Cambridge NATIONALS

Accredited

# Science
# LEVEL 1/2
## UNIT R072 - How scientific ideas have developed
# DELIVERY GUIDE

VERSION 1 NOVEMBER 2012

OCR

# INDEX

# INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic. The Guide is structured by learning objective so you can see how each activity helps you cover the specification.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resourcesfeedback@ocr.org.uk.

# PLEASE NOTE

The activities suggested in this Delivery Guide MUST NOT be used for assessment purposes. (This includes the Consolidation suggested activities).

The timings for the suggested activities in this Delivery Guide DO NOT relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from www.ocr.org.uk.

# OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.

# KEY


English

Maths

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

Guided learning hours : 30

## AIM OF THE UNIT

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.

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

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| LO1 | 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:<br><br><u>How the variety of life on Earth has developed</u><br>the ways in which organisms function are related to the genes in their cells, i.e.:<br>• 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**<br>• Franklin and Wilkins: x-ray diffraction to produce data on the helical structure of DNA<br>• Watson and Crick: physical models of DNA: 4 base pairs, linked in pairs (A-T, C-G) holding double helix together<br>• 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**<br><br>that variation within species can lead to evolutionary changes; organisms are adapted to their environments, i.e.:<br>• evidence for evolution: fossil record, selective breeding<br>• Lamarck: environmental causes of variation; inheritance of useful acquired characteristics<br>• Darwin: natural selection as the mechanism for adaptation to the environment; Darwin's finches as evidence for natural selection<br><br>that similarities and differences between species can be measured and classified, i.e.:<br>• Linnaeus and the binomial system – genus and species names – based on external characteristics<br>• artificial classification systems with no reference to evolution; natural systems based on evolutionary relationships<br>• **use of cladistics to generate evolutionary trees from multiple characteristics, including DNA.**<br><br><u>How the internal environment of the human body is controlled</u><br>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.:<br>• Galvani and Volta: electricity to stimulate muscle contraction<br>• CNS and peripheral nerves (sensory and motor neurones) for rapid, specific reaction of animals to environmental changes<br>• 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** |

| LO1 (continued...) | CONTENT |
|---|---|
| LO1: Know and understand how the work of scientists has resulted in the development of scientific ideas | • 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<br>• 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**.<br><br><u>The history of the Earth and the Universe</u><br>that the surface and the atmosphere of the Earth have changed since the Earth's origin and are changing at present, i.e.:<br>• Wegener: evidence for continental drift from fossils and 'jigsaw' fit of continents and reasons why ideas not initially accepted<br>• 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;<br>• 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**<br>• 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)<br><br>that the solar system is part of the universe, which has changed since its origin and continues to show long-term changes, i.e.:<br>• 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'<br>• the Copernican universe with the Sun at the centre: provides a simpler mathematical model<br>• 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<br>• 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**). |

| LO1 (continued...) | CONTENT |
|---|---|
| LO1: Know and understand how the work of scientists has resulted in the development of scientific ideas | <u>Using waves to communicate</u><br>that radiations in the form of waves can be used for communication, i.e.:<br>• Maxwell: models visible light as a short wavelength electromagnetic wave at a fixed speed (300,000 km/s)<br>• Hertz: apparatus for making and detecting radio waves, and measuring speed as 300,000 km/s<br>• Marconi: application of discovery of radio waves for 'over the horizon' digital communication by Morse code<br>• 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<br>• 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<br>• spectrum of electromagnetic waves includes, in order of increasing wavelength: light, infra-red, microwaves, radio waves. |

| LO2 | CONTENT |
|---|---|
| LO2: Understand the process of science: the scientific method | Learners should be taught the following content:<br><br><u>In the context of the development of the scientific ideas in LO1:</u><br><br>how scientific data can be collected and analysed, i.e.:<br>• the development of scientific equipment, techniques and instrumentation allow new data to be collected<br><br>how explanations of many phenomena can be developed using scientific theories, models and ideas<br><br>how interpretation of data, using creative thought, provides evidence to test ideas and develop theories, i.e.:<br>• 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<br><br>how uncertainties in scientific knowledge and scientific ideas change over time, i.e.:<br>• scientific explanations are provisional because they only explain the current evidence |

| LO2 (continued...) | CONTENT |
|---|---|
| LO2: Understand the process of science: the scientific method | that there are some questions that science cannot currently answer, and some that science cannot address, i.e.:<br>• current equipment, techniques and instrumentation limit what science can do<br>• some questions are a matter of belief and can never be addressed by science<br><br>about the role of the scientific community in validating changing scientific ideas, i.e.:<br>• publishing results of experiments enables other scientists to replicate the work and further evidence to be collected<br>• the importance of the peer review process in which scientists check each other's work<br>• the value of using teams of scientists to investigate scientific problems. |

| LO3 | CONTENT |
|---|---|
| LO3: Be able to evaluate scientific information | Learners should be taught the following content:<br><br><u>In the context of scientific research:</u><br><br>• how variables are controlled or taken into account<br><br>how to use both qualitative and quantitative approaches, i.e.:<br>• process data using qualitative and quantitative (mathematical) techniques to identify trends or patterns<br><br>how to analyse, interpret, apply and question scientific information or ideas, i.e.:<br>• assess the quality and validity of the evidence and suggest scientific explanations for unexpected results<br>• interpret evidence and suggest conclusions<br>• identify conflicting evidence, or weaknesses in the evidence, which lead to different interpretations; what further evidence would help to make a conclusion more secure<br>• compare different explanations of scientific evidence and identify shortcomings in explanations<br>• use ideas of correlation and cause when analysing data and identify what further work would be needed to establish a causal link. |

| LO4 | CONTENT |
|---|---|
| LO4: Be able to communicate scientific information | Learners should be taught the following content:<br><br><u>In the context of LO1–LO3:</u><br><br>how to use scientific, technical and mathematical language, conventions and symbols, i.e.:<br>• ensure that text is legible and that spelling, punctuation and grammar are accurate so that the meaning is clear. |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Why there are debates in science | Learners could explore the role of evidence in developing and adapting theories by carrying out Activity 3.1 'Developing Explanations/Alternative Explanations' on page 10 of the USEG's Stepping Stones teaching guide (http://www.oup.com/21cScience/docs/c21-steppingstones.doc). | 1 hour | R072: LO2 |
| | Learners could explore the difference between data and scientific explanations by carrying out the 'Who were the Neanderthals' activity developed by the University of York and the Nuffield Foundation (Higher level: http://www.nuffieldfoundation.org/twenty-first-century-science/assessing-ias-3-developing-explanations). This activity also gives learners an opportunity to identify questions that science can't currently answer. | 45 minutes | R072: LO2 |
| | Learners could carry out a survey to identify 10 questions science can't currently answer. Learners could then pick one question and identify the types of data that would be needed to answer the question. Learners should be encouraged to be creative – the aim of the activity is to increase understanding of the idea that scientific discoveries continue to be made. Discussion of recent discoveries could be used to illustrate this. | 30 minutes–1 hour | R072: LO2 |
| | Learners could explore the relationship between correlation, cause and effect by carrying out Activity 2.4 'Pirates' on page 8 of the USEG's Stepping Stones teaching guide (http://www.oup.com/21cScience/docs/c21-steppingstones.doc). | 20 minutes | R072: LO2 |
| | Learners could use the articles and/or activities listed here (http://jfmueller.faculty.noctrl.edu/100/correlation_or_causation.htm) to examine how science is presented in the media. Learners could take the role of a media analyst and analyse a particular report for scientific accuracy, with particular attention given to whether causal relationships suggested are valid. | 1–2 hours | R072: LO2 |
| | Learners could explore the role of the science community in checking new scientific theories by carrying out the 'Barrington Crater' activities developed by the University of York and the Nuffield Foundation (Higher level: http://www.oup.com/21cScience/docs/KAT%20IAS4%20H.doc; | 45 minutes–1 hour | R072: LO2 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Why there are debates in science | Learners could explore issues of data validity, reliability and reproducibility by completing this activity from the Nuffield Foundation (http://www.nuffieldfoundation.org/teaching-about-science/lesson-e-mobile-phones). In the activity, learners take on the role of expert witnesses in a case of a former employee suing their employer over health problems they claim is due to mobile phone use.<br>*Guidance on the common misconceptions learners often hold about these aspects of how science works can be found here:* https://wiki.bath.ac.uk/download/attachments/56399023/Osborne+Dillon+chapter+2.pdf?version=1&modificationDate=1317051468000 | 1 ½ hours | R072: LO2 |
| Debate: Plate tectonics (Wegner, Holmes) | Learners could annotate a map of the world to identify the different types of evidence for continental drift. | 20 minutes | R072: LO1, LO2 |
| | Learners could complete the "Wegner and Continental Drift" activity from the Natural Environmental Research Council which has a focus on how scientific theories become accepted and the role of new evidence in verifying theories (http://www.nationalstemcentre.org.uk/elibrary/resource/5841/wegener-and-continental-drift). | 1–1 ½ hours | R072: LO1, LO2 |
| | Learners could research the theories of plate tectonics and expanding earth before designing a theoretical test that would help to identify which theory is correct. Learners should be encouraged to think creatively as well as scientifically when designing their tests. | 1 hour | R072: LO1, LO2 |
| What is causing climate change? | What is climate change?<br>Learners could complete Lesson 1 of 'Explaining Climate Change' (http://www.explainingclimatechange.ca/Climate%20Change/Lessons/Lesson%201/lesson1.html ) as an introduction to the Earth's climate. | 45 minutes | R072: LO1 |
| | How do we know that climate change happens?<br>http://eo.ucar.edu/educators/ClimateDiscovery/LIA_lesson2_9.28.05.pdf - provides an opportunity to explore indirect evidence (proxies).<br>Lyell: http://www.nationalstemcentre.org.uk/elibrary/resource/734/second-hand-rocks-introducing-sedimentary-processes | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| What is causing climate change? | What is causing climate change?<br>The following areas could be introduced using the websites provided:<br>Greenhouse effect (Fourier) http://www.explainingclimatechange.ca/Climate%20Change/swf/atmosphere/atmosphere.swf.<br>Is it man-made? History of climate change – Lyell 'cold' deposits, temperature variations (and how they are measured) http://www.explainingclimatechange.ca/Climate%20Change/swf/climatetrends/historyGraphs.swf.<br>Natural – volcanoes http://eo.ucar.edu/educators/ClimateDiscovery/LIA_lesson8_9.28.05.pdf. | 2 hours | R072: LO1 |
| | What are the impacts of climate change?<br>Learners could research a range of business case studies of effects of changing climate and extreme weather (http://www.ukcip.org.uk/case-studies/business-case-studies/) in order to provide advice on how to prepare for these effects for a company in a particular sector. | 1 hour | R072: LO1 |
| | Learners could carry out this activity from the California Academy of Sciences to model the impact of rising temperatures of global sea levels http://www.calacademy.org/teachers/resources/lessons/global-climate-change-and-sea-level-rise/. | 1–2 hours | R072: LO1 |
| Debate: Structure of the Solar System | Learners could work in groups or pairs to answer a number of 'How do you know...' questions including: How do you know that the Earth is round? How do you know that the Sun exists? How do you know that the Earth goes around the Sun? How do you know that the Moon goes around the Earth? How do you know that there are other planets in our Solar System? This activity provides a good opportunity for learners to explore different types of knowledge and how they decide that scientific theories are valid. | 30 minutes–1 hour | R072: LO1 |
| | Learners could use the Teachers TV video on 'Models of the Solar System' (http://www.youtube.com/watch?v=Mgn5GOCCgLw) to draw diagrams of the models scientists have developed of the solar system through time or write an explanation of how models are used in science. | 45 minutes–1 hour | R072: LO1 |
| | Learners could carry out activities from "The Scientific Revolution" resources here http://hti.osu.edu/history-lesson-plans/european-history/scientific-revolution to explore the social context at the time of major changes in how we viewed our solar system. | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Structure and origin of the Universe | Learners could watch the 'Big Bang Theory' video (http://www.nationalstemcentre.org.uk/elibrary/resource/1920/big-bang-theory) to create a timeline of events since the Big Bang and the 'Big Bang Evidence' video (http://www.nationalstemcentre.org.uk/elibrary/resource/1921/big-bang-evidence) to draw visual representations of the different types of evidence that support the idea that a 'Big Bang' occurred. | 1 hour | R072: LO1, LO3 |
| | Learners could complete Pupil Researcher Initiative activity 'Understanding the Universe' (http://www.nationalstemcentre.org.uk/elibrary/resource/5842/understanding-the-universe) to investigate how scientific ideas change through time. | 1 hour | R072: LO1, LO3 |
| | Learners could carry out a survey to find out where people think the centre of the universe is and then design a demonstration to show that the universe appears to be expanding from any viewpoint within it. | 1 hour | R072: LO1 |
| Debate: Explanations for variations (Lamark and Darwin) | Learners could complete Practical Biology's 'Mapping Change over time' activity (http://www.nuffieldfoundation.org/practical-biology/mapping-change-over-time) to develop their ideas about evolution and the different kinds of evidence available. | 1 hour | R072: LO1, LO3 |
| | Learners could complete the 'History of Evolution' activities (http://sciencenetlinks.com/lessons/the-history-of-evolutionary-theory/) to examine the historical context of different ideas about evolution. | 1 hour | R072: LO1 |
| | Learners could use the scenario sheets and associated questions in the 'Comparing Theories' lesson pack (http://sciencenetlinks.com/lessons/comparing-theories-lamarck-and-darwin/) to investigate the evidence for Lamark and Darwin's theories about the mechanisms of evolution. | 2–3 hours | R072: LO1, LO3 |
| | Learners could take on the role of scientists exploring why hammer head sharks have a hammer using aspects of the National Geographic lesson plan: http://www.nationalgeographic.com/xpeditions/lessons/08/g912/hammerfor.html. | Variable | R072: LO1, LO3 |
| Debate: Explanations for variations (Lamark and Darwin) | Learners could carry out one of a range of practical activities available on Practical Biology to model natural selection (http://www.nuffieldfoundation.org/practical-biology/modelling-natural-selection). | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Debate: Explanations for variations (Lamark and Darwin) | Learners could watch the set of Darwin 2000 videos about current views on Darwin (http://www.wellcome.ac.uk/Education-resources/Teaching-and-education/Darwin-200/index.htm) as background for developing a leaflet, blog or podcast for the general public to increase awareness of Darwin's work. | 30 minutes | R072: LO1, LO3 |
| | Learners could play 'Brine Date' as an introduction to ideas about the selection of the most suitable mates (http://survivalrivals.org/brine-date/game). | 1 hour | R072: LO1 |
| | Learners could work through a presentation on how Darwin's ideas developed (found here: http://www.christs.cam.ac.uk/darwin200/docs/content/how_science_works.pdf) to create a case study to explain the processes of scientific discovery for the general public. | 1 hour | R072: LO1, LO3 |
| | Learners could use the 'Sneaky Males' cartoon from the University of Berkeley (http://evolution.berkeley.edu/evolibrary/article/0_0_0/sneakermales_01) as inspiration for their own cartoons about natural selection in a species of their choice. | 1 hour | R072: LO1 |
| How do we inherit features? (Mendel) | Learners could carry out the 'Introducing ideas about inheritance' activity from the Nuffield Foundation (http://www.nuffieldfoundation.org/practical-biology/introducing-ideas-about-inheritance). | 45 minutes | R072: LO1 |
| | Learners could model Mendel's experiments and collect virtual data by running the interactive pea experiment found here: http://www.sonic.net/~nbs/projects/anthro201/ . | 45 minutes | R072: LO1 |
| | Learners could research to prepare for a class debate about: 'Who is the Father of modern genetics – Darwin or Mendel?' to emphasise how scientific knowledge builds on earlier discoveries. | 1–2 hours | R072: LO1, LO3 |
| Debate: Who deserves credit for discovering the structure of DNA? | To consolidate earlier learning, learners could create a timeline of key discoveries that led to the discovery of DNA (e.g. Darwin, Mendel etc). | 1–2 hours | R072: LO1 |
| | Learners could complete activities from the Ulster Science in Society activity pack about DNA discovery (http://www.ulster.ac.uk/scienceinsociety/dna_discovery.pdf) to learn about the contribution of different scientists to the discovery of DNA and its structure and explore issues around collaboration and the sharing of credit for scientific discoveries. | 1 hour | R072: LO1, LO3 |
| | Learners could carry out the Practical Biology activity to extract DNA (http://www.nuffieldfoundation.org/practical-biology/extracting-dna-living-things). | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Debate: Classification (Linnaeus, binomial, cladistics) | Learners could explore the Wellcome Trust's interactive Tree of life (http://www.wellcometreeoflife.org/interactive/) and "Back to our roots" activity (found here: http://www.wellcometreeoflife.org/resources/education/) to develop their understanding of classification. | 1 hour | R072: LO1 |
| Debate: Classification (Linnaeus, binomial, cladistics) | Learners could watch two videos from Schools And Plant Sciences to identify the similarities and differences between Linnean (http://www.saps.org.uk/secondary/teaching-resources/829-linnean-system) and Binomial (http://www.saps.org.uk/secondary/teaching-resources/826-binomial-system) systems of classification. | 1 hour | R072: LO1 |
| | Learners could complete the 'What did a T-Rex taste like?' activities from the University of Berkeley to explore 'how life is related' and the concept of cladistics (http://www.ucmp.berkeley.edu/education/explorations/tours/Trex/index.html). | 2–3 hours | R072: LO1 |
| The electric current debate: Galvani and Volta, CNS and peripheral nerves) Understanding of nerves | As an introduction to the nervous system, learners could carry out the Practical Biology activity on measuring nerve-controlled reaction times (http://www.nuffieldfoundation.org/practical-biology/measuring-reaction-time-human-nerve-controlled-reaction). | 1 hour | R072: LO1 |
| | Learners could carry out research to write a historical newspaper article about Galvani and Volta's experiments and their different conclusions (learners could be given extracts from the Nuffield Chemistry 'The Discovery of the Electric Current' which can be found here: http://www.nationalstemcentre.org.uk/elibrary/resource/1866/the-discovery-of-the-electric-current). Questions and source material could also be adapted from a University of Hong Kong resource (learningscience.edu.hku.hk/Files/Current/Current_T(E).doc) to prompt learners to think about the evidence basis behind the competing theories. | 1 hour | R072: LO1, LO3 |
| | Learners could explore the interactive Nobel Prize Education activity (http://www.nobelprize.org/educational/medicine/nerve_signaling/game/nerve_signaling.html#/plot1) to investigate the central and peripheral nerve systems and create a timeline of discoveries that led to our current understanding of the nervous system. | 1 hour | R072: LO1, LO3 |
| Diabetes (Avicenna, Banting and Best) | Learners could carry out research using a variety of websites (e.g. http://www.youtube.com/watch?v=zJFNOBNxl-Y&feature=player_embedded# or http://235.stem.org.uk/Diabetes/diabetes/diabetes1.html) to create a series of cartoons to show how diabetes was recognised and treated through history. | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Diabetes (Avicenna, Banting and Best) | Learners could research the Nobel Prize awarded to Banting and Macleod (1923) for the discovery of insulin (e.g. http://www.nobelprize.org/educational/medicine/insulin/discovery-insulin.html) in preparation for a class debate on who should have won the Nobel prize. This could be tied in with a similar activity looking at the controversy surrounding the Nobel Prize awarded for the discovery of the structure of DNA. | 1–2 hours | R072: LO1, LO3 |
| | Learners could take on the role of medical support staff and carry out research (e.g. http://www.diabetes.org.uk) to create an introductory guide for new patients who have diabetes or who have a family member with diabetes explaining how insulin is made in the body, the causes and effects of diabetes and the different ways that diabetes can be treated. | 1 hour | R072: LO1 |
| Homeostatis and temperature control | Learners could create an animation showing the different parts of the body involved in the negative feedback loop involved in temperature regulation in humans. | 1 hour | R072: LO1 |
| | Learners could explore ideas about how our bodies maintain a steady internal temperature by completing the following: http://www.nuffieldfoundation.org/sites/default/files/PB_interpreting-information-about-sweating-and-temperature-ss.doc | 30–45 minutes | R072: LO1 |
| | Learners could carry out the following practicals about temperature control/homeostasis:<br>http://www.nuffieldfoundation.org/practical-biology/investigating-factors-affecting-heart-rate-daphnia<br>http://www.nuffieldfoundation.org/practical-biology/observing-effects-exercise-human-body<br>http://www.nuffieldfoundation.org/practical-biology/monitoring-body%E2%80%99s-reactions-stress | Variable | R072: LO1 |
| Communications – ideas about waves (Maxwell), making and detecting radio (Hertz), Morse code (Marconi), microwaves in phones, infra-red for long distance communications | A class discussion could be used to generate a definition of 'wireless technology' (learners should be encouraged to think outside the association of 'wireless' with internet provision) and learners could then write a diary of a day in a world where Maxwell, Hertz and Marconi had not made their scientific discoveries – a world without wireless technology. | 1 hour | R072: LO1 |

# UNIT R072 – HOW SCIENTIFIC IDEAS HAVE DEVELOPED

| Suggested content | Suggested activities | Suggested timings | Possible relevance to |
|---|---|---|---|
| Communications – ideas about waves (Maxwell), making and detecting radio (Hertz), Morse code (Marconi), microwaves in phones, infra-red for long distance communications | Learners could carry out research and create a timeline of scientific discoveries that have led to mobile phones being available today. This could be expanded into a broad project looking at the materials used in mobile phones as well as the communication technology involved. | 1 hour | R072: LO1 |
| | Learners could research the history of trans-Atlantic communication and create a series of case studies of how they would communicate with a friend in America at different times in history. Timelines (e.g. http://www.doe.in.gov/sites/default/files/curriculum/timeline1.pdf) could be provided as source materials. | 1 hour | R072: LO1 |
| | Learners could be set a research task to discover why Marconi won a medal for saving lives in the Titanic disaster (the answer is provided in this resource http://www.nps.gov/caco/forteachers/upload/Marconi.pdf from the United States National Park Service). | 1 hour | R072: LO1 |

**cambridgenationals.org.uk**

## Contact us

Staff at the OCR Customer Contact Centre are available to take your call between 8am and 5.30pm, Monday to Friday.

**Telephone 02476 851509**

**Email cambridgenationals@ocr.org.uk**

PART OF THE CAMBRIDGE ASSESSMENT GROUP

7255963478