Cambridge NATIONALS

Accredited

Specification

Level 1/2 Cambridge National Certificate in Science (120 glh)

September 2012

OCR
Oxford Cambridge and RSA

Cambridge Nationals are vocationally related qualifications that take an engaging, practical and inspiring approach to learning and assessment.

They're industry relevant, geared to key sector requirements and very popular with schools and colleges because they suit such a broad range of learning styles and abilities.

The new generation of Cambridge Nationals has been developed to ensure that they build upon the legacy and reputation of the existing qualifications, which are taught in over 3,000 centres.

Created to bring together the Wolf Report recommendations and industry need

The Cambridge Nationals in Science have been founded upon the recommendations of the Wolf Report and created in partnership with teachers, students, education specialists and industry-leading employers. This collaborative approach has resulted in a qualification that offers students a solid foundation for their future studies and career.

Cambridge Nationals and Cambridge Technicals – how they differ

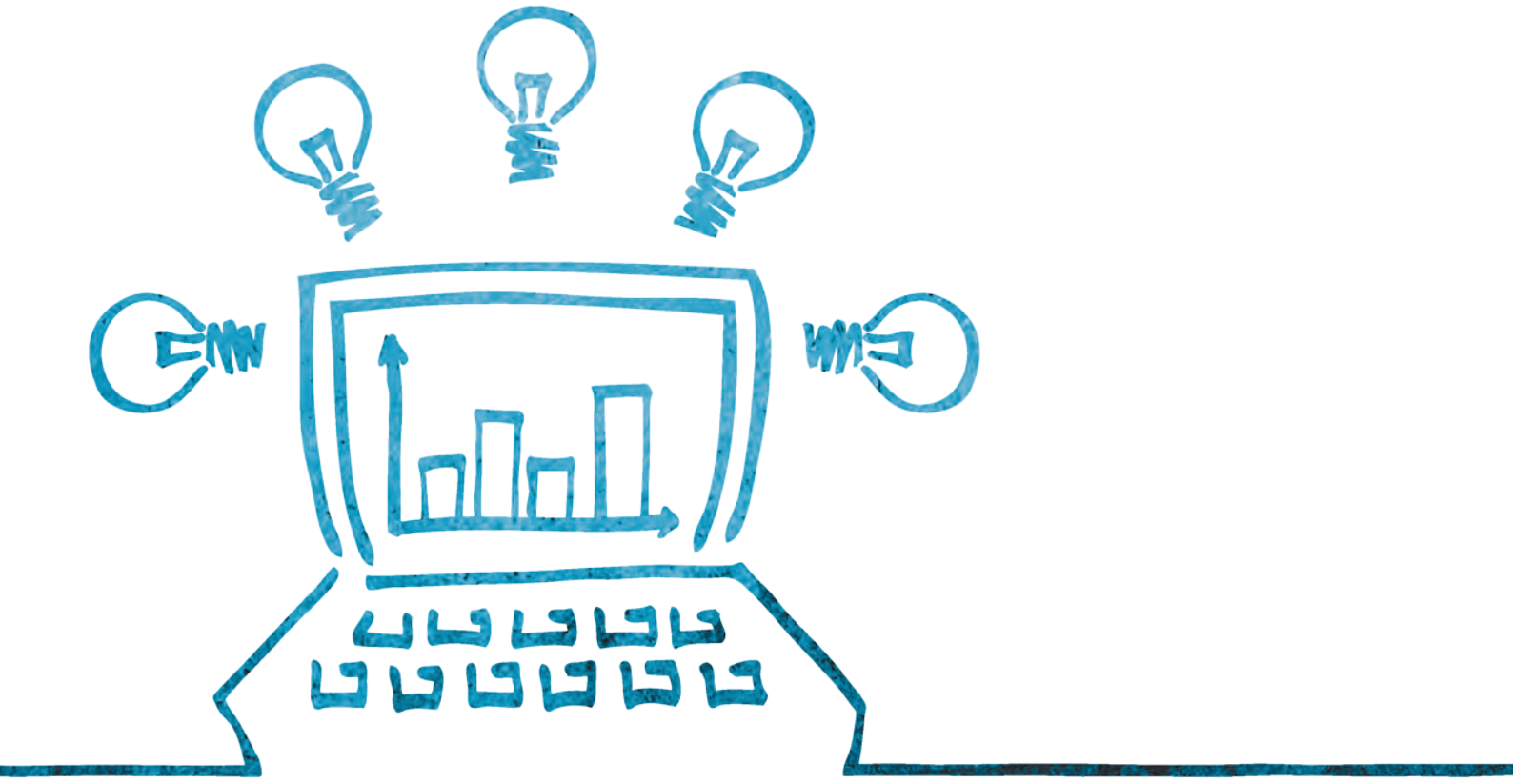
The **Cambridge National** in Science is targeted at 14-16 year olds in a school environment. It's available as a Certificate, which is the same size as a GCSE. It uses both internal and external assessment and is recognised by the recently published DfE Performance Tables for 2014.

Cambridge Technicals are targeted at students aged 16+ in either a school or FE environment. They allow for greater flexibility with the choice of units that make up the qualification and are both internally and externally assessed. In addition, the Level 3 qualifications have UCAS points, supporting progression to HE. Cambridge Technicals in Science are currently being developed for first teaching in September 2013 and further information will be available shortly.

A few good reasons to work with OCR

- You can enjoy the **freedom and excitement** of teaching Science qualifications that have been developed to help you inspire students of all abilities
- We've built specifications **with you in mind**, using a clear and easy-to-understand format, making them straightforward to deliver
- Our **clear and sensible assessment** approach means that assessment material and requirements are clearly presented and sensibly structured for you and your students
- **Pathways for choice** – we have the broadest range of vocational qualifications, and Cambridge Nationals provide an ideal foundation for students to progress to more advanced studies and science-related careers
- **Working in partnership to support you** – together with teachers, we've developed a range of practical help and support to save you time. We provide everything you need to teach our specifications with confidence and to ensure that your students get as much as possible from the programme of learning
- Cambridge Nationals are **supported with new innovative support products** and training – to help you get started, prepare to teach and share best practice

Sign up to teach – let us know you will be teaching this specification to ensure you receive the support you need. Simply complete the online form at **cambridgenationals.org.uk/signup**



Cambridge National in Science

This qualification will equip students with sound, specialist scientific knowledge and skills for everyday use.

It will challenge all students by introducing them to demanding material, encouraging independence and creativity and providing tasks that develop a combination of practical, analytical and communication skills.

Cambridge Nationals deliver these skills across the whole range of learning styles and abilities, effectively engaging and inspiring all students to achieve great things.

Overview of the qualification

Units	Assessment Method	GLH
Mandatory		
R071: How scientific ideas have an impact on our lives	Portfolio of work, including 9 assessment tasks Centre-assessed tasks OCR moderated.	60
R072: How scientific ideas have developed	Written paper, tiered, 1 hour	30
R073: How scientists test their ideas	Practical investigation. Centre-assessed task OCR moderated.	30

Assessment and moderation

We've introduced external assessment to share the load. Unit R072 contains a written paper, which is set and assessed by ourselves, while units R071 and R073 are internally assessed and externally moderated.

Simple and sensible certification

Units are graded Pass, Merit or Distinction for Level 1. Level 2 students have the same grades, but with a new grading of Distinction* to inspire students to achieve more.

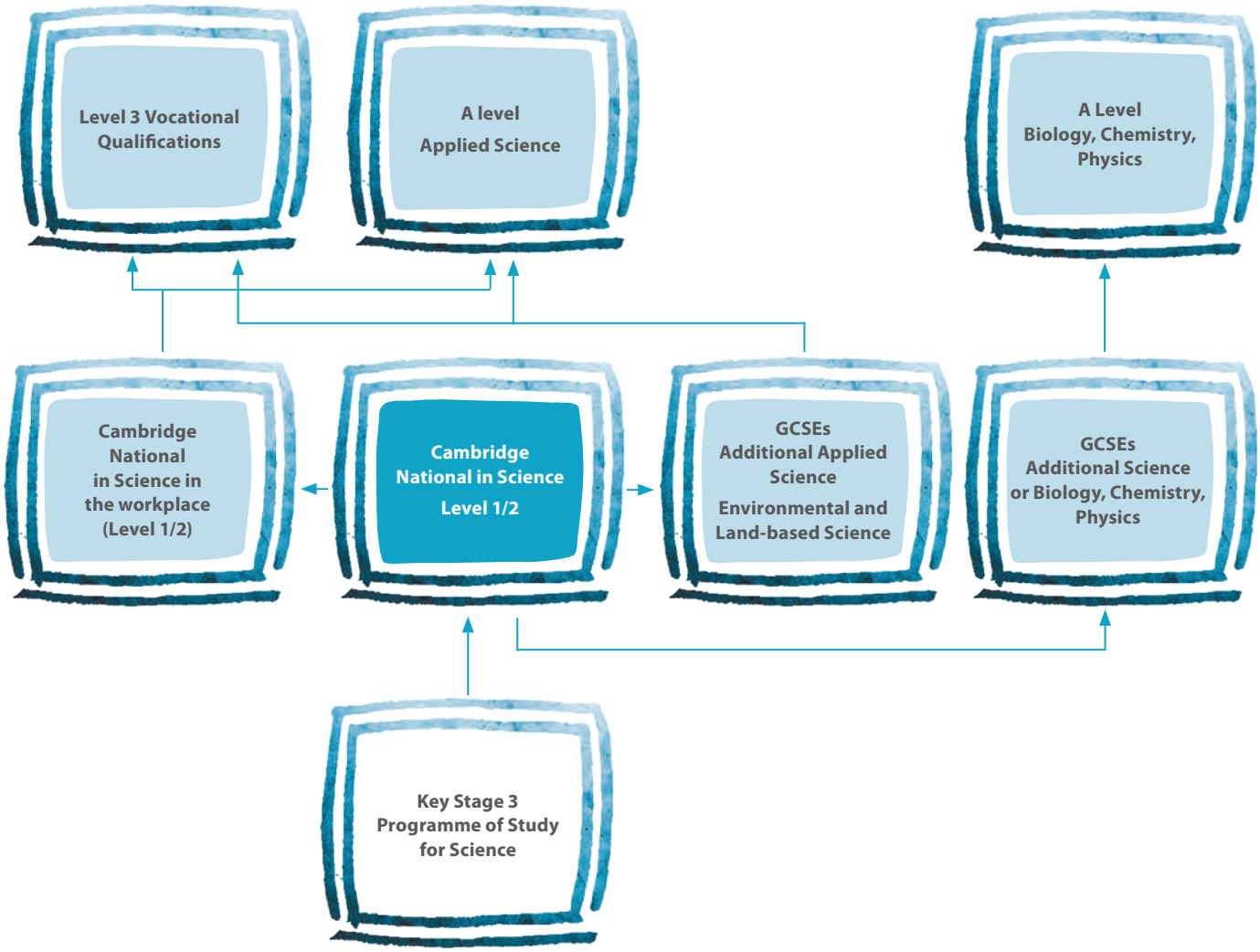
The seven characteristics for attainment tables

Seven characteristics will be necessary for vocational qualifications that are included in future attainment tables. The seven characteristics are:

- **Appropriate size:** The Certificate is 120 glh, meeting the requirement for size
- **Detailed grading:** Cambridge Nationals from OCR are graded Pass, Merit and Distinction for Level 1, and Pass, Merit, Distinction and Distinction* for Level 2
- **External assessment of at least 20%:** The Cambridge National Certificate (120 glh) includes 25% of external assessment
- **Synoptic assessment:** The breadth of the content within Cambridge Nationals ensures that students achieve a broad level of knowledge and experience which can then be applied in different contexts
- **Progression:** Students can progress either to Level 3 Vocational Qualifications or via the traditional A and A/S Level route
- **Proven track record:** With over 3,000 centres and over 1.5 million registrations to date, OCR has a proven track record in providing vocational qualifications
- **Appropriate content:** The content for each qualification was developed in partnership with students, centres, educational specialists and industry-specific experts.

Next steps for your students – future progression to other qualifications

The Cambridge Nationals in Science lead to a wide range of general and vocational qualifications for your students.



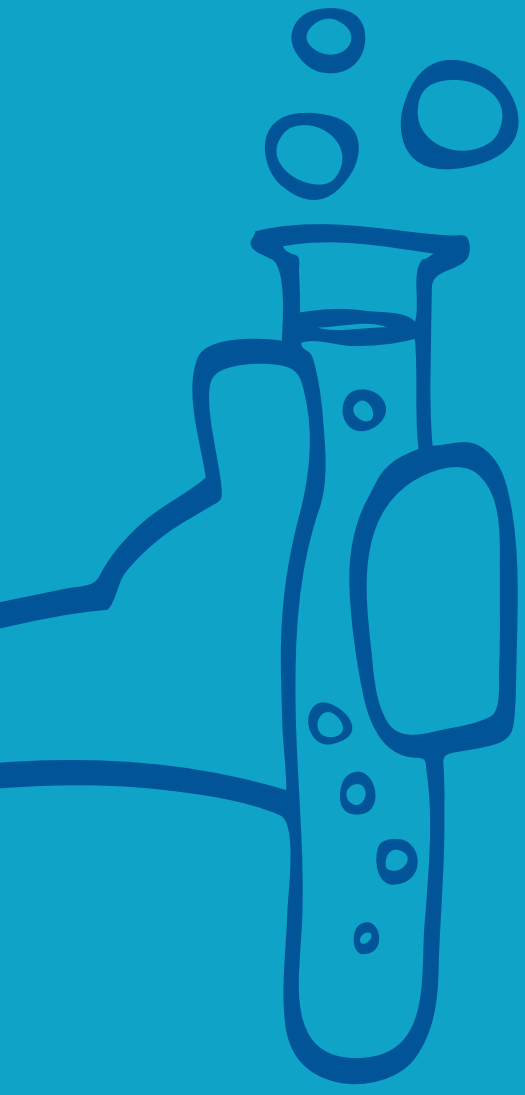
Continuing Professional Development (CPD) and learning resources

Our support is carefully designed to help you at every stage, from preparation through to the delivery of our specifications.

Continuing Professional Development (CPD)

As with all our qualifications, there will be a range of events and activities to support you. The reputation of our Professional Development is second to none and we will continue to build up our reputation in providing exemplary support.

To keep up to date visit www.ocreventbooker.org.uk



Learning resources are an important part of any qualification and the Cambridge Nationals are no exception.

We have developed a suite of support and learning resources that provide what teachers tell us they want.

We've worked in partnership with teachers and education specialists to develop ideas and ensure that there is a range of tasks that suit differing levels and abilities of students.

By working in this collaborative way, we've ensured that our range of resources support classroom activities, from lesson planning and teaching to monitoring student progression and success. This includes our 'teaching links', offering additional resource information, and teaching tools such as games and activities directly linked to some units.

Cambridge Nationals are supported by a wide range of learning resources:

Administration guides and tools that include online tools and a progress tracker

Sample assessment materials

Teaching packs, including introductory unit presentations

These resources are free and available from www.ocr.org.uk

Preparing for first teaching

Adopting a new specification can appear daunting. There's quite a lot of information to weigh up: the demands of the course, the quality of support, and the needs and expectations of teachers and candidates. Here's some advice to help you make the best decision.

7 Steps to First Teaching

MAKE THE MOST OF THE OCR WEBSITE

The unit specifications will be available online. While the overall programme of study might be familiar, it's important to check each unit specification to make sure that you're happy with the learning outcomes, knowledge, understanding and skills.

TAKE A TOUR OF THE SAMPLE ASSESSMENTS

They give a clear idea about the type of tasks to be undertaken. OCR will provide model assignments for centre assessed units (R071 and R073). They can be used directly or adapted to suit your needs.

MAKE GOOD MARKING DECISIONS

The specification contains information on performance indicators, which indicate the level of attainment associated with grades, marking criteria glossary of terms and guidance on assessment for you to use in addition to the marking criteria to support your marking decisions.

GET SOCIAL

Visit our social media site (**www.social.ocr.org.uk**). By registering, you'll have FREE access to a dedicated platform where teachers can engage with each other – and OCR – to share best practice, offer guidance and access a range of support materials produced by other teachers, such as lesson plans, presentations, videos and links to other helpful sites.

ENJOY SUPPORT AND GUIDANCE

It's wise to review our Report to Centres for generic guidance and explore the summary of key issues from previous assessment series. These will be available on the OCR website once the qualifications have been through their first cycle of assessment.

GET GREAT TRAINING

Check OCR's website to see if there is a convenient course available. OCR's Professional Development courses are an excellent way to get practical advice on the best ways to deliver Cambridge Nationals.

EXPLORE EXTERNAL WEBSITES

It's often worthwhile carrying out an internet search to see if there is any free or paid-for resource material available. But please always check that whatever material you incorporate into your teaching meets the qualification's assessment requirements.

Level 1/2 Cambridge National Certificate in Science (120 GLH) J815

© OCR 2012 OCR Cambridge National in Science

Contents

© OCR 2012 OCR Cambridge National in Science

Contents

© OCR 2012 OCR Cambridge National in Science

Introduction to the Cambridge National Certificate in Science

1

1.1 Qualification aims

Science education provides learners with the skills, knowledge and understanding to participate as active and informed citizens in a modern democratic society, where science and technology play key roles in shaping our lives. As well as informing personal and social decisions throughout our lives, science education is a key pillar of the UK economy, with constant demand from employers for an increasingly skilled and technically literate workforce.

The Cambridge National Certificate in Science will equip learners with sound specialist scientific knowledge and skills for everyday use. It will challenge all learners, including high attaining learners, by introducing them to demanding material, encouraging independence and creativity, and providing tasks that develop a combination of practical, analytical and communication skills. These transferable skills will improve their learning in other subjects with the aim of enhancing their employability when they leave education, contributing to both their personal development and future economic well-being.

The practical and experiential approach that will be required for teaching and learning will engage and motivate learners. When taken with the Cambridge National Certificate in Science in the Workplace, the design of these qualifications, including the range of units available, will provide learners with pathways which allow the freedom to explore more deeply the areas that interest them, with opportunities to enhance their learning related to other curriculum areas and with progression routes to further qualifications in the sciences.

This Level 1/2 Certificate specification enables learners who fail to achieve the Level 2 standard to be awarded Level 1, and those learners who make progress during the course to move from work at Level 1 to achieve a qualification at Level 2.

1.2 Qualification summary

The OCR Cambridge Nationals in Science qualifications consists of:

- OCR Level 1/2 Cambridge National Certificate in **Science**
- OCR Level 1/2 Cambridge National Certificate in **Science in the Workplace**

OCR Level 1/Level 2 Cambridge National Certificate in Science

This qualification covers the National Curriculum Programme of Study for Science at Key Stage 4. It therefore meets the statutory requirement for learners in centres subject to the National Curriculum.

In teaching this course, teachers follow a scheme of work in which learners explore the way in which scientific ideas have developed, how these ideas have been applied and how these applications have affected our lives. They undertake practical and investigatory activities throughout the course to explore the way in which scientists develop and test their ideas and they develop practical skills and skills in analysing, interpreting and evaluating evidence.

OCR Level 1/2 Cambridge National Certificate in Science in the Workplace

This qualification is designed to be taken alongside or following the OCR Level 1/2 Certificate in Science or any other Level 1 or Level 2 course which covers the National Curriculum Programme of Study for Science at Key Stage 4.

In teaching this course, teachers follow a scheme of work in which learners explore the way in which people use science in their work. The qualification offers the opportunity to prepare learners for further academic or work-related study leading to other qualifications in science. The mandatory units are focussed on the transferable, underpinning knowledge and skills of analytical techniques to collect data, interpretation and evaluation methods and scientific conventions for communicating scientific ideas and data. Candidates take one of the optional units that explore how science is used in practice. The options cover science in the environment, in fitness and health and in production. The choice of optional units allows for a flexible programme of delivery so that the course can reflect learners' interests, local business links and the employment environment. Learners will undertake practical and investigatory activities throughout the course as part of exploring the way in which science is used in the workplace.

These two qualifications will replace and extend the existing OCR Science Nationals provision for which accreditation ends in 2012. They provide continuity of provision for centres currently using OCR Nationals in Science at Level 2. By providing two separate Cambridge National Certificate courses in the sciences, centres will have greater flexibility to use GCSE and Nationals courses throughout Key Stage 4, according to the needs of learners. They offer progression to further study in the sciences rather than employment.

This booklet contains the specification for OCR's Cambridge National Certificate in Science for first teaching from September 2012.

1.3 Guided learning hours (GLH)

OCR Level 1/2 Cambridge National Certificate in Science requires 120 GLH in total.

1.4 Prior learning/attainment

Learners who are taking courses leading to this qualification should normally have completed a course covering the National Curriculum Programme of Study for Science at Key Stage 3.

1.5 Overview of the qualification

Units	Assessment method	GLH	J815 certificate 120 GLH
R071: *How scientific ideas have an impact on our lives*	Portfolio of work incorporating 9 assessment tasks Centre assessed tasks – OCR moderated Approx 21 hours – 120 marks (120 UMS)	60	Mandatory unit
R072: *How scientific ideas have developed*	Written paper, tiered OCR set and marked 1 hour – 60 marks (60 UMS) Learners answer all questions	30	Mandatory unit
R073: *How scientists test their ideas*	Practical investigation Centre assessed tasks – OCR moderated Approx 5.5 – 7 hours – 60 marks (60 UMS)	30	Mandatory unit

A bank of model assignments is available free of charge from the OCR website for the centre assessed units R071 and R073.

© OCR 2012 OCR Cambridge National in Science

2.1 Guidance on unit content

Use of i.e./e.g. in unit content

The unit content describes what has to be taught to ensure that learners are able to access the highest marks.

Anything which follows an i.e. details what must be taught as part of that area of content.

Anything which follows an e.g. is illustrative, it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, though these do not need to be the same ones provided in the unit content.

Teachers will need to ensure that any modifications to tasks, from the bank of model assignments for the optional units do not expect the learner to do more than they have been taught, but they must enable them to access the full range of marks as described in the marking criteria.

For externally assessed units, where the content contains i.e. and e.g. under specific areas of content, the following rules will be adhered to when setting questions:

- direct question may be asked where the unit content is shown with an i.e.
- where unit content is shown as an e.g., a direct question will not be asked about that example. Any questions relating to the area of content will offer learners the opportunity to provide their own examples as the unit has not specified which examples they should be familiar with.

2.2 Unit R071: *How scientific ideas have an impact on our lives*

Introduction

In this unit, learners explore the way in which applications of science have an impact on our lives. The unit has been divided into three teaching modules:

Module 1: Using energy

Module 2: Keeping healthy

Module 3: Materials for a purpose

In each module there are opportunities to undertake practical work and develop skills in analysing, interpreting and evaluating evidence which will build towards the assessment of an investigation in Unit 3. Working with evidence is also assessed in Unit 2.

Learners produce a portfolio of work incorporating nine assessment tasks which are internally assessed and moderated by OCR. The tasks for each module are marked out of 40, giving an overall total for the unit of 120 marks.

The unit is weighted at 50% of the qualification and requires 60 GLH.

Aims

In LO1, learners will be taught about the personal and social (including political) choices that must be made in supplying electricity to people's homes. The factors to consider in making such choices include the capital and running costs of the energy sources (including transportation) and distribution of electricity. The focus should be on the social, economic and environmental effects of such decision making and how these decisions are made in the UK. Opportunities should be taken to make use of local examples of electricity generation, including renewable sources, by visits or by inviting visitors to the centre. More able learners will carry out calculations of the efficiency of energy transfer in electricity generation and distribution.

The focus of learning for LO2 should be on the risks and benefits of using nuclear radiation, including the generation of electricity and industrial and medical applications. Learners will need to understand the different types of radiation and how their properties make them useful in different ways. They will need to understand how risk can be evaluated and more able learners will approach this quantitatively, including the calculation of probabilities.

In teaching LO3, learners should have opportunities to set up electrical circuits and take measurements of voltage and current and to use these measurements to calculate resistance, power and energy transferred. Learners should also carry out practical work to measure energy transferred when materials are heated, using measurements of temperature change and specific heat capacity, and so calculate the efficiency of energy transfer.

In LO4, learners should have access to data to show the impact on measurable health parameters (life span, incidence of disease, heart activity, lung function etc.) of different factors. In the interpretation of this data, they will gain experience of value in the assessment of Units 2 and 3. The approach taken should be that of how health can be improved and learners may wish to look at threats to health over a person's lifetime, from birth to old age, and how these can be addressed. Learners should consider a range of client groups (e.g. pregnant mothers, young children or old people) in order to learn what types of question to ask and how the threats to health vary with different client groups.

© OCR 2012 OCR Cambridge National in Science

The focus of learning for LO5 should be on the risks and benefits of medical treatments and how risks can be reduced, for example by appropriate testing. Learners should develop an understanding of risk and more able learners should be able to carry out calculations of risk and make quantitative comparisons of the risks and benefits of alternative treatments. Learners need to develop the confidence to criticise stories in the media on risk and to develop materials which explain risks and benefits to a lay audience or client group.

In LO6, learners should have opportunities to use different sampling techniques and to use biotic and abiotic indicators to assess the health of different environments. Learners will learn how to collect and display data to demonstrate differences between environments and to interpret data to show the interdependence of organisms. More able learners will learn how mathematical techniques can be used to make comparisons between different environments, by calculating measures such as a simple index of biodiversity.

In LO7, learners will learn how materials we use everyday in familiar products are made from natural resources. Raw materials will include crude oil (for plastics and fibres), rocks and ores (for building materials, glass and metals) and the air (for ammonia). The focus should be on the impact of these manufacturing processes on the environment, but to appreciate this, learners will need to understand the chemical reactions involved, the conditions required, the yields produced and understand the quantities of materials and energy needed. Opportunities should be taken to make use of local examples of such manufacturing processes, by visits or by inviting visitors to the centre. Where possible, learners should carry out the chemical reactions involved (or equivalent reactions) practically and more able learners should be able to make calculations of yield. In collecting, analysing and interpreting data, they will gain experience of value in the assessment of Units 2 and 3.

The focus of learning for LO8 should be on how the properties of materials are determined by their chemical structures and how these properties influence how materials are used. Learners should be encouraged to think about products that they use in everyday life, the materials they contain and what properties these materials need. It may also be helpful to think about how modern materials have replaced more traditional ones and whether this is because modern materials have more suitable properties.

It is suggested that the teaching of LO8 and LO9 should be integrated so that when testing the properties of materials practically, they learn about how these properties are determined by the structures of the materials they are testing. Learners should have opportunities to use a range of methods for measuring the properties of materials and they will learn how to collect and display data to demonstrate differences between materials and to interpret data to show how materials are suited to different uses.

The specific requirements of the assessed tasks must not be included in this work but the skills and techniques necessary for the assessed tasks must be familiar to learners before they attempt the tasks. Skills, knowledge and understanding developed will be valuable in the assessment of Units 2 and 3 and LO3 / LO6 / LO9 provide possible contexts for the assessment task (investigation) for Unit 3.

© OCR 2012 OCR Cambridge National in Science

Module 1: Using energy	
Learning Outcome (LO)	**Content**
LO1: Be able to analyse personal and social choices related to energy supply	Learners should be taught the following content: that energy transfers can be measured and their efficiency calculated, which is important in considering the economic costs and environmental effects of energy use, i.e.: • different sources of energy: primary and secondary • renewable and non renewable fuels • energy density, ease of transportation and cost • environmental effects of energy use that electrical power is readily transferred and controlled, and can be used in a range of different situations, i.e.: • production of electricity using different energy sources, to include fossil fuels, nuclear fuels and renewables • distribution of electricity by the National Grid • the economic costs and environmental effects of electricity use how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions, i.e.: • limited to the context of energy supply • potential impacts on different groups and individuals within society • decision making processes and structures within the UK • the ideal that the best decision will have the best outcome for the majority of the people involved.

© OCR 2012 OCR Cambridge National in Science

Module 1: Using energy	
Learning Outcome (LO)	**Content**
LO2: Understand the risks and benefits related to the applications of nuclear radiation	Learners should be taught the following content: that radiations, including ionising radiations, can transfer energy, i.e.: • electromagnetic and nuclear radiations • different types and characteristics of nuclear radiation • detection of nuclear radiation and the energy transferred • radiation energy can be beneficial or harmful • natural emission of nuclear ionising radiations by some materials the use of contemporary scientific and technological developments and their benefits, drawbacks and risks, i.e.: • limited to the contexts of electricity generation and the industrial and health care applications of nuclear radiation • quantitative and qualitative analysis of risk factors including the calculation of probabilities.
LO3: Be able to measure energy transfers and calculate efficiencies	Learners should be taught the following content: how to collect data from primary or secondary sources, including ICT sources and tools, i.e.: • set up scientific equipment to measure: voltage and current; mass and temperature change; time how to work accurately and safely, individually and with others, when collecting first-hand data how to use the relationships between: • voltage, current, power • voltage, current, resistance • power, energy, time • specific heat capacity, mass, temperature change, energy • energy input, useful and wasteful outputs and efficiency.

© OCR 2012 OCR Cambridge National in Science

Module 2: Keeping healthy	
Learning Outcome (LO)	**Content**
LO4: Understand how human health can be improved	Learners should be taught the following content: that human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments, i.e.: • environmental factors that may affect health, including diet, exercise, smoking, drug use, pollution, noise, agrochemicals • nutrients in foods • what is meant by 'good health' • assessment of fitness and health • inherited conditions that affect health • types of drugs including depressants, stimulants, hallucinogens • types of microorganisms that cause infectious diseases • prevention by immunisation and treatment by antibiotics.
LO5: Understand the risks and benefits of medical treatments	Learners should be taught the following content: the use of contemporary scientific and technological developments and their benefits, drawbacks and risks, i.e.: • in the context of developing medical applications (preventative and treatment) • the need to test medical developments, including surgery, and drugs • in vitro testing, including testing antibiotics on bacterial cultures • in vivo testing • 'open label', 'blind' and 'double blind' trials • ethical considerations • the benefits and risks of medical treatments to include transplant surgery, blood transfusion, immunisation, gene therapies and stem-cell technologies • quantitative treatment of risk.

© OCR 2012 OCR Cambridge National in Science

Module 2: Keeping healthy	
Learning Outcome (LO)	**Content**
LO6: Be able to measure the environmental effects of human activity	Learners should be taught the following content: that organisms are interdependent, i.e.: • interdependence to include feeding relationships and competition for resources • indirect effects on organisms due to human activity, including effects on food webs and inter-specific competition due to introduced species that the effects of human activity on the environment can be assessed using living and non-living indicators – the health of environments, i.e.: • components of an ecosystem: biotic and abiotic • effects that can be assessed such as air and water pollution, noise, land-use • measurement of living indicators that can be used to assess the effect of human activity on the environment, to include bio-diversity, frequency and distribution • measurement of non-living indicators that can be used to assess the effect of human activity on the environment, to include pH, temperature, chemical testing, particulates how to collect data from primary or secondary sources, including ICT sources and tools, i.e.: • sampling techniques, including use of quadrats and transects • measuring the level of indicators and the visualisation of data how to work accurately and safely, individually and with others, when collecting first-hand data.

© OCR 2012 OCR Cambridge National in Science

Module 3: Materials for a purpose	
Learning Outcome (LO)	**Content**
LO7: Understand how materials we use are made from natural resources	Learners should be taught the following content: that new materials are made from natural resources by chemical reactions, i.e.: • crude oil as a source of new materials, including plastics and fibres • construction materials, including cement, brick, glass, steel • metals from their ores: copper by electrolysis and iron by heating ores with carbon • ammonia from nitrogen in the air (Haber process) • batch and continuous processes • calculations of percentage yields for different processes and using different conditions • issues of sustainability and environmental impact, including production quantities, energy budgets and atom economy that chemical change takes place by the rearrangement of atoms in substances, and that there are patterns in the chemical reactions between substances, i.e.: • polymerisation of alkenes • oxidation and reduction • word and balanced symbol equations • reversible reactions and equilibria • use of catalysts.

© OCR 2012 OCR Cambridge National in Science

Module 3: Materials for a purpose	
Learning Outcome (LO)	**Content**
LO8: Understand how the properties of materials we use are determined by structure and bonding	Learners should be taught the following content: that the properties of a material determine its uses, and can be explained by its chemistry, i.e.: • the structure and bonding of a material, including elements and compounds, can explain its properties • the way molecules are arranged in polymers determines the properties: chain length, cross-linking, use of plasticizers, crystallinity • alloys, including steel • uses of materials depend on their properties, including boiling and melting points, strength (compression and tension), stiffness, hardness, density.
LO9: Be able to measure the properties of materials to recommend appropriate uses	Learners should be taught the following content: how to collect data from primary or secondary sources, including ICT sources and tools, i.e.: • set up scientific equipment to measure properties of materials • interpret data about the properties of materials to assess their suitability for particular purposes how to work accurately and safely, individually and with others, when collecting first-hand data how to process data using mathematical techniques, to identify trends and patterns, i.e.: • calculate the gradients of graphs or average values • identify anomalous results.

© OCR 2012 OCR Cambridge National in Science

2.3 Unit R072: *How scientific ideas have developed*

Introduction

In this unit, learners explore the way in which scientific ideas have developed, by studying the work of a number of scientists.

Learners sit a 1 hour written examination paper which is externally set and marked by OCR.

Papers are available at Level 1 and Level 2. Each paper carries 60 raw marks. Content examined in the Level 2 paper only is shown **in bold**.

The unit is weighted at 25% of the qualification and requires 30 GLH.

Aims

The focus of learning for this unit is the way in which scientific ideas develop. Scientific research starts with observations which have no scientific explanation. A provisional scientific explanation of such observations is called a hypothesis. From a hypothesis it is possible to develop predictions which can be tested by experiment and this process is often called the 'scientific method'.

The development of many scientific ideas can be presented in narrative form, to both captivate the interest of learners, and guide their comprehension of the scientific method. The range of ideas covered in this unit include examples of collaboration, the impact of creative thinking, the rapid emergence of new ideas as well as ideas that have developed over thousands of years.

It is important in teaching this unit that all four Learning Outcomes are integrated, so that learners are taught about the scientific method (LO2) in the context of the work of scientists and the development of scientific ideas (LO1). In undertaking this learning, learners need to understand the way in which experiments are designed and scientific evidence is interpreted and evaluated (LO3) and to be able to communicate their own ideas (LO4).

In preparation for the first questions on the examination paper, based on a case study of the work of some modern scientists, learners should have some experience of working with a similar case study, in which they evaluate the information presented to them and consider how the scientific method has been used in the research.

Learners will bring to this unit skills, knowledge and understanding from Unit 1, including the use of scientific equipment to collect data and the interpretation of data to reach conclusions.

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO1: Know and understand how the work of scientists has resulted in the development of scientific ideas	Learners should be taught the following content: <u>How the variety of life on Earth has developed</u> the ways in which organisms function are related to the genes in their cells, i.e.: • Mendel and the particulate theory of inheritance: idea that characteristics are inherited by genes passing from one generation to the next through gametes; breeding experiments with peas, pure breeding lines and dominant and recessive characteristics; leading to idea of dominant and recessive alleles **and prediction of proportions of offspring with different characteristics** • Franklin and Wilkins: x-ray diffraction to produce data on the helical structure of DNA • Watson and Crick: physical models of DNA: 4 base pairs, linked in pairs (A-T, C-G) holding double helix together • sequence of base pairs in DNA is the genetic code for protein synthesis in cells; **transcription (into mRNA) and translation (to protein structure) at ribosomes** that variation within species can lead to evolutionary changes; organisms are adapted to their environments, i.e.: • evidence for evolution: fossil record, selective breeding • Lamarck: environmental causes of variation; inheritance of useful acquired characteristics • Darwin: natural selection as the mechanism for adaptation to the environment; Darwin's finches as evidence for natural selection that similarities and differences between species can be measured and classified, i.e.: • Linnaeus and the binomial system – genus and species names – based on external characteristics • artificial classification systems with no reference to evolution; natural systems based on evolutionary relationships • **use of cladistics to generate evolutionary trees from multiple characteristics, including DNA**.

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO1: Know and understand how the work of scientists has resulted in the development of scientific ideas (cont.)	<u>How the internal environment of the human body is controlled</u> that chemical and electrical signals enable body systems to respond to internal and external changes, in order to maintain the body in an optimal state, i.e.: • Galvani and Volta: electricity to stimulate muscle contraction • CNS and peripheral nerves (sensory and motor neurones) for rapid, specific reaction of animals to environmental changes • Avicenna: symptoms of diabetes and treatment using diet; Banting and Best: extraction and purification of insulin and use in treatment; role of pancreas in producing insulin to control glucose levels in the blood, **converting glucose into glycogen in the liver** • endocrine and nervous systems and the differences in their functions for homeostasis, as applied to temperature control mechanisms and control of glucose concentration in the blood • temperature control in humans as an example of a negative feedback system: receptor and processor in the brain and effectors for sweating, shivering, **vaso-constriction and dilation**. <u>The history of the Earth and the Universe</u> that the surface and the atmosphere of the Earth have changed since the Earth's origin and are changing at present, i.e.: • Wegener: evidence for continental drift from fossils and 'jigsaw' fit of continents and reasons why Wegener's ideas were not initially accepted • Holmes: plate tectonics due to convection currents in the mantle to explain continental drift; sea floor spreading, earthquakes, mountain building and volcanoes at edges of plates • Lyell: climate change used to explain evidence in rocks for periodic ice ages; Fourier: the role of carbon dioxide, **methane and water vapour** in determining the temperature of the atmosphere by the greenhouse effect (proportion of radiation from the Sun not escaping into space); **atmosphere is transparent to visible radiation from the Sun but not to infra-red radiation from the Earth** • correlation between global temperature and carbon dioxide levels; consequences of global warming due to human activity (climate change, rise in sea levels, rapid environmental change)

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO1: Know and understand how the work of scientists has resulted in the development of scientific ideas (cont.)	that the solar system is part of the universe, which has changed since its origin and continues to show long-term changes, i.e.: • early Greek ideas about a universe centred on the Earth: sun and moon on invisible spheres rotating at different speeds around the Earth, the stars on the outermost sphere, planets as 'wanderers' • the Copernican universe with the Sun at the centre: provides a simpler mathematical model • Galileo and Newton: scientific explanation of the Copernican model, using laws of motion and the idea of gravity keeping planets in orbit around the Sun • Hubble and motion of the galaxies: the big bang and the expanding universe (**evidenced by red shift and the Hubble Law; microwave background radiation due to cooling of the universe**). <u>Using waves to communicate</u> that radiations in the form of waves can be used for communication, i.e.: • Maxwell: models visible light as a short wavelength electromagnetic wave at a fixed speed (300,000 km/s) • Hertz: apparatus for making and detecting radio waves, and measuring speed as 300,000 km/s • Marconi: application of discovery of radio waves for 'over the horizon' digital communication by Morse code • microwaves for digital communication using mobile phones: each phone in a given area (cell) allocated a different wavelength – spreading out and weakening of microwaves allows wavelengths to be re-used in different areas • infra-red pulses in optical fibres for long distance rapid communication of large quantities of data (**data rates in bits per second, amounts of data in bits, megabits and gigabits; a byte as 8 bits**); pulses stay within fibre so do not spread out • spectrum of electromagnetic waves includes, in order of increasing wavelength: light, infra-red, microwaves, radio waves.

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO2: Understand the process of science: the scientific method	Learners should be taught the following content: <u>In the context of the development of the scientific ideas in LO1:</u> how scientific data can be collected and analysed, i.e.: • the development of scientific equipment, techniques and instrumentation allow new data to be collected how explanations of many phenomena can be developed using scientific theories, models and ideas how interpretation of data, using creative thought, provides evidence to test ideas and develop theories, i.e.: • confidence increases in scientific explanations if hypotheses based on them are supported by results of experiments, but unexpected results can lead to new understanding of science how uncertainties in scientific knowledge and scientific ideas change over time, i.e.: • scientific explanations are provisional because they only explain the current evidence that there are some questions that science cannot currently answer, and some that science cannot address, i.e.: • current equipment, techniques and instrumentation limit what science can do • some questions are a matter of belief and can never be addressed by science about the role of the scientific community in validating changing scientific ideas, i.e.: • publishing results of experiments enables other scientists to replicate the work and further evidence to be collected • the importance of the peer review process in which scientists check each other's work • the value of using teams of scientists to investigate scientific problems.

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO3: Be able to evaluate scientific information	Learners should be taught the following content: <u>In the context of scientific research:</u> • how variables are controlled or taken into account how to use both qualitative and quantitative approaches, i.e.: • process data using qualitative and quantitative (mathematical) techniques to identify trends or patterns how to analyse, interpret, apply and question scientific information or ideas, i.e.: • assess the quality and validity of the evidence and suggest scientific explanations for unexpected results • interpret evidence and suggest conclusions • identify conflicting evidence, or weaknesses in the evidence, which lead to different interpretations; what further evidence would help to make a conclusion more secure • compare different explanations of scientific evidence and identify shortcomings in explanations • use ideas of correlation and cause when analysing data and identify what further work would be needed to establish a causal link.
LO4: Be able to communicate scientific information	Learners should be taught the following content: <u>In the context of LO1-LO3:</u> how to use scientific, technical and mathematical language, conventions and symbols, i.e.: • ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear.

© OCR 2012 OCR Cambridge National in Science

Outline of assessment

Externally set and marked examination: 60 minutes, 60 marks. All questions are compulsory.

Tiered question papers: Level 1 and Level 2, with some overlapping questions, allowing learners performing at the top of Level 1 to be given a Pass grade at Level 2.

Structured questions are used, with a balance of short and long answers, some requiring 6 mark extended answers in which quality of written communication (QWC) will be assessed. During the external assessment, learners will be expected to demonstrate their understanding through questions that require the skills of analysis and evaluation in particular contexts.

A case study provides the context for the first questions (15 marks) on the paper, targeting LO2 and LO3, but using knowledge and understanding from one or more parts of LO1. The case study presents information about the work of some modern scientists, including information about their research and some of their results. Pre-release material sent to centres before the examination gives learners an opportunity to become familiar with the case study.

The remaining questions on the paper will primarily address LO1 and LO2.

Weighting of LOs in the examination papers

The relative weighting of the Learning Outcomes in the written examination papers is shown in the following grid:

Learning Outcome (LO)		%
LO1	Know and understand how the work of scientists has resulted in the development of scientific ideas	42
LO2	Understand the process of science: the scientific method	25
LO3	Be able to evaluate scientific information	25
LO4	Be able to communicate scientific information	8

© OCR 2012 OCR Cambridge National in Science

2.4 Unit R073: *How scientists test their ideas*

Introduction

In this unit, learners develop their skills in designing and carrying out experimental work, including the collection of data and its analysis, interpretation and evaluation.

The assessment task is a practical investigation which is internally assessed and moderated by OCR. The investigation is marked out of 60 marks. The assessment includes a synoptic element – the task may be set in any context drawn from Units R071 and R072. Learners will need to draw on the appropriate scientific knowledge and understanding from the earlier units.

The unit is weighted at 25% of the qualification and has 30 GLH.

Aims

In this unit, learners will develop their skills in planning and carrying out experimental work. The Learning Outcomes for the unit build on those in Unit 1 and Unit 2: in Unit 1 learners have opportunities to carry out practical work, taking measurements and interpreting their results and in Unit 2, learners are taught about the scientific method and how scientists carry out research.

In Unit 3, learners will develop further their understanding of how scientific information is evaluated, and in the assessment task (investigation) for Unit 3, learners will apply an understanding of the scientific method to their own research project.

It is recommended that the teaching for this unit should be integrated into the other two units so that learners develop their experimental skills in the context of the scientific content of the other two units.

Learning Outcomes (LO)	Content
LO1: Be able to plan a scientific investigation	Learners should be taught the following content: how to plan to test a scientific idea, answer a scientific question, or solve a scientific problem, i.e.: • how variables are controlled or taken into account • the equipment and techniques needed to minimise error and collect high quality, valid data • sources of data/information.
LO2: Be able to collect scientific data	Learners should be taught the following content: how to collect data from primary and secondary sources, including ICT sources and tools how to work accurately and safely, individually and with others, when collecting first-hand data, i.e.: • the need for a risk assessment.
LO3: Be able to analyse scientific information	Learners should be taught the following content: <u>In the context of scientific investigation:</u> how to use both qualitative and quantitative approaches, i.e.: • process data using qualitative and quantitative (graphical and mathematical) techniques to identify trends or patterns how to analyse, interpret, apply and question scientific information or ideas, i.e.: • identify relationships between variables • level of uncertainty of data, including anomalous results.

© OCR 2012 OCR Cambridge National in Science

Learning Outcomes (LO)	Content
LO4: Be able to evaluate scientific information	Learners should be taught the following content: <u>In the context of scientific investigation:</u> how to evaluate methods of collection of data and consider their validity and reliability as evidence, i.e.: • assess the quality and validity of the evidence and suggest scientific explanations for unexpected results • how improvements in methods of data collection would improve the quality of the data • identify conflicting evidence, or weaknesses in the evidence, which lead to different interpretations; what further evidence would help to make a conclusion more secure to show how interpretation of data, using creative thought, provides evidence to test ideas and develop theories, i.e.: • our confidence increases in scientific explanations if hypotheses based on them are supported by results of experiments, but unexpected results can lead to new understanding of science • interpret evidence and suggest conclusions • use ideas of correlation and cause when analysing data and identify what further work would be needed to establish a causal link.
LO5: Be able to communicate scientific information	Learners should be taught the following content: <u>In the context of LO1–LO4:</u> how to present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols, i.e.: • ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear • use of explanations, arguments, diagrams, graphs, flow charts, pictures and tables.

© OCR 2012 OCR Cambridge National in Science

3 Assessment of the Cambridge National Certificate in Science

3.1 Overview of the assessment in the Cambridge National Certificate in Science

Entry code	Qualification title	GLH	Reference
J815	**OCR Level 1/2 Cambridge National Certificate in Science**	**120**	600/4790/2

Made up of:

- Units R071, R072 and R073.

Individual unit details below:

Unit Details	
Unit R071: *How scientific ideas have an impact on our lives*	
60 GLH Approx 21 hours internal assessment 120 marks (120 UMS) Centre assessed and OCR moderated	The centre assessed tasks: • consists of a portfolio of work incorporating 9 assessment tasks.
Unit R072: *How scientific ideas have developed*	
30 GLH 1 hour written paper 60 marks (60 UMS) OCR set and marked	The question paper: • is based on a pre-release article, • is tiered.
Unit R073: *How scientists test their ideas*	
30 GLH Approx 5.5 – 7 hours internal assessment 60 marks (60 UMS) Centre assessed and OCR moderated	The centre assessed tasks: • consists of a practical investigation task, • includes a synoptic element.

To claim the Certificate in Science (120 GLH) qualification learners must complete unit R071, unit R072 and unit R073. All three units are mandatory.

A bank of model assignments is available free of charge from the OCR website for the centre assessed units R071 and R073.

3.2 Links between units and synoptic assessment

The DfE has recently announced that only those qualifications that provide evidence of synoptic assessment that demonstrates pupils' broad understanding of what they have studied in their courses will be counted in the school attainment tables.

This qualification is designed with that requirement in mind. It has been written in a way that allows learners to sequentially build up their knowledge, understanding and skills between the units R071, R072 and R073 over the course of their programme of learning, which will support them in the assessment of their units.

© OCR 2012 OCR Cambridge National in Science

Learners will bring to unit R072, skills, knowledge and understanding from unit R071, including the use of scientific equipment to collect data and the interpretation of data to reach conclusions.

The LOs for unit R073 build on those in unit R071 and unit R072: in unit R071 learners have opportunities to carry out practical work, taking measurements and interpreting their results and in unit R072, learners are taught about the scientific method and how scientists carry out research.

In unit R073, learners will develop further their understanding from units R071 and R072 of how scientific information is evaluated and in the assessment task for unit R073, learners will apply in their own Investigation an understanding of the scientific method from unit R072.

The teaching for unit R073 should be integrated into the other two units so that learners develop their experimental skills in the context of the scientific content of the other two units.

There are synoptic elements in the assessment of both unit R072 and unit R073. In unit R072, questions will require learners to draw on skills, knowledge and understanding learned in unit R071 about the way in which data is collected, analysed and interpreted to reach conclusions.

In unit R073, learners carry out their own investigation, the assessment of which will draw on their understanding of the 'scientific method' from unit R072; in the interpretation of their results they will need to have an understanding of the science context (drawn from unit R071 or unit R072) in which the investigation is set.

While we will not prescribe in which order the units are assessed it is important to be aware of the links between units so that the teaching, learning and assessment can be planned accordingly then when being assessed learners can apply their learning in ways which show they are able to make connections across the qualification.

This specification booklet will support synoptic assessment by:

- showing teaching and learning links between the units across the specification
- giving guidance, with the marking criteria for the centre assessed units, about where learners could apply the knowledge and understanding from other units to improve their performance.

This qualification supports synoptic learning and assessment by employing the following principles:

- to provide content that will allow for holistic delivery and the application of prior or concurrent learning
- to enable learners to demonstrate an ability to use and apply a range of different methods and/or techniques
- to provide assessment that encourages learners to put forward different ideas and/or explanations to support decisions they have made
- to develop learners' ability to suggest or apply different approaches to contexts, situations
- to develop and assess the learners' use of transferable skills
- to enable learners to demonstrate analytical and interpretation skills (of situations and/or results) and the ability to formulate valid well-argued responses
- to enable learners to evaluate and justify their decisions, choices and recommendations.

3.3 Grading and awarding grades

3.3.1 Grade scale

All results are awarded on the following scale:

- Distinction* at Level 2 (*2)
- Distinction at Level 2 (D2)
- Merit at Level 2 (M2)
- Pass at Level 2 (P2)
- Distinction at Level 1 (D1)
- Merit at Level 1 (M1)
- Pass at Level 1 (P1).

The shortened format of the grade will be displayed on Interchange and some administrative documents provided by OCR. However the full format of the grade will appear on the certificates issued to learners.

Grades are indicated on qualification certificates. However, results for learners who fail to achieve the minimum grade (Pass at Level 1) will be recorded as *unclassified* (U or u) and this is **not** certificated.

3.3.2 For internally assessed units, R071 and R073

The boundaries for Distinction at Level 2, Pass at Level 2, and Pass at Level 1 are set judgementally. Other grade boundaries are set arithmetically.

The Merit (Level 2) is set at half the distance between the Pass (Level 2) grade and the Distinction (Level 2) grade. Where the gap does not divide equally, the Merit (Level 2) boundary is set at the lower mark (e.g. 45.5 would be rounded down to 45).

The Distinction* (Level 2) grade is normally located as far above Distinction (Level 2) as Merit (Level 2) is below Distinction (Level 2).

To set the Distinction (Level 1) and Merit (Level 1) boundaries, the gap between the Pass (Level 1) grade and the Pass (Level 2) grade is divided by 3, and the boundaries set equidistantly.

Where this division leaves a remainder of 1, this extra mark will be added to the Distinction (Level 1)-Pass (Level 2) interval (i.e. the Distinction (Level 1) boundary will be lowered by 1 mark). Where this division leaves a remainder of 2, the extra marks will be added to the Distinction (Level 1)-Pass (Level 2) interval, and the Merit (Level 1)-Distinction (Level 1) interval, i.e. the Distinction (Level 1) boundary will be lowered by 1 mark, and the Merit (Level 1) boundary will be lowered by 1 mark.

For example, if Pass (Level 2) is set judgementally at 59, and Pass (Level 1) is set judgementally at 30, then Distinction (Level 1) is set at 49, and Merit (Level 1) is set at 39.

3.3.3 For the externally assessed unit, R072

The boundaries for Distinction at Level 2, Pass at Level 2, Distinction at Level 1 and Pass at Level 1 are set judgementally. Other grade boundaries are set arithmetically.

The Merit at Level 2 boundary is set at half the distance between the Pass at Level 2 boundary and the Distinction at Level 2 boundary. Where the gap does not divide equally, the Merit at Level 2 boundary is set at the lower mark (e.g. 45.5 would be rounded down to 45).

© OCR 2012 OCR Cambridge National in Science

The Distinction* at Level 2 boundary is normally located as far above the Distinction at Level 2 boundary as the Merit at Level 2 boundary is below the Distinction at Level 2 boundary.

The Merit at Level 1 boundary is set at half the distance between the Pass at Level 1 boundary and the Distinction at Level 1 boundary. Where the gap does not divide equally, the Merit at Level 1 boundary is set at the lower mark (e.g. 36.5 would be rounded down to 36).

A candidate entered for Level 1 who performs markedly above the level required for the Distinction at Level 1 can achieve a Pass at Level 2.

3.3.4 Grading

This qualification is unitised. Learners can take units across several different series. They can also re-sit units. Please refer to section 7.3 *Unit and qualification re-sits* for more information. When working out learners' overall grades, OCR needs to be able to compare performance on the same unit in different series when different grade boundaries may have been set, and between different units. OCR uses a Uniform Mark Scale to enable this to be done.

A learner's uniform mark for each unit is calculated from the learner's raw mark on that unit. The raw mark boundary marks are converted to the equivalent uniform mark boundary. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the learner's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit, e.g. 40/60.

The uniform mark boundaries for the units are shown below.

Unit GLH	Max Unit Uniform Mark	Unit Grade							
		distinction* at L2	distinction at L2	merit at L2	pass at L2	distinction at L1	merit at L1	pass at L1	u
30 L1	36	–	–	–	36	30	24	18	0
30 L2	60	54	48	42	36	–	–	–	0
30	60	54	48	42	36	30	24	18	0
60	120	108	96	84	72	60	48	36	0

The learner's uniform mark for unit R072 will be combined with the uniform mark for the centre assessed units R071 and R073 to give a total uniform mark for the qualification. The learner's grade will be determined by the total uniform mark.

The following table shows the minimum total mark for each overall grade:

Qualification	Max Uniform Mark	Qualification Grade							
		Distinction* at L2	Distinction at L2	Merit at L2	Pass at L2	Distinction at L1	Merit at L1	Pass at L1	U
Certificate	240	216	192	168	144	120	96	72	0

3.4 Performance descriptions

The performance descriptors indicate the level of attainment associated with Distinction at Level 2, Pass at Level 2 and Pass at Level 1. They are for use at awarding meetings. They give a general indication of the levels of attainment likely to be shown by a representative learner performing at these boundaries.

Performance descriptor – Distinction at Level 2

Learners will be able to recall, select and communicate precise knowledge and detailed understanding of how and why scientific ideas have changed over time. They can clearly account for how these ideas are tested and supported by the collection and analysis of data. They demonstrate a clear understanding of the tentative nature of scientific knowledge, appreciate how and why this is restricted by the limitations of measuring equipment, and are able to describe in detail how new scientific ideas can be validated.

In their portfolio work, learners will be able to demonstrate detailed understanding of science and its applications in a range of contexts, which have had an impact on our lives. They will be able to work with confident independence to create material which reflects thoughtful planning, a critical analysis and interpretation of a broad range of quantitative and qualitative information and a perceptive evaluation of their findings. They will use scientific and technical knowledge, terminology and conventions appropriately and consistently. Learners will be able to develop balanced views about risks and benefits and communicate these clearly and coherently in their work, including quantitative evaluation of risk where relevant.

In experimental and investigative work, learners apply a comprehensive understanding of practical methods and processes and demonstrate sound judgement in the selection of appropriate scientific equipment and techniques. They apply competent mathematical, technical and observational skills, knowledge and understanding in a wide range of practical contexts. They follow procedures and methods consistently, evaluating and managing risk and working accurately and safely. Where relevant, learners reflect on the limitations of the methods and procedures they have used and the data they have collected and both propose and justify improvements. They make reasoned judgements consistent with the evidence to develop substantiated conclusions.

Performance descriptor – Pass at Level 2

Learners will be able to recall, select and communicate a secure knowledge and understanding of how and why scientific ideas have changed over time. They are able to account for how some of these ideas are tested and supported by the collection and analysis of data. They demonstrate an understanding that scientific knowledge changes when more accurate observations and measurements can be made, and are able to describe in broad terms how new scientific ideas can be validated.

In their portfolio work, learners will be able to demonstrate a secure understanding of science and its applications in a range of contexts, which have had an impact on our lives. They will be able to work with independence to create material which reflects effective planning, analysis and interpretation of both quantitative and qualitative information and relevant evaluation of their findings. They will use scientific and technical knowledge, terminology and conventions appropriately. Learners will be able to develop views about risks and benefits and communicate these effectively in their work, including qualitative evaluation of risk where relevant.

© OCR 2012 OCR Cambridge National in Science

In experimental and investigative work, learners apply an understanding of practical methods and processes after practice and demonstrate adequate judgement in the selection of appropriate scientific equipment and techniques, with limited help provided. They apply secure mathematical, technical and observational skills, knowledge and understanding in some practical contexts, requiring limited guidance in others. They follow procedures and methods with limited help, make appropriate risk assessments, and work with care to achieve meaningful results. Where relevant, learners are able to comment on limitations of the methods and procedures they have used to collect data and make suggestions for improvements. They draw conclusions consistent with the available evidence.

Performance descriptor – Pass at Level 1

Learners will be able to recall, select and communicate a limited knowledge and understanding of how and why scientific ideas have changed over time. They appreciate that data is needed to test scientific ideas. They demonstrate an understanding that more accurate observations can be made with more accurate equipment, and appreciate the need for other scientists to replicate measurements.

In their portfolio work, learners will be able to demonstrate a limited understanding of science and its applications in the contexts which have had an impact on our lives. They will be able to show evidence of independent work which has been planned, developed and evaluated in a simplistic way. They will use limited scientific and technical knowledge, terminology and conventions. Learners will be able to list relevant risks and benefits and make simplistic judgements about them.

In experimental and investigative work, learners will be able to use given scientific equipment with support. They will follow procedures and methods with guidance and make relevant observations, recording results in a limited way. They will demonstrate a limited understanding of risks in procedures with standard laboratory safety. They can draw elementary conclusions having collected limited evidence.

3.5 Quality of written communication

Quality of written communication is assessed in units R072 and R073. It is included in the marking criteria for Unit R073 and in the mark schemes for questions requiring extended answers in the externally assessed examinations for unit R072.

Learners are expected to:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
- present information in a form that suits its purpose
- use a suitable structure and style of writing
- use specialist terminology, where applicable.

4 The centre assessed units (R071 and R073)

This section provides guidance on the completion of the centre assessed units.

4.1 The centre assessed units

Each of the internally assessed units (R071 and R073) are designed to provide learners with the opportunity to build a portfolio of evidence to meet the learning outcomes for that unit.

We recommend that teaching and development of subject content and associated skills be referenced to real vocational situations, through the utilisation of appropriate industrial contact, vocationally experienced delivery personnel, and real life case studies.

Units R071 and R073 are centre assessed and externally moderated by OCR. Centres can choose whether they would like moderation via the OCR Repository, postal or visiting moderation.

Appendix B of this specification contains assessment guidance for the centre assessed units, which should be referred to in conjunction with the unit content and marking criteria grids to inform delivery of the units. The assessment guidance aims to provide clarification regarding the scope of the learning required in specific areas of the units where this is felt to be beneficial.

4.2 Tasks for the centre assessed units

A bank of model assignments is provided by OCR for units R071 and R073. Centres must select from the model assignments provided, to use when assessing their learners. The assignments will be available free of charge from the OCR website. Learners are able to work on the tasks anytime until the date the centre collects the work for internal assessment. OCR will review the model assignments annually which may result in an assignment being withdrawn and replaced. It is up to the centre to check the OCR website to see which model assignments are available to be used. We will give approximately 12 months' notice if a model assignment is to be withdrawn and replaced so that we do not disadvantage any learners who have already started working on an assignment that is to be replaced.

Centres can make some modifications to the model assignments that OCR provides so that the assignment can be put within a local context that learners might relate to more easily, or to allow for differences in the materials, equipment and facilities at different centres. Guidance on what can be modified is given in each assignment in the section Teacher Information under *Scope of permitted model assignment modification*. If modifications are made to the model assignment, whether to just the scenario or to both the scenario and tasks, it is up to the centre to ensure that all learning outcomes can be met and that learners can access the full range of marks.

The duration of the assessment is included in the guided learning hours for the unit. Guidance will be given within "Information for Teachers" in each model assignment as to how long learners should expect to spend on each task.

The OCR model assignments are provided for summative assessment.

Teachers must ensure learners are clear about the task they are to undertake and the criteria which they are expected to meet.

Teachers must supervise practical work, in accordance with normal practice, to ensure safety procedures (see Appendix E for further guidance).

© OCR 2012 OCR Cambridge National in Science

4.2.1 Unit R071: *How scientific ideas have an impact on our lives*

When the skills, knowledge and understanding identified above have been taught, learners should be given the assessment tasks to complete. Each task is relevant to a particular Learning Outcome, so tasks may be presented to learners when they are judged to be ready to undertake them; they do not all need to be left until the end of the module.

Learners may work individually or in groups on the task for LO1. It is suggested that the task should be set in the context of an enquiry into alternative ways in which energy can be supplied to new town, remote village or island. Each learner or group of learners should represent an interest group at the enquiry and present evidence on the advantages and disadvantages of different schemes from the point of view of the interest group represented. If working in groups, the contribution of each learner must be clear, either in their work or by using witness statements. There are many opportunities in the task to make creative use of ICT, in producing documents, videos etc., including the visualisation of quantitative data on the efficiency of energy transfer, but teachers and learners should be aware of the marking criteria so that learners' work can be assessed against the criteria and that marks are not limited by the media used.

The task for LO2 is set in the context of the use of nuclear radiation and it might be helpful to learners to see how stories in the media about nuclear radiation are often misleading and alarmist. Learners produce briefing material and there are opportunities in this task for learners to use ICT in producing visual imagery to illustrate their work, but teachers and learners should be aware of the marking criteria so that learners' work can be assessed against the criteria and that marks are not limited by the media used.

For LO3, learners undertake a practical task: to measure the efficiency of an energy transfer involving electricity. They will need to select appropriate equipment and techniques to obtain data which can then be analysed to reach conclusions. Learners may need to work in groups to undertake these tasks, but the contribution of each learner must be clear, either in their work or by using witness statements.

Learners should work individually on the tasks for LO4 and LO5. These tasks are designed so that they can be made directly relevant to client groups (workers, and patients) and it is suggested that this can be made more realistic and motivation improved by providing opportunities to talk to clients or those concerned with their management, for example by visiting a place of work or by inviting a manager or nurse into the centre to explain their needs. Within the teaching group it may be helpful if different learners (or sub-groups) take on the role of developing materials for different client groups (workers doing different types of jobs; patients with different conditions). In this way it should be clear that the materials produced are targeted at the needs of the client groups concerned.

There are many opportunities in the tasks for LO4 and LO5 to make creative use of ICT, in producing documents, videos etc. but teachers and learners should be aware of the marking criteria so that learners' work can be assessed against the criteria and that marks are not limited by the media used.

To undertake the task for LO6, learners should be introduced to an area where human activity has affected the environment. To measure the effects of human activity, they will also need to have access to an area where there is no impact, or the impact is less. They will need to select appropriate measures and the materials and equipment to obtain data which can then be analysed to show the effects of human activity. This could be as simple as the effect on parts of a school field of different amounts of wear. Learners may need to work in groups to undertake this task, so that sufficient data can be collected, but the contribution of each learner must be clear, either in their work or by using witness statements.

© OCR 2012 OCR Cambridge National in Science

Learners should work individually on the task for LO7. They need to identify a range of different types of material used for a construction project, and it may be helpful to visit a building site. There is now much concern about the environmental impact of production and this may provide a focus for the work which could be directed towards a particular real or imaginary client.

The task for LO8 is set in the context of a complex product and this could be a building, which would allow an integrated approach to LO7 and LO8. There are opportunities in this task for learners to use ICT in producing visual imagery to illustrate their work, but teachers and learners should be aware of the marking criteria so that learners' work can be assessed against the criteria and that marks are not limited by the media used.

For LO9, learners test a range of different materials to see which is most suitable for a particular purpose. They will need to select appropriate equipment and techniques to obtain data which can then be analysed to make a recommendation. Learners may need to work in groups to undertake this task, so that sufficient data can be collected, but the contribution of each learner must be clear, either in their work or by using witness statements. It is possible to integrate the assessment of LO9 with that for LO8 by undertaking testing of materials in the context of the complex product used in the Research Report.

There is a list of most commonly used terms in the *marking criteria glossary of terms* in Appendix C.

4.2.2 Unit R073: *How scientists test their ideas*

When the skills, knowledge and understanding identified above have been taught, learners should be given the assessment task to complete.

Learners may work individually or in groups on the task but the contribution of each learner must be clear, either in their work or by using witness statements.

There are many opportunities in the task to make use of ICT, in the collection, processing and visualisation of quantitative data, but teachers and learners should be aware of the marking criteria so that learners' work can be assessed against the criteria and that marks are not limited by the media used.

The assessment for unit R073 includes a synoptic element – the task may be set in any context drawn from Units R071 and R072. Learners will need to draw on the appropriate scientific knowledge and understanding from the earlier units to be able to frame an appropriate question or problem to investigate and to be able to interpret results and draw conclusions.

There is a list of most commonly used terms in the *marking criteria glossary of terms* in Appendix C.

© OCR 2012 OCR Cambridge National in Science

4.2.3 Methods of assessment

It is the assessor's responsibility to choose the best method of assessing a learner in relation to their individual circumstances. The methods chosen must be:

- valid
- reliable
- safe and manageable and
- suitable to the needs of the learner.

Valid

Validity can be compromised if a learner does not understand what is required of them. For example, one valid method of assessing a learner's knowledge and understanding is to question them. If the questions posed are difficult for the learner to understand (not in terms of the content but the way they are phrased, for example) the validity of the assessment method is questionable.

As well as assessment methods being valid, the evidence presented must also be valid. For example, it would not be appropriate to present an organisation's equal opportunities policy as evidence towards a learner's understanding of the how the equal opportunities policy operates within the organisation. It would be more appropriate for the learner to incorporate the policy within a report, describing different approaches to equal opportunities.

Reliable

A reliable method of assessment will produce consistent results for different assessors on each assessment occasion. Internal moderators must make sure that all assessors' decisions are consistent.

Safe and manageable

Assessors and internal moderators must make sure that the assessment methods are safe and manageable and do not put unnecessary demands on the learner.

Suitable to the needs of the learner

OCR is committed to ensuring that achievement of these awards is free from unnecessary barriers. Centres must follow this commitment through when designing tasks and/or considering assessment.

4.3 Completing the tasks

Teachers/assessors are expected to supervise and guide learners when undertaking work that is internally assessed. It should be remembered, however, that the final pieces of work must be produced solely by the individual learner.

When supervising tasks, teachers/assessors are expected to:

- exercise continuing supervision of work in order to monitor progress and to prevent plagiarism
- exercise continuing supervision of practical work to ensure essential compliance with Health and Safety requirements (see Appendix E)
- ensure that the work is completed in accordance with the specification requirements and can be assessed in accordance with the specified marking criteria and procedures.

Centre assessed work should be completed in the course of normal curriculum time, and supervised and marked by the teacher/assessor. Some of the work, by its very nature, may be undertaken outside the centre, for example, research work, testing etc. As with all centre assessed work, the teacher/assessor must be satisfied that the work submitted for assessment is the learner's own.

Learners are free to revise and redraft work without teacher involvement before submitting the work for assessment. The advice provided prior to final submission should only enable the learner to take the initiative in making amendments, rather than detailing what amendments should be made. This means that teachers must not provide templates, model answers or detail specifically what amendments should be made.

Adding, amending or removing any work after it has been submitted for final assessment will constitute malpractice.

4.3.1 Presentation of the final piece of work

Learners must observe the following procedures when producing their final piece of work for the centre assessed tasks:

- work can be word processed or hand written
- tables, graphs and spreadsheets may be produced using appropriate ICT. These should be inserted into the report at the appropriate place
- any copied material must be suitably acknowledged
- quotations must be clearly marked and a reference provided wherever possible
- a completed cover sheet must be attached to work submitted for moderation. The cover sheet must include the following information as well as the marks given for each of the assessment criteria:
  - centre number
  - centre name
  - candidate number
  - candidate name
  - unit code and title
  - assignment title.

Work submitted in digital format (CD or online) for moderation or marking must be in a suitable file structure as detailed in Appendix I at the end of this specification. Work submitted on paper must be secured by treasury tags or other suitable method.

© OCR 2012 OCR Cambridge National in Science

4.4 Marking and moderating centre assessed units

All centre assessed units are internally marked by centre staff using OCR marking criteria and guidance and externally moderated by the OCR-appointed moderator.

The centre is responsible for appointing someone to act as the assessor. This could be the teacher who has delivered the programme or another person from the centre.

The marking criteria must be used to mark the learners' work. These specify the levels of skills, knowledge and understanding that the learner is required to demonstrate.

The following assessment methods are considered suitable for teachers/assessors to adopt for these qualifications alongside the assessment of the evidence submitted by the learner:

- **observation** of a learner doing something
- **questioning** of the learner or witness.

Observation

The teacher/assessor and learner should plan observations together but it is the teacher/assessor's responsibility to record the observation properly.

Questioning

Questioning the learner is normally an ongoing part of the assessment process, and may in some circumstances provide evidence to support achievement of learning outcomes.

Questioning is often used to:

- test a learner's understanding of work which has been completed outside of the classroom
- check if a learner understands the work they have undertaken
- collect information on the type and purpose of the processes a learner has gone through.

If questioning is to be used as evidence towards achievement of specific learning outcomes, it is important that teachers/assessors record enough information about what they asked and how the learner replied, to allow the assessment decision to be moderated.

Questioning witnesses is normally an ongoing part of validating written witness statements. However, questioning witnesses can be used for other purposes. Teachers/assessors should be able to speak to witnesses and record, in whatever way is suitable, the verbal statements of these witnesses. A record of a verbal statement is a form of witness statement and could provide valuable evidence. Further guidance on the use of witness statements can be found in Appendix A.

4.4.1 Use of a 'best fit' approach to marking criteria

The assessment tasks should be marked by teachers/assessors according to the OCR marking criteria using a 'best fit' approach. For each of the marking criteria, teachers/assessors select the band descriptor provided in the marking grid that most closely describes the quality of the work being marked.

Marking should be positive, rewarding achievement rather than penalising failure or omissions.

The award of marks **must be** directly related to the marking criteria.

- Each band descriptor covers all the relevant content for the learning outcomes.
- The descriptors should be read and applied as a whole.
- Make a best fit match between the answer and the band descriptors.
- An answer does not have to meet all of the requirements of a band descriptor before being placed in that band. It will be placed in a particular band when it meets more of the requirements of that band than it meets the requirements of other bands.
- Where there is more than one strand within the band descriptors for a learning outcome and a strand has not been addressed at all, it is still possible for the answer to be credited within that mark band depending upon the evidence provided for the remaining strands. The answer should be placed in the mark band most closely reflecting the standard achieved across all strands within the band descriptors for a learning outcome; however in this scenario, the mark awarded for that band should reflect that a strand has not been addressed.

When deciding the mark within a band, the following criteria should be applied:

- the extent to which the statements within the band have been achieved.

For example:

- an answer that convincingly meets nearly all of the requirements of a band descriptor should be placed at or near the top of that band. Where the learner's work *convincingly* meets the statements, the highest mark should be awarded
- an answer that meets many of the requirements of the band descriptor should be placed in the middle of the band. Where the learner's work *adequately* meets the statements, the most appropriate mark in the middle range should be awarded
- if an answer is on the border-line between two bands but it is decided that it fits better the descriptors for the lower of these two bands, then it should be placed near the top of that band. Where the learner's work just meets the statements for the higher band, the lowest mark for that band should be awarded.

Teachers/assessors should use the full range of marks available to them and award full marks in any band for work that fully meets that descriptor. This is work that is 'the best one could expect from learners working at that level'.

4.4.2 Annotation of learners' work

Each piece of internally assessed work should show how the marks have been awarded in relation to the marking criteria.

The writing of comments on learners' work, and cover sheet, provides a means of communication between teachers during the internal standardisation and with the moderator if the work forms part of the moderation sample.

© OCR 2012 OCR Cambridge National in Science

4.5 Authentication

Teachers/assessors must be confident that the work they mark is the learner's own. This does not mean that a learner must be supervised throughout the completion of all work, but the teacher must exercise sufficient supervision, or introduce sufficient checks, to be in a position to judge the authenticity of the learner's work.

Wherever possible, the teacher should discuss work-in-progress with learners. This will not only ensure that work is underway in a planned and timely manner, but will also provide opportunities for teachers/assessors to check authenticity of the work.

Learners must not plagiarise. Plagiarism is the submission of another's work as one's own and/or failure to acknowledge the source correctly. Plagiarism is considered to be malpractice and could lead to the learner being disqualified. Plagiarism sometimes occurs innocently when learners are unaware of the need to reference or acknowledge their sources. It is therefore important that centres ensure that learners understand that the work they submit must be their own and that they understand the meaning of plagiarism and what penalties may be applied. Learners may refer to research, quotations or evidence but they must list their sources. The rewards from acknowledging sources, and the credibility they will gain from doing so, should be emphasised to learners as well as the potential risks of failing to acknowledge such material.

Both learners and teachers must declare that the work is the learner's own:

- **Each learner** must sign a declaration before submitting their work to their teacher. A learner authentication statement that can be used is available to download from the OCR website. These statements should be retained within the centre until all enquiries about results, malpractice and appeals issues have been resolved. **A mark of zero must be recorded if a learner cannot confirm the authenticity of their work.**
- Centres must confirm to OCR that the evidence produced by learners is authentic. **Teachers** are required to declare that the work submitted for centre assessment is the learner's own work by completing a Centre Authentication Form for each unit. If a centre fails to provide evidence of authentication, **we will set the mark for the learner(s) concerned to Pending (Q) for that unit until authentication can be provided.** The Centre Authentication Form is available to download from the OCR website and includes a declaration which teachers must sign.

4.5.1 Internal standardisation

It is important that all teachers/assessors work to common standards. Centres must ensure that, within each unit, the internal standardisation of marks across teachers/assessors and teaching groups takes place using an appropriate procedure.

This can be done in a number of ways. In the first year, reference material and OCR training meetings will provide a basis for centres' own standardisation. In subsequent years, this, or centres' own archive material, may be used. Centres are advised to hold preliminary meetings of staff involved to compare standards through cross-marking a small sample of work. After most marking has been completed, a further meeting at which work is exchanged and discussed will enable final adjustments to be made.

4.5.2 Submitting marks

All work for centre assessment is marked by the teacher/assessor and internally standardised by the centre. Marks are then submitted to OCR; see Section 4.6 for submission dates of the marks to OCR.

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

4.6 Moderation

The purpose of external moderation is to ensure that the standard of marking is the same for each centre and to ensure that internal standardisation has taken place.

Centres can select from:

- **Moderated via OCR Repository (see section 4.6.1)**
- **Moderated via postal moderation (see section 4.6.2)**
- **Moderated via visiting moderation (see section 4.6.3)**

The deadline dates for entries and submission of marks for each moderation method are detailed below. Centres must ensure when selecting a moderation method that the appropriate entry and marks submission deadlines can be adhered to.

Moderation method	January series		June series		November series (2013 onwards)	
	Entries	Marks	Entries	Marks	Entries	Marks
Moderated via OCR Repository	21st Oct	10th Jan	21st Feb	15th May	4th Oct	5th Nov
Moderated via postal moderation	21st Oct	10th Jan	21st Feb	15th May	4th Oct	5th Nov
Moderated via visiting moderation	21st Oct	10th Dec	21st Feb	31st Mar	Not available	

When making your entries, the entry option specifies how the work is going to be moderated.

For each unit, you must choose the same moderation method for **all** learners (i.e. all learners for that unit in that series must be entered using the same entry option). However, you can choose different moderation methods for different units and in different series.

Sample requests

Once you have submitted your marks, your exams officer will receive an email telling you which work will be sampled as part of the moderation. Samples will include work from across the range of attainment of the learners' work.

Each learner's work must have a cover sheet attached to it with a summary of the marks awarded for the task. If the work is to be submitted via OCR Repository this cover sheet must also be submitted electronically within each learner's files.

OCR will require centres to release work for awarding and archive purposes and the co-operation of the centre is most appreciated in these instances, as it is imperative to have work available at awarding meetings. If this is required then centres will be notified as early as possible.

Centres will receive the final outcome of moderation when the provisional results are issued. The following reports will be issued via Interchange:

- Moderation adjustments report – This lists any scaling that has been applied to internally assessed units
- Moderator report to centres – This is a brief report by the moderator on the internal assessment of learners' work.

© OCR 2012 OCR Cambridge National in Science

4.6.1 Moderated via OCR Repository

The OCR Repository is a secure website for centres to upload candidate work and for assessors to access this work digitally. Centres can use the OCR Repository for uploading marked candidate work for moderation.

Centres can access the OCR Repository via OCR Interchange, find their candidate entries in their area of the Repository, and use the Repository to upload files (singly or in bulk) for access by their moderator.

The OCR Repository allows candidates to produce evidence and files that would normally be difficult for postal submissions, for example multimedia and other interactive unit submissions.

The OCR Repository is seen as a faster, greener and more convenient means of providing work for assessment. It is part of a wider programme bringing digital technology to the assessment process, the aim of which is to provide simpler and easier administration for centres.

All moderated units can be submitted electronically to the OCR Repository via Interchange: please check section 7.2.2 for unit entry codes for the OCR Repository.

There are three ways to load files to the OCR Repository:

1. Centres can load multiple files against multiple candidates by clicking on 'Upload candidate files' in the Candidates tab of the Candidate Overview screen.

2. Centres can load multiple files against a specific candidate by clicking on 'Upload files' in the Candidate Details screen.

3. Centres can load multiple administration files by clicking on 'Upload admin files' in the Administration tab of the Candidate Overview screen.

Instructions for how to upload files to OCR using the OCR Repository can be found on OCR Interchange.

4.6.2 Moderated via postal moderation

Your sample of work must be posted to the moderator within three days of receiving the request. You should use one of the labels provided by OCR to send the learner's work.

We would advise you to keep evidence of work submitted to the moderator, e.g. copies of written work or photographs of practical work. You should also obtain a certificate of posting for all work that is posted to the moderator.

Work may be submitted in digital format (on CD) for moderation but must be in a suitable file structure as detailed in Appendix I at the end of this specification.

4.6.3 Moderated via visiting moderation

Your sample of work must be retained in the centre ready for the moderation visit.

The work that is presented to the visiting moderator as their initial sample must be available in rank order, by unit, to allow moderation to take place. All work not selected for initial sampling **must** be available to the visiting moderator during their visit should they need to extend their sample.

At the end of the visit, the moderator may need to take samples of work away or request for work to be posted to them for further consideration.

All learners' work must be retained securely within the centre until results are issued and it is certain that no enquiries about results or appeal procedure is required.

5 Support for Cambridge Nationals in Science

5.1 Free resources available from the OCR website

The following materials will be available on the OCR website:

- specification
- specimen assessment materials for unit R072
- bank of model assignments.

5.2 Other resources

OCR has produced a range of resources, all available free of charge from the OCR website.

Endorsed publications

OCR endorses a range of publisher materials to provide quality resources for centres delivering its qualifications. You can be confident that materials branded with OCR's 'Official Publisher Partnership' or 'Approved publication' logos have undergone a thorough quality assurance process to achieve endorsement. All responsibility for the content of the publisher's materials rests with the publisher.

These endorsements would not mean that such materials would be the only suitable resources available or necessary to achieve an OCR qualification.

5.3 Training

OCR will offer a range of support activities for all practitioners throughout the lifetime of the qualification to ensure they have the relevant knowledge and skills to deliver the qualification.

Please see Event Booker for further information.

© OCR 2012 OCR Cambridge National in Science

5.4 OCR support services

5.4.1 Active Results

Active Results is available to all centres offering the Cambridge Nationals qualifications.

Active Results is a free results analysis service to help teachers review the performance of individual learners or whole schools.

Devised specifically for the UK market, data can be analysed using filters on several categories such as gender and other demographic information, as well as providing breakdowns of results by question and topic.

Active Results allows you to look in greater detail at your results:

- richer and more granular data will be made available to centres including question level data available from e-marking for unit R072
- you can identify the strengths and weaknesses of individual learners and your centre's cohort as a whole
- our systems have been developed in close consultation with teachers so that the technology delivers what you need.

Further information on Active Results can be found on the OCR website.

5.4.2 OCR Interchange

OCR Interchange has been developed to help you to carry out day-to-day administration functions online, quickly and easily. The site allows you to register and enter learners online. In addition, you can gain immediate and free access to learner information at your convenience. Sign up at https://interchange.ocr.org.uk.

6 Access to Cambridge Nationals in Science

6.1 Equality Act information relating to Cambridge Nationals in Science

Cambridge Nationals in Science often require assessment of a broad range of competences and, as such, prepare learners for a wide range of occupations and higher level courses.

The Cambridge Nationals in Science qualifications were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any disabled learners. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject.

Reasonable adjustments are made for disabled learners in order to enable them to access the assessments and to demonstrate what they know and can do. For this reason, very few learners will have a complete barrier to the assessment. Information on reasonable adjustments is found in *Access Arrangements, Reasonable Adjustments and Special Consideration* produced by the Joint Council for Qualifications www.jcq.org.uk.

The access arrangements permissible for use in this specification are as follows:

Access arrangement	Yes/No	Type of assessment
Readers	Yes	All assessments
Scribes	Yes	All assessments
Practical assistants	Yes	All assessments
Word processors	Yes	All assessments
Transcripts	Yes	All assessments
BSL interpreters	Yes	All assessments
Oral language modifiers	Yes	All assessments
Modified question papers	Yes	All assessments
Extra time	Yes	All assessments

6.2 Arrangements for learners with particular requirements

All learners with a demonstrable need may be eligible for access arrangements to enable them to show what they know and can do. The criteria for eligibility for access arrangements can be found in the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration*. Learners who have been fully prepared for the assessment but who have been affected by adverse circumstances beyond their control at the time of the examination, may be eligible for special consideration. Centres should consult the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration*.

If a successful application for an access arrangement has been made for either GCSE or GCE, then there is no need to make an additional application for the same learner completing a Cambridge National qualification.

Learners who have been fully prepared for the assessment but who have been affected by adverse circumstances beyond their control at the time of the examination, may be eligible for special consideration. Centres should consult the JCQ document *Access Arrangements, Reasonable Adjustments and Special Consideration*.

© OCR 2012 OCR Cambridge National in Science

7 Administration of Cambridge Nationals in Science

Full details of the administrative arrangements can be found in the Cambridge Nationals Admin Guide. The Admin Guide is available from the OCR website.

7.1 Availability of assessment

There are three assessment series each year in January, June and November. All units will be assessed from January 2013. Assessment availability can be summarised as follows:

	Unit R072	Units R071 and R073
January 2013	✓	✓
June 2013	✓	✓
November 2013	–	✓*
January 2014	✓	✓
June 2014	✓	✓
November 2014	–	✓*

Certification is available for the first time in January 2013 and each January, June and November thereafter.

* Visiting moderation is not available in the November series. Please see section 4.6 for details on the moderation methods available in each series.

7.2 Making entries

Centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries. Details on how to register with OCR can be found on the OCR website.

Centres must have made an entry for a unit in order for OCR to supply the appropriate forms and allocate a moderator for centre assessment.

It is essential that unit entry codes are quoted in all correspondence with OCR.

7.2.1 Making estimated unit entries

Estimated entries must be made prior to each assessment series. Estimated entries are used by OCR to allocate examiners and moderators to centres.

7.2.2 Making final unit entries

When making an entry centres must quote unit entry code and component codes. For the centre assessed units, centres must decide whether they want to submit learners' work for moderation via the OCR Repository or for postal or visiting. Learners submitting work must be entered for the appropriate unit entry code from the table below.

Unit entry code	Component code	Assessment method	Unit titles
R071 A	01	Moderated via OCR Repository	*How scientific ideas have an impact on our lives*
R071 B	02	Moderated via postal moderation	
R071 C	03	Moderated via visiting moderation	
R072 A	01	Written paper – Level 1	*How scientific ideas have developed*
R072 B	02	Written paper – Level 2	
R073 A	01	Moderated via OCR Repository	*How scientists test their ideas*
R073 B	02	Moderated via postal moderation	
R073 C	03	Moderated via visiting moderation	

The short title for these Cambridge National qualifications is CAMNAT and will display as such on Interchange and some administrative documents provided by OCR.

7.3 Certification rules

Learners must be entered for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded.

Learners may be entered for:

- OCR Level 1/2 Cambridge National Certificate - certification code J815

There are no terminal requirements for this qualification therefore learners can complete units in any order.

© OCR 2012 OCR Cambridge National in Science

7.4 Unit and qualification re-sits

Learners may re-sit each unit an unlimited number of times. The best unit result will be used to calculate the certification result.

Learners may enter for the qualification an unlimited number of times. Learners must retake at least one unit for a new result to be issued.

7.5 Enquiries about results

Under certain circumstances, a centre may wish to query the result issued to one or more learners. Enquiries about results for all units must be made immediately following the series in which the relevant unit was taken (by the enquiries about results deadline).

Please refer to the JCQ Post-Results Services booklet and the OCR Admin Guide for further guidance about action on the release of results. Copies of the latest versions of these documents can be obtained from the OCR website.

For internally assessed units the enquiries about results process cannot be carried out for one individual learner; the outcome of a review of moderation must apply to a centre's entire cohort.

7.6 Shelf-life of units

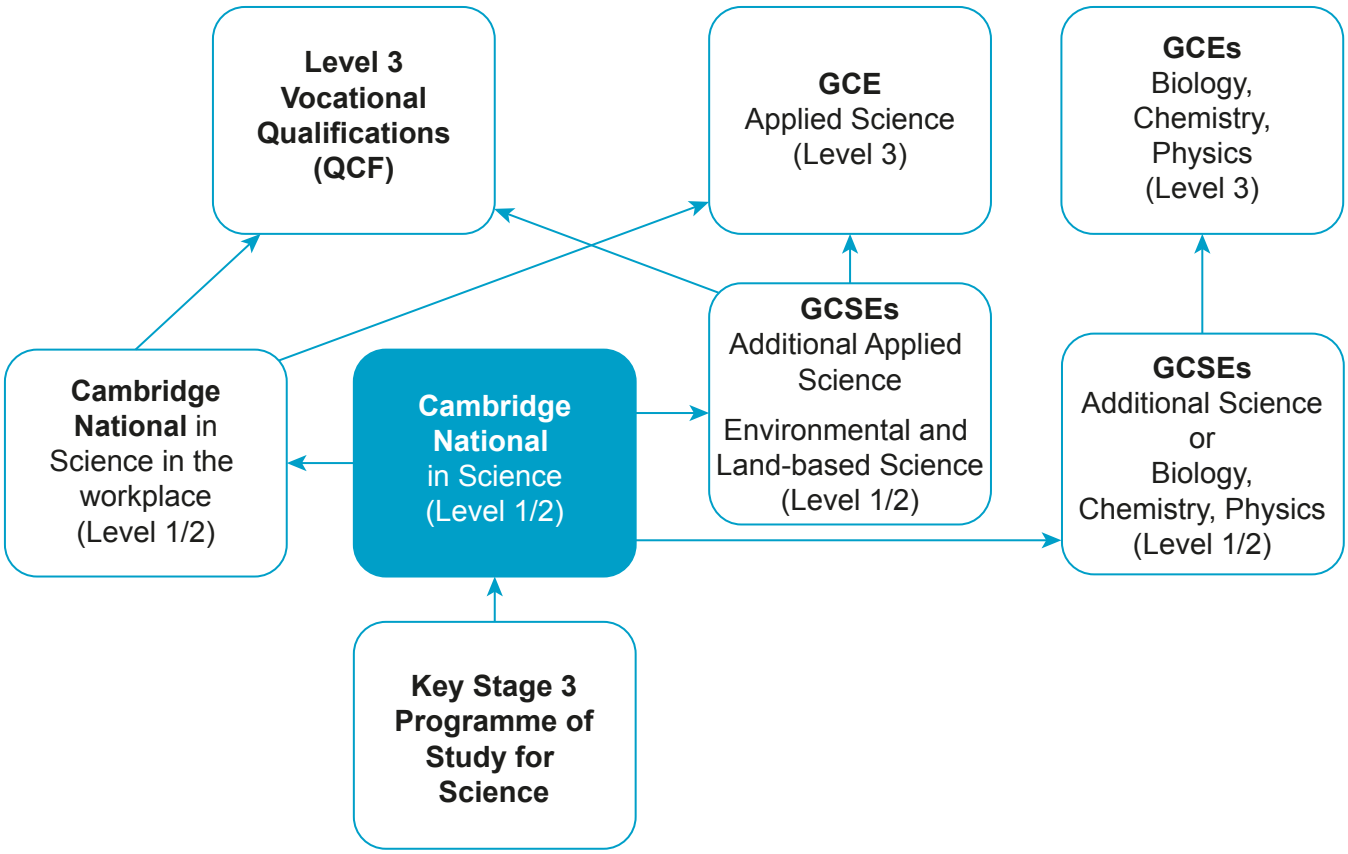
Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

8 Other information about Cambridge Nationals in Science

8.1 Overlap with other qualifications

There is some overlap between the content of this qualification and that of GCSE in Science (and the GCSE separate sciences), as all cover the Key Stage 4 Programme of Study for Science.

8.2 Progression from/to this qualification



OCR offers a flexible and responsive range of general and vocational qualifications in the sciences that allow suitable progression routes for all types of learners.

Centres are able to use these qualifications to create pathways that provide learners with the underpinning skills and knowledge that will enable them to choose the most appropriate progression routes for their particular needs (further study, Further Education (FE)).

Progression from the Cambridge National Certificate in Science to the Cambridge National Certificate in Science in the Workplace:

- This qualification is designed to be taken alongside or following the OCR Level 1/2 Cambridge National Certificate in Science (or any other Level 1/2 course which covers the National Curriculum Programme of Study for Science at Key Stage 4).
- Progression from this qualification is to Level 3 vocational qualifications (including qualifications in science) or to GCE Applied Science.

© OCR 2012 OCR Cambridge National in Science

Progression from the Cambridge National Certificate in Science to **GCSE qualifications** in *applied science*:

- Additional Applied Science
- Environmental and Land-based Science
- Progression from these qualifications is to Level 3 vocational qualifications (including qualifications in science) or to GCE Applied Science.

Progression from the Cambridge National Certificate in Science to other **GCSE qualifications** in *science*:

- Additional Science
- Separate sciences: Biology, Chemistry, Physics
- Progression from these qualifications is to GCE qualifications in the sciences.

8.3 Avoidance of bias

OCR has taken great care in preparation of this specification and assessment materials to avoid bias of any kind. Special focus is given to the 9 strands of the Equality Act with the aim of ensuring both direct and indirect discrimination is avoided.

8.4 Criteria requirements

This specification complies in all respects with the Ofqual General Conditions of Recognition.

8.5 Language

This specification and associated assessment materials are in English only.

8.6 Spiritual, moral, ethical, social, legislative, economic and cultural issues

This qualification provides potential for centres to develop learners' understanding of spiritual, moral, ethical, social, legislative, economic and cultural issues. This specification offers opportunities to contribute to an understanding of these issues in the following topics.

Issue	Examples of opportunities for developing an understanding of the issue during the course
Spiritual issues Scientific explanations which give an insight into the scale and wonder of natural processes and phenomena.	○ The nature of the universe (unit R072) ○ The way in which the Earth has changed over vast time periods (unit R072)
Moral issues The endeavour of scientists in the development of scientific ideas and their commitment to publish their results and to subject their ideas to testing by others.	○ Moral issues in the scientific method (unit R072) ○ The impact of human activity, including the work of scientists, on the environment and other living organisms (unit R071)
Ethical issues The ethical issues arising from the applications of scientific ideas.	○ Ethical issues arising from making choices about energy supply (unit R071) ○ Ethical considerations in the testing of new medical treatments (unit R071)
Social issues Social implications of the applications of scientific ideas.	○ The social impact of decisions made about energy sources (unit R071) ○ The risks and benefits of the use of nuclear radiation and medical treatments (unit R071)
Legislative issues Health and safety legislation and its impact on practical work in science.	○ The need to carry out a risk assessment before undertaking practical work (unit R073)
Economic issues The range of factors which have to be considered when weighing the costs and benefits of scientific activity; the importance of science to the economy of the UK.	○ The economics of decisions made about energy sources (unit R071) ○ Economic issues in the production of new materials from natural resources (unit R071)
Cultural issues The culture of science.	○ The role of the scientific community in validating scientific ideas (unit R072) ○ The questions that science can and cannot address (unit R072)

© OCR 2012 OCR Cambridge National in Science

8.7 Sustainable development, health and safety considerations and European developments, consistent with international agreements

This qualification incorporates work on health and welfare, safety and the environment which encourage learners to develop responsibility for their own health and for the environment, consistent with current EU agreements.

There are opportunities for learners to develop a sound understanding of sustainable development in:

- making choices related to energy supply (unit R071)
- the production of new materials from natural resources (unit R071).

Heath and safety considerations are important in all practical work in science and the need to carry out a risk assessment before starting practical work is part of the learning and assessment for unit R073. The impact on human health of environmental and inherited factors, of the use and mis-use of drugs and of medical treatments are covered in unit R071.

Environmental issues

There are opportunities for learners to develop a sound understanding of environmental issues in the study of:

- the environmental effects of energy use and the choices made of energy sources (unit R071)
- the effects of human activity on the environment (unit R071)
- the environmental impact of making new materials from natural resources (unit R071)
- global warming (unit R072).

In units R071 and R073, learners may be given assessment tasks set in contexts related to health, welfare, safety or the environment.

8.8 Key Skills

This qualification provides opportunities for the development of the Key Skills of *Communication, Application of Number, Information and Communication Technology, Working with Others, Improving Own Learning and Performance and Problem Solving* at Levels 1 and/or 2. 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 Levels 1 and/or 2 for each unit.

Unit	C		AoN		ICT		WwO		IOLP		PS	
	1	2	1	2	1	2	1	2	1	2	1	2
Unit R071	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unit R072	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unit R073	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

© OCR 2012 OCR Cambridge National in Science

8.9 Functional Skills

This qualification provides opportunities for the development of the Functional Skills of:

- *English: Speaking and Listening, Reading and Writing*
- *Mathematics: Representing, Analysing and Interpreting*
- *ICT: Use ICT systems, Find and select information and Develop, present and communicate information*

at Levels 1 and 2. However, the extent to which this evidence fulfils the 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 criteria at Levels 1 and/or 2 for each unit.

Unit	English						Maths						ICT					
	S&L		R		W		R		A		I		U		F&SI		D,P&C	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Unit R071	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unit R072	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Unit R073	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

© OCR 2012 OCR Cambridge National in Science

Appendix A: Guidance on witness statements

A

It is anticipated that the majority of evidence will be produced directly by the learner. Indirect evidence, such as witness statements, should only be used where it would be impractical for the learner to produce the evidence themselves.

Witness statements will, ideally, support the direct evidence produced by the learner.

- Care should be taken that a witness statement is impartial and free from bias. The use of relatives and close friends as witnesses should be avoided, if possible.
- In all cases the witness will be required to declare their relationship to the learner.
- A witness statement should record what the learner has done and in doing so should not seek to repeat or paraphrase the marking criteria.
- The evidence presented by the witness should record the learner's individual contribution and should focus on the contribution made by the individual learner, as distinct from that of the group or team as a whole.
- Witnesses should describe what the learner did and not assess the learner. It is the responsibility of the teacher/assessor to judge the learner's skill, knowledge and understanding against the marking criteria. In doing so the teacher/assessor will use the witness statement to determine the value of the evidence against the marking criteria and award marks accordingly.
- The teacher/assessor is responsible for briefing anyone who is to provide a witness statement. It is expected that the teacher/assessor will ensure that the witness is appropriately prepared and that any issues related to child protection have been fully considered.
- The role of the witnesses should be that of impartial observers and they should not become involved in carrying out the activity on behalf of the learner.
- In circumstances where a witness does assist the learner in accomplishing a task or activity their input must be recorded within the statement so that the teacher/assessor can reflect this appropriately in the award of marks.

Where the above guidance has not been followed, the reliability of the witness statement may be called into question. In circumstances where doubt exists about the validity of a witness statement, it cannot be used as assessment evidence and no marks may be awarded on the basis of it. If the unreliability of a witness statement becomes apparent during the visiting moderation process, moderators will be instructed to adjust centre marks in accordance with this directive.

An exemplar template for recording a witness statement is available from the OCR website and centres are encouraged to use this to assist in recording witness evidence. However, witness evidence may take different forms including digitally recorded spoken commentary or video. In these cases additional accompanying documentation may be required to corroborate that the guidelines on witness statements detailed above have been followed.

Appendix B: Marking criteria for centre assessment

B

The centre assessed units for this qualification are combined Level 1/2, therefore, the marking criteria for units R071 and R073 span both levels.

Unit R071: *How scientific ideas have an impact on our lives*

Marking criteria guidance

0 marks must be given where there is no evidence or no evidence worthy of credit.

A range of marks is allocated to each learning outcome. Where marks are allocated to a number of statements within a learning outcome, marks should be awarded using a 'best fit' approach. For each of the learning outcomes, one of the descriptors provided in the mark scheme that most closely describes the quality of the work being marked should be selected. Marking should be positive, rewarding achievement rather than penalising failure or omissions. The award of marks **must be** directly related to the marking criteria.

- Each band descriptor covers all the relevant content for the learning outcomes.
- The descriptors should be read and applied as a whole.
- Make a best fit match between the answer and the band descriptors.
- An answer does not have to meet all of the requirements of a band descriptor before being placed in that band. It will be placed in a particular band when it meets more of the requirements of that band than it meets the requirements of other bands.

When deciding the mark within a band, the following criteria should be applied:

- the extent to which the statements within the band have been achieved.

For example:

- an answer that convincingly meets nearly all of the requirements of a band descriptor should be placed at or near the top of that band. Where the learner's work *convincingly* meets the statement, the highest mark should be awarded
- an answer that meets many of the requirements of the band descriptor should be placed in the middle of the band. Where the learner's work *adequately* meets the statement, the most appropriate mark in the middle range should be awarded
- if an answer is on the border-line between two bands but it is decided that it fits better the descriptors for the lower of these two bands, then it should be placed near the top of that band. Where the learner's work *just* meets the statement for the higher band, the lowest mark for that band should be awarded.

When learners are taking an assessment task, or series of tasks, for this unit they will be able to use relevant, appropriate knowledge, understanding and skills that they will have developed.

For a description of the key words in the marking criteria, please see the *Marking criteria glossary of terms* in Appendix C.

Marking criteria grid

LO1: Be able to analyse personal and social choices related to energy supply		
MB1: 1–7 marks	**MB2: 8–13 marks**	**MB3: 14–18 marks**
• **Lists** different energy sources available • **Basic** understanding of factors with influence the choice of energy supply • **Limited qualitative** analysis of efficiencies of energy transfer in electricity generation	• **Limited** description of the different energy sources available for electricity generation • **Sound** understanding of some of the relevant factors which influence the choice of energy supply • **Limited quantitative** analysis of efficiencies of energy transfer in electricity generation	• **Detailed** description of the different energy sources available for electricity generation • **Comprehensive** understanding of the relevant factors for the interest group which influence the choice of energy supply • **Complex quantitative** analysis of efficiencies of energy transfer in electricity generation and distribution • Quantitative data displayed in **appropriate** formats
LO2: Understand the risks and benefits related to the applications of nuclear radiation		
MB1: 1–4 marks	**MB2: 5–7 marks**	**MB3: 8–10 marks**
• Identifies a **relevant** beneficial use (application) of nuclear ionising radiation • **Lists** risks and benefits of the application • **Limited** justification of application in terms of benefit outweighing risk	• Selection of **relevant** beneficial uses (applications) of nuclear ionising radiation. • **Some detailed** analysis of applications in terms of characteristics of radiation • **Some detailed** analysis of risks and benefits of energy transfer to the individual or wider society, to include a **qualitative** evaluation of risk • **Relevant** analysis of the ways risks from the applications are reduced	• Selection of a **wide range** of beneficial uses (applications) of nuclear ionising radiation to include healthcare, industrial and power generation examples • **Thorough** analysis of applications in terms of characteristics of radiation • **Thorough** analysis of the risks and benefits of energy transfer to the individual / wider society, to include a **quantitative** evaluation of risk • Well **justified** realistic analysis of the ways risks from the applications are reduced

© OCR 2012 OCR Cambridge National in Science

LO3: Be able to measure energy transfers and calculate efficiencies		
MB1: 1–5 marks	**MB2: 6–9 marks**	**MB3: 10–12 marks**
• When provided with method and equipment, **significant support** needed to set it up and to take measurements • **Some** measurements taken and recorded • When provided with equations, data substituted correctly and some calculations carried out correctly	• **Independent** selection of equipment to take measurements; **little support** needed to set up correctly • Measurements taken and recorded using an **appropriate** format • Correct equations **independently** selected; **support** needed to manipulate equations where necessary • **Some** calculations carried out correctly and one outcome derived correctly	• **Independent** selection of equipment to take measurements; equipment set up correctly • Measurements taken and recorded to appropriate accuracy and precision using an appropriate format, **including** use of correct units • Correct equations **independently** selected and manipulated where necessary • Both outcomes calculated correctly to **appropriate** numbers of significant figures

LO4: Understand how human health can be improved		
MB1: 1–7 marks	**MB2: 8–13 marks**	**MB3: 14–18 marks**
• **Lists some** of the ways in which factors affect health • **Some** suggestions made for a health education programme • **Limited** qualitative data displayed on the impact on health of some of the factors identified • **Some** brief materials and resources produced	• **Description** of the way in which factors affect health of a client group of workers used to design a health education programme • **Some** quantitative data displayed on the impact on health from the factors identified • A **range** of **relevant** materials and resources produced	• **Detailed** explanation of the way in which factors affect health of a client group of workers used to design a **detailed**, **relevant** health education programme • A **range** of **relevant** quantitative data on the impact on health of the factors identified and displayed accurately in appropriate formats • A **wide range** of relevant and **imaginative** materials and resources produced

LO5: Understand the risks and benefits of medical treatments		
MB1: 1–4 marks	**MB2: 5–7 marks**	**MB3: 8–10 marks**
• **Lists** risks and benefits of a medical treatment • **Basic** understanding of the reasons for the testing of medical treatments • **Some** materials produced	• **Simple** qualitative analysis of the risks and benefits of a medical treatment • **Sound** understanding of the reasons for the testing of medical treatments • Materials are **relevant** to the needs of the client group	• **Quantitative** and qualitative analysis **relevant** for the client group of the risks and benefits of a medical treatment • **Thorough** understanding of the reasons for the testing of medical treatments • Materials are **concise** and sensitive to the needs of the client group

© OCR 2012 OCR Cambridge National in Science

LO6: Be able to measure the environmental effects of human activity		
MB1: 1–5 marks	**MB2: 6–9 marks**	**MB3: 10–12 marks**
• When provided with method and equipment, **some support** needed to set up equipment and carry out the testing • **Some** data collected and recorded • **Some simple** visualisation of data	• **Appropriate** choice of measures of effects of human activity on a local environment • **Independent** selection of **appropriate** sampling and testing methods; **little support** needed to select and set up the equipment needed to carry out testing • A range of relevant data collected and recorded using an **appropriate** format • **Some** relevant visualisation of data and calculation of **simple** measures such as frequency	• **Justification** of choice of measures of the effects of human activity on a local environment • **Independent** selection of **appropriate** sampling and testing methods and the equipment needed to carry out testing; equipment set up correctly • A **range** of data collected and recorded to appropriate accuracy and precision using an appropriate format, **including** use of correct units • **Relevant** and **accurate** visualisation of data and correct calculation of complex measures such as indices of biodiversity
LO7: Understand how materials we use are made from natural resources		
MB1: 1–7 marks	**MB2: 8–13 marks**	**MB3: 14–18 marks**
• **Lists some** different materials used for a construction project • **Basic** knowledge of chemical processes, including **some** use of word equations • **Limited qualitative** analysis of the impact on the environment of the production of materials from natural resources • **Some** alternative production methods or materials suggested which would have a lower environmental impact	• **Some support** needed for selection of a **range** of different materials linked to different parts of a construction project • **Sound** knowledge of chemical processes, including some use of symbol equations and chemical nomenclature • Analysis of the impact on the environment of the production of materials from natural resources, to include **some** data on production quantities, yields or energy budgets • **Some** evaluation of alternative production methods or materials which would have a lower environmental impact	• **Independent** selection of a range of different types of materials linked to different parts of a construction project, chosen for their **properties** • **Detailed** knowledge of chemical processes, including correct and appropriate use of balanced symbol equations and chemical nomenclature • **Thorough** analysis of the impact on the environment of the production of materials from natural resources, to include **relevant** data on production quantities, yields and energy budgets • Well **justified realistic** evaluation of alternative production methods or materials which would have a lower environmental impact

© OCR 2012 OCR Cambridge National in Science

LO8: Understand how the properties of materials we use are determined by structure and bonding		
MB1: 1–4 marks	**MB2: 5–7 marks**	**MB3: 8–10 marks**
• **Significant support** needed to identify some different types of materials used in a **complex** product; **some simple** reasons for their use suggested • **Limited description** of the properties of selected materials and their structures • Qualitative information on the properties of materials and performance of components	• **Limited support** needed for selection of a **range** of different materials used in a **complex** product; **sound** understanding of the reasons why these materials are used, with **some** links to their properties • **Limited explanation** of how the properties of these materials depend upon structure and bonding • **Some quantitative** data displayed on the properties of materials and performance of components	• **Independent** selection of an **appropriate range** of different types of materials used in a **complex** product; **thorough** understanding of the reasons why these materials are used, **clearly** related to their properties • **Detailed** explanation of how the properties of these materials depend upon structure and bonding • **Independent** selection of **relevant** quantitative data on the properties of materials and performance of components used to support explanations • Quantitative data displayed in **appropriate** formats, including use of correct units
LO9: Be able to measure the properties of materials to recommend appropriate uses		
MB1: 1–5 marks	**MB2: 6–9 marks**	**MB3: 10–12 marks**
• When provided with method and equipment, **some support** needed to set up and take measurements • **Some** measurements taken and recorded • When provided with the mathematical techniques to use, **some** data processed correctly	• **Independent** selection of equipment to take measurements; **little support** needed to set up correctly • Measurements taken and recorded using an **appropriate** format • **Support** needed to process data using **appropriate** mathematical techniques	• **Independent** selection of equipment to take measurements; equipment set up correctly • Measurements taken and recorded to appropriate accuracy and precision using an appropriate format, **including** use of correct units • Data processed **accurately** using **appropriate** mathematical techniques to identify trends or patterns

© OCR 2012 OCR Cambridge National in Science

Guidance on synoptic assessment

Synoptic assessment is based upon demonstrating a broad understanding of the subject. This is achieved by drawing upon the skills/knowledge/understanding that have been studied across the specification and utilising them in an appropriate and relevant way to complete the assessment for this unit in order to meet the marking criteria for a specific Learning Outcome. When completing work for assessment, learners should be encouraged to apply the **relevant** skills/knowledge/understanding from other units within the specification and not seek to incorporate input from all the previously studied units or content unless it is appropriate to do so. When assessing the learner's work teachers should focus on whether the skills/knowledge/understanding applied are relevant. The links identified below are guidance only and learners may find other skills/knowledge/understanding that they are able to apply synoptically either in addition to or in place of this guidance.

Learners will bring to unit R072, skills, knowledge and understanding from unit R071, including the use of scientific equipment to collect data and the interpretation of data to reach conclusions.

The Learning Outcomes for unit R073 build on those in unit R071 and unit R072: in unit R071 learners have opportunities to carry out practical work, taking measurements and interpreting their results and in unit R072, learners are taught about the scientific method and how scientists carry out research.

In unit R073, learners will develop further their understanding from units R071 and R072 of how scientific information is evaluated and in the assessment task for unit R073, learners will apply in their own investigation an understanding of the scientific method from unit R072.

© OCR 2012 OCR Cambridge National in Science

Assessment guidance

Outline of assessment tasks	Typical evidence/output of the task
Analytical task (LO1 / LO3) Learners consider possible ways of supplying energy to a community, for example a new town, village or island. Learners analyse the advantages and disadvantages of the different schemes.	Material is likely to be in a variety of forms to meet the requirements of presenting a range of different types of evidence, including graphical presentations of quantitative information, pictures etc. and could include the use of ICT, posters and videos, as well as answers to possible questions from the enquiry.
Research report (LO2) Stories in the media about nuclear radiation are often misleading and alarmist. Learners produce briefing material, for example for journalists, to explain why nuclear ionising radiation is used despite the associated risks.	Material could be in the form of a PowerPoint presentation or a short video, an article (for a magazine) or a leaflet.
Practical Procedures (LO3) Learners measure the efficiency of an energy transfer involving electricity.	Witness statements of learners' ability to select and set up equipment. Written record of the measurements taken and the calculations necessary to derive the outcomes required.

Outline of assessment tasks	Typical evidence/output of the task
Case Study (LO4) The bosses of a company are concerned that members of staff are taking too much time off because of illness. Design a health education programme for a client group of staff, including appropriate materials and resources, to help them to improve their health.	Material is likely to be in a variety of forms to meet the requirements of presenting a range of different types of information to the workforce, including graphical presentations of quantitative information, pictures etc. and could include the use of ICT, posters and videos, as well as answers to possible questions.
Case Study (LO5) Patients often need to understand the risks and benefits of the treatment recommended for them. Produce resources to be used by medical staff to present this information to a client group of patients.	Material could be in the form of a leaflet, poster or a short video which could be shown to patients.
Practical Procedures (LO6) Measure the environmental effects of human activity in a local environment using living and non-living indicators.	Witness statements of learners' ability to select appropriate methods, carry out sampling techniques, identify organisms and carry out testing. Record of the data collected and the calculations necessary to derive the outcomes required.

© OCR 2012 OCR Cambridge National in Science

Outline of assessment tasks	Typical evidence/output of the task
Analytical report (LO7) The increasing population of the UK creates a demand for materials which are made from natural resources. The production of these materials has an impact on the environment. Identify a range of materials used for a construction project, and carry out an analysis of the environmental impact of their production from natural resources. Identify where there may be alternative materials or production methods which have a lower environmental impact.	Material is likely to be in the form of a written report but may include flow diagrams of production processes, chemical equations and data on production quantities, yields and energy budgets.
Research report (LO8) Manufacturing a complex product, for example a motor car or a building, requires the use of a range of different materials selected because of their properties. Identify a range of materials used in a complex product; explain why they are used and how the structure of these materials makes them suitable for their functions.	Material is likely to be in the form of a written report but may include photographs or drawings, diagrams of molecular structures and data on the properties of materials and on the performance of the components identified.
Practical Procedures (LO9) Carry out scientific tests to measure the properties of a range of materials which could be used for a particular purpose.	Witness statements of learners' ability to select appropriate scientific equipment and set it up to measure the properties of materials. Record of the data collected, and the processing of the data to identify trends or patterns.

© OCR 2012 OCR Cambridge National in Science

Unit R073: *How scientists test their ideas*

Marking criteria guidance

0 marks must be given where there is no evidence or no evidence worthy of credit.

A range of marks is allocated to each learning outcome. Where marks are allocated to a number of statements within a learning outcome, marks should be awarded using a 'best fit' approach. For each of the learning outcomes, one of the descriptors provided in the mark scheme that most closely describes the quality of the work being marked should be selected. Marking should be positive, rewarding achievement rather than penalising failure or omissions. The award of marks **must be** directly related to the marking criteria.

- Each band descriptor covers all the relevant content for the learning outcomes.
- The descriptors should be read and applied as a whole.
- Make a best fit match between the answer and the band descriptors.
- An answer does not have to meet all of the requirements of a band descriptor before being placed in that band. It will be placed in a particular band when it meets more of the requirements of that band than it meets the requirements of other bands.

When deciding the mark within a band, the following criteria should be applied:

- the extent to which the statements within the band have been achieved.

For example:

- an answer that convincingly meets nearly all of the requirements of a band descriptor should be placed at or near the top of that band. Where the learner's work *convincingly* meets the statement, the highest mark should be awarded
- an answer that meets many of the requirements of the band descriptor should be placed in the middle of the band. Where the learner's work *adequately* meets the statement, the most appropriate mark in the middle range should be awarded
- if an answer is on the border-line between two bands but it is decided that it fits better the descriptors for the lower of these two bands, then it should be placed near the top of that band. Where the learner's work *just* meets the statement for the higher band, the lowest mark for that band should be awarded.

When learners are taking an assessment task, or series of tasks, for this unit they will be able to use relevant, appropriate knowledge, understanding and skills that they will have developed.

For a description of the key words in the marking criteria, please see the *Marking criteria glossary of terms* in Appendix C.

© OCR 2012 OCR Cambridge National in Science

Marking criteria grid

LO1: Be able to plan a scientific investigation		
MB1: 1–6 marks	**MB2: 7–11 marks**	**MB3: 12–15 marks**
• **Limited** plan includes equipment and techniques to be used • Plan provides a 'fair test' • Identifies how **some** errors will be minimised • **Some** sources of secondary data/information identified	• Plan gives **sufficient detail** for investigation to be repeated, including choices of: ○ equipment, including instrumentation ○ range and number of data points ○ number of replicates ○ control of variables to result in the collection of data of an appropriate quality • **Some** explanation of how errors will be minimised • **Range** of **relevant** sources of secondary data/ information identified	• **Comprehensive** plan shows scientific understanding in making appropriate choices of: ○ equipment, including instrumentation ○ range and number of data points ○ number of replicates ○ control of variables to result in the collection of accurate data to address the scientific problem • **Detailed** explanation of: ○ how errors will be minimised ○ variables which cannot be controlled • **Wide range** of **relevant** sources of secondary data/ information identified and selection of **appropriate** sources justified
LO2: Be able to collect scientific data		
MB1: 1–4 marks	**MB2: 5–7 marks**	**MB3: 8–10 marks**
• **Basic** understanding of risks in procedures with only standard laboratory safety precautions identified • **Significant** teacher intervention required to ensure safety **or** help set up equipment • Results recorded **clearly**	• **Some** risks in procedures identified and **some** specific responses suggested to reduce risks • **Most** risks managed successfully with no significant incidents or accidents and no requirement for teacher intervention • **Little support** required to set up equipment • Results tabulated to include all data collected, **including** use of correct headings	• All significant risks in the plan **evaluated** and **reasoned** judgements made to reduce risks by use of **appropriate** specific responses • All risks managed successfully with no incidents or accidents and no requirement for teacher intervention • Measurements taken and recorded to appropriate accuracy and precision using an appropriate format, **including** use of correct headings and units

© OCR 2012 OCR Cambridge National in Science

LO3: Be able to analyse scientific information		
MB1: 1–5 marks	**MB2: 6–9 marks**	**MB3: 10–13 marks**
• **Some** evidence of processing of quantitative data: ○ data presented as **simple** charts of graphs ○ use of a **simple** mathematical technique where appropriate • **Some** trends/patterns in the data identified	• Graphical and mathematical techniques used to reveal patterns in data: ○ charts or graphs used to display data in an **appropriate** way ○ **correct** use of simple mathematical techniques where appropriate ○ **appropriate qualitative** treatment of the levels of uncertainty in the data, including identification of any anomalous results • Main trends/patterns in the data **described** with reference to quantitative data	• **Appropriate** graphical and mathematical techniques used to reveal patterns in data: ○ **appropriate** scales and axes used in graphs and data plotted **accurately**, including where **appropriate**, use of lines of best fit ○ correct use of complex mathematical techniques where **appropriate** ○ **appropriate quantitative** treatment of levels of uncertainty in the data • Main trends/patterns in the data described in detail and interpreted correctly with reference to quantitative data and **relevant** scientific understanding
LO4: Be able to evaluate scientific information		
MB1: 1–5 marks	**MB2: 6–9 marks**	**MB3: 10–13 marks**
• **Limited** comments made about the quality of the data and the methods used • **Simple** conclusion given which is consistent with the data collected and shows **limited** scientific understanding • There is **limited** application of skills/knowledge/understanding from other units in the specification	• **Some relevant** comments made about the quality of the data including accuracy and sources of error, linked to the methods of collection: ○ limitations in the methods of data collection identified and suggestions for improvements given • Conclusion given and **justified** based on an analysis of the data, showing **sound** understanding of the underlying science • Applies skills/knowledge/understanding from other units in the specification in a way which is **mostly relevant**	• **Detailed** and **critical** consideration given to the data and methods used to obtain them: ○ sources of error and quality of data **discussed** and **explained**, including accuracy, repeatability and uncertainty ○ limitations of the method identified and suggestions for improvements **justified** • Conclusion given and **justified** based on **critical** analysis of primary and secondary data, clearly linked to **relevant** scientific understanding ○ identification of conflicting evidence ○ what further evidence is needed to make the conclusion more secure • Applies skills/knowledge/understanding from other units in the specification in an **effective** relevant way

© OCR 2012 OCR Cambridge National in Science

LO5: Be able to communicate scientific information		
MB1: 1–4 marks	**MB2: 5–7 marks**	**MB3: 8–9 marks**
• **Limited** use of scientific, technical and mathematical language, conventions and symbols • **Some** errors in grammar, punctuation and spelling • **Limited** use of diagrams, graphs, flow charts and pictures	• Information is presented in a **structured** format • **Sound** use of scientific, technical and mathematical language, conventions and symbols • **Occasional** errors in grammar, punctuation and spelling • **Some appropriate** use of diagrams, graphs, flow charts and pictures	• Information presented is **clear**, well organised and structured, and in a **coherent** format • Scientific, technical and mathematical language, conventions and symbols are used **effectively** • **Few**, if any, errors in grammar, punctuation and spelling • Diagrams, graphs, flow charts and pictures are used **appropriately** and accurately

Guidance on synoptic assessment

Synoptic assessment is based upon demonstrating a broad understanding of the subject. This is achieved by drawing upon the skills/knowledge/understanding that have been studied across the specification and utilising them in an appropriate and relevant way to complete the assessment for this unit in order to meet the marking criteria for a specific Learning Outcome. When completing work for assessment, learners should be encouraged to apply the **relevant** skills/knowledge/understanding from other units within the specification and not seek to incorporate input from all the previously studied units or content unless it is appropriate to do so. When assessing the learner's work teachers should focus on whether the skills/knowledge/understanding applied are relevant. The links identified below are guidance only and learners may find other skills/knowledge/understanding that they are able to apply synoptically either in addition to or in place of this guidance.

The Learning Outcomes for unit R073 build on those in unit R071 and unit R072: in unit R071 learners have opportunities to carry out practical work, taking measurements and interpreting their results and in unit R072, learners are taught about the scientific method and how scientists carry out research.

In unit R073, learners will develop further their understanding from units R071 and R072 of how scientific information is evaluated and in the assessment task for unit R073, learners will apply in their own investigation an understanding of the scientific method from unit R072.

The teaching for unit R073 should be integrated into the other two units so that learners develop their experimental skills in the context of the scientific content of the other two units.

In unit R073, learners carry out their own investigation, the assessment of which will draw on their understanding of the 'scientific method' from unit R072; in the interpretation of their results they will need to have an understanding of the science context (drawn from unit R071 or unit R072) in which the investigation is set.

© OCR 2012 OCR Cambridge National in Science

Assessment guidance

Outline of assessment tasks	Typical evidence/output of the task
Practical investigation (LO1 – LO5) Learners will plan and carry out an investigation to test a scientific idea, answer a scientific question, or solve a scientific problem. This will involve the collection and analysis of primary and secondary data, and evaluation of the data, the methods used to collect it and the conclusions generated.	Material is likely to be in the form of a written report, with associated diagrams or pictures, to include an account of the problem to be investigated and the methods used to collect the data (including a risk assessment of the practical work involved). Data collected will be presented and analysed, including graphical presentations of quantitative information. There will be opportunities to use ICT in the collection and analysis of data. Witness statements will be required for the practical elements of LO2.

© OCR 2012 OCR Cambridge National in Science

Appendix C: Marking criteria glossary of terms

C

Accurately	Acting or performing within care and precision; within acceptable limits from a standard
Appropriate	Relevant to the purpose/task
Basic	The work comprises the minimum required and provides the base or starting point from which to develop. Responses are simple and not complicated; the simplest and most important facts are included
Clearly	Focussed and accurately expressed, without ambiguity
Coherent	Logical; consistent
Comment	Present an informed opinion
Communicate	Make known, transfer information
Complex	Consists of several interwoven parts, all of which relate together
Comprehensive	The work is complete and includes everything that is necessary to evidence understanding in terms of both breadth and depth
Concise	Expressing or covering much in few words; brief in form but comprehensive in scope; succinct
Considered	Reached after or carried out with careful thought
Critical	Incisive - exposing/recognising flaws
Describe	Set out characteristics
Design	Work out creatively/systematically
Detail	To describe something item by item, giving all the facts
Detailed	Point-by-point consideration of (e.g. analysis, argument)
Discuss	Present, explain and evaluate salient points (e.g. for/against an argument)
Evaluate	Make a qualitative judgement taking into account different factors and using available knowledge/experience
Explain	Set out the purposes or reasons
Few	A small number or amount, not many but more than one
Imaginative	New, original and clever; creative
Independent	Not relying on another or others for support or guidance
Justified	Reasoning is explained in full; well-grounded
Limited	The work produced is small in range or scope and includes only a part of the information required; it evidences partial, rather than full, understanding
List	Document a series of outcomes or events or information

© OCR 2012 OCR Cambridge National in Science

Little	A very small amount of evidence, or low number of examples, compared to what was expected, is included in the work
Most	Greatest in amount; the majority of; nearly all of; at least 75% of the content which is expected has been included
Occasionally	Occurring; appearing or done infrequently and irregularly
Range	The evidence presented is sufficiently varied to give confidence that the knowledge and principles are understood in application as well as in fact
Realistic	Interested in, concerned with, or based on what is real or practical
Reasoned	Justified, to understand and to make judgments based on practical facts
Relevant	Correctly focused on the activity
Significant	Sufficiently great or important to be worthy of attention; notable
Simple	The work is composed of one part only, either in terms of its demands or in relation to how a more complex task has been interpreted by the learner
Some	About 50% of the content which would have been expected is included
Sound	Valid, logical, shows the learner has secured relevant knowledge/understanding
Structured	Having a clearly defined structure or organisation
Sufficient	Adequate for the purpose; enough to meet a need or purpose
Support	Teacher gives training, instruction, guidance and advice as appropriate and monitors activities to assist learners in tackling/ completing their projects, ensuring authenticity and a fair and accurate assessment
Thorough	Extremely attentive to accuracy and detail
Wide	The learner has included many relevant details, examples or contexts thus avoiding a narrow or superficial approach, broad approach taken to scope/scale; comprehensive list of examples given

© OCR 2012 OCR Cambridge National in Science

Appendix D: Mathematics skills

D

Learners are permitted to use calculators in all assessments.

Learners should be able to:

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

In addition, Level 2 learners should be able to:

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

E Appendix E: Health and safety

In UK law, health and safety is the responsibility of the employer. For most establishments entering learners for Nationals for Schools, this is likely to be the local education authority or the governing body. Employees, i.e. teachers and lecturers, have a duty to cooperate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 2002 and the Management of Health and Safety at Work Regulations 1999, require that before any activity involving a hazardous procedure or harmful micro-organisms is carried out, or hazardous chemicals are used or made, the employer must provide a risk assessment. A useful summary of the requirements for risk assessment in school or college science can be found at www.ase.org.uk/htm/teacher_zone/safety_in_science_education.php.

For members, the CLEAPSS® guide, *Managing Risk Assessment in Science** offers detailed advice. Most education employers have adopted a range of nationally available publications as the basis for their Model Risk Assessments. Those commonly used include:

Safety in Science Education, DfEE, 1996, HMSO, ISBN 0 11 270915 X.

Now out of print but sections are available at:
www.ase.org.uk/htm/teacher_zone/safety_in_science_education.php;

Topics in Safety, 3rd edition, 2001, ASE ISBN 0 86357 316 9;

Safeguards in the School Laboratory, 11th edition, 2006, ASE ISBN 978 0 86357 408 5;

CLEAPSS® *Hazcards*, 2007 edition and later updates*;

CLEAPSS® *Laboratory Handbook**;

Hazardous Chemicals, A Manual for Science Education, 1997, SSERC Limited
ISBN 0 9531776 0 2 (see www.sserc.org.uk/public/hazcd/whats_new.htm).

Where an employer has adopted these or other publications as the basis of their 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, 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, although a few employers require this.

Where project work or individual investigations, sometimes linked to work-related activities, are included in specifications this may well lead to the use of novel procedures, chemicals or micro-organisms, 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® (or, in Scotland, SSERC).

*These, and other CLEAPSS® publications, are on the CLEAPSS® Science Publications CD-ROM issued annually to members. Note that CLEAPSS® publications are only available to members. For more information about CLEAPSS® go to www.cleapss.org.uk. In Scotland, SSERC (www.sserc.org.uk) has a similar role to CLEAPSS® and there are some reciprocal arrangements.

© OCR 2012 OCR Cambridge National in Science

Appendix F: Physical quantities and units

F

It is expected that candidates will show an understanding of the physical quantities and corresponding SI units listed below and will be able to use them in quantitative work and calculations. Whenever they are required for such questions, units will be provided and, where necessary, explained.

Fundamental physical quantities	
Physical quantity	Unit(s)
length	metre (m); kilometre (km); centimetre (cm); millimetre (mm)
mass	kilogram (kg); gram (g); milligram (mg)
time	second (s); millisecond (ms); year (a); million years (Ma); billion years (Ga)
temperature	degree Celsius (°C); kelvin (K)
current	ampere (A); milliampere (mA)

Derived quantities and units	
Physical quantity	Unit(s)
area	mm^2; cm^2; m^2
volume	cm^3; dm^3; m^3; litre (l); millilitre (ml)
density	kg/m^3; g/cm^3
force	newton (N)
gravitational field strength	N/kg
pressure	N/m^2; pascal (Pa)
speed, velocity	m/s; km/h
acceleration	m/s^2; km/h^2
energy	joule (J); kilojoule (kJ); megajoule (MJ); kilowatt hour (kWh); megawatt hour (MWh)
power	watt (W); kilowatt (kW); megawatt (MW)
resistance	ohm (Ω)
voltage	volt (V); millivolt (mV)
specific heat capacity	J/kg°C
frequency	hertz (Hz); kilohertz (kHz); megahertz (MHz); gigahertz (GHz)
radioactivity	becquerel (Bq)
radiation dose	sievert (Sv)
information	bit (b); bytes (B); kilobytes (kB); megabytes (MB)

© OCR 2012 OCR Cambridge National in Science

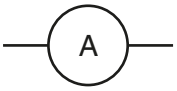
Prefixes for units			
nano (n)	one thousand millionth	0.000000001	$\times 10^{-9}$
micro (μ)	one millionth	0.000001	$\times 10^{-6}$
milli (m)	one thousandth	0.001	$\times 10^{-3}$
kilo (k)	× one thousand	1000	$\times 10^{3}$
mega (M)	× one million	1 000 000	$\times 10^{6}$
giga (G)	× one thousand million	1 000 000 000	$\times 10^{9}$
tera (T)	× one million million	1 000 000 000 000	$\times 10^{12}$

© OCR 2012 OCR Cambridge National in Science

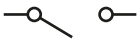
Appendix G: Electrical symbols

Junction of Conductors

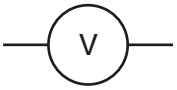
Ammeter



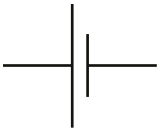
Switch



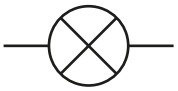
Voltmeter



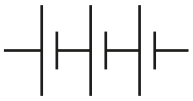
Primary or secondary cell



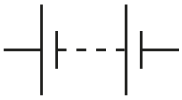
Indicator or light source



Battery of cells

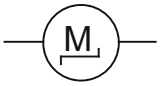


or

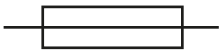


Power supply

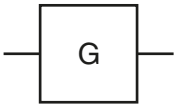
Motor



Fuse

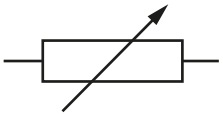


Generator

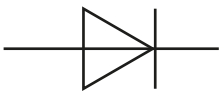


Fixed resistor

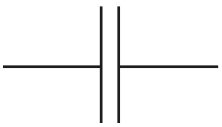
Variable resistor



Diode

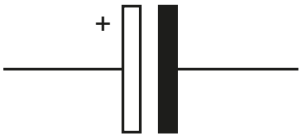


Capacitor

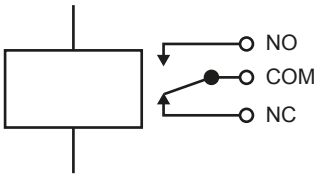


© OCR 2012 OCR Cambridge National in Science

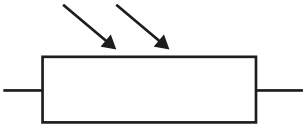
Electrolytic capacitor



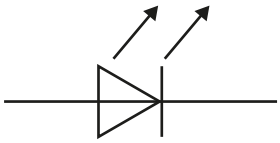
Relay



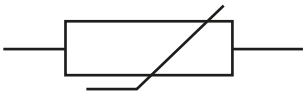
Light dependent resistor (LDR)



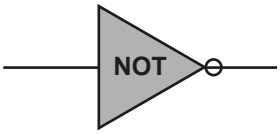
Light emitting diode (LED)



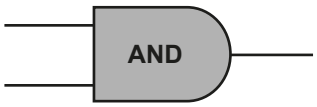
Thermistor



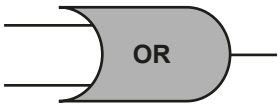
NOT gate



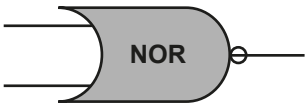
AND gate



OR gate



NOR gate



NAND gate

© OCR 2012 OCR Cambridge National in Science

Appendix H: Periodic table

H

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

© OCR 2012 OCR Cambridge National in Science

I Appendix I: Guidance for the production of electronic internal assessment

Structure for evidence

The centre assessed units are comprised of units R071 and R073. For each learner, all the tasks together will form a portfolio of evidence, stored electronically. Evidence for each unit must be stored separately.

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 learner's centre number, OCR candidate number, surname and forename, together with the unit code (R071, R073), so that the portfolio is clearly identified as the work of one learner.

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

Centre assessed tasks are 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 digital photographs (as required by the specification) and 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.

© OCR 2012 OCR Cambridge National in Science

Accepted File Formats
Movie formats for digital video evidence
MPEG (*.mpg)
QuickTime movie (*.mov)
Macromedia Shockwave (*.aam)
Macromedia Shockwave (*.dcr)
Flash (*.swf)
Windows Media File (*.wmf)
MPEG Video Layer 4 (*.mp4)
Audio or sound formats
MPEG Audio Layer 3 (*.mp3)
Graphics formats including photographic evidence
JPEG (*.jpg)
Graphics file (*.pcx)
MS bitmap (*.bmp)
GIF images (*.gif)
Animation formats
Macromedia Flash (*.fla)
Structured markup formats
XML (*xml)
Text formats
Comma Separated Values (.csv)
PDF (.pdf)
Rich text format (.rtf)
Text document (.txt)
Microsoft Office suite
PowerPoint (.ppt)
Word (.doc)
Excel (.xls)
Visio (.vsd)
Project (.mpp)

© OCR 2012 OCR Cambridge National in Science

© OCR 2012 OCR Cambridge National in Science

Your checklist

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

- ☑ Bookmark **cambridgenationals.org.uk**
- ☑ Be among the first to hear about support materials and resources as they become available. Register for email updates at **cambridgenationals.org.uk**
- ☑ Join our social network community for teachers at **www.social.ocr.org.uk**

Need more help?

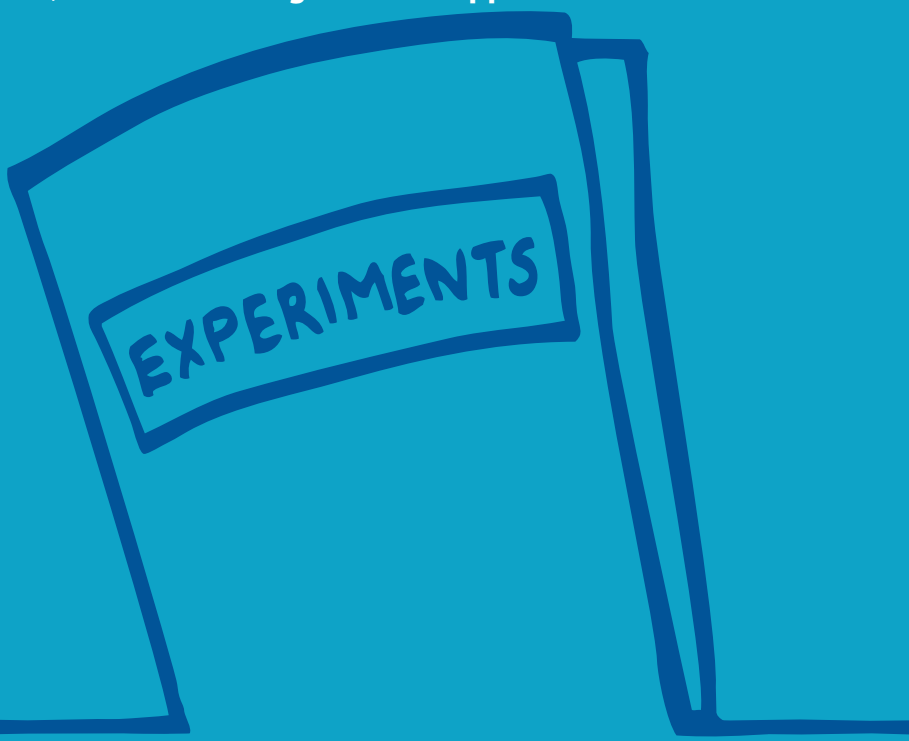
Here's how to contact us for specialist advice:

Phone: 02476 851509
Email: cambridgenationals@ocr.org.uk
Online: http://answers.ocr.org.uk
Fax: 01223 552627
Post: Customer Contact Centre, OCR, Progress House, Westwood Business Park, Coventry CV4 8JQ

What to do next

1) Sign up to teach – let us know you will be teaching this specification to ensure you receive the support you need. Simply complete the online form at **cambridgenationals.org.uk/signup**

2) Become an approved OCR centre – if your centre is completely new to OCR and has not previously used us for any examinations, visit **www.ocr.org.uk/centreapproval** to become an approved OCR centre.



For more information visit
ocr.org.uk/cambridgenationals
or call our Customer Contact Centre on
01223 553998

Alternatively, you can email us on
vocational.qualifications@ocr.org.uk

Cambridge Assessment

OCR
Oxford Cambridge and RSA

OCR is part of the Cambridge Assessment Group, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. ©OCR 2018 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office 1 Hills Road, Cambridge CB1 2EU. Registered company number 3484466. OCR is an exempt charity.