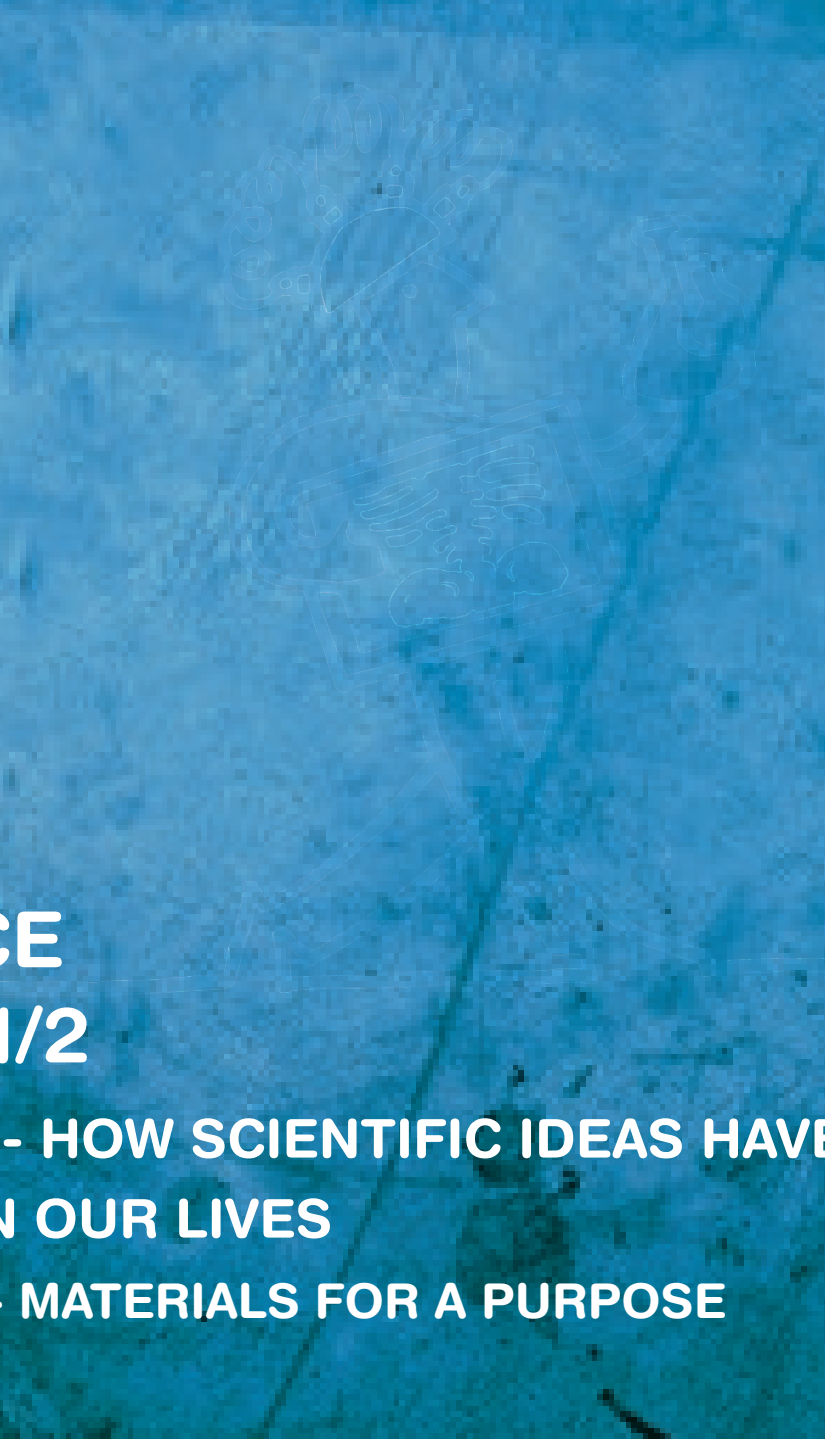




Accredited



SCIENCE LEVEL 1/2

UNIT R071 - HOW SCIENTIFIC IDEAS HAVE AN
IMPACT ON OUR LIVES

MODULE 3 - MATERIALS FOR A PURPOSE

DELIVERY GUIDE

VERSION 2 DECEMBER 2012



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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.

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 opportunities.

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 opportunities.

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 R071 - HOW SCIENTIFIC IDEAS HAVE AN IMPACT ON OUR LIVES

Guided learning hours : 60

AIM OF THE UNIT

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.

MODULE 3 - MATERIALS FOR A PURPOSE

LO7	CONTENT
Understand how materials we use are made from natural resources	<p>Learners should be taught the following content:</p> <p>that new materials are made from natural resources by chemical reactions, i.e.:</p> <ul style="list-style-type: none"> • 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 <p>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.:</p> <ul style="list-style-type: none"> • polymerisation of alkenes • oxidation and reduction • word and balanced symbol equations • reversible reactions and equilibria • use of catalysts.

LO8	CONTENT
Understand how the properties of materials we use are determined by structure and bonding	<p>Learners should be taught the following content:</p> <p>that the properties of a material determine its uses, and can be explained by its chemistry, i.e.:</p> <ul style="list-style-type: none"> • 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, crosslinking, 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	CONTENT
Be able to measure the properties of materials to recommend appropriate uses	<p>Learners should be taught the following content:</p> <p>how to collect data from primary or secondary sources, including ICT sources and tools, i.e.:</p> <ul style="list-style-type: none"> • set up scientific equipment to measure properties of materials • interpret data about the properties of materials to assess their suitability for particular purposes <p>how to work accurately and safely, individually and with others, when collecting first-hand data</p> <p>how to process data using mathematical techniques, to identify trends and patterns, i.e.:</p> <ul style="list-style-type: none"> • calculate the gradients of graphs or average values • identify anomalous results.

MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Introduction	Learners could be introduced to module 3 by using ' Unit R071 – Module 3 - Introductory presentation '.	5 minutes	R071: LO7, LO8
	As an introduction to natural and man-made materials, learners could carry out a survey of the materials used in their local built environment (eg within their classroom or building or as an external visit to the local area or an industrial site) or investigate and classify the materials used in a range of common products.	20 minutes – 1 hour	R071: LO7
	Learners could research the history of the different materials used for a particular product (eg bikes, shoes, cars, clothes, food packaging etc) and explain why the materials used have changed through time. Explanations should focus on how the discovery of new materials and production methods have influenced product design and the desirable properties of the materials used.	1 hour	R071: LO7
What is crude oil and where does it come from?	Working in pairs, learners could carry out research on the internet to produce a diagram of how crude oil is formed. These diagrams could then be discussed as a group to gain consensus on how crude oil is formed.	5–10 minutes	R071: LO7
	Learners could be introduced to how crude oil is formed by watching this animation (available at: http://www.hk-phy.org/energy/power/source_phy/flash/formation_e.html - select 'oil formation'). Learners could use the animation to create a glossary of key terms relating to oil formation.	20 minutes	R071: LO7
	Learners could work through GCSE Bitesize (http://www.bbc.co.uk/schools/gcsebitesize/science/ocr_gateway_pre_2011/carbon_chem/4_crude_oil1.shtml) and complete the 'Test Bite'.	30–45 minutes	R071: LO7
How do we make crude oil useful?	Teachers could introduce learners to the fractional distillation of crude oil by using this animation (http://www.footprints-science.co.uk/fractional.htm). Learners could create their own model to demonstrate how fractional distillation separates hydrocarbon chains based on their length.	30 minutes	R071: LO7
	Learners could watch their teacher demonstrate fractional distillation or alternatively this could be done as a class practical – details of how to carry out this practical can be found here (http://www.rsc.org/learn-chemistry/wiki/Lab:The_fractional_distillation_of_crude_oil). This experiment simulates the industrial fractional distillation of crude oil in the laboratory. Learners should record their results about viscosity, colour, smell and flammability in an appropriate format. The results from the practical should then be discussed as a group.	Teacher demo 20 minutes Class practical 1 hour	R071: LO7, LO8, LO9 R073: LO2, LO3





MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Crude oil as a source of new materials i.e. plastics	As a starter learners could be asked to list all the things they use in daily life which are made of plastic. This could lead to a discussion about what life would be like without plastics. Learners could then carry out the practical activity suggested here (http://www.reachoutmichigan.org/funexperiments/quick/plastic.html). These discussions and the practical activity will help to establish the importance of plastics.	45 minutes – 1 hour	R071: LO7, LO8
	Learners could watch their teacher demonstrate the production of nylon - Making nylon – the ‘nylon rope trick’ (http://media.rsc.org/Classic%20Chem%20Demos/CCD-64.pdf). This forms a good introduction to a theory lesson on polymerisation.	30 minutes	R071: LO7
	Learners could carry out an experiment from Practical Chemistry to make plastic from potato starch and investigate the effect of adding a plasticiser on the properties of the polymer they make (http://www.nuffieldfoundation.org/practical-chemistry/making-plastic-potato-starch).	30 minutes	R071: LO7 R073: LO2, LO3
	Learners could watch the animation and read the information about plastics provided by Resource Link , (http://pdf.ocr.org.uk/images/82424-unit-r071-resources-link.pdf) as a briefing for planning an advertising campaign to raise public awareness of the importance of recycling plastics.	45 minutes	R071: LO7 R073: LO5
Construction Materials – Cement, bricks, glass and steel	Learners could use the Portland Cement Association’s interactive cement plant (http://www.cement.org/basics/images/flashtour.html) to write a summary of the chemistry of cement.	30 minutes	R071: LO7
	Learners could research how bricks are made by different communities around the world and investigate the similarities and differences between the different products in order to define what makes a brick a brick.	45 minutes	R071: LO7
	Learners could read through information from here (http://whyzz.com/how-is-glass-made) or Resource Link , (http://pdf.ocr.org.uk/images/82424-unit-r071-resources-link.pdf) about the manufacture of glass). Using the information, learners could produce a poster for younger learners to explain how glass is made.	30–45 minutes	R071: LO7 R073: LO5
	Learners could use the Resource Link , page 31 (http://pdf.ocr.org.uk/images/82424-unit-r071-resources-link.pdf) to produce a flow diagram on the process of manufacturing steel.	15–20 minutes	R071: LO7





MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Making ammonia by the Haber process	Learners could be introduced to the concepts of equilibria and reversible reactions using any of a range of activities suggested in the RSC's 'Equilibria Teaching Notes' (http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/953/Equilibria.pdf?v=1348841324350)	30 minutes	R071: LO7, LO9
	Learners could make and test the properties of ammonia by carrying out or observing a demonstration of a Royal Society of Chemistry 'Classic Chemistry Experiment' (http://www.rsc.org/learn-chemistry/resource/res00000433/classic-chemistry-experiments-the-properties-of-ammonia)	20 minutes	R071: LO7 R073: LO2, LO3
	The RSC's powerpoint and embedded videos about 'Manufacturing Ammonia' (http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/001/192/Manufacturing%20Ammonia%20vids.pptx) could be used as an introduction to the Haber process.	30 minutes	R071: LO7
	 The following website (http://www.schoolsnet.com/pls/hot_school/sn_lessons.page_pls_lesson_detail?x=16180339&p_lesson_id=54&p_res_type_id=8) provides a lesson plan and resources for teaching the Haber process to learners. The resources can be adapted to suit learners.	30 minutes – 1 hour depending on detail covered	R071: LO7
	The teacher could start the lesson by showing a graph showing the effects of increasing temperature and pressure on the yield of ammonia produced by the Haber process. Learners could use an interactive graph to identify the effect of increasing temperature and pressure on yield of ammonia: Resource Link , (http://pdf.ocr.org.uk/images/82424-unit-r071-resources-link.pdf) This could lead on to a discussion about why low temperature and high pressure are not favoured in the reaction, why a compromise is used, and the role of the catalyst in this reaction.	20 minutes	R071: LO7
Extracting metals from their ores	This RSC Classic Chemistry Experiment (http://www.rsc.org/learn-chemistry/content/filerepository/CMP/00/000/537/cce-83.pdf?v=1348843882601) could be used to introduce learners to the concept of oxidation and reduction reactions.	30 minutes	R071: LO7 R073: LO2, LO3
	The extraction of iron from its ore could be demonstrated using this experiment from Education in Chemistry (http://www.rsc.org/Education/EiC/issues/2007Nov/ExhibitionChemistry.asp).	20 minutes	R071: LO7






MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Extracting metals from their ores	Learners could carry out a practical to extract copper by reducing copper carbonate (malachite – a copper ore, consisting mainly of basic copper(II) carbonate, $\text{CuCO}_3 \cdot \text{Cu(OH)}_2$) with carbon. Details of this practical can be found here (http://www.nuffieldfoundation.org/practical-chemistry/extracting-metals-rocks) While carrying out the practical learners could be encouraged to peer assess each other by completing a practical observation sheet about practical skills and working safely. Learners could then provide feedback to one another using the observation sheet.	1 hour	R071: LO7, LO9 R073: LO2
	Learners could carry out a practical to extract copper using the electrolysis of copper sulphate solution. Details of this practical can be found here (http://www.nuffieldfoundation.org/practical-chemistry/electrolysis-copperii-sulfate-solution). Resource Link , page 33 (http://pdf.ocr.org.uk/download/sm/ocr_68820_sm_nationals_r071_res_link.pdf?) can be used to underpin the theory behind the electrolysis of copper.	1 hour	R071: LO7, LO9 R073: LO2
	 Learners could calculate and compare the percentage yields for the two methods of extracting copper from their own experimental data or from teacher-generated data. This activity could be extended to compare more widely the atom economy, cost implications, energy use and environmental impact of each method.	30 minutes – 1 hour	R071: LO7 R073: LO3
Batch and continuous processes	 Learners could read through the information on batch and continuous processes from Resource Link , page 32 (http://www.ocr.org.uk/images/82424-unit-r071-resources-link.pdf). Learners could then complete the 'Test bite Quiz'.	20–30 minutes	R071: LO7
	Learners could be provided with a list of chemical reactions discussed in this module and asked to classify them as either batch or continuous processes. More able learners could be asked to provide reasons for their choice.	10–15 minutes	R071: LO7
	Learners could research the batch and continuous methods of producing ethanol and create case studies of the method that would be most suitable for ethanol production in the UK and in Brazil.	45 minutes	R071: LO7
	  Learners could carry out an analysis of the environmental impact of some of the production processes used to make plastics and fibres, cement, glass or ammonia, or extract iron or copper from natural resources. They could identify alternative production methods which have a lower environmental impact. Refer to OCR's Lesson Element – Production Processes.	3 hours	R071: LO7

MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Batch and continuous processes 	Learners could take the role of a product design engineer and create a proposal for a product made from recycled materials that has no environmental impact. Learners should be encouraged to consider how to minimize and offset the environmental impact of any processing required to create their product and the cost implications of this.	2 hours	R071: LO7 R073: LO5
	Learners could design poster to highlight differences between atoms, elements and compounds for a Year 8 class. Learners could include definitions of keywords - atoms, elements, compounds, molecules, mixtures and alloys. Learners could give examples of each key term and descriptions of separating methods. This should provide an opportunity for the teacher to address learners' misconceptions related to atoms, elements, compounds etc.	1 hour	R071: LO8 R073: LO5
	 Teacher could split the class into 3-4 small groups. Each group to do a role play representing atoms in molecules, compounds, elements and mixtures. Learners could describe their physical and chemical properties. Each group to select a narrator to explain what is being acted out.	45 minutes	R071: LO8 R073: LO5
	Teachers could use this resource (http://www.rsc.org/Education/Teachers/Resources/Afchem/resources/25/index.htm) 'What do chemical words mean?' to address common misconceptions.	30 minutes	R071: LO8
	 Learners could carry out an experiment to make slime (http://www.msm.cam.ac.uk/SeeK/slime.htm). The practical is a good introduction to polymers and focuses on cross-linking. The slime made displays both liquid-like and solid-like property known as visco-elasticity. The practical provides a good basis for learning about how the arrangement of molecules determines the properties of polymers, eg chain length, cross-linking, use of plasticizers and crystallinity.	30–45 minutes	R071: LO8
Using the structure and bonding of materials to explain their properties	Learners could plan and carry out an investigation into the properties of ionic and covalent compounds and metals.	2 hours	R071: LO8 R073: LO1, LO2, LO3
	Learners could carry out an experiment from Practical Chemistry to investigate the effect of structure on the properties of chocolate (http://www.nuffieldfoundation.org/practical-chemistry/chocolate-and-structure).	45 minutes	R071: LO8 R073: LO2, LO3

MODULE 3 – MATERIALS FOR A PURPOSE

Suggested content	Suggested activities	Suggested timings	Possible relevance to
Linking properties of materials to their use – molecular structure    	<p>Learners could produce a fact file on metals, eg copper, ceramics, eg glass, and polymers, eg nylon. In their fact file learners should link the structure e.g. metallic bond in metals, arrangement of ions in glass and covalent bonds in nylon to their uses. Lesson element 'Fact file – Metals' is an example of what learners could be given to complete.</p>	1 hour	R071: LO8
	<p>Working in pairs learners could carry out a survey of a science lab to identify different materials (furniture and equipments) and what they are made from (metals, plastics or glass). They could then give reasons (properties) to explain why they are made of such material. Alternatively this activity could be focused on identifying alloys and their properties that make them suitable for certain uses.</p>	20 minutes	R071: LO8
	<p>Learners could take on the role of a project manager for a new house/restoration project. Learners will decide which materials will be used and link to their properties. They should give justification for the materials used based on their properties. As a possible extension activity, learners could be tasked with making their design eco-friendly.</p> <p>Useful websites from OCR's Resource Link, (http://pdf.ocr.org.uk/images/82424-unit-r071-resources-link.pdf).</p>	1 hour	R071: LO8
	<p>Learners could take on the role of a product design engineer and, selecting a product of their choice, create a proposal to redevelop the product by identifying the materials used in the existing product and explaining how different materials could be used to improve the existing product.</p>	1 hour	R071: LO8 R073: LO5
Testing the properties of materials – data handling 	<p>Learners could carry out a practical to measure the density of regular solid shapes, instructions can be found here (http://www.nuffieldfoundation.org/practical-physics/measuring-density-regular-solid-shapes). Alternatively, the practical detailed here (Resource link, page 37 - www.ehow.com/how_6726978_calculate-density-copper-sheet.html) could be used. Extend to compare density of copper with other known metals and how this relates to their uses. The information the learners find out could then be added to their fact file on metals.</p>	1 hour	R071: LO8, LO9 R073: LO2, LO3
	<p>Learners could make and test their own bouncing balls (e.g. http://resources.schoolscience.co.uk/salters/pdfs/voltwo/SCC2_Prac3.pdf) with a focus on identifying the properties that increase the bounce of the ball.</p>	1 hour	R071: LO8, LO9 R073: LO2, LO3

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Suggested content	Suggested activities	Suggested timings	Possible relevance to
Testing the properties of materials – data handling	Learners could carry out one of a range of activities available here (http://www.education.vic.gov.au/studentlearning/teachingresources/science/samplesci/su4performmat.htm) to identify and test the properties of materials used for sporting activities.	1 hour	R071: LO8, LO9 R073: LO2, LO3
	Learners could be given a range of potential 'brick ingredients' and then design an experiment to make and test the properties of a range of different hand-made bricks	2 hours	R071: LO8, LO9 R073: LO1, LO2, LO3

Contact us

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

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