Qualification Regulated

OCR
Oxford Cambridge and RSA

ENTRY LEVEL CERTIFICATE

Specification

SCIENCE

R483

For first assessment in 2017

Version 2.0 (January 2024)

Disclaimer

Specifications are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published resources and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk

We will inform centres about changes to specifications. We will also publish changes on our website. The latest version of our specifications will always be those on our website (ocr.org.uk) and these may differ from printed versions.

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1 Why choose an OCR Entry Level Certificate in Science?

1a. Why choose an OCR qualification?

Choose OCR and you've got the reassurance that you're working with one of the UK's leading exam boards. Our new Entry Level Certificate in Science has been refreshed to fit with reformed GCSE (9–1) Science qualifications to provide learners with a qualification that's relevant to them and meets their needs.

We're part of the Cambridge Assessment Group, Europe's largest assessment agency and a department of the University of Cambridge. Cambridge Assessment plays a leading role in developing and delivering assessments throughout the world, operating in over 150 countries.

We work with a range of education providers, including schools, colleges, workplaces and other institutions in both the public and private sectors. Over 13,000 centres choose our A Levels, GCSEs and vocational qualifications.

Our Specifications

We believe in developing specifications that help you bring the subject to life and inspire your learners to achieve more.

We've created teacher-friendly specifications that are designed to be straightforward and accessible so that you can tailor the delivery of the course to suit your needs. We aim to encourage learners to become responsible for their own learning, confident in discussing ideas, innovative and engaged.

Our Entry Level Certificate in Science is made up of 100% internally assessed tests and tasks. The flexibility allowed through this approach to assessment will allow you to take any issues into account in your planning that may affect your learners' performance.

We provide support services designed to help you at every stage, from preparation through to the delivery of our specifications. This includes:

- Ability to use the GCSE (9–1) Combined science Practical Assessment Group (PAG) activities as the basis for the practical science component.
- Specified can-do tasks.
- Interim awards to split the course into manageable stages and help motivate learners through earning teacher-managed awards – see Section 5k.
- Access to Subject Advisors to support you through the transition and throughout the lifetime of the specification.
- Access to Subject Advisor support to assist with selecting appropriate practicals for the practical component of the course.

All Entry Level Certificate qualifications offered by OCR are regulated by Ofqual, the regulator for qualifications offered in England. The accreditation number for OCR's Entry Level Certificate in Science is QN603/0226/4.

1b. Why choose an OCR Entry Level Certificate in Science?

1

OCR's Entry Level Certificate in Science provides an entry into the understanding of the physical, chemical and biological world. Scientific understanding is changing our lives and is vital to world's future prosperity, and all learners should be taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate how the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas relating to the sciences which are both inter-linked, and are of universal application.

Aims and learning outcomes

The OCR Entry Level qualification will encourage learners to:

- understand the use of conceptual models and theories to make sense of the observed diversity of natural phenomena
- understand the assumption that every effect has one or more cause
- understand that change is driven by differences between different objects and systems when they interact
- understand that many such interactions occur over a distance and over time without direct contact
- understand that science progresses through a cycle of hypothesis, practical experimentation, observation, theory development and review
- understand that quantitative analysis is a central element both of many theories and of scientific methods of inquiry
- develop scientific curiosity and knowledge and understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science, through different types of scientific enquiries that help them to answer scientific questions about the world around them
- develop and learn to apply observational, practical and problem-solving skills, both in the laboratory and in other learning environments
- develop their ability to question claims based on science through analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively.

1c. What are the key features of this specification?

This specification has been specifically designed to meet the need of those learners in Key Stage 4 for whom courses leading to a GCSE (9–1) examination do not represent a realistic or appropriate goal. The specification can be used as the basis of an independent course for those learners identified as unlikely to be entered for GCSE (9–1). The course can be started prior to KS4 if this is deemed appropriate by the centre.

It meets the requirements of the Ofqual common criteria and criteria for Entry Level qualifications and covers those aspects of the Science National Curriculum Programme of Study for Key Stage 4 appropriate for learners working at this level. The course will lead to final certification by OCR at Entry Level 1, 2 or 3. It is possible for interim certification to be achieved by learners at stages during the course. These interim progress certificates can be awarded by the centre at Bronze, Silver, Gold, Platinum and Diamond levels.

During the Entry Level Certificate some learners may show sufficient progress for them to be entered into a single science GCSE (9–1). To ensure that the KS4 programme of study is followed these learners may continue with the Entry Level qualification in the science subjects not being continued at GCSE (9–1). For example if a learner is following the GCSE (9–1) in Chemistry they may continue Entry Level Certificate in Biology and Physics.

The course material can also be used and as a source of support materials for the teaching of Foundation Tier of a GCSE (9–1) examination. The specification consists of 36 items, equally divided between biology, chemistry and physics. Learners do not need to have been assessed for all items in order to enter for certification. There is no minimum number of items required but it is expected that there is at least one item from biology, chemistry and physics.

There is no terminal examination, and assessment is by means of a combination of short end-of-item tests, can-do tasks and a practical task (see section 3f). All assessments are centre-based, are supervised by the learner's own teacher, and are carried out at times determined by the centre. All assessments will be subject to standard moderation procedures by OCR.

Part of the inherent flexibility of the Entry Level Certificate in Science specification is the linking of the mark descriptors for the practical task to those for the practical activities for OCR Twenty First Century GCSE (9–1) Science and OCR Gateway GCSE (9–1) Science. This allows the possibility of progression from Entry Level Certificate in Science to GCSE (9–1) Science. Learners making this progression can be entered, as late as February of Year 11, for the Foundation Tier of an OCR GCSE (9–1) Science qualification.

1d. What is new in OCR Entry Level Certificate in Science?

This section is intended for teachers using OCR Entry Level Certificate in Science.

It highlights the differences between the current Entry Level Certificate in Science (R591) and the new version for first teaching from September 2016:

What stays the same?	What's changing?
• The overall structure of the end-of-item assessment • Practical task • Interim school-based awards (Gold 80%, Silver 60% and Bronze 40%)	• A change from 13 to 12 items per science subject has been done to enable centres to better split the course into 1, 2, 3 or 4 years as appropriate, taking 12, 6, 4 and 3 tests per year, respectively • In order to make the Entry Level qualification co-teachable with the GCSE (9–1) at either combined science or separate science qualifications centres may use the Practical Assessment Group activities as a basis for the practical science component of Entry Level Certificate. These can be found in Appendix 5g. Can-do-tasks have been changed to enable them to be closer to the GCSE (9–1)/KS4 programme of study • New platinum and diamond internally awarded certificates (see section 5k)

1e. How do I find out more information?

If you are already using OCR specifications you can contact us at: www.ocr.org.uk

If you are not already a registered OCR centre then you can find out more information on the benefits of becoming one at: www.ocr.org.uk

If you are not yet an approved centre and would like to become one go to: www.ocr.org.uk

Find out more?

Ask the Subject Advisor:

Email: gcsescience@ocr.org.uk

Customer Contact Centre: 01223 553998

Visit our Online Support Centre at support.ocr.org.uk

Check what CPD events are available: www.cpdhub.ocr.org.uk

Follow us on Twitter: @OCR_Science

2 The specification overview

2a. OCR's Entry Level Certificate in Science (R483)

OCR's Entry Level Certificate in Science is a course designed to provide learners with realistic targets, encouraging them to develop scientific skills. This enables more able learners to progress to GCSE (9–1) science.

It is assessed with a combination of end-of-item tests, can-do tasks and a practical task. These are internally standardised by the centre and then externally moderated by OCR.

It provides flexibility to link between the GCSE (9–1) at either combined science and separate science qualifications.

The can-do tasks are based on the skills required for the new GCSE (9–1) courses to enable co-teachability.

The practical task can be devised by the centre or the OCR GCSE (9–1) practical assessment groups (PAGs) could be used/adapted for this purpose.

The course has been designed for teaching over 1, 2, 3 or 4 years. It can be started before year 10 and used to assist centres to assess the suitability of learners for GCSE (9–1) studies and will equip them with many of the skills they will require.

For learners that are only doing the Entry Level Certificate in Science (R483) the following schematic provides an overview of the course and assessment.

Course overview

Biology items

ELB1	Dead or alive (cells)	**ELB7**	You can only have one life – look after it
ELB2	Babies (reproduction)	**ELB8**	Body wars
ELB3	Control systems	**ELB9**	Creepy crawlies
ELB4	Fooling your senses	**ELB10**	Extinction
ELB5	Gasping for breath	**ELB11**	My genes
ELB6	Casualty	**ELB12**	Food factory

Chemistry items

ELC1	Physical or chemical change	**ELC7**	Let's get together
ELC2	Acids and alkalis	**ELC8**	Heavy metal
ELC3	Everything in its place	**ELC9**	Fuels
ELC4	Clean air and water	**ELC10**	Are you overreacting?
ELC5	Novel materials	**ELC11**	How fast? How slow?
ELC6	Sorting out	**ELC12**	CSI plus

Physics items

ELP1	Getting the message	**ELP7**	Our electricity supply
ELP2	Full spectrum	**ELP8**	Attractive forces
ELP3	Medical rays	**ELP9**	Pushes and pulls
ELP4	Hot stuff	**ELP10**	Driving along
ELP5	Alternative energy	**ELP11**	Fly me to the moon
ELP6	Nuclear power	**ELP12**	Final frontiers

Assessment overview

The assessment is made up of three elements listed below. There is one assessment series each year in May/June

Element 1: **End-of-item-tests** 72% of the total 72 points	Learners should submit a maximum of 36 tests. The marks for each test are converted into points. Each test is worth a maximum of two points.
Element 2: **Can-do-tasks** 8% of the total 8 points	There are 16 can-do-tasks. For each task learners have done 0.5 can be awarded.
Element 3: **Practical task** 20% of the total 20 points	Centres are able to devise their own practical task or use/adapt the GCSE (9–1) PAGs (see Section 5g). Learners can attempt more than one of these but the points must be awarded from one task.

When the total points attained for end-of-item tests, can-do tasks and practical task are combined to give a total with a half point, the total points must be rounded **down** to the nearest whole number.

2

Combining Entry Level Certificate in Science and GCSE (9–1) studies

This Entry Level Certificate in Science provides the flexibility to enable more able learners to take a combination of single science GCSEs (9–1) and OCR's Entry Level Certificate in Science, which will provide KS4 provision, at an appropriate level.

The following example shows how GCSE (9–1) in Biology can be taught alongside Entry Level (please note this can also be done with chemistry and physics using a similar approach). The biology content would be covered by the GCSE (9–1) in Biology whilst chemistry and physics provision would be provided by the Entry Level Certificate. This enables the learner to follow the KS4 science subject content at an appropriate level.

Assessment for the GCSE (9–1) will be done by examination at the end of the course. Learners using this approach should also enter for the Entry Level Certificate in Science to ensure that they have the best chance to gain a certificate in science (GCSE (9–1) and/or Entry Level Certificate). To do this the learner would need to take the Entry Level Certificate end-of-item tests for biology. This could be incorporated as preparation for the GCSE (9–1) whilst also enabling them to gain valuable points for the Entry Level Certificate in Science.

Course overview
GCSE (9–1) Biology
Biology items This content will be covered by the GCSE (9–1) biology content.
Chemistry items **ELC1** Physical or chemical change **ELC2** Acids and alkalis **ELC3** Everything in its place **ELC4** Clean air and water **ELC5** Novel materials **ELC6** Sorting out **ELC7** Let's get together **ELC8** Heavy metal **ELC9** Fuels **ELC10** Are you overreacting? **ELC11** How fast? How slow? **ELC12** CSI plus
Physics items **ELP1** Getting the message **ELP2** Full spectrum **ELP3** Medical rays **ELP4** Hot stuff **ELP5** Alternative energy **ELP6** Nuclear power **ELP7** Our electricity supply **ELP8** Attractive forces **ELP9** Pushes and pulls **ELP10** Driving along **ELP11** Fly me to the moon **ELP12** Final frontiers

Assessment overview	
Will be assessed as part of the GCSE (9–1) series examinations	
The assessment is made up of three elements listed below. There is one assessment series each year in May/June	
Element 1: **End-of-item-tests** 72% of the total 72 points	Learners should submit a maximum of 36 tests. The marks for each test are converted into points. Each test is worth a maximum of two points.
Element 2: **Can-do-tasks** 8% of the total 8 points	There are 16 can-do-tasks. For each task learners have done 0.5 can be awarded.
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When the total points attained for end-of-item tests, can-do tasks and practical task are combined to give a total with a half point, the total points must be rounded **down** to the nearest whole number.

2b. Subject content

The Entry Level Certificate can be used as a pre-GCSE (9–1) course to enable centres to determine the best route for their learners. If using the course as a pre-GCSE (9–1) course then the EL end-of-item tests, can-do tasks and practical task (see section 3f) can be used to provide regular information as to the progression and level of attainment of the learner. Using this information centres can then decide whether to continue the learner on the Entry Level course or transfer the learner to GCSE (9–1). If using this route the learners can be presented the Bronze, Silver or Gold award as a motivational award.

The GCSE (9–1) codes have been included in the tables where appropriate to assist teachers in delivering both courses.

Biology content

Tested through end-of-item tests ELB1–ELB12 (see section 2a)

Biology key ideas

Biology is the science of living organisms (including animals, plants, fungi and microorganisms) and their interactions with each other and the environment. The study of biology involves collecting and interpreting information about the natural world to identify patterns and relate possible cause and effect. Biological information is used to help humans improve their own lives and strive to create a sustainable world for future generations. Learners should be helped to understand how, through the ideas of biology, the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below. These ideas include:

- life processes depend on molecules whose structure is related to their function
- the fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling living processes to be performed effectively
- living organisms may form populations of single species, communities of many species and ecosystems, interacting with each other, with the environment and with humans in many different ways
- living organisms are interdependent and show adaptations to their environment
- life on Earth is dependent on photosynthesis in which green plants and algae trap light from the Sun to fix carbon dioxide and combine it with hydrogen from water to make organic compounds and oxygen
- organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life
- the chemicals in ecosystems are continually cycling through the natural world
- the characteristics of a living organism are influenced by its genome and its interaction with the environment
- evolution occurs by a process of natural selection and accounts both for biodiversity and how organisms are all related to varying degrees.

ELB1 Dead or alive (cells)				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB1a	Recall the life processes: movement, respiration, sensitivity, growth, reproduction, excretion, and nutrition.	Discuss the processes of life and how we know that someone is still alive. Make up a mnemonic (e.g. Mrs Gren) to remember this.		
ELB1b	Be able to name the body systems involved with these life processes: circulatory, respiratory and digestive.	Build up systems to show organisation using diagrams of cells, tissues, organs, and systems. Look at the position of organs within the body. Stick cut-out organs into position on a body outline.	B2.2c	B5.1.3
ELB1c	Be able to label the nucleus, cytoplasm and cell membrane of an animal cell.	Build simple 3D models to show and label an animal cell.	B1.1b	B1.1.a
ELB1d	Know that the nucleus controls the cell; the membrane allows some chemicals to pass in and out, and the cytoplasm is where useful chemical reactions take place.	http://www.ibiblio.org/virtualcell/index.htm (The cell.)	B1.1b	B1.1.a
ELB1e	Know that cells get substances in by diffusion, and active transport [No knowledge of the process is required].		B2.1a	B3.2.2a
ELB1f	Know that new cells are made when cells divide.		B2.1b	B4.3.1
ELB1g	Know that new body cells are needed for growth and repair.		B2.1b	
ELB1h	Know that cancer can be caused when cell division is out of control.		B6.3o	B4.3.1

ELB1 Dead or alive (cells)				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB1i	Know that bigger organisms have cells that are adapted for different roles to include nerve cells/root hair cells/red blood cells.		B2.1c	B4.3.5
ELB1j	Know that stem cells are cells that can change into other cells.		B2.1d	B4.3.4
ELB1k	know that stem cells can be used in medicine to repair the body.		B6.3p	B4.4.1
Suggested can-do tasks: B4, U3, U4		**Suggested PAG: B1**		

ELB2 Babies (reproduction)				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB2a	Recall the names of the main organs of the female reproductive system: ovary, oviduct, womb, and vagina.	Label simple diagrams of male/female reproductive systems.		
ELB2b	Recall the names of the main organs of the male reproductive system: penis, testis, sperm duct.	Discuss the role of male and female in sexual intercourse. Add arrows to a diagram of the female reproductive system to show direction of sperm movement towards the egg.		
ELB2c	Recall the functions of testes (make sperm), ovary (make eggs).			
ELB2d	Recall that normal body cells have 46 chromosomes: females have 23 pairs (including xx); males have 22 pairs and an odd pair (xy).	Use a gene pairing game to show males have an odd set of chromosomes (xy) while females have (xx).	B5.1i	B1.2.8
ELB2e	Know that sperm and egg cells have 23 chromosomes each.		B5.1f	B4.3.3
ELB2f	Know that fertilisation occurs by the fusion of a sperm and an egg cell, which produces a fertilised egg with 46 chromosomes.	Discuss what fertilisation involves, and how the egg can separate to form twins.		
ELB2g	Recall that the fertilised egg develops into a foetus.			

ELB2 Babies (reproduction)				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB2h	Know that the placenta is the exchange surface used to transfer substances between the mother and foetus and what happens to it after child birth.	Cut and stick work sheets to show positions of placenta, cord, foetus, bag of water. Complete a table to show the basic role of these structures.	B2.2a	B5.1.7
ELB2i	Know that chemicals called hormones are involved in reproduction to include male: testosterone and female: oestrogen and progesterone.		B3.2a	B5.5.1
ELB2j	Recall some of the changes that occur in the female body after fertilisation: stopping periods and gaining weight.	Discuss the changes that take place in the female body after fertilisation. https://syllabus.med.unc.edu/courseware/embryo_images/unit-welcome/welcome_htms/akgs.htm (development of the embryo.)	B3.2c	B5.5.1
ELB2k	Know that periods start again after childbirth.	Sequence statements of events of labour leading up to birth. Visit to clinic/midwife.		
ELB2l	Explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception.		B3.2e	B5.5.3

ELB3 Control systems				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB3a	Understand that changes in our surroundings can affect our body's internal environment.	Introduce the idea that our internal environment needs controlling.		
ELB3b	Understand that the body's internal environment can change and that the body tries to control this change, use temperature regulation as an example.	Discuss changes in our surrounding environment which can affect our body's internal environment.	B3.3a	B5.4.1
ELB3c	Know the ways the body gains or loses water.	Survey the amount of liquid drunk in summer and winter.	B2.2b	B5.1.1
ELB3d	Be able to name and locate the kidneys and the bladder.	Label a simple diagram of a kidney and a bladder. Show/dissect a kidney.		
ELB3e	Know that kidneys remove excess water and urea.	Discuss the use of isotonic liquids by athletes.	B2.2b	B5.1.1
ELB3f	Know that blood sugar levels need to be controlled.	Read a story about a diabetic.	B3.3a	B5.6.1
ELB3g	Know that the body controls blood sugar levels with insulin.	Discuss how being a diabetic affects your life.	B3.3c	B5.6.1
ELB3h	Be able to name and locate the pancreas.			
ELB3i	Know that insulin is produced by the pancreas.	Design a leaflet to explain what being a diabetic means.		
ELB3j	Know that diabetes can be managed by controlling sugar levels in the diet and use of insulin.	Discuss that there are two types of diabetes and that their treatment can be different.	B3.3e	B5.6.3
Suggested can-do tasks: B1, B2, B4, U3, U4		**Suggested PAG: B1**		

ELB4 Fooling your senses				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB4a	Be able to label a diagram of the eye (limited to cornea, iris, pupil, lens, retina, optic nerve).	Look at a model/video/website of the structure of the eye.	B3.1a	B5.2.1
ELB4b	Recall the job of the pupil, lens, retina, optic nerve and iris.	Build a cut and stick model of the eye.	B3.1a	B5.2.1
ELB4c	Know that the nose is lined with nerves sensitive to chemicals in the air.	Identify substances by smell, e.g. different types of crisps. Taste food when the sense of smell is impaired, e.g. apple and onion.	B3.1a	B5.2.1
ELB4d	Recall that taste buds are located on the tongue and are sensitive to four tastes: salt, sweet, sour, bitter.	Investigate the four taste areas on the tongue.	B3.1a	B5.2.1
ELB4e	Know that different areas of the tongue are more sensitive to different tastes.		B3.1b	B5.2.1
ELB4f	Understand that the flavour of food diminishes when we have a cold and cannot smell.		B3.1b	B5.2.1
ELB4g	Know that sensor (receptor) cells detect stimuli, and effector cells (muscles) produce a response.	Watch a video/website simulation of how nerve impulses work.	B3.1b	B5.2.1
ELB4h	Understand the need for simple reflex actions, i.e. for protection.	Investigate reflex reactions, e.g. knee jerk, pupil dilation and blinking.	B3.1b	B5.2.2
ELB4i	Recall examples of simple reflex actions limited to knee jerk, iris, touching a hot surface.		B3.1c	B5.2.2
ELB4j	Interpret simple data on reaction times.	Measure reaction times by catching a dropped ruler.	B3.1c	B5.2.2

ELB4 Fooling your senses				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB4k	Know that the skin contains sensory nerves for touch, temperature, pain and pressure.	Use 'feelie' boxes to test skin sensitivity. Test water temperature with the hands.	B3.1b	B5.2.2
ELB4l	Know that pressure sensors are deeper than pain sensors.		B3.1b	B5.2.2
ELB4m	Know that some areas of skin contain more nerve endings than others.	Test different areas of skin for sensitivity.	B3.1b	B5.2.2
Suggested can-do tasks: B1, U1, U3, U4				

ELB5 Gasping for breath				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB5a	Be able to name and locate the windpipe, lungs and ribs on a diagram of the thorax.	Make a model thorax.		
ELB5b	Understand that lung volumes vary and may be affected by smoking.	Measure lung volumes.	B6.3n	B2.4.2
ELB5c	Understand that the speed of ventilation varies and may be affected by smoking.	Measure chest movement during breathing. Use a peak flow meter.	B6.3n	B2.4.2
ELB5d	Know that smoking can cause heart disease and cancer.	Demonstrate a model smoking machine.	B6.3l	B2.4.1
ELB5e	Recall that tobacco smoke contains carbon monoxide, nicotine, tars and solid particles.	Debate smoking in public places.		
ELB5f	Know that carbon monoxide is odourless, colourless and poisonous.	Use websites/books to find out about smoking.		
ELB5g	Know that nicotine is addictive and that nicotine patches can be used to help someone give up smoking.			
ELB5h	Interpret data relating to health studies on smoking.			
ELB5i	Know that other people may be affected by passive smoking.			
ELB5j	Know that in all cells, glucose from food and oxygen breathed in combine to release energy and that this process is called respiration.	Watch a video/simulation (e.g. www.bbc.co.uk/bitesize) to show respiration in cells.	B1.3a	B4.1.2
ELB5k	Know that carbon dioxide and water are the waste products of respiration.		B1.3a	B4.1.2

ELB5 Gasping for breath				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB5l	Recall how to test breath for carbon dioxide using limewater, and for water vapour with a mirror or cobalt chloride paper.		B2.2b	B5.1.1
ELB5m	Know that carbon dioxide is removed from our bodies via the lungs.	Test exhaled air to show it contains carbon dioxide and water vapour.	B2.2b	B5.1.1
ELB5n	Know that during exercise, more oxygen and glucose is needed by muscles, and water and carbon dioxide are removed more quickly.	Link exercise to respiration rate.	B2.2b	B5.1.1
Suggested can-do tasks: B1, B2, U1, U3, U4				

ELB6 Casualty				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB6a	Understand the importance of maintaining the supply of oxygen to the body.	Learn basic first aid for an emergency – video/St John Ambulance etc. Practise simple first aid techniques. Discuss how and when to call for help: making a 999 call.	B2.2b	B3.2.1
ELB6b	Know that the heart is made of muscle.	Look at the structure of the heart (dissection or model).	B2.2d	B5.1.4
ELB6c	Know that the heart pumps to force blood out to the lungs or around the body.	http://www.smm.org/heart/heart/top.html (the structure of the heart.) Different ways of measuring pulse rate including using a stethoscope, finger monitors, radial pulse etc.	B2.2d	B5.1.4
ELB6d	Know that the heart acts as a double pump.	Show that in one complete circuit of the body blood goes through the heart twice.	B2.2d	B5.1.4
ELB6e	Know that arteries carry blood away from the heart, and veins to the heart.	Discuss differences between arteries and veins and capillaries.	B2.2d	B5.1.5
ELB6f	Be able to recognise the difference between an artery and a vein.	Look at microscope slides to show the structures of arteries veins and capillaries.	B2.2d	B5.1.5
ELB6g	Know why the heart muscles need a good blood supply.	Look at the structure of the heart (dissection or model) and illustrate the coronary arteries.	B2.2d	B5.1.4
ELB6h	Explain how red blood cells and plasma are adapted to their functions in the blood.		B2.2e	B5.1.6
ELB6i	Know that energy is needed for muscle contraction.	Carry out a simple exercise to show muscle fatigue (finger stretching an elastic band, or fist clenches with arm raises).		

ELB6 Casualty				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB6j	Understand that during exercise muscles need to be supplied with more oxygen and be able to relate this to an increase in heart rate.	Find out how exercise affects breathing rate and pulse rate. Discuss the link between recovery time and fitness.		
ELB6k	Know the equation for respiration.	glucose + oxygen → carbon dioxide + water.		
ELB6l	Compare the processes of aerobic and anaerobic respiration to include the products of both reactions and their effects.		B1.3c	B4.1.1
ELB6m	Interpret simple data on breathing and pulse rates during exercise [no recall expected].	Measuring the effect of exercise on pulse rate.	B2.2b	B5.1.1
ELB6n	Understand that a cut to a major blood vessel is more serious than a cut to a capillary.	Discuss that the body can cope with a 10% blood loss and that a 30% blood loss is serious and that the casualty may need a blood transfusion.	B2.2d	B5.1.5
ELB6o	Know that heart disease often happens when arteries supplying the heart with blood become blocked.	Look at health education leaflets and identify factors that increase the risk of heart disease. Explore heart disease risk factors for different individuals.	B6.3n	
ELB6p	Know that the risk of heart disease is increased by some factors including high-fat diet and smoking and understand that these factors increase the risk of heart disease, but will not cause it in everyone.	Consider patterns in evidence that smoking increases the risk of heart disease. Look at video material reporting studies of risk factors for heart disease.	B6.3m	
Suggested can-do tasks: B1, B4, U1, U3, U4				

ELB7 You only have one life – look after it!				
EL science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB7a	Know that being overweight or underweight is linked to increased health risks.		B6.3n	B2.3.2
ELB7b	Understand that regular exercise is important for a healthy lifestyle.		B6.3m	B2.3.2
ELB7c	Know that regular exercise reduces the risk of heart disease.		B6.3m	B2.5.3
ELB7d	Know that different people have different lifestyles and therefore dietary requirements.		B6.3m	B2.4.2
ELB7e	Understand, in simple terms, the processes of digestion and absorption and where these events occur.	Produce a full size model body with labelled cut-outs of the organs.	B2.1a	B5.1.3
ELB7f	Know that enzymes speed up reactions in humans.	Model the enzyme 'lock and key'	B2.1d	B3.1.3a
ELB7g	Understand that enzymes speed up digestion to produce smaller soluble chemicals (which can pass into the blood by diffusion).	Discuss the role of enzymes in digestion. Show that large molecules (e.g. starch) cannot pass through visking tubing, while smaller molecules can (e.g. simple sugars).	B1.2d B2.1a B2.2a	B3.1.3a B3.2.2a
ELB7h	Know that there are different enzymes in the mouth, stomach and intestines, each of which digests a different type of food.	Show that only particular types of enzyme can digest certain foods, e.g. protease cannot digest starch.		
ELB7i	Know that drugs can be beneficial or harmful.	Research the classification of drugs.	B6.3n	B2.4.2
ELB7j	Know that a drug is a chemical that has an effect on the mind or the body.		B6.3n	B2.4.2
ELB7k	Know that some drugs are addictive.	Research ideas about making cannabis legal.	B6.3n	B2.4.2

ELB7 You only have one life – look after it!				
EL science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB7l	Know how the effect of caffeine on heart rate can be measured.	Measure the effect of caffeine on heart rate e.g. in *Daphnia.*	B6.3n	B2.4.2
ELB7m	Know that alcohol abuse accounts for more deaths and crime than any other drug.		B6.3n	B2.4.2
ELB7n	Know the short term effects of alcohol (limited to blurred vision, slurred speech, poor balance and slower reactions).		B6.3n	B2.4.2
ELB7o	Know the dangers of drink driving.	Research drink driving laws in different countries. Produce a poster on the dangers of drink driving.		
ELB7p	Know the long term effects of alcohol (limited to liver damage).		B6.3n	B2.4.2
Suggested can-do tasks: B1, B2, U1, U2, U3, U4		**Suggested PAGs: B1, B3**		

ELB8 Body wars				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB8a	Describe the relationship between health and disease.		B6.3a	B2.1.1
ELB8b	Describe different types of diseases (including diseases that can be caught and those that cannot be caught).	Discuss diseases that can be caught and those that cannot e.g. cold and cancer.	B6.3b	B2.1.2
ELB8c	Know that if you are infected with two diseases it may make you feel worse.		B6.3c	B2.4.4
ELB8d	Know that plants can get diseases too.	Show some examples of plant disease e.g. powdery mildew, tobacco mosaic virus disease and crown gall disease.	B6.3f B6.3e	B2.1.5
ELB8e	Recall that harmful microbes (pathogens) are bacteria, fungi, protists and viruses.	Look at pictures of the microbes.	B6.3d	B2.1.3
ELB8f	Describe a minimum of one common human infection plus a sexually transmitted infection in humans, including HIV/AIDS.		B6.3f B6.3e	B2.3.1 B2.1.4
ELB8g	Understand that our bodies provide good conditions for microbes to reproduce rapidly.			
ELB8h	Recall that the skin, chemicals in tears, sweat, and stomach acid stop microbes getting in.	Test the effect of acidic pH (stomach acid) or protease (tears) on growth of bacterial agar plates.	B6.3h	B2.2.1
ELB8i	Know that microbes can enter the body through natural openings, or cuts in the skin.			
ELB8j	Know that white blood cells are part of the immune system.		B6.3j	B2.2.3

ELB8 Body wars				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB8k	Know that the immune system fights infections.		B6.3j	B2.2.3
ELB8l	With reference to infection explain how white blood cells, platelets and plasma are adapted to their functions in the blood.		B6.3g	B2.2.4
ELB8m	Describe the process of discovery and development of new medicines.		B6.3k	B2.5.4
ELB8n	Know that antibiotics are chemicals that kill bacteria and fungi, but not viruses.	Test the effect of antiseptics and/or antibiotic discs on growth of bacterial agar plate.	B6.3j	
ELB8o	Know that some bacteria have evolved which are not killed by some antibiotics.		B5.2e	B6.1.5 B6.1.7
ELB8p	Know that vaccines can make people immune to a disease.	Find out what vaccinations you have had.	B6.3j	B2.3.2
ELB8q	Know that a vaccine usually contains a safe form of a disease-causing microorganism.	Discuss why vaccines are given – to protect the majority against a possible deadly disease.	B6.3j	B2.3.2
ELB8r	Know that once you are immune you are protected from a particular disease.		B6.3j	B2.3.2
ELB8s	Understand different viewpoints that parents may have about giving their child a vaccination.	Discuss why some parents don't have their children vaccinated (risk of side effects).	B6.3j	B2.3.2
ELB8t	Understand that media reports of health studies are not always accurate.	Match changing media headlines about the MMR vaccine over time to different pieces of evidence (source from the web).	B6.3j	B2.3.2
Suggested can-do tasks: B1, B2, U1, U3, U4		**Suggested PAGs: B1, B5**		

ELB9 Creepy crawlies				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB9a	Know that animals get their food from eating plants or other animals.	Identify adaptations of prey and predators.	B1.4a	B3.3.2
ELB9b	Know that may different materials cycle through an ecosystem.		B4.1a	B3.3.6
ELB9c	Explain the importance of the carbon cycle and the water cycle to living organisms.		B4.1c	B3.3.7
ELB9d	Explain that microorganisms are involved in the cycling of materials through an ecosystem.		B4.1b	B3.3.5
ELB9e	Understand how some animals are adapted as successful predators.		B5.2c	B3.4.1
ELB9f	Understand the terms herbivore and carnivore.	Construct a food chain using well-known examples.	B4.1d	B3.3.4
ELB9g	Be able to construct a simple food chain with a plant, a herbivore and a carnivore.	Use simple food webs to predict effects of changes on different members of the food web.	B4.1d	B3.3.4
ELB9h	Be able to interpret a simple food web (limited to 3 organisms at any level).		B4.1d	B3.3.4
ELB9i	Understand how a change affecting one species in a food web can affect another species in the same food web.		B4.1e B4.1f	B3.4.1
ELB9j	Be able to describe and carry out simple sampling methods: limited to pooters, nets, pitfall traps and quadrat surveys.	Collect data using a variety of sampling techniques.	B6.1a	B3.4.3c

ELB9 Creepy crawlies				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB9k	Be able to use simple keys to name plants and animals.	Collect pond or leaf-litter organisms. Use a key to identify collected organisms.	B6.1a	
ELB9l	Describe that DNA is now used to help classify organisms.		B5.2b	B6.2.1
ELB9m	Know the meaning of the term habitat.	Match plants and animals to their habitats.		
ELB9n	Understand that organisms are adapted to live in their habitat.		B5.2c	
ELB9o	Be able to estimate the number of plants in an area using results of a quadrat survey.	Estimate the number of weeds in a field.	B6.1a	B2.3.3c
ELB9p	Describe the impact of humans on biodiversity.		B6.1b	B6.3.1
ELB9q	Explain some of the reasons why scientists want to maintain biodiversity.		B6.1c	B6.3.2
Suggested can-do tasks: B3, U1, U3, U4		**Suggested PAG: B2**		

ELB10 Extinction				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB10a	Know that fossils provide evidence of living organisms from long ago to include fossil formation.	Look at display/pictures of fossils. Discuss how fossils were formed.	B5.2e	B6.1.7
ELB10b	Know that living things have been changing through evolution.		B5.2d	B6.1.3
ELB10c	Understand the term *species*.			
ELB10d	Know that some species have changed very little over thousands of years e.g. crocodiles.		B5.2d	B6.1.3
ELB10e	Be able to identify variations in animals or plants of the same species [no recall expected].	Spot variation in animals and plants of the same species (photographs/living things).	B5.2a	B6.1.1
ELB10f	Know that all variations in a species arise from mutations.	Discuss that a mutation is a very small change in the DNA.	B5.1d	B6.1.2
ELB10g	Understand that living things compete for shelter, food and mates, in order to survive.		B4.1f	B3.3.5 B6.1.4
ELB10h	Know that the better adapted individuals will survive and can breed and pass on their features to the next generation.		B5.2c	B6.1.4
ELB10i	Understand the term *habitat*.			
ELB10j	Understand that a species may become extinct if their habitat changes or another species is better adapted to survive there.	Match species to the reasons for them becoming endangered /extinct. Match species to the reasons for them becoming endangered /extinct.	B5.2d	B6.1.4
ELB10k	Understand how human beings have caused some species to become endangered or extinct: habitat destruction, hunting, pollution.	Use the internet to find names of some animals/plants that are endangered species. Produce a poster on how to protect a chosen species.	B6.1.b	B3.3.5

ELB11 My genes				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB11a	Know that human cells contain a nucleus.	Make models, use books, use the internet or multi-media to show that the nucleus contains chromosomes.	B1.1.b	B1.1.1a
ELB11b	Know that the nucleus contains chromosomes which can be seen with a light microscope during cell division but can be seen in greater detail with an electron microscope.	Look at chromosomes using a root tip squash in allium or lily. Show an electron micrograph of DNA/ chromosome.	B1.1c	B1.1.1a
ELB11c	Know that chromosomes are made of DNA.			
ELB11d	Describe DNA as two strands forming a double helix.	Use pipe cleaners or coloured sweets to make models of DNA.	B1.2a B1.2b	B1.1.3
ELB11e	Know that lengths of DNA in chromosomes are genes.		B1.2b	B1.1.5
ELB11f	Know that our DNA carries our unique genetic code.		B5.1b	B1.1.2
ELB11g	Describe the genome as the entire genetic material of an organism.		B5.1b	B1.1.2
ELB11h	Know that most human features are determined by a person's genes.	Record and present data on variation in human features.	B5.1c	B1.1.4
ELB11i	Be able to classify a range of human features as genetic: e.g. tongue rolling, ear lobes, environmental e.g. scars, accent, and both e.g. hair colour, good at sport.	Look at photographs of families and identify similar features.	B5.2a	B6.1.1
ELB11j	Understand that environment also affects many features.	Discuss if scars are passed from parent to offspring.	B5.1c	B1.1.4

ELB11 My genes				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB11k	Understand that most features are affected by several genes, e.g. height.		B5.1j	B1.3.1
ELB11l	Interpret data on human variation.			B6.1.1
ELB11m	Know that some genes are dominant and some are recessive.	Discuss that a person gets two genes for each feature – one from their mum and one from their dad. One may be dominant one is recessive.	B5.1a	B1.2.1
ELB11n	Know how to use simple Punnett squares to show inheritance of genotype ratios.	Use the resource Sexual reproduction – Kittens and variation: http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-biology-a-j247-from-2016/ Use simple Punnett squares to show possible genotypes and the ratio of each.	B5.1g B5.1h	B1.2.2 B1.2.3
ELB11o	Know that some diseases are caused by 'faulty genes'.	Watch video material describing genetic diseases.	B6.3r	B1.3.1
ELB11p	Know that embryos can be tested for certain genes.	Discuss the '23 and me' test.	B6.3r	B1.3.1
ELB11q	Understand that people have different viewpoints about such testing.	Discuss viewpoints people may have about testing embryos for certain genes.	B6.3r	B1.3.1
Suggested can-do tasks: B1, B4, U1, U3, U4		**Suggested PAG: B1**		

ELB12 Food factory				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB12a	Know that plants make their own food from carbon dioxide in the air and water.		B1.4b	B3.1.1
ELB12b	Know that this process is called photosynthesis.		B1.4b	B3.1.1
ELB12c	Know that plants also need light to make their own food.		B1.4b	
ELB12d	Explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis.	Investigate the factors that can affect the rate of photosynthesis on *Cabomba.*	B1.4e	B3.1.4
ELB12e	Know that plants make sugars and some is stored as starch.	Test a leaf for starch.	B1.4c	B3.3.2
ELB12f	Know that oxygen is a waste product of photosynthesis.	Discuss that photosynthesis is the reverse equation to respiration.	B1.4b	B3.1.1
ELB12g	Explain how the structure of xylem and phloem are adapted to their functions in the plant.	Look at the 'strings' of banana to look for xylem.	B2.2j	B3.2.5a
ELB12h	Explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function.	Compare grass grown with and without fertiliser.	B2.2f	B3.2.4
ELB12i	Describe the processes of transpiration and translocation, including the structure and function of the stomata.		B2.2g	B3.2.6
ELB12j	Explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement and temperature.	Investigate the effect of changes in light intensity, air movement and temperature on transpiration.	B2.2i	B3.2.7

ELB12 Food factory				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELB12k	Know that most of the milk we buy comes from cows (or sheep or goats) and is processed before being supplied to customers.	Compare the taste of different types of milk. Test samples of milk to see how fresh it is. Make cheese or yoghurt. Carry out a consumer preference test on varieties of cheese and yoghurt.		
ELB12l	Explain the impact of the selective breeding of food plants and domesticated animals to include milk yield in cattle.		B6.2a	B6.1.6
ELB12m	Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics.		B6.2b	B1.3.2
ELB12n	Explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology and cloning in modern agriculture and medicine.	Know that cuttings, runners and tubers are examples of cloning. Know that cloning produces identical offspring. Grow plants from cuttings, and/or compare cuttings grown with or without rooting powder. Discuss the advantages and disadvantages to garden centres of cloning plants.	B6.3a	B1.3.4
Suggested can-do tasks: B1, B2, B4, U1, U2, U3, U4		**Suggested PAG: B4**		

Chemistry content

Tested through end-of-item tests ELC1–ELC12 (see section 2a)

Chemistry key ideas

2

Chemistry is the science of the composition, structure, properties and reactions of matter, understood in terms of atoms, atomic particles and the way they are arranged and link together. It is concerned with the synthesis, formulation, analysis and characteristic properties of substances and materials of all kinds.

Learners should be helped to appreciate the achievements of chemistry in showing how the complex and diverse phenomena of both the natural and man-made worlds can be described in terms of a small number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below. These ideas include:

- matter is composed of tiny particles called atoms and there are about 100 different naturally occurring types of atoms called elements
- elements show periodic relationships in their chemical and physical properties these periodic properties can be explained in terms of the atomic structure of the elements
- atoms bond by either transferring electrons from one atom to another or by sharing electrons
- the shapes of molecules (groups of atoms bonded together) and the way giant structures are arranged is of great importance in terms of the way they behave
- there are barriers to reaction so reactions occur at different rates
- chemical reactions take place in only three different ways:
    - proton transfer
    - electron transfer
    - electron sharing
- energy is conserved in chemical reactions so can therefore be neither created nor destroyed.

ELC1 Physical or chemical change				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC1a	Explain states of matter using the particle model.	Demonstrate the particle model using a suitable example – e.g. using the students as the particles or using balls.		C1.1.1
ELC1b	Explain changes of state using the particle model.	Investigate how rain is made using a suitable experiment: https://www.youtube.com/watch?v=9kRkQ9tyq3U	C1.1.b	C1.1.1
ELC1c	Describe the physical states of products and reactants using state symbols: (s), (l), (g) and (aq).		C3.1f	C2.4.4
ELC1d	Plan an experiment to work out the melting point of a solid.	Investigate the melting and boiling point of water and plot the results.	C2.1b	
ELC1e	Use data to predict states of substances under given conditions.	Discuss if water is a solid, liquid or gas at different stated temperatures.	C2.3e	C1.1.4
ELC1f	Explain chemical reactions using the particle model.	Investigate a suitable chemical reaction. Discuss what makes a successful collision.	C1.1.b	C1.1.1
ELC1g	Use ideas about the behaviour of particles and bonds to explain what happens during of state.	Discuss what happens to water molecules and the bonds between hydrogen and oxygen during a change of state.	C2.3d	C1.1.1
ELC1h	Know that during a change of state the mass of the substance remains the same.	Weigh the mass of ice and water after melting.	C3.1k	C5.2.1
ELC1i	Explain using the particle model why in a non-enclosed reaction there may be loss of mass during a chemical reaction limited to one of the products being a gas.		C3.1l	C5.2.2
ELC1j	Know that some reactions may be reversed e.g. forward reaction: a+b → c+d and backwards: c+d → a+b.	Investigate a reversible reaction.	C5.2a	C6.3.1
Suggested can-do tasks: C1, U1, U2, U3, U4		**Suggested PAG: C5**		

ELC2 Acids and alkalis				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC2a	Be able to label simple laboratory apparatus used to obtain a dye from a plant (limited to beaker, stirring rod, heating apparatus, filter funnel, filter paper and mortar and pestle).	Find/select and name the apparatus needed to obtain a dye from a plant. Extract plant dyes from flowers, beetroot or red cabbage and use the solution to identify acids and alkalis.		
ELC2b	Know that the colour of some dyes can be changed by adding acids and alkalis.	Investigate how the colour of dyes changes when acids or alkalis are added.		
ELC2c	Understand safety precautions when using acids or alkalis.			
ELC2d	Interpret simple information about the use of indicators to classify solutions as acid, neutral or alkali.	Use other indicators such as litmus to identify solutions that are acidic, alkaline or neutral. Use universal indicator to measure the pH of common substances.	C3.3h	C6.1.4
ELC2e	Know how to use the pH scale.	Use Universal Indicator to measure the pH of common substances. Create a 'rainbow' of colours using Universal Indicator.	C3.3h	C6.1.4

ELC2 Acids and alkalis				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC2f	Know that pH can be measured electronically.			
ELC2g	Know that neutralisation occurs when acids and alkalis are mixed.		C3.3d	C5.3.3
ELC2h	Know that acids produce protons (H^+) and alkalis produce hydroxide ions (OH^-).	Find the names and uses of common acids and alkalis.	C3.3e	C5.3.4
ELC2i	Know that when you mix acids and alkalis together the protons (H^+) and hydroxide ions (OH^-) form H_2O this is called neutralisation (introduce the name ions to higher level learners, lower level learners may just refer to 'H' and 'OH').	Investigate the change in pH when acid and alkali are mixed.	C3.3e	C5.3.5
ELC2j	Understand the uses of neutralisation, limited to curing indigestion and reducing the acidity of soils.		C3.3d	C5.3.3
ELC2k	Know that excess acid in the stomach is a cause of indigestion.	Find out about the contents of different types of indigestion remedies.	C3.3d	C5.3.3
ELC2l	Interpret simple information comparing the effectiveness of different indigestion remedies [no recall expected].	Compare different indigestion remedies by finding out how much acid they neutralise.	C3.3d	C5.3.3
Suggested can-do tasks: C1, C3, U1, U2, U3, U4				

ELC3 Everything in its place				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC3a	Know the relative size of atoms and small molecules.		C1.2c	C2.1.5
ELC3b	Know that scientists' ideas of what an atom looks like (called the atomic model) has changed over time.	Use the superheroes of the atomic model activity (http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-chemistry-a-j248-from-2016/).	C1.2a	C2.1.1
ELC3c	Describe the atom as a nucleus surrounded by particles called electrons.	Build a model of an atom.	C1.2b	C2.1.2
ELC3d	Recall relative charges and approximate relative masses of protons, neutrons and electrons.	Fill in a table of sub-atomic particles.	C1.2d	C2.1.3
ELC3e	Explain how the position of an element in the Periodic Table is related to its atomic number (the number of protons in the nucleus). Use the names and symbols of common elements from the Periodic Table.		C2.2c	C2.2.1
ELC3f	Use the names and symbols of the first 20 elements from the Periodic Table.		C3.1c	C2.4.3
ELC3g	Use the names and symbols of the first Groups 1, 7 and 0 elements from the Periodic Table.	Colour in a Periodic Table using different colours for the different groups.		
ELC3h	Recall the names of the periodic Groups [1 (alkali metals), 7 (halogens) and 0 (noble gases)].	Label the Periodic table appropriately.	C4.1a	C2.4.3
ELC3i	Know that the elements in Groups 1, 7 and 0 are clustered together because they all have the same number of electrons in the outer shell (Group 1 has one electron, Group 7 has seven and Group 0 has eight electrons).		C4.1a	C2.4.3

ELC3 Everything in its place				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC3j	Recognise that the atomic structure of metals and non-metals relates to their position in the Periodic Table.	Draw a line on the Periodic Table to separate the metals from the non-metals. Compare the simple properties of metals and non-metals.	C2.2b	C2.3.4
ELC3k	Explain that isotopes are different forms of the same atom with a different number of neutrons.		C2.2e	C2.2.2
ELC3l	Calculate numbers of protons, neutrons and electrons in atoms given their atomic number and mass (higher level learners can also do this exercise with isotopes).		C1.2e	C2.1.7
Suggested can-do task: U1				

ELC4 Clean air and water				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC4a	Know that the Earth is surrounded by a mixture of gases called the atmosphere.	Compare charts showing the composition of polluted and unpolluted air.	C6.2a	C1.1.5
ELC4b	Know how the atmosphere was formed and has changed over time.		C6.2a	
ELC4c	Know that the atmosphere now contains about 80% nitrogen and 20% oxygen.	Watch a demonstration to show that not all of the air is reactive.	C6.2b	C1.1.6
ELC4d	Know that there are smaller amounts of water vapour, carbon dioxide and other gases in the air.	Draw pie charts to show the composition of the atmosphere.		
ELC4e	Know that fuels contain carbon, which forms carbon dioxide when the fuel burns.	Demonstrate that carbon dioxide and water form when fuels burn.	C6.2d	C1.3.3.
ELC4f	Know how to test for the presence of carbon dioxide.	Bubble the gas produced through limewater.	C3.1g	C1.1.13
ELC4g	Know that the amount of carbon dioxide in the atmosphere is slowly increasing.	Look at/plot a graph of global CO_2 levels against time (years).	C6.2d	C1.3.2
ELC4h	Know that the increasing level of carbon dioxide is linked to global warming.	Design a poster describing the main causes of global warming.	C6.2c	C1.3.1
ELC4i	Know that burning fuels may add harmful chemicals into the atmosphere.	Watch or read news reports about a way of reducing pollution from burning fuels.	C6.2d	C1.3.2
ELC4j	Know that these harmful chemicals are called pollutants.	Look at maps showing levels of nitrogen oxides across a region.	C6.2f	C1.1.7
ELC4k	Understand some of the problems these pollutants cause.	Research and present information on air pollution and health. Survey the number of asthma sufferers (class/ form/ school/ family).	C6.2f	C1.1.8

ELC4 Clean air and water				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC4l	Know that carbon monoxide forms when fuels from crude oil burn in a limited supply of air.	Look at advice to the public about carbon monoxide poisoning and how to avoid the accidents that it can cause. Examine a carbon monoxide detector and the instructions for its use.	C6.2f	C1.1.7
ELC4m	Know that fossil fuels contain small amounts of sulfur which are released as sulfur dioxide when the fuel is burnt.	Demonstrate (in a fume cupboard) burning sulfur in a gas jar, adding water and testing the pH to show SO_2 dissolves to form an acidic solution.	C6.2f	C1.1.7
ELC4n	Know that sulfur dioxide is a cause of acid rain.	Produce a poster on acid rain.	C6.2f	C1.1.7
ELC4o	Know that nitrogen and oxygen from the air can make nitrogen oxides in a car engine.		C6.2f	C1.1.7
ELC4p	Know that a catalytic converter gets rid of pollutants like nitrogen oxides.		C6.2f	C1.1.7
ELC4q	Interpret simple data on the removal of pollutants from car exhausts.	Research ways in which atmospheric pollution from motor vehicles can be reduced, e.g. use more efficient engines, use low sulfur fuels, use catalytic converters, and have laws and tests on cars.	C6.2f	C1.1.7
ELC4r	Be able to state the benefits and drawbacks of using catalytic converters.		C6.2f	C1.1.7
ELC4s	Know that exhaust gas emissions are part of an MOT vehicle test.	Look at the results from an MOT test on a car and work out why it has failed the test.	C6.2f	C1.1.7
Suggested can-do tasks: C1, C3, U1, U2, U3, U4				

ELC5 Novel materials				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC5a	Know that carbon can form four bonds (covalent).	Construct simple organic compounds using chemical model kits.	C2.3a	C4.2.2
ELC5b	Know that carbon can form many compounds because it can arrange itself into a variety of shapes limited to chains and rings.	Look at the variety of bonds carbon can form. Demonstrate models of diamond and graphite.	C2.3b	C4.2.3
ELC5c	Explain the properties of diamond, graphite, fullerenes and graphene in terms of their structures and bonding.	Demonstrate the structure of graphene.	C2.3c	C4.2.6 C4.3.4
ELC5d	Using graphite and diamond explain that their different properties are related to the arrangements of bonds they contain.	Demonstrate the hardness of diamond with a diamond drill/cutting disk *versus* a pencil. Link hardness of minerals to Mohs' scale.	C2.3c	C4.2.6
ELC5e	Interpret simple data comparing the properties of different materials [no recall expected].	Compare tennis rackets made from carbon fibre, metals and wood frames. Study data on different materials and make predictions about the suitability of particular materials for different uses. Produce a display about materials used for sports.	C6.1d	C4.1.2
ELC5f	Know that a composite material contains at least two different materials.	Demonstrate the advantages of composite materials by showing the properties jelly *versus* jelly containing spiral pasta.	C2.1e C6.1e	C4.1.1 C5.1.1
ELC5g	Know that an alloy is a mixture of two or more elements, at least one of which is a metal.	Produce a poster to show uses of alloys/what elements are in different alloys.	C2.1e C6.1e	C4.1.1 C5.1.1

ELC5 Novel materials				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC5h	Know the names and one use of the alloys: steel, solder, aluminium alloy and brass.	Demonstrate making an alloy of solder (in fume cupboard) by melting 60% lead and 40% tin.	C2.1e C6.1e	C4.1.1 C5.1.1
ELC5i	Know that the properties of alloys are different from the properties of the metals from which they are made.	Compare the ease of melting solder and pure lead or pure tin.	C2.1e C6.1e	C4.1.1 C5.1.1
ELC5j	Interpret information linking the properties of materials to their uses [no recall expected].	Discuss the use of alloys in everyday life, e.g. bike frames, coins and window frames.	C6.1e	C4.1.2
ELC5k	Understand the term '*smart*' alloy.	Investigate/demonstrate nitinol – a smart alloy.	C2.1e C6.1d	C4.1.1 C4.1.2 C5.1.1
Suggested can-do tasks: C1, C3, U1, U2, U3, U4				

ELC6 Sorting out				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC6a	Explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term '*pure'.*	Get students to define what pure means and compare this to the dictionary definition of the word. Investigate the freezing and boiling point of pure water, and how impurities such as salt affect this.	C2.1a	C5.1.2
ELC6b	Know that a mixture contains two or more uncombined substances.		C2.1e	C5.1.1
ELC6c	Know that mixtures contain substances that can be separated from each other.	Watch a presentation about the separation techniques used in hospitals: – dialysis uses thin membrane to separate the waste in blood. – centrifuging used to separate a suspended solid from a liquid.		
ELC6d	Suggest suitable separation techniques given information about the substances.	Choose how to separate a mixture (by dissolving and filtering), e.g. salt and sand.	C2.1j	C5.1.8
ELC6e	Be able to plan how to obtain a soluble substance (e.g. salt, copper sulfate or sugar) from an aqueous solution by crystallisation.	Make crystals from a salt solution.	C2.1f	C5.1.7
ELC6f	Be able to plan how to a separate an insoluble substance from water by filtration e.g. sand.	Discuss how filtering works. Investigate the best paper for tea bags or coffee filters. Look at various ways to separate mixtures in everyday life e.g. sieves, vacuum cleaner filters, car air-intake filters.	C2.1f	C5.1.7

ELC6 Sorting out				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC6g	Know how chromatography is used to separate mixtures into their constituents.	Use chromatography to solve a simple forensic problem or to investigate food colours.	C2.1h	C5.1.4
ELC6h	Interpret simple chromatograms.	Use and make chromatograms.	C2.1i	C5.1.5
ELC6i	Suggest how chromatography can be used to test pure from impure substances.		C2.1k	C5.1.6
ELC6j	Following a chromatography experiment measure the distance moved by the solvent and the spots.		C2.1i	C5.1.5
ELC6k	Calculate the R_f value from the spots by dividing the distance moved by the spot by the distance moved by the solvent.		C2.1i	C5.1.5
ELC6l	Understand that distillation is used to separate liquids with different boiling points.	Investigate the freezing and boiling point of pure water, and how impurities such as salt affect this.	C2.1f	C5.1.7
ELC6m	Know that distillation is used to produce some alcoholic drinks, e.g. whisky.	Watch a video about the use of distillation in industry.	C2.1f	C5.1.7
ELC6n	Use melting point data to distinguish pure from impure substances.	Investigate the melting point of salol and compare the experimental results with the pure melting point.	C2.1b	C5.1.3
ELC6o	Know how drinking water is purified.	Distil pure water from salt water.	C6.2g	C1.4.1
Suggested can-do tasks: C1, C2, C3, U1, U2, U3, U4		**Suggested PAGs: C2, C3, C4**		

ELC7 Let's get together				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC7a	Using sodium and chlorine show how atoms can donate electrons.	For more advanced students show how atoms can donate electrons using magnesium and oxygen.	C2.2g	C2.3.6
ELC7b	Know that when sodium loses an electron it becomes positive and when chlorine gains an electron it becomes negative and that these charges hold the two together as salt (sodium chloride).	For more advanced students discuss that when magnesium loses two electrons it becomes 2+ and when chlorine gains two electrons it becomes 2– and that these charges hold the two together as salt (magnesium chloride).	C2.2g	C2.3.5
ELC7c	Construct dot-and-cross diagrams for sodium chloride [outer shell only].		C2.2h	C2.3.8
ELC7d	Know that after reacting the mass of salt produced should be the same as the mass of sodium and chlorine gas.	Demonstrate the reaction of sodium and chlorine (http://www.rsc.org/learn-chemistry/resource/res00000732/heating-group-1-metals-in-air-and-in-chlorine?cmpid=cmp00005145).	C3.1k	C5.2.1
ELC7e	Calculate masses of the product of a simple chemical reaction when given the reactants in a balanced chemical equation.		C2.1c	C5.2.3
ELC7f	Recognise representations of atomic models limited to dot-and-cross diagrams, ball and stick models and two- and three-dimensional representations.		C2.2i	C2.3.5
ELC7g	Use chemical symbols to write the formulae of elements and simple compounds limited to sodium chloride, magnesium oxide, sodium hydroxide, hydrochloric acid, hydrogen and carbon dioxide.		C3.1a	C2.4.1

ELC7 Let's get together				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC7h	Use the formulae of two common ions to deduce the formula of a compound limited to similar charged ions e.g. +/– or 2+/2– etc.		C3.1a	C2.4.1
ELC7i	From a model or a diagram to work out the proportion of sodium and chlorine atoms in a molecule of sodium chloride.	Use sweets and pasta to create a model of a sodium chloride lattice.	C2.1d	C3.4.6
ELC7j	Use the names and symbols of the first 20 elements from the Periodic Table to write the product names of some chemical reactions limited to chloride, fluoride and oxide.	For more advanced students use the names and symbols of the first 20 elements from the Periodic Table to write chemical formulae.	C3.1c	C2.4.6
ELC7k	Describe how to get the sodium and chlorine back by electrolysis with the positive sodium being attracted to the negative electrode and the negative chloride being attracted to the positive electrode.	Carry out the electrolysis of aqueous sodium chloride. Discuss that to get sodium metal and chlorine gas molten sodium chloride would have to be used. Discuss why this is not done in a class.	C3.4d	C3.3.1
ELC7l	Know that sodium metal is formed at the negative electrode (cathode) and the chlorine/non-metal formed at the positive electrode (anode) using inert electrodes.		C3.4a	C3.3.3

ELC7 Let's get together				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC7m	Know that after electrolysis the theoretical mass of sodium and chlorine gas produced should be the same as the starting mass of salt.		C3.1k	C5.2.1
ELC7n	Know that at the cathode electrons are added to the positively charged sodium to remake sodium metal.		C3.4c	C3.3.3
ELC7o	Predict which electrode magnesium metal will be made during the electrolysis of magnesium chloride.		C3.4d	C3.3.3
ELC7p	Know the names of other chemical bonds limited to covalent and metallic bonds.		C2.2f	C2.3.6 C3.1.1
Suggested can-do tasks: C1, C2, C3, C4, U1, U2, U3, U4		**Suggested PAG: C1**		

ELC8 Heavy metal				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC8a	Describe the properties of metals on the basis of their characteristic physical and chemical properties.		C2.2a	C2.2.4
ELC8b	Position carbon in the reactivity series of metals.			C2.2.4
ELC8c	Know how some metals (e.g. iron and copper) can be extracted by heating its ore with carbon.	Extract copper by heating malachite and carbon. Research some uses of copper.	C6.1a	C3.2.4
ELC8d	Know that rusting needs iron, water and oxygen.	Investigate the corrosion of aluminium and iron using different conditions e.g. salt water, acid rain and moist air.	C6.1e	C4.4.3
ELC8e	Explain reduction and oxidation in terms of loss or gain of oxygen, identifying if iron is being reduced or oxidised when rusting.		C3.3a	C4.4.1
ELC8f	Know that paints are used to decorate or protect surfaces.	Find out about corrosion prevention on large structures such as the Eiffel Tower or Forth Road Bridge.	C6.1d	C4.4.3
ELC8g	Know that salt water speeds up rusting.		C6.1e	C4.4.4
ELC8h	Be able to describe similarities and differences between the properties of iron and aluminium, limited to: iron is more dense than aluminium; iron is magnetic; aluminium is not; iron corrodes (rusts) easily and aluminium does not.	Research uses of aluminium and iron. Compare the physical properties of iron and aluminium by data search and/or by experiment.	C6.1d	C4.4.3
ELC8i	Know that electrolysis is used to extract some metals (e.g. aluminium) from their ores because they are more reactive than carbon.		C6.1b	C3.2.5

ELC8 Heavy metal				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC8j	Know that the aluminium is formed at the cathode non-metals are formed at the anode in electrolysis using inert electrodes.		C3.4a	C3.3.3
ELC8k	Recall one advantage and one disadvantage of making cars from aluminium.		C6.1e	C4.4.3
ELC8l	Interpret simple information about metals used to make cars [no recall expected].	Discuss the advantages and disadvantages of aluminium cars e.g. Land Rovers.	C6.1d	C4.4.4
ELC8m	Understand why metals are worth recycling (metals are a finite resource and recycling metal is cheaper than making it from the ore and that it saves resources and energy).	Find data about the amounts of metal ores remaining in the Earth's crust. Discuss why recycling is cheaper than mining it (e.g. no mining costs, less processing and transport, less energy to make a product).	C6.1f	C4.4.5
ELC8n	Interpret information on the recycling of materials [no recall expected].	Research how much your local council recycles.	C6.1g	C4.4.6
Suggested can-do tasks: C1, C2, U1, U2, U3, U4		**Suggested PAG: C5**		

ELC9 Fuels				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC9a	Know that crude oil is a toxic, dark, sticky liquid.	Show a sample of crude oil.	C6.1k	C3.4.3
ELC9b	Know that crude oil is made mainly of hydrocarbons in chains of varying length.	Make polymer chains using monomer paper clips or chemical model kits.	C6.1j	C3.4.4
ELC9c	Know that hydrocarbons are composed of hydrogen and carbon.	Demonstrate model hydrocarbons.	C6.1j	C3.4.4
ELC9d	Recognise that the formula of hydrocarbons will contain carbons, hydrogens and numbers.	Using a model hydrocarbon demonstrate how the chemical formula of hydrocarbons is derived.	C3.1a C6.1j	C2.4.3 C3.4.4
ELC9e	Know that you can calculate the number of hydrogens on a simple hydrocarbon by counting the carbons, multiplying this number by 2 and adding two to the answer.	You may wish to introduce C_nH_{2n+2}.	C6.1j	C3.4.4
ELC9f	Know that modern life is crucially dependent upon hydrocarbons from crude oil and recognise that crude oil is a finite resource.	Research the reserves of gas and oil.	C6.1l	C3.4.1 C3.4.2
ELC9g	Know that crude oil is a good source of hydrocarbons that are used to make many products we enjoy and rely on.	Investigate the use of hydrocarbons in products.	C6.1k	C3.4.2
ELC9h	Know that crude oil can be separated into more useful parts at an oil refinery.	Watch a demonstration of distillation of artificial crude oil in the laboratory.	C6.1h	C3.4.3

ELC9 Fuels				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC9i	Know that in an oil refinery crude oil is separated into fractions based on the boiling point of the hydrocarbon.	Make a virtual visit to an oil refinery on the internet or watch a video about refining.	C2.1f	C3.4.3
ELC9j	Know that petroleum gases, petrol, kerosene and diesel are all hydrocarbons that come from crude oil.	Make models of hydrocarbon chains of various lengths.		
ELC9k	Know the uses of these fuels: petroleum gases, such as propane, in portable gas cylinders; petrol in cars; kerosene in airplanes; diesel in lorries, buses, trains and cars.	Construct a presentation or display matching each of the fractions to their uses.	C6.1.j	C3.4.3
ELC9l	Understand that some fuels ignite more easily than others do and that this is important for their uses.	Watch a demonstration that some fuels catch fire more easily than others.	C6.1e	C1.2.3
ELC9m	Know that burning fuels produces energy for heating, transport and making electricity in power stations.	Compare the advantages of different fuels – solids, liquids and gases.	C3.2a	C1.2.1
ELC9n	Be able to label the apparatus used to find out how much energy a flame gives out.	Burn a fuel and use the energy to heat water.	C3.2a	C4.4.3
ELC9o	Interpret data to decide which fuel gives out most energy when the same amount burns.	Compare the energy values of various fuels.	C6.1e	C4.4.4
ELC9p	Give one advantage and one disadvantage of petrol and diesel for transport.	Watch or read a news report about a way of reducing pollution from burning fuels.	C6.1e	C4.4.4
ELC9q	Interpret simple information about the use of different fuels [no recall expected].	Compare information for customers about diesel cars and petrol cars e.g. fuel consumption, 0–60 mph time, pollution and cost.	C6.1e	C4.4.4

ELC9 Fuels				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC9r	Understand that people can make choices about which fuels to use.		C6.1e	C4.4.4
ELC9s	Know that hydrocarbons can be made into smaller molecules by a process called cracking and that the products of cracking can be used to make plastics.	Demonstrate cracking.	C6.1m	C3.4.15
ELC9t	Know that plastics are made from these small molecules called monomers.		C6.1m	C3.4.15
ELC9u	Know that lots of monomers join together to form a long chain polymer.	Demonstrate the manufacture of nylon (http://www.rsc.org/learn-chemistry/resource/res00000755/making-nylon-the-nylon-rope-trick?cmpid=cmp00000834).	C6.1m	C3.4.15
Suggested can-do tasks: C1, C3, U1, U2, U3, U4				

ELC10 Are you overreacting?				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC10a	Know that the rates of chemical reactions can vary greatly.			
ELC10b	Interpret simple visual images showing different rates of chemical reactions.	Demonstrate the iodine clock reaction https://www.youtube.com/watch?v=KWJpKNQfXWo http://www.rsc.org/learn-chemistry/resource/res00000744/iodine-clock-reaction?cmpid=CMP00005152.		
ELC10c	Know that a reaction stops when one of the reacting substances is used up.			
ELC10d	Know that a reaction can go forwards or backwards and that a reaction may finish when the rate of the forward reaction may equal the rate of backward reaction.		C5.2b	C6.3.2
ELC10e	Deduce an order of reactivity of alkali metals based on their reaction with water.	Demonstrate the reaction of Group 1 metals with water.	C4.1e	C3.2.1
ELC10f	Know that the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive charge the easier the positive charge is formed the more reactive it is.	Investigate the reactivity of metals in dilute acids.	C4.1c	C3.2.2
ELC10g	Predict possible reactions and probable reactivity of elements from their positions in the Periodic Table limited to Group 1, 7 and 0.	Research into noble gases and their uses.	C4.1c	C2.2.7

ELC10 Are you overreacting?				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC10h	Know that magnesium, zinc and iron react with acids to make hydrogen gas.	Investigate the gas produced by the reaction of metals with dilute acids.	C4.1d	C3.2.2
ELC10i	Know the test for hydrogen.	Test the gas produced by the reaction of metals with dilute acids.	C3.1g	C1.1.13
ELC10j	Deduce an order of reactivity of magnesium, zinc and iron based on their reaction with acid.	From experimental data produce a reactivity series of metals.	C4.1d	C3.2.1
Suggested can-do tasks: C1, C3, U1, U2, U3, U4		**Suggested PAG: C5**		

ELC11 How fast? How slow?				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC11a	Know ways of monitoring the progress of a reaction.	Watch video clips of fires (including chip pan fires), rusting and explosions to illustrate different rates of chemical reactions. Look at the application of rate of reaction in everyday life (e.g. speed of cooking with a pressure cooker, slowing up rusting, rate of dissolving tablets for medicinal use). Video clip (or demonstration) of flour/*lycopodium* explosions.	C5.1a	C6.2.7
ELC11b	Interpret information from charts and graphs about rates of reaction.	Investigate the effect of temperature on the speed of dissolving indigestion tablets.	C5.1b	C6.2.8
ELC11c	Understand how particle collisions can be used to explain reaction rates.		C5.1d	C6.2.2
ELC11d	Know that increasing temperature usually speeds up chemical reactions.	Investigate the effect of making tea using ice water, room temperature and boiling water. Investigate the effect of temperature when baking powder is added to vinegar.	C5.1c	C6.2.1
ELC11e	Know that lowering the temperature (in a refrigerator or freezer) slows down the changes that make food go bad.	Investigate how long a food takes to lose quality at room temperature, in the fridge and in the freezer.	C5.1c	C6.2.1
ELC11f	Know that increasing the concentration increases the speed of a chemical reaction.	Investigate the effect of concentration on reaction time, e.g. magnesium ribbon and hydrochloric acid, resin and hardener in car body filler.	C5.1c	C6.2.1

ELC11 How fast? How slow?				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC11g	Be able to label simple laboratory apparatus used to find out about rates of reaction, limited to: beaker, flask, measuring cylinder, thermometer, stirring rod, test tube, gas syringe, top pan balance, stop clock/digital watch.		C5.1a	C6.2.7
ELC11h	Know that the rate of reaction is increased when several small lumps of solid are used rather than a few large lumps.	Investigate the effect of particle size on reaction time, e.g. marble and hydrochloric acid.	C5.1c	C6.2.1
ELC11i	Understand that a difference in the rate of reaction can be explained by a difference in the surface area.		C5.1c	C6.2.1
ELC11j	Know that catalysts can alter the rate of a reaction but are not used up in the reaction.	Investigate the effect of metal oxides as catalysts on a solution of hydrogen peroxide and washing up liquid.	C5.1f	C6.2.4
ELC11k	Explain that to get a reaction to start often energy has to be supplied e.g. heat by a Bunsen burner.	Demonstrate the thermite reaction using a magnesium fuse.	C5.1h	C6.2.6
ELC11l	State that activation energy is the energy that needs to be added to start a chemical reaction.		C3.2c	C6.2.6
ELC11m	Label the activation energy on a graph showing the energy profile of a reaction.	Show that catalysts can often get a reaction started without the use of a Bunsen burner by reducing the amount of energy required to start the reaction.	C3.2b	C6.2.5 C6.2.6

ELC11 How fast? How slow?				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC11n	Interpret simple information on the use of different catalysts [no recall expected].		C5.1a	C6.2.4
ELC11o	Know that enzymes act as catalysts in biological systems.	Investigate the effectiveness of biological washing powders.	C5.1i	C6.2.13
Suggested can-do tasks: C1, C3, U1, U2, U3, U4		**Suggested PAG: C5**		

ELC12 CSI plus				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC12a	Know that anyone present at a crime scene will leave some evidence behind.	Observe evidence at a made up crime scene, then again after it has been tampered with.		
ELC12b	Understand why crime scene investigators wear special clothing to avoid leaving evidence at a crime scene.	Practise collecting evidence without contaminating or mixing it up.		
ELC12c	Know how an investigator collects evidence at a crime scene – in precisely labelled evidence bags.	Discuss the types of evidence that could be left at a crime scene.		
ELC12d	Know fingerprints are left on a surface because oils from the skin are deposited.	Use sealed jars containing iodine crystals to develop prints on filter paper.		
ELC12e	Know how dusting a surface with a special powder can make fingerprints show up.	Dust for prints using fine aluminium powder.		
ELC12f	Know how fingerprints can be removed from a surface.	Investigate the best method to take fingerprints from different surfaces.		
ELC12g	Know how to make a record of a person's fingerprints.	Use ink pads to make a record of fingerprints.		
ELC12h	Understand that innocent people have their fingerprints taken for elimination.			
ELC12i	Recognise loop, arch and whorl as features of fingerprints.	Research the main ways of classifying fingerprints. Compare fingerprints to recognise simple arches, loops and whorls.		
ELC12j	Know that no two people have identical fingerprints – not even identical twins.	Discuss why the police keep fingerprints from convicted criminals on file, but not from innocent people.		

ELC12 CSI plus				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELC12k	Know that blood contains red blood cells, white blood cells, platelets and plasma.	Make a model of blood e.g. pop bottle containing water, dried peas, red lentils.		
ELC12l	Recall that the main blood groups are A, B, AB and O.	Research the different blood groups, and blood transfusions. Discuss why people volunteer to be blood donors, and why some people cannot give blood.		
ELC12m	Know how chromatography can be used to separate colours in ink.	Separate dyes using chromatography e.g. in a made up solution containing different dyes.		
ELC12n	Understand how the results of separating colours can identify a particular ink as being used e.g. to write a forged cheque.	Compare inks from a 'forged' cheque.		
ELC12o	Know that DNA is inherited from parents.	Make a simple model of a DNA double chain using twisted pipe cleaners.		
ELC12p	Know that identical twins have identical DNA but otherwise DNA is unique.			
ELC12q	Interpret data from a crime scene and decide whether or not it confirms a suspect's presence.	Produce a poster showing evidence from a made up crime scene.		
Suggested can-do tasks: C1, C3, U1, U2, U3, U4		**Suggested PAG: C3**		

Physics content

Tested through end-of-item tests ELP1–ELP12 (see section 2a)

Physics key ideas

Physics is the science of the fundamental concepts of field, force, radiation and particle structures, which are inter-linked to form unified models of the behaviour of the material universe. From such models, a wide range of ideas, from the broadest issue of the development of the Universe over time to the numerous and detailed ways in which new technologies may be invented, have emerged. These have enriched both our basic understanding of, and our many adaptations to, our material environment.

Learners should be helped to understand how, through the ideas of physics, the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas which are of universal application and which can be illustrated in the separate topics set out below.

These ideas include:

- the use of models, as in the particle model of matter or the wave models of light and of sound
- the concept of cause and effect in explaining such links as those between force and acceleration, or between changes in atomic nuclei and radioactive emissions
- the phenomena of 'action at a distance' and the related concept of the field as the key to analysing electrical, magnetic and gravitational effects
- that differences, for example between pressures or temperatures or electrical potentials, are the drivers of change
- that proportionality, for example between weight and mass of an object or between force and extension in a spring, is an important aspect of many models in science
- that physical laws and models are expressed in mathematical form.

ELP1 Getting the message				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP1a	Describe how sound waves in air are longitudinal waves.	Demonstrate a longitudinal wave with a spring (e.g. a slinky).	P4.1e	P1.3.2 P1.3.4
ELP1b	Explain how the motion of the molecules in a gas is related to its pressure e.g. shouting *versus* whispering.	Investigate the range of spoken messages in the playground.	P4.2f	P1.3.2 P1.3.4
ELP1c	Know that even when whispering voice can be overheard.	Find out alternative communication methods e.g. historical uses of light or sound for communication e.g. semaphore, asdic and smoke signals.	P4.2f	P1.3.2 P1.3.4
ELP1d	Know that coding a message increases its security.	Send a coded message by hand signals. Send a message by pigpen cipher.		
ELP1e	Understand that light can be used for communication but requires the use of digital code (e.g. Morse code).	Send a Morse code message by turning a lamp on and off. Discuss the '*Some Mother's Do 'Ave 'Em'* theme (http://news.bbc.co.uk/1/hi/magazine/7026637.stm).	P4.2g	P1.1.8
ELP1f	Know that digital signals are either on (1) or off (0).	Investigate binary code.		
ELP1g	Know that light travels through space at a speed of 300 000 km/s.		P4.2f	P1.3.6
ELP1h	Understand how using light allows messages to be transmitted quickly.		P4.2g	P1.1.3 P1.3.6
ELP1i	Understand how light travels along an optical fibre from one end to the other by reflection.	Discuss the uses of optical fibres for communication.	P4.2g	P1.3.8
ELP1j	Know that optical fibres transmit data very quickly.	Use optical fibres to send messages in code.	P4.2g	P1.1.3

ELP1 Getting the message				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP1k	Know that light is not the only method of transmitting a signal digitally there are other examples which use the electromagnetic spectrum.	Investigate other forms of using the electromagnetic spectrum for communication.	P4.2g	P1.1.9
ELP1l	Know that household remote control devices use infrared radiation.	Examine a remote control device and use an infrared detector to show that infrared is emitted from it.	P4.2g	P1.1.9
ELP1m	Know that wireless communication devices use radio waves.	Compare mobile and fixed phones.	P4.2g	P1.1.9
ELP1n	Understand the advantages of wireless technology for radio, mobile telephones and laptop computers.	Discuss the advantages and disadvantages of wireless links for computers.	P4.2g	P1.1.9
ELP1o	Know that mobile phones use microwave signals.	Find out how the mobile phone system works. Discuss how the everyday life of a student would be different without a mobile phone.	P4.2g	P1.1.9
ELP1p	Know that sound and images can be transmitted digitally.		P4.2g	P1.1.9
ELP1q	Know that the main reason for switching to digital television and radio is the improved quality of picture and sound.			
Suggested can-do tasks: P2, P3, U1, U3, U4		**Suggested PAG: P4**		

ELP2 Full spectrum				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP2a	Know that visible light is part of a group of waves called the electromagnetic spectrum.	Use a mnemonic such as roll out your Guinness boys in vats or rural old yokels guzzle beer in volumes.	P4.2f	P1.3.11
ELP2b	Know that all waves from the electromagnetic spectrum travel at the speed of light.		P4.2a	P1.1.3
ELP2c	Be able to list the colours of the visible spectrum in order from red to violet.	Make a rainbow using water from a garden hose.	P4.2d	P1.1.1
ELP2d	Know that a rainbow is a naturally occurring example of the visible spectrum.		P4.2e	P1.1.2
ELP2e	Know that a visible spectrum can be produced when white light passes through a prism.	Investigate what a prism does to white light.	P4.2d	P1.1.2
ELP2f	Know that a laser produces a narrow, intense beam of light.	Research uses for lasers.	P4.2e P4.2g	P1.1.9
ELP2g	Recall uses of lasers limited to: read CDs, light shows, pointers, weapon guidance, cutting tools.		P4.2g	P1.1.9
ELP2h	Know that warm and hot objects emit infrared radiation.	Use an infrared detector to show there is radiation beyond red.	P4.2g	P1.1.9
ELP2i	Know that passive infrared sensors and thermal imaging cameras work by detecting body heat.	Look at examples of photographs taken at night, e.g. from surveillance cameras.	P4.2g	P1.1.9
ELP2j	Know that infrared is useful for: remote control for TV etc.; short distance data links for computer or mobile phone; night photography; burglar alarms; heating things, e.g. electric fire, toaster, grill.	Identify household objects which work by using infrared radiation.	P4.2g	P1.1.9

ELP2 Full spectrum				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP2k	Recall two examples of uses of microwave radiation from: cooking; mobile phones; radar; communication with satellites.		P4.2g	P1.1.9
ELP2l	Know that microwaves cause heating when absorbed by water or fat and this is the basis of microwave cooking.	Demonstrate a microwave e.g. using a bar of soap and marshmallows.	P4.2g	P1.1.9
ELP2m	Know that radio waves produce electrical signals in metal aerials.	Demonstrate a crystal radio.	P4.2g	P1.1.9
ELP2n	Recall two examples of uses of radio waves: radio; wireless links for laptop computers.		P4.2g	P1.1.9
ELP2o	Understand the advantages of wireless technology for global communications.	Discuss the advantages and disadvantages of wireless links for communication.	P4.2g	P1.1.9
Suggested can-do tasks: U1, U2, U3		**Suggested PAG: P4**		

ELP3 Medical rays				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP3a	Understand the difference between the diagnosis of an illness and its treatment.			
ELP3b	Recall some benefits of a doctor being able to see inside a patient's body.	Consider why a doctor may need to see inside a patient's body to confirm a diagnosis.		
ELP3c	Know that all surgical procedures have risks.	Discuss the risks of exploratory surgery.		
ELP3d	Recall some medical uses of UV radiation.	Use case studies to learn about medical uses of UV radiation e.g. treating eczema and jaundice, revealing the presence of bacteria, setting dental fillings.	P4.2g	P1.1.9
ELP3e	Know that exposure to UV radiation can cause suntan, sunburn and skin cancer.		P4.2g	P1.1.8
ELP3f	Understand that the use of UV radiation involves balancing benefits against risk.	Discuss the advantages and disadvantages of sun bathing.	P4.2g	P1.1.8
ELP3g	Recall some ways of reducing the risk of exposure to UV radiation.		P4.2g	P1.1.8
ELP3h	Interpret data on the use of sunscreens [no recall expected].	Show how sunblock works by spraying it onto white paper then illuminating it with a uv lamp.		
ELP3i	Understand that bone absorbs X-rays and so produces shadow pictures.	Look at X-rays of normal and broken bones.	P4.2g	P1.1.9
ELP3j	Know that too much exposure to X-rays is dangerous.	Discuss advantages and disadvantages of X-rays in medicine.	P4.2g	P1.1.8
ELP3k	Understand that the use of X-rays involves balancing benefits against risk.		P4.2g	P1.1.8

ELP3 Medical rays				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP3l	Know that gamma radiation is very penetrating.	Watch a demonstration/simulation of the penetrating power of gamma radiation. Look at gamma camera images of the thyroid.	P4.2g	P1.1.8
ELP3m	Know that a gamma camera detects gamma radiation and that a computer linked to it can make pictures.	Watch a demonstration/simulation of the penetrating power of gamma radiation. Discuss how radioactive chemicals can produce an image outside the patient's body.	P4.2g	P1.1.9
ELP3n	Know that exposure to gamma rays is dangerous.		P4.2g	P1.1.8
ELP3o	Understand that the use of gamma rays involves balancing benefits against risk.	Watch a video showing procedures in the radiology department in a hospital to see how staff and patients are protected from unnecessary doses of X-rays.	P4.2g	P1.1.8
ELP3p	Know that UV radiation, X-rays and gamma rays are part of a family called the electromagnetic spectrum.		P4.2d	P1.1.9
ELP3q	Know that UV radiation, X-rays and gamma rays can damage living cells.	Discuss the risks of nuclear medicine.	P4.2g	P1.1.8

ELP4 Hot stuff				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP4a	Know that energy can be transferred as heat.	Circus of energy experiments.	P5.1c	P6.1.3
ELP4b	Know that the main uses of heat are generating electricity, heating, cooking.	Record energy transfers as block flow charts.	P5.1c	P6.1.3
ELP4c	Know that heat energy flows from a hot to a cooler body.	Discuss why a lump of ice held in the hand melts and why the hand feels cold.	P5.1c	P6.1.3
ELP4d	Know that temperature is measured in °C and that heat is measured in J.			
ELP4e	Understand that the energy to change the temperature of a body depends on: its mass; the material it is made from; the temperature change.	Examine thermograms to see where hot spots occur.	P5.1c	P6.1.5a
ELP4f	Interpret simple data on heating/cooling experiments [no recall expected].	Carry out experiments to measure the energy required to change the temperature of objects.	P5.1c	P6.1.3
ELP4g	Recall and use the words: melting, boiling, freezing, condensing, evaporating.		P1.2a	P6.2.2
ELP4h	Using the particle model define density and explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules.		P1.1d	P6.1.1
ELP4i	Describe how, when substances melt, freeze, evaporate, condense or sublimate, mass remains the same, but that these physical changes recover its original properties if the change is reversed.		P1.2a	P6.2.2
ELP4j	Describe what happens during a change of state in terms of internal energy, energy transfers and particle motions.		P1.2e	P6.2.3

ELP4 Hot stuff				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP4k	Know that a solar furnace uses radiation from the Sun focussed by a curved mirror.		P6.2a	P1.1.9
ELP4l	Understand that when light is absorbed by a material the energy of the material increases and it becomes hotter.	Build a solar collector from aluminium foil and an umbrella.		
ELP4m	Know that a solar furnace is used for heating water which can be used for cooking or electricity generation.		P6.2a	P1.1.9
ELP4n	Know that hot air rises and is replaced by colder air.			
ELP4o	Know that metals are good conductors of heat and that trapped air and plastics are good insulators.		P5.2f	P2.1.7
ELP4p	Understand the terms *insulator* and *conductor*.	Apply the terms conductor and insulator to different materials.	P5.2f	P2.1.7
ELP4q	Know that insulation reduces heat loss.	Investigate the insulating properties of packaging for takeaway foods.	P5.2g	P2.1.6
ELP4r	Be able to design and carry out a test to evaluate the effectiveness of takeaway food packaging.	Find optimum thickness for loft insulation using a scientific model e.g. reducing heat loss in a cup of hot water using cloth/cardboard.	P5.2g	P2.1.7
ELP4s	Calculate energy efficiency for any energy transfer, and describe ways to increase efficiency.		P5.2d	P2.1.8
ELP4t	Interpret simple data on home insulation [no recall expected].	Compare temperature changes in insulated and non-insulated model houses.	P5.2g	P2.1.8
Suggested can-do tasks: P3, U1, U2, U3, U4		**Suggested PAGs: P1, P5**		

ELP5 Alternative energy				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP5a	Understand that every power station needs an energy source.			
ELP5b	Recall that crude oil, coal and natural gas are fossil fuels used in power stations.			
ELP5c	Understand that fossil fuels are a limited energy source.			
ELP5d	Know that burning fossil fuels produces carbon dioxide which is a greenhouse gas.			
ELP5e	Know that greenhouse gases contribute to global warming.			
ELP5f	Understand that the demand for energy is increasing and this means that renewable sources will become more important.	Research to find different energy sources (e.g. http://www.cat.org.uk/index.html).		
ELP5g	Know that some energy sources are renewable: wind, sunlight, waves, tide, geothermal, hydro-electric, biomass.	Discuss renewable energy resources.	P6.2a	P2.2.1
ELP5h	Interpret information about the demand for energy and the availability of energy sources [no recall expected].		P6.2b	P2.2.7
ELP5i	Know that wind turbines use energy from the wind to generate electricity.	Make a model windmill and investigate the angle of the blades and the use of a rudder.	P6.2a	P2.2.1
ELP5j	Know that the up and down movement of water in a wave can be used to turn a turbine and so generate electricity.	Make a model 'bobbing duck' to produce electricity.	P6.2a	P2.2.1
ELP5k	Describe in simple terms wave motion in terms of amplitude, wavelength, frequency and period.		P4.1a	P1.3.1
ELP5l	Define wavelength and frequency and describe and apply the relationship between these and the wave velocity.		P4.1f	P1.3.6

ELP5 Alternative energy				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP5m	Describe how ripples on water surfaces are examples of transverse waves and how the speed of each may be measured; describe evidence that it is the wave and not the water or air itself that travels.		P4.1g	P1.3.2
ELP5n	Describe the difference between transverse and longitudinal waves.	Demonstrate transverse waves with rope and longitudinal waves with a spring.	P4.1e	P1.3.4
ELP5o	Know that the Sun is a source of energy.	Find out how the voltage of a photocell depends on distance from a lamp.	P6.2a	P2.2.1
ELP5p	Know that photocells transform light into electrical energy.	Use a photocell to make electricity.	P6.2a	P1.1.9
ELP5q	Know that photocells produce direct current.	Find out how photocells can be connected to increase their voltage.	P6.2a	P1.1.9
ELP5r	Understand that photocells are useful sources of electricity for remote locations.	Discuss appropriate uses of photocells.	P4.2g	P1.1.9
ELP5s	Know that heating a house requires a lot of energy and that alternative sources of heating can be used.		P1.2c	P6.2.3
ELP5t	Know that radiation from the Sun can be absorbed by a surface and transferred into heat.		P4.2g	P1.1.9
ELP5u	Be able to describe an experiment to show that black matt surfaces absorb more energy than white shiny surfaces.	Compare energy absorption by different coloured surfaces.	P4,2b	P1.1.4
ELP5v	Know that solar panels have circulating water which is heated by radiation from the Sun.	Make a model solar panel using black rubber tubing and a small water pump e.g. from a windscreen washer to circulate the water.	P4.2g	P1.1.4
Suggested can-do tasks: P1, P2, P3, U1, U3, U4				

ELP6 Nuclear power				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP6a	Describe the atom as a nucleus surrounded by electrons.		P1.1.b	P5.1.1
ELP6b	Know the relative size of atoms and small molecules.		P1.1.c	P5.1.3
ELP6c	Know that scientists' ideas of what an atom look likes (called the atomic model) has changed over time.		P1.1.a	P5.1.2
ELP6d	Recall that atomic nuclei are composed of both protons and neutrons.		P4.3a	P5.1.4
ELP6e	Explain that isotopes are different forms of the same atom.	Discuss that atoms of the same elements can differ in nuclear mass by having different numbers of neutrons.	P4.3c	P5.1.6
ELP6f	Know that changes in an atoms nucleus can generate radiation.	Demonstrate the atom decaying by making popcorn.	P4.3i	P1.1.7
ELP6g	Be able to recognise a diagram of nuclear decay and give a simple description as to the process.	Simulate the fission of a large atom into smaller radioactive atoms.	P4.3i	P1.1.7
ELP6h	Explain the concept of half-life and how this is related to the random nature of radioactive decay.	Demonstrate half-life with M&Ms throw them into the air then remove all the ones with the m uppermost. Half-life can also be demonstrated by measuring the decay of a head of beer in a measuring cylinder – cheaper beer works best as it produces a larger head.	P4.3j	P5.1.10
ELP6i	Know that uranium is a non-renewable resource.	Watch an animation of a nuclear reactor to see how fission boils water in the steam generator.	P6.2a	P2.2.2

ELP6 Nuclear power				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP6j	Know that in a nuclear power station, the uranium provides the source of energy.		P6.2a	P2.2.1
ELP6k	Know that a lot of energy is released by the splitting of uranium atoms.		P4.3d	P5.1.7 P5.1.8
ELP6l	Know that a nuclear power station produces harmful radioactive waste.	Watch a demonstration showing the penetration of radioactivity through different materials.	P4.3m	P5.2.2
ELP6m	Know the differences between contamination and irradiation effects and compare the hazards associated with these two.	Discuss the safe siting of nuclear power stations. Find out about commissioning, operating and decommissioning nuclear power stations. Design a poster for use in school reminding teachers how to handle radioactive material safely.	P4.3m	P5.2.2
ELP6n	Know that waste from nuclear power is: harmful; radioactive but is not a cause of global warming.		P6.2a	P2.2.1
ELP6o	Know that nuclear waste can be disposed of: low level waste in land fill sites (low level waste); by burying deep underground; by reprocessing.	Investigate different types of nuclear waste and how they are stored. Discuss the government's plans for disposing of nuclear waste.	P4.3m	P5.2.2
ELP6p	Recall one risk and one benefit of nuclear power.	Consider the need for security of nuclear installations.		

ELP7 Our electricity supply				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP7a	Explain the difference between direct and alternating voltage.	Discuss appropriate uses for different batteries.		
ELP7b	Know that batteries produce d.c. electricity from chemical reactions.	Make a fruit battery and investigating its properties. Make a chemical battery.	P5.2b	P2.1.1
ELP7c	Know that the domestic supply in the UK is a.c. (at 50 Hz and about 230 volts).		P6.2f	P2.2.4
ELP7d	Know the main stages in the production of electricity: heat from the energy source changes water into steam, the steam is used to rotate turbines, turbines turn a generator, and the generator produces electricity.	Watch an animation showing how a power station works. Find out about the parts of a power station. Model a power station with a bicycle dynamo or steam engine.	P5.1c	P2.2.1
ELP7e	Understand the terms *insulator* and *conductor*.	Discuss the terms with respect to electricity.	P5.2f	P2.1.6
ELP7f	Know that electricity is transferred from a power station through a grid of high voltage transmission lines.		P6.2c	P2.2.5
ELP7g	Understand that transformers are required at either end of the transmission lines to increase or decrease voltage.	Assemble and test transformers with a.c. supplies and oscilloscopes.	P6.2e	P3.3.5 P3.3.6
ELP7h	Know that a transformer is two coils of wire wound onto a core of iron.	Demonstrate a model transmission line system.	P6.2c	P3.3.5
ELP7i	Know that electricity in the home is conducted by wires.		P6.2c	P2.2.6

ELP7 Our electricity supply				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP7j	Know the differences in function between the live, neutral and earth mains wires, and the potential differences between these wires; hence explain that a live wire may be dangerous even when a switch in a mains circuit is open, and explain the dangers of providing any connection between the live wire and earth.	Design a leaflet to warn of the dangers of electrical wiring.	P6.2i	P2.2.6
ELP7k	Know that current is a rate of flow of charge, that for a charge to flow, a source of potential difference and a closed circuit are needed and that a current has the same value at any point in a single closed loop.	Demonstrate electricity using a suitable model.	P3.1e	P3.1.1
ELP7l	Know and use the relationship between quantity of charge, current and time.		P3.1f	P3.1.2
ELP7m	Know that current (*I*) depends on both resistance (*R*) and potential difference (*V)* and the units in which these are measured.		P3.2c	P3.1.3
ELP7n	Know and apply the relationship between *I, R* and *V*, and that for some resistors the value of *R* remains constant but that in others it can change as the current changes.		P3.2c	P3.1.4a
ELP7o	Explain the design and use of circuits to explore such effects – including for lamps, diodes, thermistors and LDRs.		P3.2c	P3.2.2a

ELP7 Our electricity supply				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP7p	Describe the difference between series and parallel circuits, explain why, if two resistors are in series the net resistance is increased, whereas with two in parallel the net resistance is decreased (qualitative explanation only).	Construct and test series and parallel circuits.	P3.2a	P3.2.2a
ELP7q	Calculate the currents, potential differences and resistances in d.c. series circuits, and explain the design and use of such circuits for measurement and testing purposes; represent them with the conventions of positive and negative terminals, and the symbols that represent common circuit elements, including diodes, LDRs and thermistors.	Test electrical circuits and draw the circuit diagrams.	P3.2j	P3.1.7
ELP7r	Know that some appliances use more electricity than others.	Demonstration of electricity meter.	P5.2b	P2.1.8
ELP7s	Know ways of reducing energy loss from the home.		P5.2f	P2.1.8
ELP7t	Interpret data for different energy saving strategies focusing on the choice of energy saving appliances [no recall expected].		P5.2f	P2.1.8
Suggested can-do tasks: P3, P4, U1, U3, U4		**Suggested PAG: P6**		

ELP8 Attractive forces				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP8a	Know that iron and steel are magnetic.	Test materials to see if they are magnetic.	P2.2a	P4.1.2
ELP8b	Know how to induce magnetism in a pin.	Investigate games using magnets (fishing, theatre).		
ELP8c	Know that magnets attract magnetic materials: limited to iron and steel.		P3.3a	
ELP8d	Know that like poles repel and unlike poles attract.		P3.3a	P3.4.1
ELP8e	Know how iron filings or a compass can be used to show up a magnetic field.	Find where magnetic fields are strongest and weakest on a bar magnet. Find the magnetic field of a magnet by using iron filings.	P3.3c	P3.4.2
ELP8f	Know that a freely swinging magnet comes to rest in a N-S direction.	Make a compass.	P3.3c	P3.4.3
ELP8g	Know that the Earth has a magnetic field around it.	Use a compass to plan a route around a school.	P3.3c	P3.4.3
ELP8h	Understand how a compass works and why it is so useful.	Follow a route using a compass.	P3.3d	P3.4.3
ELP8i	Know that the Earth's magnetic field protects us from cosmic rays.	Find out about the Earth's magnetic field. Use the internet to find out about the 'Northern Lights'.	P3.3d	P3.4.3
ELP8j	Know that a current-carrying wire behaves like a magnet.		P3.3d	P3.4.3

ELP8 Attractive forces				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP8k	Know how to construct an electromagnet.	Make an electromagnet and use it to sort aluminium and steel drinks cans.	P3.3a	
ELP8l	Understand how the strength of an electromagnet depends on: the number of turns on the coil, the current in the coil.	Make and test an electromagnet. Devise ways of improving the electromagnet.	P3.3a	P3.4.8
ELP8m	Understand that the core of an electromagnet is made of iron because iron is a temporary magnet.		P3.3b	P3.4.8
ELP8n	Know that the strength of the field depends on the current and the distance from the conductor, and explain how solenoid arrangements can enhance the magnetic effect.		P3.3f	P3.4.7
ELP8o	Be able to label the magnet, core and cone in a loudspeaker.	Make and use a loudspeaker.	P3.3c	P3.4.7 P3.4.8
ELP8p	Be able to plan how to compare how the number of turns on the coil (or strength of magnet) affects how well a loudspeaker works.		P3.3c	P3.4.7 P3.4.8
ELP8q	Recall uses of electromagnets limited to: MRI scan, sorting scrap metals, lifting iron/steel/cars.		P3.3c	P3.4.7 P3.4.8
Suggested can-do tasks: P1, P4, U1, U3, U4				

ELP9 Pushes and pulls				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP9a	Know that forces can be pulls, pushes, twists or bends.	Explore the size and feel of a range of forces. Investigate types and operation of screwdrivers, spanners, levers etc.	P2.2a	P4.1.2
ELP9b	Know that forces are measured in Newtons.	Make and testing a Newton meter (spring-balance). Test the breaking strain of a fishing line.		
ELP9c	Understand that unbalanced forces change the motion of an object.		P2.2b P2.2c	P4.1.3
ELP9d	Know that gravity is a force pulling things towards the Earth.	Measure gravity force using a Newton meter.	P2.2c	P4.1.5
ELP9e	Understand that weight is due to the force of gravity.		P2.3h	P4.1.7
ELP9f	Know that an objects gravitational potential energy is composed of its mass, height and gravity.		P5.1e	P4.4.1
ELP9g	Know that falling objects are acted on by gravity and drag.	Measure the speed of falling objects. Make parachutes.	P2.1d	P4.2.5
ELP9h	Understand the effect of air resistance on falling objects.	Investigate gliders and airplanes.	P2.3i	P4.2.11
ELP9i	Know that falling objects can reach a maximum speed.		P2.3i	P4.2.11
ELP9j	Know that a stretched elastic band exerts a force.	Make model bungee ropes and test them.	P1.1a	P6.3.6a
ELP9k	Know that an increased force increases the length of an elastic material.		P2.3a	P6.3.5

ELP9 Pushes and pulls				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP9l	Give a simple description of the relationship between force and extension in stretching a spring.		P2.2l	P6.3.3a
ELP9m	Know that the extension of an elastic material is proportional to the force applied to it.		P5.1e	P6.3.5
ELP9n	Know that elastic materials return to their original shape unless the force becomes too big.		P2.3b	P6.3.2
ELP9o	Apply the relationship between work done = force × distance moved.		P2.2l	
Suggested can-do tasks: P1, P2, P3, U1, U3, U4		**Suggested PAG: P2**		

ELP10 Driving along				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP10a	Recall and be able to use: speed = distance ÷ time.	Survey speeds outside the school by timing cars over a given distance.	P2.1b	P4.4.2
ELP10b	Understand that speed limits were introduced to save fuel and improve road safety.	Watch a road safety video.	P6.1d	P4.3.13
ELP10c	Know that the national speed limit is 60 mph on most roads, 70 mph on motorways and dual carriageways.		P6.1d	P4.3.13
ELP10d	Understand why speed limits are less than the national limits in towns, outside schools and other areas.		P6.1d	P4.3.13
ELP10e	Relate the amounts of energy associated with a moving body (limited to faster speed = more energy).		P5.1e	P4.4.1
ELP10f	Describe with examples where there are energy transfers in a system, that there is no net change to the total energy of a closed system (qualitative only).		P5.1a	P2.1.4
ELP10g	Describe, with examples, how in all system changes, energy is dissipated, so that it is stored in less useful ways.		P5.2a	P2.1.5
ELP10h	Know that more power is required to stop a fast moving car (during braking energy is converted to heat in the brakes–the faster the speed the faster the energy needs to be converted to heat).	Design a poster for a road safety campaign to reduce speeding.	P2.2n	P2.1.2

ELP10 Driving along				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP10i	Know that thinking distance is the distance travelled between seeing danger and starting to brake.		P6.1d	P4.3.11
ELP10j	Explain methods of measuring human reaction times and recall typical results.	Measure reaction time by dropping calibrated 'ruler' between fingers.	P6.1d	P4.3.11
ELP10k	Know that braking distance is the distance travelled whilst braking.	Mark out thinking distances, braking distances and stopping distances on playground or field for speeds up to 100 mph.	P6.1e	P4.3.12
ELP10l	Know that: stopping distance = thinking distance + braking distance.		P6.1e	P4.3.12
ELP10m	Interpret data from table of thinking, braking and stopping distances [no recall expected].		P6.1e	P4.3.12
ELP10n	Explain the dangers caused by large decelerations.	Talk about the links between traffic speed and injury. Design a poster for a road safety campaign to reduce speeding.	P6.1e	P4.3.13
ELP10o	Know that crumple zones in vehicles reduce the impact force.	Build crumple zones on model cars and test them.	P6.1e	P4.3.13
ELP10p	Know that air bags and seatbelts reduce impact forces for occupants.		P6.1e	P4.3.13
Suggested can-do tasks: P1, P2, P3, U1, U4		**Suggested PAG: P3**		

ELP11 Fly me to the moon				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP11a	Know that the moon orbits the Earth.	What causes an eclipse of the Sun? Find out about the Moon. Plan a space expedition to the Moon.		
ELP11b	Know the order of the eight planets in the solar system.	Devise a mnemonic to remember the names of the planets in our solar system e.g. 'My Very Excellent Mother Just Served Us Noodles'. Make a simple model of the solar system.		
ELP11c	Interpret information about the planets and other bodies in the Universe [no recall expected].	Use the internet to find out about planets around stars other than the Sun. Discuss the chances of life on other planets.		
ELP11d	Know that other planets have moons.	Find out which other planets have moons.		
ELP11e	Know that large rockets are needed to put things in space.	Discuss how gravity needs to be overcome to put objects into space. Test a compressed air and water rocket. Find out about chemically-fuelled rockets used in firework displays.	P5.1b	P4.4.7
ELP11f	Apply Newton's first law to explain why a rocket on a launch pad remains where it is before take-off.		P2.2d	P4.3.6
ELP11g	Know that Newton's second law is used by scientists to work out how the rocket lifts off the pad relating forces, masses and accelerations $F = ma$.		P2.2i	P4.3.5

ELP11 Fly me to the moon				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP11h	Explain how the thrust of the rocket is provided by heating a gas to increase its volume.		P1.2g	P6.2.4
ELP11i	Explain how the motion of the molecules in a gas is related both to its temperature and its pressure: (qualitative only).	Discuss that the hotter the temperature the faster the particles move. The more particles the more collisions and therefore the greater pressure.	P1.2g	P6.2.4
ELP11j	Explain what would happen if you had a blockage in a rocket motor.		P1.2h	P6.2.4
ELP11k	Recall Newton's third law to the forces of the rocket.	Discuss that the force of the fuel going one way pushes the rocket the other way.	P2.2o	P4.1.1
ELP11l	Apply Newton's law to explain why the rocket in space keeps a constant speed.	Show the feather penny free-fall in a vacuum experiment.	P2.2o	P4.1.1
ELP11m	Know that some parts of some rockets/ shuttles return to the Earth and can be reused.	Show a video of the Space shuttle or SpaceX.		
ELP11n	Understand that manned spacecraft need resources that unmanned spacecraft do not e.g. oxygen, food, water.	Investigate voyager and pioneer spacecraft.		
ELP11o	Know that other (artificial) satellites orbit the Earth and are used for communication, mapping, spying and tracking.			
Suggested can-do tasks: P1, P2, P3, U1, U3, U4				

ELP12 Final frontiers				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP12a	Know that the Sun is at the centre of our solar system.			
ELP12b	Know that the Sun is a star.			
ELP12c	Know that the Earth orbits the Sun.			
ELP12d	Recall that the Earth moves in its orbit through space at an enormous speed.	Work out the speed of the Earth and relate this to how long it would take to get to Sydney, Australia.		
ELP12e	Understand that other planets take longer/shorter times to orbit the Sun if they are further/nearer to the Sun.	Discuss what would be different if the expedition was going to Mars or Neptune.		
ELP12f	Interpret information about the planets and other bodies in the Universe [no recall expected].			
ELP12g	Know that space contains many stars of which the Sun is one.	Find out the name of the nearest stars to our Solar System.		
ELP12h	Know that the Sun is a star in the Milky Way galaxy.			
ELP12i	Know that there are billions of stars in the Milky Way.			
ELP12j	Know that there are billions of galaxies in the Universe.	Discuss whether we would ever be able to visit another galaxy.		
ELP12k	Be able to compare the sizes of the moon, the Earth, the Sun, the Milky Way and the Universe.			
ELP12l	Know that astronomers use astronomical telescopes to study the sky.	Use a telescope to look at the moon.		

ELP12 Final frontiers				
EL in science content ref.	**Content statement**	**Suggested activities and experiences**	**GCSE (9–1) Gateway A combined science ref.**	**GCSE (9–1) 21st Century Science B combined science ref.**
ELP12m	Know that the Sun is a source of light.	Recognise the difference between luminous and non-luminous objects.		
ELP12n	Know that planets and moons reflect light which enable them to be seen.			
ELP12o	Know that it is dangerous to look at the Sun.	Discuss why you must NEVER look at the Sun with a telescope.		
ELP12p	Understand that light pollution and dust in the atmosphere interferes with observations by astronomers.			
ELP12q	Know that astronomers have discovered planets around other stars.	Investigate the Hubble space telescope.		

2c. Practical science requirements

Learners are expected to be given the opportunity to do at least SIX practicals.

For the qualification there are two levels of practical activity: can-do tasks and a practical science activity. The can-do tasks can be completed at appropriate times during the course. Can-do tasks can be used to develop practical skills that learners will utilise for their practical science activity.

It is therefore likely that whilst we encourage full practicals to be done throughout Entry Level Certificate the most appropriate activity for submission will be done towards the latter part of the course. The marking criteria for the practical task is detailed fully in section 3f. Suggestions for practicals are given in Appendix 5g.

2d. Prior knowledge, learning and progression

- No prior learning of the subject is required.
- Progression – this Entry Level Certificate is a general qualification designed to enable learners to progress either directly to employment or to foundation level courses.

The progress of some learners during the course might be sufficient to allow their transfer to any GCSE (9–1) Science qualification.

There are a number of Science qualifications at OCR. Find out more at www.ocr.org.uk

3 Assessment of Entry Level Certificate in Science

3a. Forms of assessment

OCR's Entry Level Certificate in Science consists of three components that are assessed by the centre and externally-moderated by OCR.

<table>
<tr><th colspan="2">Element 1</th></tr>
<tr><td>End-of-item tests
72% of total
72 points</td><td>Element 1 will comprise the end-of-item tests the learner has completed.
Marks for the end-of-item tests will be awarded as follows:
<table>
<tr><td>Raw mark</td><td>3–5</td><td>6–8</td><td>9–11</td><td>12–15</td></tr>
<tr><td>Points</td><td>0.5</td><td>1.0</td><td>1.5</td><td>2.0</td></tr>
</table></td></tr>
<tr><th colspan="2">Element 2</th></tr>
<tr><td>Can-do task
8% of total
8 points</td><td>There are 16 can-do tasks. For each task learners have done 0.5 points can be awarded.</td></tr>
<tr><th colspan="2">Element 3</th></tr>
<tr><td>Practical task
20% of total
20 points</td><td>It is expected that the learners complete as many practical activities as possible during this course.
The marks for one whole practical task will be submitted to OCR for certification. The practical submitted needs to be marked using the practical task grid (section 3f).</td></tr>
</table>

If a learner has a final total points containing a half point, the total points awarded will need to be rounded **down** to the nearest whole number.

3b. Assessment objectives (AO)

There are three Assessment Objectives in OCR Entry Level Certificate in Science. These are detailed in the table below.

Learners are expected to demonstrate their ability to:

Assessment Objective		Weighting (%)
AO1	**Demonstrate knowledge and understanding of:** • scientific ideas • scientific techniques and procedures.	40
AO2	**Apply knowledge and understanding of:** • scientific ideas • scientific enquiry, techniques and procedures.	40
AO3	**Analyse information and ideas to:** • interpret and evaluate • make judgements and draw conclusions • develop and improve experimental procedures.	20

AO weightings in OCR Entry Level Certificate in Science

The relationship between the Assessment Objectives and the components are shown in the following table:

Assessments	% of overall Entry Level Certificate in Science R483			Total (%)
	AO1	AO2	AO3	
End-of-item tests	36	36	0	**72%**
Can-do tasks	4	4	0	**8%**
Practical task	0	0	20	**20%**
Total %	**40**	**40**	**20**	**100%**

3c. Total qualification time

Total qualification time (TQT) is the total amount of time, in hours, expected to be spent by a learner to achieve a qualification.It includes both guided learning hours and hours spent in preparation, study and assessment. The total qualification time for Entry Level Certificate in Science is 120 hours.

3d. Qualification availability outside of England

This qualification is available in England. For Wales and Northern Ireland please check the Qualifications in Wales Portal (QIW) or the Northern Ireland Department of Education Performance Measures / Northern Ireland Entitlement Framework Qualifications Accreditation Number (NIEFQAN) list to see current availability.

3e. Language

This qualification is available in English only. All assessment materials are available in English only and all candidate work must be in English.

3f. Assessment availability

There will be one examination series available each year in May/June to **all** learners.

This specification will be certificated from the June 2017 examination series onwards.

3g. Retaking the qualification

Learners can retake the qualification as many times as they wish.

3h. Internal assessment tasks

All internal assessment tasks are set by OCR or by the Centre.

Assessment	Set by Centre	Set by OCR
End-of-item tests		✓
Can-do tasks		✓
Practical tasks	✓	

The end-of-item tests can be found on the OCR Interchange (see pages 8+9): https://interchange.ocr.org.uk

The can-do tasks can be found on the OCR website (see pages 8+9): www.ocr.org.uk

3i. Non-exam assessment – marking criteria

Work submitted for the Entry Level components should reflect the standard expected for a learner after a full Entry Level course of study.

All components for OCR's Entry Level Certificate in Science are internally assessed and externally moderated.

Learners' work should be marked by the centre assessor to the marking criteria in the relevant table, using a 'best-fit' approach.

Marking should be positive, rewarding achievement rather than penalising failure or omissions. The awarding of marks must be directly related to the marking criteria.

Teachers should use their professional judgement in selecting band descriptors that best describe the work of the learner to place them in the appropriate band for each assessment objective strand.

To select the most appropriate mark in the band descriptor, teachers should use the following guidance:

- where the learner's work convincingly meets the statement, the highest mark should be awarded
- where the learner's work adequately meets the statement, the most appropriate mark in the middle of the range should be awarded
- where the learner's work just meets the statement, the lowest mark should be awarded.

Teachers should use the full range of marks available to them and award full marks in any band for work which fully meets that descriptor.

There should be clear evidence that work has been attempted and some work produced. If a learner submits no work for a component then the learner should be indicated as being absent from that component. If a learner completes any work at all for the component then the work should be assessed according to the marking criteria and the appropriate mark awarded, which may be zero.

Include controls: comparability of question/ word limit and time limit.

End-of-item tests

An end-of-item test is an integral part of each of the 36 items forming the specification. Centres are expected to submit the results from all the tests that the learner has completed. There is no minimum number of items required but it is expected that there is at least one item from Biology, Chemistry and Physics. Also it would be unwise for centres to enter a learner who has not completed enough of the course to enable them to be certificated.

The tests are supervised by teachers in normal lesson time and will be taken at times convenient to the centre. Teachers are required to ensure that normal examination conditions for supervision and invigilation are maintained. It is accepted that absence through illness, or other unforeseen circumstances, may affect learners' assessment; therefore learners who miss a test may take it on another occasion convenient to the centre.

For each item, learners are only allowed **one** attempt at the associated end-of-item test. Learners are **not** allowed to retake any end-of-item tests or take an alternative version of any end-of-item test.

All tests carry 15 marks and are constructed to a common format. Detailed mark schemes are included on OCR Interchange. It is expected that the tests should take approximately 15 minutes, but if learners require extra time to complete an end-of-item test then this can be given.

Practical tasks

It is expected that during their course learners must attempt at least six practical tasks covering a wide range of tasks at a variety of levels and that all learners will be able to achieve success at their level.

One full practical is to be assessed using the criteria in the Appendix and the marks (as a percentage) will be submitted for the task.

Learners are assessed on their ability to:

- plan a suitable safe procedure
- display data in a suitable format
- recognise patterns in data
- interpret data and relate to relevant science
- comment on the method used to collect data.

Centres are free to set the practical tasks that can be used for this as long as they allow learners to access the marking criteria.

The performance descriptors for the practical task are provided in section 3f.

Since the collection of data is not assessed in the practical task it is **not** essential for learners to collect all of the data which is to be used in the task. Their own primary data may be supplemented with extra data from other learners or classes, demonstrations or other sources.

The practical task is expected to take 4–5 hours.

Can-do tasks

These tasks are designed to provide, at frequent intervals, positive reinforcement of learners' attainment and generate an assessment of the practical application of their knowledge, understanding and skills.

The tasks enable all learners to achieve success but still provide challenge and reward for high attaining learners.

The can-do tasks are based on the GCSE (9–1) skills to enable co-teachability of Entry Level Certificate and GCSE (9–1). Opportunities to demonstrate proficiency in can-do tasks are indicated throughout the specification content and are summarised in Appendix 5g. Frequent opportunities will arise during the course for learners to attempt these tasks.

A total of 16 can-do groups totalling 8 marks may be done. There is no formal time limit for these can-do tasks. It is expected that learners are assessed by their teachers in their practical lessons.

Can-do tasks provide progression in the attainment of and application of skills. Learners will have different levels of skills at the start of the course and will progress to different levels at different rates. A suitable learners' record sheet has been produced by OCR and can be used to monitor progress. This contains the individual skills that the learner is expected to master. There are 16 separate skill areas to work through.

Universal science skill areas (U)

U1 Use of appropriate apparatus to make and record a range of measurements accurately

U2 Safe use of appropriate heating devices and techniques

U3 Obtaining and recording the results of a practical activity in an appropriate format

U4 Follow a plan.

Biology skill areas (B)

B1 Use of appropriate apparatus to observe and measure a biological change or process

B2 Measure the rate of a reaction in biology

B3 Use appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem *via* direct use in the field

B4 Use of appropriate apparatus, and techniques to magnify a biological sample.

Chemistry skill areas (C)

C1 Use of appropriate apparatus to conduct and monitor chemical reactions

C2 Safe use of a range of equipment to purify and/or separate chemical mixtures

C3 Safe and careful handling of gasses, liquids and solids

C4 Use of appropriate apparatus and techniques carry out electrolysis.

Physics skill areas (P)

P1 Use of appropriate apparatus and techniques to measure and observe the effects of forces on the extension of springs

P2 Use of appropriate apparatus and techniques for measuring motion

P3 Safe use of appropriate apparatus to measure energy changes/transfers including work done

P4 Use of appropriate apparatus to measure current, potential difference and resistance.

Some of these skill areas are sub-divided into individual skills. Learners can be given half a point (0.5) for each skill area successfully demonstrated. Where there are a number of individual skills in a skill area then the learner can be credited the mark when they have done **over half of the** individual skills.

Example of internal assessment marking grid

Performances are described at the 1–2 mark and 3–4 mark standards.

Aspects		1–2 marks	3–4 marks	Assessment Objectives
A	Planning to collect data	outlines a simple plan which would enable a limited amount of data to be collected	describes the method and apparatus selected to collect data makes an appropriate comment about safe working	AO1–2 AO2–2
B	Processing the data	displays a few results in charts or graphs, using given axes or scales	constructs simple charts or graphs to display data in an appropriate way, allowing some errors in scaling or plotting	AO3–4
C	Patterns in the data	notes at least one difference between situations/cases, or compares individual results	identifies trend(s) or pattern(s) in the data	AO3–4
D	Interpreting the data	makes a simple attempt to interpret the data	relates the trend(s) or pattern(s) to the relevant science	AO3–4
E	Reviewing the method	makes a simple comment about the method used to collect data	comments on the method used and how it affects the quality of data collected	AO3–4

0 marks = no response or no response worthy of credit.

3j. Calculating qualification results

A learner's overall qualification grade for OCR Entry Level Certificate in Science will be calculated by adding together their marks from the tasks taken to give their total mark. This mark will then be compared to the qualification level grade boundaries for the relevant exam series to determine the learner's overall qualification grade.

4 Admin: what you need to know

The information in this section is designed to give an overview of the processes involved in administering this qualification so that you can speak to your exams officer. All of the following processes require you to submit something to OCR by a specific deadline.

More information about the processes and deadlines involved at each stage of the assessment cycle can be found in the Administration area of the OCR website.

OCR's *Admin overview* is available on the OCR website at https://www.ocr.org.uk/administration.

4a. Pre-assessment

Estimated entries

Estimated entries are your best projection of the number of learners who will be entered for a qualification in a particular series. Estimated entries should be submitted to OCR by the specified deadline. They are free and do not commit your centre in any way.

Final entries

Final entries provide OCR with detailed data for each learner, showing each assessment to be taken. It is essential that you use the correct entry code, considering the relevant entry rules.

Final entries must be submitted to OCR by the published deadlines or late entry fees will apply.

All learners taking this Entry Level Certificate in Science must be entered for R483.

Entry option		Components		
Entry code	**Title**	**Code**	**Assessment type**	**Submission method**
R483 A	Science	01	Non-exam assessment	Moderated upload
R483 B	Science	02	Non-exam assessment	Moderated postal

Collecting evidence of student performance to ensure resilience in the qualifications system

Regulators have published guidance on collecting evidence of student performance as part of long-term contingency arrangements to improve the resilience of the qualifications system. You should review and consider this guidance when delivering this qualification to students at your centre.

For more detailed information on collecting evidence of student performance please visit our website at: https://www.ocr.org.uk/administration/general-qualifications/assessment/.

4b. Access arrangements and special consideration

Adjustments to standard assessment arrangements are made on the basis of the individual needs of learners.

It is important, therefore, that centres identify as early as possible whether learners have disabilities or particular difficulties that will put them at a disadvantage in the assessment situation and select an appropriate qualification or adjustment that will allow them to demonstrate attainment.

The responsibility for providing adjustments to assessment is shared between your centre and OCR.

For further information please read the Joint Council of Qualifications' (JCQ) publication Access Arrangements and Reasonable Adjustments.

There are sections providing eligibility criteria and details relating to the delivery of each access arrangement. Please pay particular attention to Chapter 8.8 in relation to Entry Level Certificate.

The access arrangements permissible for use in the Entry Level Certificate qualifications are as follows:

Access Arrangements for Entry Level Certificate in Science.	
The arrangements listed on the right may be granted by the centre and do not need to be recorded. Evidence of need is not required to be held on file.	• Amplification equipment, taped questions and responses • Bilingual dictionary • Braille transcript • Braillers • Brailling of non-secure assessment material • Closed Circuit Television (CCTV) • Colour naming by the invigilator for candidates who are colour blind • Coloured overlays • Communication Professional for written questions and responses (but not in MFL Speaking assessments) • Enlarge or photocopy the question paper on to coloured paper • Fidget toys and stress balls • Live speaker for pre-recorded examination components • Low vision aid/magnifier • Non-electronic ear defenders/ear plugs • Optical Character Reader (OCR) scanners • Prompter • Read aloud (which can include an examination reading pen) • Separate invigilation within the centre (sitting the examination outside of the main examination hall/room, e.g. a room for a smaller group of candidates • Squared paper for visual spatial difficulties • Supervised rest breaks • Word processor (with spelling and grammar checks switched off)

Access Arrangements for Entry Level Certificate in Science.	
Where permitted by the specification, the following arrangements may be granted by the centres without prior approval from OCR , but Form 11 – JCQ/EL/NF must be completed online. Form 11 can be accessed online through the Centre Admin Portal (CAP), via Interchange.	• Bilingual dictionary with 10% extra time (for the use of the dictionary) • Computer reader/reader • Extra time in timed components • Practical Assistant • Scribe

The access arrangements detailed above may be appropriate for learners with disabilities, special educational needs or temporary injuries impacting on their ability to access the assessment, but this is not an exhaustive list. If you have any queries regarding Access Arrangements, please contact the Special Requirements Team at OCR (srteam@ocr.org.uk).

The JCQ document *A Guide to the Special Consideration Process* should also be referred to regarding post-assessment special consideration in cases of temporary illness, indisposition, or injury at the time of the examination/assessment. For Entry Level Certificate, applications for special consideration should be submitted using Special Consideration Online, accessed via OCR Interchange.

4c. Admin of non-exam assessment

Regulations governing arrangements for internal assessments are contained in the JCQ *Instructions for conducting non-examination assessments.*

For each of the three assessments, the teacher may help learners to understand the tasks but may not help them with the content of their answers. There are three broad levels of support which teachers can offer to enable learners to complete tasks independently, from High level support, substantial support, to Low level, minimal support. Teachers can offer a different level of support for different tasks. The level of support given to a learner may impact to some extent on the maximum mark which can be awarded for a task. The following descriptions indicate the degree of support that teachers can give to enable learners to complete the tasks independently.

Accessing end-of-item tests

Science has a number of novel concepts and words. Teachers may also read out any scientific names that may not readily be recognised. Teachers may read out any question to any learner. Teachers are free to write down answers at the learner's dictation. Where a word in a question response is illegible, teachers should supply a readable version. If necessary, a learner may be asked to identify the word.

High: Learners working with high level support will complete the end-of item tests in collaboration with the teacher. The teacher will expect to read the texts with the learner and to help them understand what the question is trying to ask. The teacher may find it appropriate to get learners to read the text aloud.

Medium: Learners working with medium level support will receive occasional help with

understanding the meanings of the end-of-item questions and with understanding occasional individual words and meanings in the texts. Some learners working with Level 2 support may also be advised to read the text aloud.

Low: Learners working with low level support will be able to complete the end-of-item read quietly and work independently on the Reading tasks. The teacher may occasionally answer questions about the wordings of tasks.

Practical tasks

The teacher must remind learners about all relevant aspects of safety for the practical (appendix 5i). Teachers should support any learners who are struggling with the practical. Can-do tasks can be repeated so a learner can benefit from deferred success.

High: Learners working with high level support will be able to make positive achievements in the practical in collaboration with the teacher. Learners working at Level 1 will usually find it difficult to carry out and obtain practical data without teacher support and high level guidance.

Medium: Learners working with medium level support will show progress with support from other members of the class and occasional support from the teacher. Learners working at Level 2 should be able to collect suitable data from their group but will require some assistance when working alone.

Low: Learners working with low level support will complete their work under normal practical lessons. Learners working at Level 3 should be able to plan and write practicals up themselves and need minimum support from a teacher when working in a group or by themselves.

Authentication of learner's work

Learners and centres must declare that the work submitted for assessment is the learner's own by completing a centre authentication form (CCS160). This information must be retained at the centre and be available on request to either OCR or the JCQ centre inspection service. It must be kept until the deadline has passed for centres to submit a review of results (RoR). Once this deadline has passed and centres have not requested a RoR, this evidence can be destroyed.

Head of Centre Annual Declaration

The Head of Centre is required to provide a declaration to the JCQ as part of the annual NCN update, conducted in the autumn term, to confirm that the centre is meeting all of the requirements detailed in the specification.

Any failure by a centre to provide the Head of Centre Annual Declaration will result in your centre status being suspended and could lead to the withdrawal of our approval for you to operate as a centre.

Private candidates

Private candidates may enter for OCR assessments.

A private candidate is someone who pursues a course of study independently but takes an examination or assessment at an approved examination centre. A private candidate may be a part-time student, someone taking a distance learning course, or someone being tutored privately. They must be based in the UK.

Private candidates need to contact OCR approved centres to establish whether they are prepared to host them as a private candidate. The centre may charge for this facility and OCR recommends that the arrangement is made early in the course.

Further guidance for private candidates may be found on the OCR website: www.ocr.org.uk/.

Internal standardisation

Centres must carry out internal standardisation to ensure that marks awarded by different teachers are accurate and consistent across all learners entered for the component from that centre.

Moderation

The purpose of moderation is to bring the marking of internally-assessed components in all participating centres to an agreed standard. This is achieved by checking a sample of each centre's marking of learner's work.

Following internal standardisation, centres submit marks to OCR and the moderator. If there are 10 or fewer learners, all the work should be submitted for moderation at the same time as marks are submitted.

Once marks have been submitted to OCR and your moderator, centres will receive a moderation sample request. Samples will include work from across the range of attainment of the learners' work.

There are two ways to submit a sample:

Moderated upload – Where you upload electronic copies of the work included in the sample using our Submit for Assessment service and your moderator accesses the work from there.

Moderated postal – Where you post the sample of work to the moderator.

The method that will be used to submit the moderation sample must be specified when making entries. The relevant entry codes are given in Section 4a above.

All learners' work must be submitted using the same entry option. It is not possible for centres to offer both options within the same series.

Each learner's work should have a cover sheet attached to it with a summary of the marks awarded for the tasks. If the work is to be submitted in digital format, this cover sheet should also be submitted electronically within each learner's folder. For more information on the evidence required for moderation, see section 5e Files.

Centres will receive the outcome of moderation when the provisional results are issued. This will include:

Moderation Adjustments Report – Listing any scaling that has been applied to internally assessed components.

Moderator Report to Centres – A brief report by the moderator on the internal assessment of learners' work.

4d. Results and certificates

Grade scale

Entry Level qualifications are graded on the scale: Entry 3, Entry 2 and Entry 1, where Entry 3 is the highest grade available. Learners who fail to reach the minimum standard of Entry 1 will be Unclassified (U). Only subjects in which grades Entry 3, Entry 2 and Entry 1 are attained will be recorded on certificates.

Results

Results are released to centres and learners for information and to allow any queries to be resolved before certificates are issued.

Centres will have access to the following results information for each learner:

- the grade for the qualification
- the total mark for the qualification.

The following supporting information will be available:

- grade boundaries for each entry option.

Until certificates are issued, results are deemed to be provisional and may be subject to amendment.

A learner's final results will be recorded on an OCR certificate. The qualification title will be shown on the certificate as 'OCR Entry Level Certificate in Science'

4e. Post-results services

A number of post-results services are available:

- **Review of results** – If you are not happy with the outcome of a learner's results, centres may request a review of their moderation.
- **Missing and incomplete results** – This service should be used if an individual subject result for a learner is missing, or the learner has been omitted entirely from the results supplied.

4f. Malpractice

It is the responsibility of the Head of Centre to report (in writing) all cases of suspected malpractice involving centre staff or learners, to OCR compliance@ocr.org.uk.

When asked to do so by OCR, Heads of Centres are required to investigate instances of malpractice promptly, and report the outcomes to compliance@ocr.org.uk.

Further information is contained in the JCQ publication: *General and Vocational Qualifications – Suspected Malpractice in Examinations and Assessments* which is available from www.jcq.org.uk

5 Appendices

5a. Awarding of grades

The grades awarded for the Entry Level Certificate in Science will be at three levels: Entry 1, Entry 2 and Entry 3.

Information on grade thresholds can be found at: https://www.ocr.org.uk/administration/grade-boundaries/

5b. Overlap with other qualifications

There is some overlap of content with the OCR GCSE (9–1) in Science, although the assessment requirements are different.

There is a small degree of overlap between the content of this specification and those for other Entry Level Certificates in Science.

5c. Key skills sections

This specification provides opportunities for the development of the Key Skills of *Communication, Application of Number, Information Technology, Working with Others, Improving Own Learning and Performance and Problem Solving* at Levels 1. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted for each unit.

The following table indicates where opportunities may exist for at least some coverage of the various Key Skills criteria at Level 1 for each unit.

Unit	C 1	AoN 1	IT 1	WwO 1	IoLP 1	PS 1
R483	✓	✓	✓	✓	✓	✓

5d. Mathematical skills requirement

In order to be able to develop their skills, knowledge and understanding in OCR Entry Level Certificate in Science, learners need to have been taught, and to have acquired competence in, the appropriate areas of mathematics relevant to the subject as indicated in the table of coverage below.

The questions and tasks used to target mathematical skills will be at a level of demand that is appropriate to Entry Level Science, see mathematical skills specific to Entry Level below.

In the Entry Level question tests, the questions that assess mathematical skills will not be of a lower demand than that which is expected of learners at Key Stage 3, as outlined in the Department for Education's document "*Mathematics programme of study: key stage 3*".

The assessment of quantitative skills would include at least 10% (or above) mathematical skills at the appropriate level.

These skills will be applied in the context of the relevant science.

All Entry level specific mathematical content will be assessed within the lifetime of the specification.

These skills could be developed in other areas of specification content as indicated in the opportunities to cover column.

The mathematical skills defined from the Department for Education for the KS4 programme of study are shown in the table below.

Learners may use calculators in Entry Level Certificate in Science.

	Mathematical skills	Subject			
M1	**Arithmetic and numerical computation**				
a	Recognise and use expressions in decimal form	B	C	P	CS
b	Recognise and use expressions in standard form	B	C	P	CS
c	Use ratios, fractions and percentages	B	C	P	CS
d	Make estimates of the results of simple calculations	B	C	P	CS
M2	**Handling data**				
a	Use an appropriate number of significant figures	B	C	P	CS
b	Find arithmetic means	B	C	P	CS
c	Construct and interpret frequency tables and diagrams, bar charts and histograms	B	C	P	CS
d	Understand the principles of sampling as applied to scientific data	B			
e	Understand simple probability	B			
f	Understand the terms mean, mode and median	B		P	CS
g	Use a scatter diagram to identify a correlation between two variables	B		P	CS
h	Make order of magnitude calculations	B	C	P	CS
M3	**Algebra**				
a	Understand and use the symbols: =, <, <<, >>, >, ∝, ~	B	C	P	CS
b	Change the subject of an equation		C	P	CS
c	Substitute numerical values into algebraic equations using appropriate units for physical quantities		C	P	CS
d	Solve simple algebraic equations	B		P	CS
M4	**Graphs**				
a	Translate information between graphical and numeric form	B	C	P	CS
b	Understand that y=mx+c represents a linear relationship	B	C	P	CS
c	Plot two variables from experimental or other data	B	C	P	CS
d	Determine the slope and intercept of a linear graph	B	C	P	CS
e	Draw and use the slope of a tangent to a curve as a measure of rate of change		C		CS
f	Understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate			P	CS
M5	**Geometry and trigonometry**				
a	Use angular measures in degrees			P	CS
b	Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects		C	P	CS
c	Calculate areas of triangles and rectangles, surface areas and volumes of cubes.	B	C	P	CS

Mathematical skills specific to Entry Level are illustrated below.

Learners should be able to:

At Entry 1:

- Recognise and use whole numbers to one decimal place
- Take measurements to whole divisions using simple equipment – ruler, thermometer, measuring cylinder, stop-clock, balance, newtonmeter and electrical meters
- Draw or complete bar charts or pictograms
- Select information from tables and charts.

At Entry 2:

- Recognise and use numbers to one decimal place
- Take accurate measurements using simple equipment – ruler, thermometer, measuring cylinder, stop-clock, balance, newtonmeter and electrical meters
- Read data from charts and graphs
- Estimate quantities such as length, volume, mass
- Record measurements in tables accurately
- Extract and interpret information from charts, graphs and tables.

At Entry 3:

- Carry our single calculations involving +, – , x, ÷
- Plot simple line graphs
- Calculate arithmetical means
- Measure speed using distance and time
- Substitute numerical values into simple formulae and equations using appropriate units.

Use of Calculators

Learners are permitted to use a scientific or graphical calculator for Entry Level Certificate in Science. Calculators are subject to the rules in the document *Instructions for Conducting Examinations* published annually by JCQ (www.jcq.org.uk)

5e. Files

Structure for evidence

An internal assessment portfolio is a collection of folders and files containing the learner's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or moderator. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index called 'Home Page'.

There should be a top level folder detailing the candidate's centre number, candidate number, surname and forename, together with the qualification code R483, so that the portfolio is clearly identified as the work of one candidate.

Each learner produces an assignment for internal assessment. The evidence should be contained within a separate folder within the portfolio. This folder may contain separate files.

Each learner's internal assessment portfolio should be stored in a secure area on the centre's network. Prior to submitting the internal assessment portfolio to OCR, the centre should add a folder to the folder tree containing internal assessment and summary forms.

Data formats for evidence

In order to minimise software and hardware compatibility issues it will be necessary to save learners' work using an appropriate file format.

Learners must use formats appropriate to the evidence that they are providing and appropriate to viewing for assessment and moderation. Open file formats or proprietary formats for which a downloadable reader or player is available are acceptable. Where this is not available, the file format is not acceptable.

Electronic internal assessment is designed to give learners an opportunity to demonstrate what they know, understand and can-do using current technology. Learners do not gain marks for using more sophisticated formats or for using a range of formats. A learner who chooses to use only word documents will not be disadvantaged by that choice.

Evidence submitted is likely to be in the form of word processed documents, PowerPoint presentations, digital photos and digital video.

To ensure compatibility, all files submitted must be in the formats listed below. Where new formats become available that might be acceptable, OCR will provide further guidance. OCR advises against changing the file format that the document was originally created in. It is the centre's responsibility to ensure that the electronic portfolios submitted for moderation are accessible to the moderator and fully represent the evidence available for each learner.

5f. Units in science

It is expected that learners will show understanding of the biological quantities and corresponding units, SI base and derived units listed below.

They will be able to use them in qualitative work and calculations. These units and their associated quantities are dimensionally independent.

SI base units		
Physical quantity	**Unit**	**Unit**
Length	metre	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Current	ampere	A
Amount of a substance	mole	mol

SI derived units		
Physical quantity	**Unit(s)**	**Unit(s)**
Area	squared metre	m^2
Volume	cubic metre; litre; cubic decimetre	m^3; *l;* dm^3
Density	kilogram per cubic metre	kg/m^3
Temperature	degree Celsius	^oC
Pressure	pascal	Pa
Specific heat capacity	joule per kilogram per degree Celsius	$J/kg/^oC$
Specific latent heat	joule per kilogram	J/kg
Speed	metre per second	m/s
Force	newton	N
Gravitational field strength	newton per kilogram	N/kg
Acceleration	metre per squared second	m/s^2

SI derived units		
Physical quantity	**Unit(s)**	**Unit(s)**
Frequency	hertz	Hz
Energy	joule	J
Power	watt	W
Electric charge	coulomb	C
Electric potential difference	volt	V
Electric resistance	ohm	Ω
Magnetic flux density	tesla	T

5g. GCSE (9–1) Practical Activity Groups (PAGs)

Centres may wish to use the GCSE (9–1) PAGs as the basis for the Entry Level practical task. This may assist co-teachability and allow teachers to plan practicals that link to the GCSE (9–1) for learners that may progress to GCSE (9–1). It will also help with technical resources. More details can be found from the GCSE (9–1) Combined Science specifications and also from the PAG sheets that cover these practicals which are available from the OCR website (http://www.ocr.org.uk/qualifications/by-subject/science/).

Practical Activity Group (PAG)	
Biology	
B1 Microbiology	Investigate different magnification techniques to draw scientific diagrams from a number of biological specimens.
B2 Sampling techniques	Investigation the differences in habitats using ecological sampling techniques.
B3 Rates of enzyme–controlled reactions	Investigate the factors that can affect the rate of enzyme activity.
B4 Photosynthesis	Investigate the factors that can affect the rate of photosynthesis on *Cabomba*.
B5 Microbiological techniques	Investigate the effectiveness of antimicrobial agents on the growth of a bacterial lawn.
Chemistry	
C1 Electrolysis	Electrolysis of aqueous sodium chloride or aqueous copper sulfate solution testing for the gases produced.
C2 Distillation	Distillation of a mixture, for example, orange juice, cherry cola, hydrocarbons, inks.
C3 Separation techniques	Use of chromatography to identify the mixtures of dyes in an unknown ink.
C4 Production of salts	Production of pure dry sample of a salt.
C5 Measuring rates of reaction	Investigate the effect of surface area or concentration on the rate of an acid/carbonate reaction.
Physics	
P1 Materials	Determine the densities of a variety of objects, both solid and liquid.
P2 Forces	Investigate the effect of forces on springs.
P3 Motion	Investigate acceleration of a trolley down a ramp.
P4 Waves	Use a ripple tank to measure the speed, frequency and wavelength of a wave **Or** Investigate the reflection of light off a plane mirror and the refraction of light through prisms.
P5 Energy	Determine the specific heat capacity of a material.
P6 Circuits	Investigate the *I*–*V* characteristics of circuit elements.

5h. Equations in physics

Learners are expected to recall and apply the following equations using standard SI units:
apply: density (kg/m^3) = mass (kg)/volume (m^3)
apply: distance travelled (m) = speed (m/s) × time (s)
apply: acceleration (m/s^2) = change in velocity (m/s)/time (s)
apply: kinetic energy (J) = 0.5 × mass (kg) × (speed (m/s))^2
apply: force (N) = mass (kg) × acceleration (m/s^2)
apply: work done (J) = force (N) × distance (m) (along the line of action of the force)
apply: power (W) = work done (J)/time (s)
apply: force exerted by a spring (N) = extension (m) × spring constant (N/m)
apply: gravity force (N) = mass (kg) × gravitational field strength, g (N/kg)
apply: (in a gravity field) potential energy (J) = mass (kg) × height (m) × gravitational field strength, g (N/kg)
recall and apply: charge flow (C) = current (A) × time (s)
recall and apply: potential difference (V) = current (A) × resistance (Ω)
recall and apply: energy transferred (J) = charge (C) × potential difference (V)
recall and apply: power (W) = potential difference (V) × current (A) = (current (A))^2 × resistance (Ω)
recall and apply: energy transferred (J, kWh) = power (W, kW) × time (s, h)
recall and apply: wave speed (m/s) = frequency (Hz) × wavelength (m)
recall and apply: efficiency = useful output energy transfer (J)/input energy transfer (J)

Learners are expected to select and apply the following equations using standard S.I. units:
apply: change in thermal energy (J) = mass (kg) × specific heat capacity (J/kg°C) × change in temperature (°C)
apply: thermal energy for a change in state (J) = mass (kg) × specific latent heat (J/kg)
apply: (final velocity (m/s))^2 – (initial velocity(m/s))^2 = 2 × acceleration (m/s^2) × distance (m)
apply: energy transferred in stretching (J)= 0.5 × spring constant (N/m) × (extension (m))^2
apply: potential difference across primary coil (V) × current in primary coil (A) = potential difference across secondary coil (V) × current in secondary coil (A)

5i. Health and safety

In UK law, health and safety is primarily the responsibility of the employer. In a school or college the employer could be a local education authority, the governing body or board of trustees. Employees (teachers/lecturers, technicians etc.), have a legal duty to cooperate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 2002 (as amended) and the Management of Health and Safety at Work Regulations 1999, require that before any activity involving a hazardous procedure or harmful microorganisms is carried out, or hazardous chemicals are used or made, the employer must carry out a risk assessment. A useful summary of the requirements for risk assessment in school or college science can be found at: https://www.ase.org.uk.

For members, the CLEAPSS® guide, *PS90*, *Making and recording risk assessments in school science*[1] offers appropriate advice.

Most education employers have adopted nationally available publications as the basis for their Model Risk Assessments.

Where an employer has adopted model risk assessments an individual school or college then has to review them, to see if there is a need to modify or adapt them in some way to suit the particular conditions of the establishment.

Such adaptations might include a reduced scale of working, deciding that the fume cupboard provision was inadequate or the skills of the learners were insufficient to attempt particular activities safely. The significant findings of such risk assessment should then be recorded in a '*point of use text*', for example on schemes of work, published teachers guides, work sheets, etc. There is no specific legal requirement that detailed risk assessment forms should be completed for each practical activity, although a minority of employers may require this.

Where project work or investigations, sometimes linked to work-related activities, are included in specifications this may well lead to the use of novel procedures, chemicals or microorganisms, which are not covered by the employer's model risk assessments. The employer should have given guidance on how to proceed in such cases. Often, for members, it will involve contacting CLEAPSS[1].

[1] These, and other CLEAPSS® publications, are on the CLEAPSS® Science Publications website www.cleapss.org.uk. Note that CLEAPSS® publications are only available to members. For more information about CLEAPSS® go to www.cleapss.org.uk.

5j. Entry Level Certificate in Science interim awards

Students achieving a total of 15, 30, 45, 60 or 75 of the available 100 points are eligible for **Bronze, Silver, Gold, Platinum and Diamond** Interim Certificates respectively.

These certificates can be downloaded from the Entry Level Tests section of OCR Interchange. https://interchange.ocr.org.uk/

A student achieving 15 points can be awarded a **Bronze Certificate** and then go on to get a **Silver Certificate** by accumulating another 15 points, making a total of 30 points. Further certificates are awarded for every additional 15 points.

Many teachers actively encourage students to monitor their own progress as a fundamental part of the recognition of achievement. A student who is aware, for example, that 28 points have already been achieved is likely to make the additional extra effort in order to obtain a **Silver Certificate** in the shortest possible time.

5

INTERIM AWARDS

Interim Bronze Award

Students gain an Interim Bronze Award when they have accumulated a total of 15 points.

This total can be obtained in a variety of ways, but is likely to be obtained early in the course before a Practical Task has been attempted. This total could be obtained from a student who gained 1 or 1.5 points from each of around ten end-of-item tests and had demonstrated success in three or four of the can-do tasks.

Interim Silver Award

Students gain an Interim Silver Award when they have accumulated a total of 30 points.

This level of award demands a more sustained effort on the part of a student.

Typically they will have gained about 20 points from around fifteen end-of-item tests and demonstrated success in a number of can-do tasks. In the practical task the student might be able to plan to collect some useful data, be able to collect and process it, and then to make realistic comments on the suitability of the procedure used to collect it.

However, since the level of attainment is determined solely by the accumulation of points, a wide variety of competence in the separate components is possible.

Interim Gold Award

Students gain an Interim Gold Award when they have accumulated a total of 45 points.

This level of award represents a consistent effort over a period of time.

A student might have obtained high marks for more than fifteen end-of-item tests, demonstrated success in half of the can-do tasks and demonstrated their capability in a practical task, scoring marks for each aspect.

Again, since the credit is based on the simple aggregation of points from a variety of activities, there are many possible ways for students to achieve the Gold Award.

For some Entry Level students, the gaining of this level of award represents a challenging target.

Interim Platinum and Diamond Awards

Students gain an Interim Platinum or Diamond Award when they have accumulated a total of 60 or 75 points respectively.

These levels of award represent a considerable amount of achievement gained by a consistent effort over a significant length of time. A student will have obtained high marks for more than twenty-five end-of-item tests, demonstrated success in most of the can-do tasks and fully demonstrated their capability in a practical task. Again, since the credit is based on the simple aggregation of points from a variety of activities, there are many possible ways for students to achieve Platinum and Diamond Awards.

Students achieving Interim Platinum or Diamond Awards could benefit from entry to the Foundation Tier of an OCR GCSE (9-1) course.

5k. The Periodic Table of elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	**18**
1 **H** hydrogen 1.0	**2**											**13**	**14**	**15**	**16**	**17**	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	13 **Al** aluminium 27.0	14 **Si** silicon 28.1	15 **P** phosphorus 31.0	16 **S** sulfur 32.1	17 **Cl** chlorine 35.5	18 **Ar** argon 39.9
19 **K** potassium 39.1	20 **Ca** calcium 40.1	21 **Sc** scandium 45.0	22 **Ti** titanium 47.9	23 **V** vanadium 50.9	24 **Cr** chromium 52.0	25 **Mn** manganese 54.9	26 **Fe** iron 55.8	27 **Co** cobalt 58.9	28 **Ni** nickel 58.7	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	39 **Y** yttrium 88.9	40 **Zr** zirconium 91.2	41 **Nb** niobium 92.9	42 **Mo** molybdenum 95.9	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	57–71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **Lv** livermorium		

Key
atomic number
Symbol
name
relative atomic mass

Summary of updates

Date	Version	Section	Title of section	Change
May 2018	1.1	Front cover	Disclaimer	Addition of disclaimer
May 2018	1.2	3f	Non-exam assessment – marking criteria	Removal of reference to PAG as a resource and clarification of tasks
September 2018	1.3	4a	Pre-assessment	Updated entry codes
November 2018	1.4	1c 5j	What are the key features of this specification? Entry Level Certificate in Science interim awards	Updated information regarding Interim Certificates, Bronze, Silver, Gold, Platinum and Diamond
January 2019	1.5	3c	Total Qualification Time	Insertion of new section
January 2020	1.6	i) 1e ii) 4c iii) 4e	i) How do I find out more information? ii) Admin of non-exam assessment iii) Post-results services	i) Insertion of Online Support Centre ii) Enquiries about results changed to Review of results iii) Enquiries about results changed to Review of results
February 2021	1.7	5a	Awarding of grades	Targeted grade thresholds removed. Update to specification covers to meet digital accessibility standards.
January 2023	1.8	4b	Special consideration	Update to access arrangements
May 2023	1.9	4a 4c	Pre-assessment Admin of non-exam assessment	Update to the wording of moderation submission options
January 2024	2.0	3d, 3e 4a Checklist	Qualification availability, Language Pre-assessment	Inclusion of disclaimer regarding language and availability Update to include resilience guidance Inclusion of resource links

YOUR CHECKLIST

Our aim is to provide you with all the information and support you need to deliver our specifications.

- ☐ Bookmark OCR website for all the latest information and news on our Science Entry Level Certificate
- ☐ Sign up for Teach Cambridge: our personalised and secure website that provides teachers with access to all planning, teaching and assessment support materials
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- ☐ View our range of skills guides for use across subjects and qualifications

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