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OCR LEVEL 2 CAMBRIDGE TECHNICALS IN SCIENCE

LEVEL 2 UNIT 3
RESEARCH AND DEVELOPMENT IN
SCIENCE

DELIVERY GUIDE
VERSION 1 SEPTEMBER 2013

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OCR Resources: *the small print*

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INTRODUCTION

This Delivery Guide and Plan 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. The Plan offers one way to deliver this unit, with suggestions on how many lessons to spend on a particular topic and the resources you could use.

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 outcome 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 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.

The latest version of this Delivery Guide can be downloaded from the OCR website.

OPPORTUNITIES FOR ENGLISH AND MATHS DEVELOPMENT

The Wolf Review of Vocational Education recommended that all learners studying post-16 qualifications have the opportunity to further develop their English and maths skills, with the aims of:

- achieving a GCSE in English and/or maths at grade A*-C if they have not already done so or
- making significant progress towards GCSE entry and success if this is some way off for the individual.

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.

OPPORTUNITIES FOR WORK EXPERIENCE

The Wolf Report also recommended that learners have the opportunity to apply their skills and extend their learning outside the classroom through work experience, part time jobs, work shadowing and work placements. There are lots of opportunities within these qualifications to take some of the teaching and learning outside of the classroom and into a work environment. We are working to provide you with resources to support you in achieving this, please visit www.ocr.org.uk shortly for more information.

KEY



English



Maths



Work experience

UNIT 3 - RESEARCH AND DEVELOPMENT IN SCIENCE

Guided learning hours : 60

Credit value: 10

PURPOSE OF THE UNIT

Science drives the research and development of many products and processes that we depend on, from the commercial products we use, the fuels we burn and the healthcare we depend on. This unit looks at the scope of scientific research and development, and also gives learners the opportunity to model the processes and skills that scientists use when they are developing new ideas ie how the scientific method was employed in solving a problem. The unit provides opportunities for lots of practical work and for project work. At the end of the unit the learners should have an awareness and an understanding of a range of recent science innovations and developments.

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
1 Understand how scientific concepts become useful applications	P1 summarise some recent scientific research and developments to show what challenges have been met	M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved	D1 summarise some current areas of innovative research and development, and outline what challenges scientists are trying to solve
2 Be able to plan and use a design process to design or improve an application of science	P2 describe a series of preliminary practical activities that identify a potential application of science	M2 explain the underlying science of the potential application of science	
	P3 design an application of science using the preliminary practical activities and report on its effectiveness	M3 describe the effectiveness of the designed application using appropriate detail in observation, measurement and recording of data	D2 evaluate the outcome of tests on the effectiveness of the designed application and report on a series of modifications to improve the design

P = Pass, M = Merit, D = Distinction

LEARNING OUTCOME 1 – UNDERSTAND HOW SCIENTIFIC CONCEPTS BECOME USEFUL APPLICATIONS

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
1 Understand how scientific concepts become useful applications	P1 summarise some recent scientific research and developments to show what challenges have been met	M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved	D1 summarise some current areas of innovative research and development, and outline what challenges scientists are trying to solve

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
Recent scientific developments	A 16 minute video is available showing the work of Shinya Yamanaka in his research into stem cells to find treatments for spinal injuries gives an insight into the whole process of research producing an innovative development in science (video can be found at http://www.eurostemcell.org/toolkititem/stem-cells-future-introduction-ips-cells). This can be a starter activity for learners developing their own research into products to fulfil specific needs.	45 minutes	P1 summarise some recent scientific research and developments to show what challenges have been met
	Learners could complete a card sort activity on Stem Cell Research available in the resources link titled "Stem Cell Activities" (found by logging in to TES secondary resources at http://www.tes.co.uk/teaching-resource/Stem-Cell-Activities-6036610/) to prompt discussion on the considerations of the nature of research into stem cells.	1 hour	P1 summarise some recent scientific research and developments to show what challenges have been met M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
Purpose of scientific development	<p>Learners could complete the card sort activity outlined in Lesson Element 1, where they are provided with the names of 10 recent scientific developments, and they must decide on the purpose of each development and whether each development should be classified as improvement to a current product, to save time and money or to do a job better. Learners may need to carry out some research about the developments included in the card sort as they may not be familiar with them, and they can decide the purpose and the driving force behind the development. A discussion could be used to address any differences of opinion. This activity could then be extended so that learners carry out their own research to identify a new scientific development not included in the card-sort.</p>	2 hours	<p>P1 summarise some recent scientific research and developments to show what challenges have been met</p> <p>M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved</p> <p>D1 summarise some current areas of innovative research and development, and outline what challenges scientists are trying to solve</p>

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
Case study	<p>There are many websites that provide information about current scientific innovations, and magazines sent to science departments in schools and colleges are also a rich source of ideas for case studies. Some examples of websites include:</p> <p>http://biomedicalnanotechnology.yolasite.com/current-products.php http://www.google.com/glass/start/ http://www.victrex.com/en/industries/aerospace/aerospace.php http://physicsworld.com/cws/article/news/2013/jul/26/electronic-skin-lights-up-when-touched</p> <p>Learners could carry out some independent research into recent scientific development as part of their case study. In order to support learners tutors may provide them with a set of questions that they must complete. The questions should guide the learner to find out:</p> <ol style="list-style-type: none"> 1. Why was the development undertaken in the first place? 2. Where was the research and development carried out (commercial/academic/military etc)? 3. Who provided the funding? 4. How far along is the development process? 5. What problems have been encountered during the development process? 6. What science underpinned this development? <p>Their independent work could be presented as a PowerPoint presentation or as a 'Top-secret' Dossier on 'Our new product' where they put a booklet together where they highlight the parts that would be 'secret information' that a company/military or academic might want to keep from rivals.</p>	45 minutes	<p>P1 summarise some recent scientific research and developments to show what challenges have been met</p> <p>M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved</p> <p>D1 summarise some current areas of innovative research and development, and outline what challenges scientists are trying to solve</p>
Historical perspective of scientific development	<p>Learners could study a historical case study that shows how a scientific development met a need at the time (for example anaesthetics, penicillin, vaccinations, biofuels from chip shop fat, smokeless gunpowder, biodegradable polymers, measuring time or longitude, development of transatlantic radio, monitoring earthquakes). The case study could be put together using a 'wiki-style' presentation, for example the work of Edward Jenner on vaccinations and Alexander Flemming on penicillin would provide an opportunity for learners to include some of the controversies associated with research and development.</p>	1 hour	

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
Visit 	<p>A visit can be made to a company (for example brewing, food production, a supermarket that uses cold storage, dry cleaning, a local garage that tests vehicle emissions, a plant nursery that propagates cuttings or uses greenhouses, a local wind farm or power station) that uses science and learners could base their assessment on how the techniques used by the company were developed and why. If this approach is adopted, it is important that learners focus on the underlying science rather than any legislation or technology that has also been involved in any advances made.</p>	6 hours	
Science meeting our needs 	<p>Learners could be tasked with producing a wall display or webpage to advertise a 'Science Innovation Conference' for the current year. This could involve them working in small groups, with each group researching a specific recent new scientific development as examples. Each group could produce relevant materials for the wall display or webpage about the new scientific development that they have researched, so that the wall display can be referred to as an ongoing point of reference.</p>	2 hours	<p>P1 summarise some recent scientific research and developments to show what challenges have been met</p> <p>M1 explain the scientific development of two applications, explaining what scientific problems were presented and solved</p>
Innovative science 	<p>Learners identify a scientific product that has been designed to meet a specific need. The broad scope of scientific development should be made clear, with the emphasis on the drive to create important products for all aspects of our lives. They should present their findings on their chosen product to the rest of the group in a format of their choice. More innovative approaches could involve learners making mini video diaries, vox pops (using video to record short responses from people when asked specific questions) surveys or carrying out web based research into modern products that have been developed to fulfil specific needs. This could also be delivered in a 'Dragons Den' style role play where a group research and identify an innovative product (or develop one from earlier work) and then produce a 'Pitch' to a group of 'Dragons' (teachers and/or selected learners). The 'Pitch' would need to emphasise the value that the product would have to the public/specified audience. They would need to be prepared to answer questions on their product from the 'Dragons'.</p>	2 hours	<p>D1 summarise some current areas of innovative research and development, and outline what challenges scientists are trying to solve</p>

LEARNING OUTCOME 2 – BE ABLE TO PLAN AND USE A DESIGN PROCESS TO DESIGN OR IMPROVE AN APPLICATION OF SCIENCE.

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
2 Be able to plan and use a design process to design or improve an application of science	P2 describe a series of preliminary practical activities that identify a potential application of science	M2 explain the underlying science of the potential application of science	
	P3 design an application of science using the preliminary practical activities and report on its effectiveness	M3 describe the effectiveness of the designed application using appropriate detail in observation, measurement and recording of data	D2 evaluate the outcome of tests on the effectiveness of the designed application and report on a series of modifications to improve the design

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
What is the design process? 	Show learners a simple flow-chart to show the steps involved in designing an application of science from ideas through development then testing, improvement and finally to market (this webpage could be used as stimulus: http://notionink.wordpress.com/2010/10/page/3/) A discussion could look at how innovations looked at earlier in the unit have used this process	15 mins	P2 describe a series of preliminary practical activities that identify a potential application of science

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
Designing a innovative scientific product 	<p>Learners develop a new 'useful' innovation through a sequence of research and development and write a report to summarise what they have made. This could be contextualised by suggesting that the learners are working for a particular company that has an interest in developing a product.</p> <p>They may work in groups, but their written assignment work must be individual. Many websites suggest science 'egg race' type activities. Some other examples include making a chemistry or physics clock (using a rate of reaction or dropping oil through a filter paper and measuring volumes, using a pendulum, a ball down a ramp or falling through oil) or a water filter for a developing country to remove mud from water using only 'natural' materials such as sand and gravel, designing crumple zones using a dynamics trolley with a ball bearing 'passenger', a design for a cup to keep coffee hot/a coat to keep arctic explorers hot etc.</p> <p>Provide learners with a Lab book/Company Record book and learners should use the skills developed in 'The design process in action' section to set out headings and record a trail of evidence including presentation of detailed processed data/measurements analysed at each stage of testing.</p>	1 hour	<p>P2 describe a series of preliminary practical activities that identify a potential application of science</p> <p>M2 explain the underlying science of the potential application of science</p> <p>P3 design an application of science using the preliminary practical activities and report on its effectiveness</p> <p>M3 describe the effectiveness of the designed application using appropriate detail in observation, measurement and recording of data</p>
Best 'prototype' 	<p>Learners choose their own style of delivery for the presentation of their best 'prototype' using the skills that they have developed during Learning Objective 1.</p>	2 hours	<p>D2 evaluate the outcome of tests on the effectiveness of the designed application and report on a series of modifications to improve the design</p>



CONTACT US

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

We're always happy to answer questions and give advice.

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