dioxide which contributes to acid rain on land, from landfill and from toxic chemicals such as pesticides and herbicides, which may be washed from land into water. <p>Students should recognise that rapid growth in human population means that more resources are used and more waste is produced.</p>	<p>Suggested activity for TDA Investigate whether rainwater in a city is more acidic than rainwater in the countryside.</p> <p>Suggested activity for TDA Compare the quality of water from different sources eg running water and still water.</p>	4.7.3.2	4.4.2.6

3.2.3 How life has developed on earth

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 8			
Darwin's theory of evolution states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.	Evidence to support this theory of evolution is limited to fossil evidence and the similarity of characteristics between species.	4.6.2.2	4.4.4.2
In natural selection, individuals with characteristics most suited to their environment are most likely to survive to breed successfully.	An example is the distribution of the peppered moth.	4.6.2.2	4.4.4.2
Artificial selection (selective breeding) is the process by which humans breed plants and animals for particular genetic traits.	Examples include disease resistance in food crops, domestic dogs with a gentle nature and plants with large flowers.	4.6.2.3	4.4.4.5

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 9			
<p>There are two types of reproduction:</p> <ol style="list-style-type: none"> 1 sexual reproduction, which involves the joining of male and female sex cells. There is a mixing of genetic information, which leads to variety in the offspring 2 asexual reproduction, where only one individual is needed as a parent. There is no mixing of genetic information, which leads to identical offspring (clones). 	<p>The term 'gamete' is not required.</p> <p>Suggested activity for TDA Asexual reproduction: investigate how alike the plants grown from runners are, eg mint or strawberries.</p>	4.6.1.1	4.4.3.1
Outcome 10			
<p>The genetic material in the nucleus of a cell is made of a chemical called DNA, which is contained in structures called chromosomes.</p> <p>Students should know that a cell consists of a nucleus that controls the actions of the cell, and cytoplasm.</p>		4.6.1.4	4.4.3.1
<p>Chromosomes carry genes that control the characteristics of the body.</p> <p>Humans have 23 pairs of chromosomes. Only one pair carries the genes that determine sex: females have the same sex chromosomes (XX); in males the chromosomes are different (XY).</p>	<p>Suggested activity for TDA Investigate whether or not two characteristics are linked, eg finger length and height.</p> <p>Diagrams of genetic crosses will not be required.</p>	4.6.1.6	4.4.3.1

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
<p>In genetic engineering, genes from chromosomes of humans and other organisms can be 'cut out' and transferred to the cells of other organisms.</p> <p>Students should be aware of the potential benefits and risks of genetic engineering.</p>		4.6.1.8	4.4.3.1

3.3 Component 3 – Chemistry: Elements, mixtures and compounds

Matter is composed of tiny particles called atoms and there are about 100 naturally occurring types of atoms called elements.

Elements are shown in the Periodic table and are either metals or non-metals. Atoms are the building blocks for all substances. When two or more elements combine chemically a compound is produced.

Different substances have different combinations of atoms joined together in different ways, which gives them different properties, such as whether they are solid, liquid or gaseous at room temperature. Many materials we use are mixtures. Mixtures can be separated by processes such as filtration. Polymers have many useful applications.

3.3.1 Atoms, elements and compounds

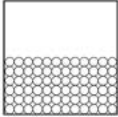
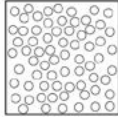
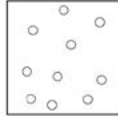
Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
All substances are made of atoms. An atom is the smallest part of an element that can exist.		5.1.1.1	

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
<p>A substance that is made of only one sort of atom is called an element. There are about 100 different elements. Elements are shown in the Periodic table.</p> <p>Metals are towards the left and the bottom of the Periodic table and non-metals towards the right and the top of the Periodic table.</p> <p>Students should know that most of the elements are metals.</p>		5.1.2.3	4.5.1.1
<p>Elements in the same group of the Periodic table have similar chemical properties.</p>	<p>Knowledge of groups is limited to Group 1 as reactive metals and Group 7 as reactive non-metals.</p> <p>Suggested activity for TDA Investigate the amount of hydrogen produced when acids react with different metals.</p>	5.1.2.1	4.5.1.1
Outcome 2			
<p>When elements react, their atoms join with other atoms to form compounds.</p>		5.1.1.1	4.5.2.1
<p>Some compounds are made from metals combined with non-metals, for example sodium chloride and magnesium oxide.</p> <p>Students should be able to recognise simple compounds from their names, eg sodium chloride, magnesium oxide, carbon dioxide.</p> <p>Some compounds are made from only non-metals, for example carbon dioxide.</p>		5.2.1.2	4.6.2.1
<p>Chemical reactions can be represented by word equations.</p> <p>Students should be able to write word equations for reactions of metals and non-metals, reactions of non-metals to produce oxides, and the other chemical reactions in this specification.</p>			4.5.2.1

3.3.2 How structure affects properties

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 3			
<p>The three states of matter are solid, liquid and gas. Melting and freezing take place at the melting point, boiling and condensing take place at the boiling point.</p> <p>The three states of matter can be represented by a simple model. In this model, particles are represented by small solid spheres.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Solid</p> </div> <div style="text-align: center;">  <p>Liquid</p> </div> <div style="text-align: center;">  <p>Gas</p> </div> </div>	<p>Students should be able to use models of particles as small spheres to represent the three states of matter.</p>	5.2.2.1	4.1.1.1
<p>When a solid melts to become a liquid the particles are able to move about but stay close together. When a liquid boils and becomes a gas the particles separate and move about rapidly. Substances with high melting points have strong forces that hold their particles together. Substances with low boiling points have weak forces between their particles.</p>	<p>Suggested activity for TDA Compare the melting points of a range different substances, eg candle wax, beeswax polish, butter, margarine, cooking fat.</p>	5.2.2.1	4.6.2.5
Outcome 4			
<p>Diamond and graphite are forms of the element carbon with different properties because of their different structures. Diamond is hard because the carbon atoms are joined together in a giant three-dimensional structure.</p> <p>Graphite is slippery because the carbon atoms are joined together in layers that can slide over each other.</p>	<p>Students should be able to recognise diamond and graphite from diagrams of their structures.</p>	5.2.3.1 and 5.2.3.2	4.8.1.1

3.3.3 Separating mixtures

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 5			
A mixture contains two or more substances not chemically combined together. Mixtures can be separated by processes such as filtration, distillation, crystallisation and chromatography.	Students should be able to select methods from those given to separate simple mixtures. Suggested activity for TDA Compare the time needed to filter mixtures of water and calcium carbonate that has different particle sizes.	5.1.1.2	
Outcome 6			
Paper chromatography can be used to separate mixtures and can give information to help identify substances. In paper chromatography a solvent moves through the paper carrying different compounds different distances.	Suggested activity for TDA Investigate the different colours in inks or food colours using paper chromatography.	5.8.1.3	4.2.2.4

3.3.4 Metals and alloys

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 7			
<p>Unreactive metals, such as gold, are found in the earth as the metal itself, but most metals are found as compounds that require chemical reactions to extract the metal.</p> <p>Metals less reactive than carbon can be produced by heating the metal compounds in the ore with carbon.</p> <p>Ores contain enough metal to make it economic to extract the metal. Large amounts of rock need to be quarried or mined to get metal ores.</p>		5.4.1.3	4.8.2.1
<p>We should recycle metals to save resources and limit environmental impacts.</p> <p>Students should be able to describe the social, economic and environmental impacts of mining ores and recycling metals.</p>		5.10.2.2	4.8.2.9
Outcome 8			
<p>Metals have giant structures of atoms with strong bonds between the atoms and so most metals have high melting points.</p>	<p>Suggested activity for TDA</p> <p>Compare the properties, such as conductivity or density, of some metals.</p>	5.2.2.7	4.6.2.7
<p>Metals are good conductors of electricity and thermal energy.</p> <p>Copper has properties that make it useful for electrical wiring and plumbing.</p>	<p>The properties of copper are limited to its ability to conduct electricity easily and the ease with which it can be worked.</p>	5.2.2.8	4.6.2.7
<p>Aluminium is a useful metal because of its low density and resistance to corrosion.</p>	<p>No knowledge of the extraction process of aluminium is required.</p>		

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 9			
Most metals in everyday use are alloys. Pure iron, gold and aluminium are too soft for many uses and so are mixed with small amounts of other elements to make alloys, which are harder for everyday use.	Knowledge of the composition of specific alloys is not required.	5.2.2.7	4.6.2.7
Most iron is converted into steels. Steels are alloys since they are mixtures of iron with carbon and other metals.	Suggested activity for TDA Investigate the hardness of different alloys or steels.		

3.3.5 Polymers

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 10			
Polymers such as poly(ethene), poly(propene) polystyrene and PVC are made from small compounds called monomers that join together to form very long chains. Polymers are waterproof, resistant to chemicals, and can be moulded, so they have many useful applications as packaging materials, pipes and containers.	Common names of these polymers will be accepted. Knowledge of the names of other polymers is not required.	5.7.3.1 and 5.7.3.2	4.6.2.4
Many polymers are not biodegradable, so they are not broken down by microbes. This can lead to problems with waste disposal.	Suggested activity for TDA Compare the biodegradability of different polymers and other materials.		

3.4 Component 4 – Chemistry: Chemistry in our world

Acids react with metals, alkalis and bases to produce compounds known as salts. Many chemical reactions produce a change in temperature. Chemical reactions can be made to go faster or slower by changing the conditions. The Earth's atmosphere has changed over billions of years. Human activities increase the amounts of some substances in the atmosphere. Water that is safe to drink is essential for human health.

3.4.1 Reactions of acids

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
Acids react with some metals to produce salts and hydrogen. Hydrochloric acid produces chlorides and sulfuric acid produces sulfates. Students should be able to complete word equations for these reactions, given the names of the reactants.	Knowledge of reactions is limited to those of magnesium, zinc and iron with hydrochloric and sulfuric acids.	5.4.2.1	4.7.3.1
The test for hydrogen uses a burning splint held at the open end of a test tube of the gas. Hydrogen burns rapidly with a pop sound.	Suggested activity for TDA Investigate the amount of hydrogen produced when acids react with different.	5.8.2.1	4.7.3.1
Outcome 2			
Acids are neutralised by alkalis (eg sodium hydroxide) and bases (eg insoluble metal oxides) to produce salts and water.	Household chemicals may be used to illustrate these reactions.	5.4.2.2	4.7.3.2
Acids are neutralised by carbonates to produce salts, water and carbon dioxide. Students should be able to complete word equations for these reactions, given the names of the reactants. Carbon dioxide turns limewater milky.	Suggested activity for TDA Investigate the reactions of acids with different carbonates.	5.4.2.4	4.7.3.1
Salt solutions can be crystallised to produce solid salts.		5.4.2.3	4.7.3.2

3.4.2 Energy and rate of reaction

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 3			
Some reactions transfer energy to the surroundings so the temperature increases. Such reactions include combustion, oxidation and neutralisation.	Students are not required to know the term 'exothermic'.	5.5.1.1	4.7.3.3
Other reactions take in energy from the surroundings, so the temperature decreases. These reactions include dissolving ammonium chloride in water and reacting citric acid with sodium hydrogencarbonate.	Students are not required to know the term 'endothermic'. Suggested activity for TDA Compare the temperature changes caused by some reactions.		
Outcome 4			
The rate of a chemical reaction may be increased by increasing the temperature, increasing the concentration of reactants, increasing the surface area of solid reactants or by adding a suitable catalyst.	Students do not need to calculate rates of reactions, but should be able to compare relative rates by measuring the time for a reactant to be used up, the volume of a gas produced in a given time, the time for a solution to become opaque or coloured. Suggested activity for TDA Investigate how to make a chemical reaction go faster.	5.6.1.2	4.7.4.6

3.4.3 Earth's atmosphere

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 5			
<p>During the first billion years of the Earth's existence, there was intense volcanic activity that released gases that formed the early atmosphere and water vapour that condensed to form the oceans.</p> <p>The early atmosphere was mainly carbon dioxide with little or no oxygen.</p>		5.9.1.2	4.4.1.1
<p>From about three billion years ago, algae and plants developed and produced the oxygen that is now in the atmosphere, by a process called photosynthesis. Photosynthesis can be represented by the word equation:</p> <p>carbon dioxide + water → glucose + oxygen</p>	<p>Suggested activity for TDA Investigate the production of oxygen by aquatic plants in different conditions by counting bubbles.</p>	5.9.1.3	4.4.1.1
Outcome 6			
<p>Carbon dioxide was removed from the early atmosphere by dissolving in the oceans and by photosynthesis. Most of the carbon from the carbon dioxide gradually became locked up in rocks as carbonates and fossil fuels.</p>		5.9.1.4	4.4.1.1
<p>The Earth's atmosphere is now about four-fifths (80%) nitrogen and about one-fifth (20%) oxygen, with small amounts of other gases, including carbon dioxide, water vapour and argon, which is a noble gas.</p>	<p>Suggested activity for TDA Compare the amount of oxygen in fresh air and exhaled air.</p>	5.9.1.1	

3.4.4 Fuels and human impacts on the atmosphere

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 7			
Crude oil is a mixture of a very large number of compounds. Crude oil is found in deposits underground, eg the oil fields under the North Sea.	Students will not be required to recall the name of any other fractions.	5.7.1.1	4.8.1.2
Crude oil may be separated into fractions by fractional distillation. This process, which takes place in a refinery, can be used to produce a range of useful fuels and oils, including petrol and diesel.		5.7.1.2	4.8.1.3
Outcome 8			
<p>When fuels burn completely the gases released into the atmosphere include carbon dioxide, water (vapour), and oxides of nitrogen. Sulfur dioxide is also released if the fuel contains sulfur.</p> <p>When fuels burn in a limited supply of air carbon monoxide is produced. Solid particles (soot) may also be produced.</p> <p>Students may be required to describe the impact on the environment of burning fossil fuels.</p> <p>Oxides of nitrogen and sulfur dioxide cause acid rain and problems for human health.</p> <p>Carbon monoxide is a colourless, odourless, poisonous gas that can cause death.</p> <p>Solid particles can cause global dimming and problems for human health.</p>	<p>Suggested activity for TDA</p> <p>Compare the amount of soot produced when burning different fuels.</p>	5.9.3.1	4.4.1.6

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 9			
Some human activities increase the amounts of greenhouse gases in the atmosphere, such as carbon dioxide from burning fossil fuels and methane from landfill and cattle farming.		5.9.2.1	4.4.1.4
Increased levels of greenhouse gases in the atmosphere cause the temperature to increase. Many scientists believe that this will result in global climate change.		5.9.2.3	4.4.1.4

3.4.5 Water for drinking

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 10			
Water that is safe to drink has small amounts of dissolved substances and low levels of microbes. Most drinking water is produced by choosing a suitable source of fresh water, filtering to remove solids and sterilising to kill microbes. If supplies of fresh water are limited, salty water can be distilled to produce fresh water. This requires a large energy input.	Suggested activity for TDA Investigate the amount of dissolved solids in water from different locations by evaporating samples and weighing residues.	5.10.1.2	4.4.1.8

3.5 Component 5 – Physics: Energy, forces and the structure of matter

Forces are pushes or pulls, and if a force causes an object to move then work is done and energy is transferred. Energy cannot be created or destroyed but can be stored in many different ways, although when energy changes to being stored in a different way, some is always 'wasted' as heat. A braking force will cause an energy transfer that makes a vehicle slow down and heats the brakes. The braking distance of a vehicle depends on many different things, such as the speed of the vehicle – speed being measured in units such as miles per hour or metres per second.

The energy resources available to use may be divided into renewable and non-renewable. Energy can also be released from atoms, which contain smaller particles such as neutrons and protons in the nucleus, because atoms can break down to emit particles or gamma rays.

3.5.1 Energy, energy transfers and energy resources

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
<p>Describe, for common situations, the changes involved in the way energy is stored when a system changes. For example:</p> <ul style="list-style-type: none"> • an object projected upwards • a moving object hitting an obstacle • a vehicle slowing down • bringing water to a boil in an electric kettle. <p>Students may be required to describe the intended energy changes and the main energy wastages that occur in a range of devices.</p>	Energy storage is limited to kinetic, gravitational potential, thermal, light, sound and elastic (strain).	6.2.1.1	4.1.1.4

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 2			
Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.		6.2.2.1	4.8.2.5
<p>The idea of efficiency. Whenever there are energy transfers in a system only part of the energy is usefully transferred. The rest of the energy is dissipated so that it is stored in less useful ways. This energy is often described as being 'wasted'.</p> <p>Unwanted energy transfers can be reduced in a number of ways, eg through lubrication and the use of thermal insulation.</p>	<p>Calculations of efficiency will not be required.</p> <p>Examples of the application of the idea of efficiency could include domestic appliances and vehicles.</p>		
<p>How the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.</p> <p>The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.</p>	<p>Suggested activity for TDA</p> <p>Investigate factors that affect the rate of cooling of a container of water, eg surface area, initial temperature, types of insulation, colour of the container.</p> <p>Suggested activity for TDA</p> <p>Investigate the thermal conductivity of different materials, eg which is better for a saucepan handle: wood or metal?</p> <p>Students do not need to know the definition of thermal conductivity.</p>		
Outcome 3			
<p>Describe the main energy resources available for use on Earth. These include fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun, water waves.</p> <p>Distinguish between energy resources that are renewable and energy resources that are non-renewable.</p>	<p>Descriptions of how electricity is generated in a power station are not required other than the idea that a turbine is used to turn a generator.</p>	6.2.3	4.8.2.4

3.5.2 Forces and work

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 4			
<p>A force is a push or pull that acts on an object due to the interaction with another object. All forces between objects are either:</p> <ul style="list-style-type: none"> • contact forces – the objects are physically touching • non-contact forces – the objects are physically separated. 	<p>Examples of contact forces include friction, air resistance, tension and normal contact force.</p> <p>Examples of non-contact forces are gravitational force, electrostatic force and magnetic force.</p>	6.1.1.2	4.6.1.1
Outcome 5			
When a force causes an object to move through a distance, work is done on the object.	Calculations involving work are not required.	6.1.2	4.7.1.10
Work done against the frictional forces acting on an object causes a rise in the temperature of the object.	<p>Suggested activity for TDA</p> <p>Investigate how different surfaces affect the amount of friction on a moving block.</p>		

3.5.3 Speed and stopping distances

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 6			
<p>Speed is measured by the distance travelled in a certain time.</p> <p>Units of speed include metres per second, kilometres per hour and miles per hour.</p> <p>Simple calculations of average speed using the equation: speed = distance/time will be required.</p>	<p>Suggested activity for TDA</p> <p>Investigate how the speed of a trolley changes as it rolls down a slope.</p>	6.1.6.1.2	4.7.1.1

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 7			
<p>The stopping distance of a vehicle is the sum of the distance the vehicle travels during the driver's reaction time (thinking distance) and the distance it travels under the braking force (braking distance).</p> <p>For a given braking force the greater the speed of the vehicle, the greater the stopping distance.</p>	<p>Students may find it helpful to refer to the <i>Highway Code</i>.</p> <p>Suggested activity for TDA Investigate factors that affect human reaction time, eg tiredness, distraction, practise.</p>	6.1.6.3.4	4.7.1.10
Outcome 8			
<p>Reaction times vary from person to person. Typical values range from 0.5 s to 0.9 s.</p> <p>Knowledge and understanding of methods used to measure human reaction times.</p> <p>Knowledge of how a driver's reaction time can be affected by tiredness, drugs and alcohol. Distractions may also affect a driver's ability to react.</p>	<p>Students should be able to interpret and evaluate measurements from simple methods to measure the different reaction times of students.</p> <p>Students should be able to evaluate the effect of various factors on thinking distance.</p>	6.1.6.3.2	4.2.1.6
Outcome 9			
<p>The braking distance of a vehicle can be affected by adverse road and weather conditions, and poor condition of the vehicle.</p> <p>Students should be able to analyse a given situation to identify how braking could be affected.</p>	<p>Adverse road conditions include wet or icy conditions. Poor condition of the vehicle is limited to the vehicle's brakes or tyres.</p>	6.1.6.3.3	4.7.1.10

3.5.4 Atoms and nuclear radiation

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 10			
<p>Some atomic nuclei are unstable. The nucleus gives out ionising radiation. This is a random process called radioactive decay.</p> <p>The nuclear radiation emitted may be:</p> <ul style="list-style-type: none"> • alpha particles • beta particles • gamma rays. <p>Properties of alpha particles, beta particles and gamma rays limited to their penetration through materials and their range in air.</p> <p>Students will be expected to know some of the uses and dangers of the three types of radiation.</p>		6.7.2.1	4.3.2.2

3.6 Component 6 – Physics: Electricity, magnetism and waves

Electricity is used in domestic and industrial situations to supply energy. Electric current is a flow of electrical charge and measured in amps. Direct current (dc) is supplied by cells and alternating current (ac) is supplied by the mains, but in both cases the size of the current depends on the resistance in the circuit. When a current flows through a coil of wire an electromagnet is formed, which like permanent magnets, can exert a force over a distance.

Electric currents can also be used to produce electromagnetic waves, which have many uses including the transmission of information and the transfer of energy from one place to another.

3.6.1 Electrical current

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 1			
Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge.	Electrical current is measured in amps using an ammeter.	6.4.1.2	4.7.2.1
The current through a component depends on both the resistance of the component and the voltage across the component. The greater the resistance of the component the smaller the current for a given voltage across the component.	Voltage is measured in volts using a voltmeter. The term 'potential difference' will not be used.	6.4.1.3	4.7.2.2
The resistance of a component is a measure of how difficult it is for an electric current to pass through it.	Calculations of resistance will not be required, nor will the units of resistance. Suggested activity for TDA Investigate which materials are the best electrical conductors.	6.4.1.3	4.7.2.2
Outcome 2			
A complete circuit is necessary for a current to flow. Cells and batteries supply current that always passes in the same direction. This is called direct current (dc).	No distinction between series and parallel circuits needs to be made. The use of conventional circuit diagram symbols will not be required.	6.4.3.1	4.7.2.5
An alternating current (ac) is one that changes direction. Mains electricity is an ac supply. In the UK it has a frequency of 50 Hz and is 230 V.			

3.6.2 Domestic electricity

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 3			
<p>Most electrical appliances are connected to the mains using a three-core flex.</p> <p>The insulation covering each wire in the flex is colour-coded for easy identification:</p> <ul style="list-style-type: none"> • live wire – brown • neutral wire – blue • earth wire – green and yellow stripes. <p>The earth wire is a safety wire to stop the appliance becoming live and the fuse contains a thin piece of wire, which melts if the current becomes too large, thereby cutting off the supply.</p> <p>Students should be able to select the correct fuse from a list when given the current rating of an appliance.</p> <p>Some appliances do not have an earth wire because they are double insulated.</p>		6.4.3.2	4.7.2.6
Outcome 4			
<p>Everyday electrical appliances are designed to bring about energy transfers.</p> <p>The amount of energy an appliance transfers depends on how long the appliance is switched on for and the power of the appliance.</p>	<p>Students may be required to use the equation:</p> $\text{energy (kWh)} = \text{power (kW)} \times \text{time (h)}$	6.4.4.2	4.7.2.8

3.6.3 Magnetism and electromagnetism

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 5			
<p>The poles of a magnet are the places where the magnetic forces are strongest. When two magnets are brought close together they exert a force on each other. Two like poles repel each other. Two unlike poles attract each other. Attraction and repulsion between two magnetic poles are examples of non-contact force.</p> <p>The patterns of magnetic fields between bar magnets will be required.</p>		6.5.1.1	4.6.3.1
Outcome 6			
<p>When a current flows through a conducting wire a magnetic field is produced around the wire.</p> <p>The strength of the magnetic field depends on the current through the wire and the distance from the wire.</p> <p>Shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire. Adding an iron core increases the magnetic field strength of a solenoid. An electromagnet is a solenoid with an iron core.</p> <p>Students should be familiar with common uses of electromagnets, eg in scrapyard cranes and relays.</p>	<p>Suggested activity for TDA Investigate factors that affect the strength of an electromagnet.</p>	6.5.2.1	4.6.3.4

3.6.4 Different types of waves

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 7			
<p>Waves may be either transverse or longitudinal.</p> <p>In a transverse wave the oscillations are perpendicular to the direction of energy transfer. The ripples on a water surface are an example of a transverse wave.</p> <p>In a longitudinal wave the oscillations are parallel to the direction of energy transfer. Longitudinal waves show areas of compression and rarefaction. Sound waves travelling through air are longitudinal.</p>	<p>Students should be able to identify whether a wave is longitudinal or transverse from a given diagram.</p>	6.3.1.1	4.1.4.1
Outcome 8			
<p>Waves are described by their amplitude, wavelength and frequency.</p> <p>The amplitude of a wave is the maximum displacement of a point on a wave away from its undisturbed position.</p> <p>The wavelength of a wave is the distance from a point on one wave to the equivalent point on the adjacent wave.</p> <p>Students may be required to use the equation:</p> <p>wave speed (m/s) = frequency (Hz) x wavelength (m)</p> <p>The frequency of a wave is the number of waves passing a point each second.</p>	<p>Students should be able to identify wavelength and amplitude on a given diagram.</p>	6.3.1.2	4.1.4.2

3.6.5 Electromagnetic waves

Students should have knowledge and understanding of the following content.

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 9			
Electromagnetic waves are transverse waves that transfer energy from the source of the waves to an absorber.	Students will not be required to memorise the values of the wavelength or frequency of these waves.	6.6.2.1	4.1.4.3
<p>Electromagnetic waves form a continuous spectrum and all types of electromagnetic wave travel at the same velocity through a vacuum (space) or air.</p> <p>The waves that form the electromagnetic spectrum are grouped in terms of their wavelength and their frequency.</p> <p>Going from long to short wavelength (or from low to high frequency) the groups are:</p> <ul style="list-style-type: none"> • radio • microwave • infrared • visible light (red to violet) • ultraviolet • X-rays • gamma rays. <p>Ultraviolet waves, X-rays and gamma rays can have hazardous effects on human body tissue. The effects depend on the type of radiation and the size of the dose.</p>	<p>Suggested activity for TDA Testing visual acuity in different colours of light.</p>	6.6.2.3	4.1.4.3

Content	Additional guidance and suggested TDAs	Specification reference GCSE Combined Science: Trilogy	Specification reference GCSE Combined Science: Synergy
Outcome 10			
<p>Electromagnetic waves have many practical applications, eg:</p> <ul style="list-style-type: none"> • radio waves – television and radio (including Bluetooth) • microwaves – satellite communications, cooking food • infrared – electrical heaters, cooking food, infrared cameras • visible light – fibre optic communications • ultraviolet – energy efficient lamps, sun tanning • X-rays – medical imaging and treatments • gamma rays – for sterilising. <p>Students should be able to give brief explanations of why each type of electromagnetic wave is suitable for the practical application.</p>	<p>Suggested activity for TDA Investigate the shielding of a mobile phone or remote control device.</p> <p>Suggested activity for TDA Investigate the range over which a Bluetooth device is effective.</p>	6.6.2.4	4.1.4.3

4 Scheme of assessment

Find specimen assignments and mark schemes on our website at aqa.org.uk/science

Assessments for this specification are available on demand on the secure area of the website e-AQA.

Certification for this specification is available for the first time in June 2017 and then every June for the lifetime of the specification.

All materials are available in English only.

4.1 Aims and learning outcomes

Courses based on this specification should encourage students to:

- develop their interest in, and enthusiasm for, science
- develop a critical approach to scientific evidence and methods
- acquire and apply social skills, knowledge and understanding of working scientifically and its essential role
- acquire scientific skills, knowledge and understanding necessary for progression to further learning
- apply literacy, numeracy and information technology skills.

4.2 Assessment objectives

The assessment objectives (AOs) have been set by AQA.

- AO1: Show knowledge and understanding of science, and how it works, and apply it where appropriate. Students should be able to:
 - recall scientific facts
 - apply scientific ideas.
- AO2: Demonstrate the ability to design an investigation, take measurements, present data and identify patterns and relationships. Students should be able to:
 - plan a simple investigation, identifying the techniques or equipment needed and the method to be followed
 - make a simple prediction about the outcome of the investigation
 - use equipment and materials safely to take simple measurements or observations that are meaningful and valid
 - record the results in an appropriate way
 - display the data using an appropriate method
 - state what has been found out during the investigation (drawing a conclusion) and describe simple relationships in the data
 - simply evaluate the investigation for its success in justifying the initial prediction.

Assessment objective weightings for ELC Science

Assessment objectives (AOs)	Weightings (approx %)		Overall weighting (approx %)
	Teacher devised assignments	Externally set assignments	
AO1		57	57
AO2	43		43
Overall weighting of components	43	57	100

4.3 Requirements

Assessment is through completion of the externally set assignments (ESAs) and teacher devised assignments (TDAs). These can be taken at a time convenient to the school or college, and different students can be assessed on different occasions.

Single Award

Students should submit evidence for **three** components, with at least one chosen from biology (components 1–2), chemistry (components 3–4) and physics (components 5–6). Students should submit three externally set assignments (ESAs) and three teacher devised assignments (TDAs). The ESAs and TDAs do not have to be from the same components.

Double Award

Students should submit evidence for all **six** components. Students should submit six externally set assignments (one each for components 1–6) and six teacher devised assignments (one each for components 1–6).

4.4 Externally set assignments (ESA)

Students can take up to 45 minutes to complete an externally set assignment (ESA). The total maximum mark for each ESA is 20 marks. Students are not permitted to use reference materials when completing an ESA. The assignments must be completed under supervision (high control).

Any teacher assistance given should be limited to the use of strategies designed to improve accessibility such as:

- the re-phrasing of tasks or questions that have not been understood
- the explanation of terms or phrases used in tasks and questions where such an explanation does not, in itself, provide the information that the student must supply
- the provision of feedback in relation to inappropriate or inadequate answers given by the student where such feedback does not, in itself, provide the information that the student must supply.

All assignments will be marked by the teacher, in accordance with mark schemes and instructions provided by AQA, and will be subsequently moderated by AQA. Marks can be shared with students but all work must be retained by the teacher and kept secure until required for moderation.

The three (single award) or six (double award) ESAs have a weighting of 57% of the total mark.

4.5 Teacher devised assignments (TDA)

The teacher devised assignments (TDAs) must be carried out under supervision (medium control). The assignments must be taken under conditions in which the teacher can authenticate that they are the student's own work.

There is no set time limit for a TDA, and the maximum mark for a TDA is 15 marks. AQA will monitor contextualisation and teachers are encouraged to contact their appointed coursework advisers for queries regarding contextualisation, eg using washing powders to test effectiveness of enzymes.

The student's work must be recorded and annotated by the teacher in accordance with instructions provided by AQA, and will be subsequently moderated by AQA.

Skill areas to be assessed for the teacher devised assignments (TDA)

The skill areas must be assessed by the teacher for each TDA.

These marking guidelines are generic. Additional guidance on how to relate these generic marking guidelines to particular investigations is given below.

All assignments must be taken under conditions in which the teacher can authenticate that they are the student's own work. The student's work must be recorded and annotated by the teacher in accordance with instructions provided by AQA, and will be subsequently moderated by AQA.

Skill area A: Experimental design

Clear annotation by the teacher is especially important in the case of ephemeral skills such as working safely and the ability to take readings from instruments.

	Entry Level 1	Entry Level 2	Entry Level 3
0 marks	1 mark	2 marks	3 marks
Nothing worthy of credit	Indicates how a problem can be investigated and identifies techniques or equipment that can be used to investigate the problem.	Indicates how a problem can be investigated and identifies techniques or equipment that can be used to investigate the problem and describes the way in which techniques or equipment can be used to produce results.	Indicates how a problem can be investigated and identifies techniques or equipment that can be used to investigate the problem and describes the way in which techniques or equipment can be used to produce results, eg by completing a flow chart for the method and makes a prediction about the outcome.
Additional guidance	eg by identifying the relevant variables or by selecting equipment from a list.	eg by completing a flow chart for the method.	eg by a statement such as 'I think that... will happen because... '.

Skill area B: Working safely and making measurements or observations

	Entry Level 1	Entry Level 2	Entry Level 3
0 marks	1 mark	2 marks	3 marks
Nothing worthy of credit	Handles equipment and materials safely.	Handles equipment and materials safely and uses equipment to make simple measurements or observations.	Handles equipment and materials safely and uses equipment to make simple measurements or observations and shows recognition of the need for results to be meaningful.
Additional guidance	eg by wearing safety goggles when appropriate.	eg by using a microscope to draw a cell, or by correctly reading the display on a meter.	eg by checking and reporting measurements, or by carrying out repeats or calculating a mean, or by reference to control variables.

Skill area C: Recording data

	Entry Level 1	Entry Level 2	Entry Level 3
0 marks	1 mark	2 marks	3 marks
Nothing worthy of credit	Records the results of an experiment.	Records the results of an experiment and uses a table or framework that has been provided.	Records the results of an experiment and uses a table or framework that has been produced by the student.
Additional guidance	eg by writing down the results.	eg by filling in the data in a table that has been provided already complete with the correct headings and units.	eg by drawing a table in which the student has decided on the correct headings and units for each column in the table.

Skill area D: Presenting data

	Entry Level 1	Entry Level 2	Entry Level 3
0 marks	1 mark	2 marks	3 marks
Nothing worthy of credit	Selects an appropriate method of displaying the data, eg a bar chart, pie chart or line graph.	Selects an appropriate method of displaying the data and displays the results using a framework that has been provided.	Selects an appropriate method of displaying the data and displays the results using a framework that has been produced by the student.
Additional guidance	eg by selecting from a list the most appropriate method, such as the use of a bar chart for categoric data.	eg after selecting the most appropriate method, the student is provided with a blank graph in which the axes have been scaled and labelled, and is able to plot the data correctly.	eg the student can independently select the correct form of display, and can decide on suitable scales and labels for the axes of a graph or bar chart, and then correctly plot the data.

Skill area E: Identifying patterns and relationships

	Entry Level 1	Entry Level 2	Entry Level 3
0 marks	1 mark	2 marks	3 marks
Nothing worthy of credit	States simply what has been found out in the experiment.	States what has been found out in the experiment and describes a simple relationship in the results or draws a simple conclusion.	States what has been found out in the experiment and describes a simple relationship in the results or draws a simple conclusion and makes a relevant comment about the success or otherwise of the experiment.
Additional guidance	eg tea cools faster in a metal cup than it does in a plastic cup.	eg noticing that tea cools faster in a metal cup than it does in a plastic cup, leading to the conclusion that plastic is a better insulator than metal.	eg by referring to any anomalous results, or by stating that any repeats always gave the same value.

4.6 Portfolio of work

At the end of the course students must submit a *Portfolio of work*. This portfolio comprises a *Candidate record form* (CRF), the evidence from the teacher devised assignments (TDAs) and the externally set assignments (EDAs).

Single Award

The level of award for Entry Level Certificate Science will be determined at an AQA annual award meeting.

The final mark is aggregated from the marks for the **three** TDAs and **three** ESAs to give a total mark out of 105. The level of award (Entry 1, Entry 2 or Entry 3) will be based on the student's mark out of 105.

Students may still be awarded a certificate even if one or more of the components is not submitted. A score of zero must be entered for a missing component.

Double Award

The level of award for Entry Level Certificate Science will be determined at an AQA annual award meeting.

The final mark is aggregated from the marks for the **six** ESAs and **six** TDAs for the Double Award. This will give a total mark out of 210.

Students may still be awarded a certificate even if one or more of the components is not submitted. A score of zero must be entered for a missing component.

5 Assessment administration

All assessments for this qualification are non-exam assessment (NEA). You can find information about all aspects of administration, as well as all the forms you need at aqa.org.uk/examsadmin

The head of school or college is responsible for making sure that the administration is conducted in line with our instructions and Joint Council for Qualifications (JCQ) instructions.

5.1 Supervising and authenticating

To meet Ofqual's qualification and subject criteria:

- **students** must sign the *Candidate record form* (CRF) to confirm that the work submitted is their own
- all **teachers** who have marked a student's work must sign the declaration of authentication on the CRF. This is to confirm that the work is solely that of the student concerned and was conducted under the conditions laid down by this specification
- teachers must ensure that a CRF is provided with each student's work
- schools or colleges must give a mark of zero if students cannot confirm the work handed in for assessment is their own.

Students must have some direct supervision to ensure that the work submitted can be confidently authenticated as their own. If a student receives additional assistance and this is acceptable within the guidelines for this specification, you should award a mark that represents the student's unaided achievement. Please make a note of the support the student received on the CRF and sign the authentication statement. If the statement is not signed, we cannot accept the student's work for assessment.

5.2 Avoiding malpractice

Please inform your students of the AQA regulations concerning malpractice. They must not:

- submit work that is not their own
- lend work to other students
- allow other students access to, or use of, their own independently-sourced source material
- include work copied directly from books, the internet or other sources without acknowledgement
- submit work that is word-processed by a third person without acknowledgement
- include inappropriate, offensive or obscene material.

These actions constitute malpractice and a penalty will be given (for example, disqualification).

If you identify malpractice **before** the student signs the declaration of authentication, you don't need to report it to us. Please deal with it in accordance with your school or college's internal procedures. We expect schools and colleges to treat such cases very seriously.

If you identify malpractice **after** the student has signed the declaration of authentication, the head of your school or college must submit full details of the case to us at the earliest opportunity. Please complete the form *JCQ/M1*, available from the JCQ website at jcq.org.uk

You must record details of any work which is not the student's own on the front of the assessment booklet or other appropriate place.

You should consult your exams officer about these procedures.

5.3 Teacher standardisation

We will provide support for using the marking criteria and developing appropriate tasks through teacher standardisation.

For further information about teacher standardisation visit our website at aqa.org.uk/5960

In the following situations teacher standardisation is essential. We will send you an invitation to complete teacher standardisation if:

- moderation from the previous year indicates a serious misinterpretation of the requirements
- a significant adjustment was made to the marks in the previous year
- your school or college is new to this specification.

For further support and advice please speak to your adviser. Email your subject team at gcsescience@aqa.org.uk for details of your adviser.

5.4 Internal standardisation

You must ensure that you have consistent marking standards for all students. One person must manage this process and they must sign the *Centre declaration sheet* to confirm that internal standardisation has taken place.

Internal standardisation may involve:

- all teachers marking some sample pieces of work to identify differences in marking standards
- discussing any differences in marking at a training meeting for all teachers involved
- referring to reference and archive material, such as previous work or examples from our teacher standardisation.

5.5 Submitting marks

You must check that the correct marks are written on the *Candidate record form* (CRF) and that the total is correct.

The deadline for submitting the total mark for each student is given at aqa.org.uk/keydates

The CRF should be used to record the components submitted, the marks for these components and the total marks for the assessments as a whole. The CRF should be attached to each student's portfolio of assessments. Copies of all forms and details regarding submission can be found at aqa.org.uk/coursework

5.6 Factors affecting individual students

For advice and guidance about arrangements for any of your students, please email us as early as possible at eos@aqa.org.uk

Occasional absence: you should be able to accept the occasional absence of students by making sure they have the chance to make up what they have missed. You may organise an alternative supervised session for students who were absent at the time you originally arranged.

Lost work: if work is lost you must tell us how and when it was lost and who was responsible, using our special consideration online service at aqa.org.uk/eaqa

Special help: where students need special help which goes beyond normal learning support, please use the CRF to tell us so that this help can be taken into account during moderation.

Students who move schools: students who move from one school or college to another during the course sometimes need additional help to meet the requirements. How you deal with this depends on when the move takes place. If it happens early in the course, the new school or college should be responsible for the work. If it happens late in the course, it may be possible to arrange for the moderator to assess the work as a student who was 'Educated Elsewhere'.

5.7 Keeping students' work

Students' work must be kept under secure conditions from the time that it is marked, with completed CRF. After the moderation period and the deadline for Enquiries about Results (or once any enquiry is resolved) you may return the teacher devised assignments. Externally set assignments must be kept secure or destroyed.

5.8 Moderation

An AQA moderator will check a sample of your students' work. If you are entering fewer than 20 students it will be the work of all your students. Otherwise it will be a percentage of your students' work.

The moderator re-marks the work and compares this with the marks you have provided to check whether any changes are needed to bring the marking in line with our agreed standards. In some cases the moderator will ask you to send in more work. Any changes to marks will normally keep your rank order but, where major inconsistencies are found, we reserve the right to change the rank order. Always keep your students' CRFs in case they are needed for further moderation.

5.8.1 School and college consortia

If you are in a consortium of schools or colleges with joint teaching arrangements (where students from different schools and colleges have been taught together but entered through the school or college at which they are on roll), you must let us know by:

- filling in the *Application for Centre Consortium Arrangements for centre-assessed work*, which is available from the JCQ website jcq.org.uk
- appointing a consortium coordinator who can speak to us on behalf of all schools and colleges in the consortium. If there are different coordinators for different specifications, a copy of the form must be sent in for each specification.

We will allocate the same moderator to all schools and colleges in the consortium and treat the students as a single group for moderation.

All the work must be available at the lead school or college.

5.9 After moderation

We will return your students' work to you after the exams. You will also receive a report when the results are issued, which will give feedback on the appropriateness of the tasks set, interpretation of the marking criteria and how students performed in general.

We will give you the final marks when the results are issued.

To meet Ofqual requirements, as well as for awarding, archiving or standardisation purposes, we may need to keep some of your students' work. We will let you know if we need to do this.

6 General administration

You can find information about all aspects of administration, as well as all the forms you need, at aqa.org.uk/examsadmin

6.1 Entries and codes

Please check the current version of *Entry Procedures and Codes* for up-to-date entry procedures.

You will only need to make one entry for this qualification, either ELC Science – Single Award or ELC Science – Double Award. This will cover certification.

Entries should be submitted by 21 February each year.

Qualification title	AQA entry code
AQA Entry Level Certificate – Single Award	5961
AQA Entry Level Certificate – Double Award	5962

This specification complies with:

- Ofqual criteria for Entry Level Certificate qualifications
- Ofqual *General conditions of recognition* that apply to all regulated qualifications
- all other relevant regulatory documents.

The Ofqual qualification accreditation number (QAN) is 601/7522/9.

6.2 Overlaps with other qualifications

ELC Science subject content matches AQA GCSE Combined Sciences to help co-teaching.

6.3 Certification and reporting results

Where a student's performance is sufficient to meet the level requirements, an Entry Level Certificate is awarded.

The student's final mark is an aggregation of the marks for the individual components. The level of award (Entry 1, Entry 2 or Entry 3) will be based on the student's total mark.

6.4 Re-sits and shelf life

Students can re-sit the qualification as many times as they want within the shelf life of the specification.

Students may not make more than one attempt at the same externally set assignment (ESA) for a component. However, they may attempt the second or third assignment for a component from the other sets available, if they fail to complete the first assignment satisfactorily.

ESAs must **not** be returned to students, but must be kept in a secure place in the school or college.

If teachers wish to allow their students to practise an ESA, one of the specimen ESAs should be used.

Students may make more than one attempt at a teacher devised assignment (TDA) for a component. However, once a student has received feedback from their teacher on a particular TDA, an alternative TDA must be used for that component.

Students' results are based on the work they submit for assessment.

6.5 Previous learning and prerequisites

This specification builds on the knowledge, understanding and skills acquired in Programmes of study at Key Stage 3 of the National Curriculum. We advise that students have experience of the Programme of study for KS3 Science. However, this is not a requirement.

We recommend that students have acquired literacy and numeracy skills of at least Level 1, as these will be used in all components.

6.6 Access to assessment: diversity and inclusion

General qualifications are designed to prepare students for a wide range of occupations and further study. Therefore our qualifications must assess a wide range of competences.

The subject criteria have been assessed to see if any of the skills or knowledge required present any possible difficulty to any students, whatever their ethnic background, religion, sex, age, disability or sexuality. If any difficulties were encountered, the criteria were reviewed again to make sure that tests of specific competences were only included if they were important to the subject.

As members of the Joint Council for Qualifications (JCQ) we participate in the production of the JCQ document *Access Arrangements and Reasonable Adjustments: General and Vocational qualifications*. We follow these guidelines when assessing the needs of individual students who may require an access arrangement or reasonable adjustment. This document is published on the JCQ website at jcq.org.uk

Students with disabilities and special needs

We can make arrangements for disabled students and students with special needs to help them access the assessments, as long as the competences being tested are not changed. Access arrangements must be agreed **before** the assessment. For example, a Braille paper would be a reasonable adjustment for a Braille reader but not for a student who does not read Braille.

We are required by the Equality Act 2010 to make reasonable adjustments to remove or lessen any disadvantage that affects a disabled student.

If you have students who need access arrangements or reasonable adjustments, you can apply using the Access arrangements online service at aqa.org.uk/eaqa

Special consideration

We can give special consideration to students who have been disadvantaged at the time of the assessment through no fault of their own – for example a temporary illness, injury or serious problem such as the death of a relative. We can only do this **after** the assessment.

Your exams officer should apply online for special consideration at aqa.org.uk/eaqa

For more information and advice about access arrangements, reasonable adjustments and special consideration please see aqa.org.uk/access or email accessarrangementsqueries@aqa.org.uk

6.7 Working with AQA for the first time

If your school or college has not previously offered any AQA specification, you need to register as an AQA centre to offer our specifications to your students. Find out how at [aqa.org.uk/becomeacentre](https://www.aqa.org.uk/becomeacentre)

Once you become an AQA registered centre you will have access to a coursework adviser who will provide you with support and advice. You will also be able to book on to appropriate courses to provide preparation for teaching the course.

6.8 Private candidates

This specification is not available to private candidates.

7 Level descriptions

These descriptions give a general indication of the standards of achievement at each level. These descriptions should be interpreted in relation to the content outlined in the subject content part of this specification – they are not designed to define that content.

7.1 Entry 1

Subject content

Students can recall and understand simple limited parts of the specification, eg a good diet and exercise is needed to keep the body healthy or that materials have a range of properties (eg texture, appearance) and these properties determine the uses of the materials.

Practical skills

Students can use simple equipment safely and can carry out simple scientific investigations, under instruction. They can describe the steps in an experiment where they were given help. They can state what they found out in an experiment.

Communication skills

Students working at this level can communicate simple ideas using everyday language. Students describe or respond appropriately to simple features of objects, living things and events based on their everyday experiences. They can communicate their findings in simple ways (eg discussion, making drawings, and simple charts) and can respond to simple questions about a topic they have studied.

7.2 Entry 2

Subject content

Students at this level can recall, understand and apply knowledge from across the specification, eg they are familiar with different ways of conserving energy in the home and can compare the efficiency of different methods. Students use their knowledge about living things to describe the basic conditions (eg a supply of food, water, air, light) that animals and plants need in order to survive. They recognise that living things grow and reproduce.

Practical skills

Students can suggest simple experiments to find out answers to given problems. They respond to suggestions about how to find things out and can make suggestions about how to collect data to answer questions. They can use apparatus to undertake a given experiment, and are able to work safely. With little help they can do all of an experiment and state whether the result is what they expected. They can record their results in given formats.

They can use simple equipment safely and make observations or simple measurements related to their task. They can observe and compare objects, living things and events. They describe their observations using scientific vocabulary and record them, using simple tables when appropriate.

Communication skills

Students working at this level can communicate using simple scientific terms.

7.3 Entry 3

Subject content

Students can recall, understand and apply knowledge from a wide range of the specification, eg students have an understanding of basic life processes (eg growth, reproduction) and understand how living things may be subjected to competition and environmental changes.

Students use their knowledge and understanding of physical phenomena to link cause and effect in simple explanations (eg the amount of electrical energy a device transfers depends on how long it is switched on for, and its power).

Practical skills

Students can put forward ideas for investigations and make simple predictions about outcomes. They can make observations with some degree of detail and make measurements using appropriate apparatus.

They can carry out scientific investigations safely and with some confidence, and record their results, create tables for data and label drawings or diagrams. They can identify and carry out a method of fair testing where this is necessary.

Students can make some comparisons between observations or measurements. If appropriate, they can find patterns in their results. Students can draw simple conclusions from the evidence found.

Communication skills

Students communicate in a scientific way what they have found out and suggest improvements in their work.

They can obtain information from data provided, assimilate it and communicate ideas and conclusions in short, coherent sentences.

8 Appendix

Accrediting the achievement of individual Entry Level Certificate components through the AQA Unit Award Scheme (UAS).

What is the UAS?

The UAS allows students to receive formal recognition for each individual component completed as they progress through the Entry Level Certificate course. It is a recording of achievement scheme, not a qualification, and has been in operation since 1984.

In recognising these smaller steps of achievement, UAS encourages and motivates students for whom the final award of an Entry Level Certificate may seem a distant goal. Also, for those students who cannot, for whatever reason, complete the required number of units to be entered for the qualification, they can receive formal recognition for each unit completed.

What UAS certification is offered?

Each time a student completes a component, they can have this achievement recognised through the issue of a UAS certificate called a *Unit Award Statement*.

This statement shows all the skills, abilities, knowledge and understanding that have been achieved by the student, together with any experiences, but does not show a level. Statements are issued promptly after the student has completed a unit and this can happen at any time of year.

How do UAS and ELC requirements differ for the student?

To receive accreditation for completion of a unit with UAS, a student must show achievement of **all** outcomes in that unit. This may be different from the requirement for the Entry Level Certificate, where students may not need to provide evidence for all outcomes, but are encouraged to complete as much as possible, thereby enabling them to reach a moderated level of Entry 1, Entry 2 or Entry 3.

Some Entry Level specifications require the completion of externally set tasks. For UAS, these assignments do not have to be completed although such evidence may be submitted as part of the other evidence required for a unit. In summary, with UAS, provided there is evidence that all outcomes have been achieved, the unit will be awarded.

What about UAS registration?

Schools and colleges wishing to use UAS must be registered specifically for UAS, and this is a separate registration process from that required for the Entry Level Certificate. You may choose to register students for:

- the Entry Level Certificate only
- the Entry Level Certificate and UAS
- UAS only.

Schools can join UAS at any time and should contact the UAS department for further information about joining, costs and how to use UAS.

There is more information on the UAS website aqa.org.uk/uas

AQA Unit Award Scheme, 31–33 Springfield Avenue, Harrogate, HG1 2HW

E: unitawardscheme@aqa.org.uk

T: 01423 534 323

Get help and support

Visit our website for information, guidance, support and resources at aqa.org.uk/subjects/5960

You can talk directly to the science subject team

E: gcsescience@aqa.org.uk

T: 01483 477 756