Cambridge TECHNICALS

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OCR LEVEL 2 CAMBRIDGE TECHNICALS IN SCIENCE

LEVEL 2 UNIT 1 SCIENCE OF THE EARTH

DELIVERY GUIDE

VERSION 1 JANUARY 2014

OCR
Oxford Cambridge and RSA

CONTENTS

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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 1 - SCIENCE OF THE EARTH

Guided learning hours : 60

Credit value: 10

PURPOSE OF THE UNIT

This unit aims to introduce learners to ideas about the changing nature of the Earth and to our place as humans living on the Earth. The unit looks at how the Earth provides the necessary conditions for life and also at our responsibilities as stewards of the Earth.

The unit begins by looking at the dynamic nature of the Earth and traces the scientific theories behind our understanding of the processes that have led to changes in the Earth's surface. The unit moves on to look at how the atmosphere provides the necessary conditions for life and how we use the hydrosphere as a resource. The unit culminates with a study, either individual or group based, in which learners trace the full life cycle of the exploitation of a natural resource from the Earth. This study gives learners the opportunity to think about issues relating to the responsible uses of the Earth's resources and sustainability.

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
1 Understand the structure of the Earth and the development of ideas and theories about the processes that change the Earth's surface.	P1 summarise the model for the structure of the Earth and describe current scientific theories about the processes that change the Earth's surface and lithosphere	M1 describe how ideas and scientific theories about changes to the Earth's surface and the lithosphere have developed and how each idea or theory was supported by the evidence available at the time	D1 evaluate the different ideas and theories about changes to the Earth's surface and the lithosphere in terms of their strengths and weaknesses in the light of accumulated evidence
	P2 identify reasons why it is important that scientists continually monitor changes to the Earth's surface and the lithosphere	M2 describe how scientists minimise the impact of changes to the Earth's surface and lithosphere in populated areas	
2 Know how the Earth's atmosphere has evolved and how it supports life.	P3 describe the structure and composition of the Earth's atmosphere and the importance of the atmosphere to life	M3 explain some of the processes occurring in the atmosphere that are important to life	
	P4 outline the key stages in the development of the atmosphere		D2 describe how scientists collect data about the Earth's atmosphere and how the data is interpreted

P = Pass, M = Merit, D = Distinction

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
3 Understand the importance of the hydrosphere for supporting human life.	P5 identify ways the hydrosphere supports human life	M4 describe the composition of sea water and how useful products are extracted from sea water	
	P6 outline how and why water is treated before and after use	M5 explain why it is necessary to treat water before and after use and why it is important to economise on the amount of water we use	
4 Understand how we extract and use resources in the lithosphere, hydrosphere, atmosphere and biosphere, and the long-term effects on the Earth.	P7 summarise information and research data about how a named natural resource is extracted and used	M6 discuss the effects on the Earth of the longterm extraction and use of the natural resource	D3 evaluate the sustainability of the use of the natural resource and outline future developments that are needed to ensure sustainability

P = Pass, M = Merit, D = Distinction

LEARNING OUTCOME 1 – UNDERSTAND THE STRUCTURE OF THE EARTH AND THE DEVELOPMENT OF IDEAS AND THEORIES ABOUT THE PROCESSES THAT CHANGE THE EARTH'S SURFACE

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
1 Understand the structure of the Earth and the development of ideas and theories about the processes that change the Earth's surface.	P1 summarise the model for the structure of the Earth and describe current scientific theories about the processes that change the Earth's surface and lithosphere	M1 describe how ideas and scientific theories about changes to the Earth's surface and the lithosphere have developed and how each idea or theory was supported by the evidence available at the time	D1 evaluate the different ideas and theories about changes to the Earth's surface and the lithosphere in terms of their strengths and weaknesses in the light of accumulated evidence
	P2 identify reasons why it is important that scientists continually monitor changes to the Earth's surface and the lithosphere	M2 describe how scientists minimise the impact of changes to the Earth's surface and lithosphere in populated areas	

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
1 The structure of the Earth 	The tutor could introduce the unit to the learners using the introductory PowerPoint.	5 minutes	
	Learners start the unit by talking about what they already know about the structure of the Earth and consider what the different parts of the Earth are called. Following this and working in groups, learners could be given the task of demonstrating their knowledge of the structure of the Earth in 60 seconds by preparing a mini-presentation to include diagrams, data for example depth of the layers, density etc and presentation notes. Learners could use the internet or textbooks/encyclopaedias to extend their knowledge of the different parts to include the properties.	1 hour	P1
2 Theories about the Earth 	Learners could work in groups to make presentations about different ideas about the Earth, for example different creation myths, myths about how rocks were formed (eg the Gorgon myths, the Giant's causeway), flood myths to explain sea shell and fish fossils in mountain ranges, the shrinking Earth theory. Each group could make a presentation to explain their 'story' and to identify the features of the Earth that each story explains.	1 - 2 hours	P1/M1/D1
	Learners could carry out research and produce a timeline of the different ideas and theories eg creation stories, stories of global floods, myths to explain rock formation, shrinking Earth theory on A3 paper and write an explanation of each theory using the evidence available at the time, detailing the strengths and weaknesses of each theory.	1 hour	P1/M1/D1

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
3 The Rock Cycle	Learners could be given a box containing different types of rock, sedimentary, igneous (intrusive and extrusive) and metamorphic as well as varying sizes of rock fragments. The learners would also be given a large diagram of the rock cycle. They would need to place the rocks in the correct place on the diagram and use the fragments to demonstrate weathering, erosion and transportation on the diagram. Learners would also produce notes justifying their choice of rock for the location, eg extrusive igneous on the outside of the volcano, large rock fragments at the top of a river, small rock fragments at the end of a water course. Learners could peer assess each other's positioning and reasoning of the rock/rock fragment places. If learners struggle with identifying and naming the rocks given the tutor could provide help. The resource 'Restless Earth - section 1' http://www.nationalstemcentre.org.uk/elibrary/resource/3824/restless-earth could be used if learners have little or no prior knowledge of rocks and/or the rock cycle.	1 hour	P1
4 Evidence for moving tectonic plates; Land masses and fossil distribution	As an introduction to tectonic plates the learners could complete the pangaea puzzle found here http://www.amnh.org/explore/curriculum-collections/dinosaurs-ancient-fossils-new-discoveries/plate-tectonics-puzzle where learners cut and stick together land masses based on the fossil distribution. Following this the learners could be given a modern printed map of the Earth showing the land masses and also the tectonic plates. Learners could be given a series of tasks such as giving likely locations of volcanoes, explaining why an earthquake happened in India, highlighting mountain ranges and explaining why they are in the location they are. To stretch learners they could be given the type of movement at a boundary and asked to relate that to the earth movement occurring at that place (earthquake, fault line, volcano). To support learners if they are struggling or have not covered this before these resources may be appropriate. Salter's Restless Earth student sheets 2.1 and 2.2 found here http://www.nationalstemcentre.org.uk/elibrary/resource/3824/restless-earth which provide structured questions with maps and guidance for learners to develop and understanding of how earthquakes, volcanoes and mountain ranges relate to tectonic plate boundaries.	1-2 hours	P1/M1/D1
	Learners could work in small groups to research tectonic plate theory and produce evidence supporting the theory. The learners could look at tectonic or Earth blogs such as http://tectonicsblogthesecond.blogspot.co.uk/ and choose one that they would like to write a guest article for. They then present the findings of their research in an article. Alternatively the tutor could set up a new blog (tumblr is an example of where one could be set up) and each learner could contribute to an article on tectonic plates. The articles could then be reviewed by other learners in the class and constructive comments left.	1 hour	M1

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
5 Evidence for moving tectonic plates: Earthquakes, volcanoes and mountain ranges	The tutor could use lesson 4 'Earthquakes as Evidence: Tying it all Together' from DLESE Teaching Boxes http://www.teachingboxes.org/jsp/teachingboxes/plateTectonics/earthquakes/index.jsp which allows learners to explore patterns in the distribution of earthquakes. The learners are given the scenario that they have an amazing job offer of selling earthquake insurance and they need to decide on the best location to sell it. The learners use the maps that are suggested in the resource - this shows either by list form or map form all of the earthquakes currently happening. Learners need to use the evidence from the maps to decide which would be the best place for them to work to sell earthquake insurance. Learners could compare the map of earthquakes to one showing tectonic plate boundaries and justify their reason for choosing/not choosing to work in a particular location using this evidence. The tutor could then give learners a structured research task based on the worksheet' Volcanoes and Plate Boundaries: what's the connection' http://www.teachingboxes.org/jsp/teachingboxes/plateTectonics/volcanoes/index.jsp. This task requires learners work independently and use suggested websites to find out current or recent volcanic activity and link it to the plate boundaries they occur on.	1-2 hours	P2/M2
6 More evidence for moving tectonic Plates	The tutor could give the learners samples of different metals and magnets to allow learners to identify which metals are magnetic and which are not. The tutor could then use the simulation 'Magnetic stripes on the ocean floor: a lab simulation' http://www.rsc.org/Education/Teachers/Resources/jesei/magflip/home.htm to show learners the effect of the Earth's magnetic field. To link this idea to sea floor spreading and tectonic plate theory learners could be given the data and task found here http://www.rsc.org/Education/Teachers/Resources/jesei/magpat/index.htm which uses the example of Iceland. Learners use data of normal or reversed magnetic fields to plot on a map of Iceland where this is actually occurring. Once learners have plotted the points they can use this to identify rock ages and suggest where an oceanic ridge has formed and what reasons there are for this.	1 hour	P1/M1
7 Tectonic plate theory	Learners could write a letter to Alfred Wegener explaining to him why they support his theory of tectonic plates based on the evidence they have previously learned about. To stretch learners they could explain to him the weaknesses of the other theories throughout that were believed in the past and the strengths of his theory of tectonic plates. They could also explain why it took so long for his theory to be accepted.	1 hour	M1/D1
	The tutor could use the activity found here http://www.teachingboxes.org/jsp/teachingboxes/plateTectonics/culminating_activity.jsp where learners work in small groups to take on expertise in a particular field of evidence. They prepare a display of their evidence and the tutor acts as Wegener and prepares questions for the learners to answer.	1 hour	P1/M1

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
8 Monitoring changes to the Earth	The learners work in small groups and each group could be given a different section from the document 'Earthquake Science Explained' http://pubs.usgs.gov/gip/2006/21/gip-21.pdf. There are ten in total but for smaller classes the tutor could choose the most appropriate. The learners have a limited amount of time, for example, ten minutes in which to read the article and discuss in their group. They are then given more time to use the information to create a teaching resource for the other groups. This could be a poster, a story, a blog etc. Once the time is up the groups can present their resource to the rest of the class and teach them what they need to know about monitoring changes in the Earth.	1-2 hours	P2/M2
9 Minimising the impact on populated areas	Learners may look at data about the location of earthquakes or volcanoes, their severity and the number of casualties. They may consider reasons why the degree of severity of seismic activity is not always linked to the number of people affected. Learners may research news stories of 'real' events. They may also research ways that scientists act to minimise damage in populated areas. The learners could focus their research on a particular real event and produce an online news article about the earthquake or volcanic eruption.	1-2 hours	P2/M2
	The learners could be given the task of finding news videos or reports on earthquake damage. Following this learners could discuss why it is important to predict the activity of Earthquakes and volcanoes. Learners could work in small groups to come up with what benefits to populated areas predictions can make. The learners could feedback their ideas to the rest of the class. The tutor could ask the learners to write down five things that relate to emergency procedures they might expect to see in the event of an earthquake. Learners could then produce a webpage for the general public advising them on what to do if they are caught in an earthquake situation.	1-2 hours	P2/M2
10 Innovations in structural design	The tutor could use the lesson plan and resources titled 'Constructing earthquake-proof buildings' http://school.discoveryeducation.com/lessonplans/programs/earthquakeproof/ where learners build a table-top earthquake generator and design and test different building designs. It includes clear instructions and discussion questions at the end of each section to allow learners to investigate how structural design can minimise earthquake destruction. The tutor could also extend this to include design features such as cross bracing.	2 hours	M2

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
11 Monitoring the effectiveness of construction design 	Learners could create a timeline of earthquakes and the effects along the San Andreas fault line. There are many earthquakes documented and the learners to could carry out research using the internet to produce their own timeline. The learners could use the information to assess whether construction techniques have had an impact on the damage caused. Learners could be stretched by extending the timeline to show a future earthquake and the damage caused based on their knowledge of new and innovative construction techniques. Some information can be found here http://pubs.usgs.gov/gip/earthq3/safaultgip.html and here http://geology.about.com/od/geology_ca/tp/aboutsaf.htm. Alternitively the learners could produce a PowerPoint along with presentation notes on construction techniques used for Earthquake prone areas to be delivered to the general public living in that area. They could use the history of damage on the San Andreas fault line to help explain how th damage is expected to be different now there are more modern construction techniques.	45 minutes	M2

LEARNING OUTCOME 2 – KNOW HOW THE EARTH'S ATMOSPHERE HAS EVOLVED AND HOW IT SUPPORTS LIFE

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinctiion
2 Know how the Earth's atmosphere has evolved and how it supports life.	P3 describe the structure and composition of the Earth's atmosphere and the importance of the atmosphere to life	M3 explain some of the processes occurring in the atmosphere that are important to life	
	P4 outline the key stages in the development of the atmosphere		D2 describe how scientists collect data about the Earth's atmosphere and how the data is interpreted

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
1 The structure of the Earth's atmosphere	The tutor could give learners data on the Earth's atmosphere including the names of the different layers, the temperature of each layer, it's density and pressure, the tutor can find information to use here http://www.visionlearning.com/en/library/Earth-Science/6/The-Composition-of-Earths-Atmosphere/107 and the tutor could use http://malagabay.wordpress.com/2013/02/07/inventions-and-deceptions-gravitational-mass-attraction/ which contains a graph halfway down the page containing data. Learners could use this information to plot graphs and use this to decide the order of the layers of the atmosphere and to justify the reason for deciding on the order of the layers. The tutor could give learners information on the type of particles found in each layer and learners could match them up to the correct layer.	1 hour	P3
	The tutor could use the resources from 'Marcia's Science Teaching Blog' http://scienceteachingideas.blogspot.co.uk/2009/02/teaching-layers-of-atmosphere.html which consists of a video and a cut and stick activity for learners to build up knowledge of the layers of the atmosphere.	45 minutes	P3
2 The atmosphere as protection	Learners could watch the BBC video clip'Atmosphere' http://www.bbc.co.uk/science/earth/atmosphere_and_climate/atmosphere#p00gbf6k to recap the atmosphere and introduce the idea of its importance in protecting life on Earth. The earners could then be given the lesson element 'A Protective Atmosphere' where learners work in small groups to decide what dangers there are from space. The learners could be asked to identify the dangers from the electromagnetic spectrum and explain how this occurs, this could be presented by learners as a blog.	1 hour	P3/M3

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
3 'Life on Earth without the mesosphere/ ionosphere/stratosphere'	Learners could produce some cartoon strips or short stories based on a science fiction theme of 'Life on Earth without the mesosphere/ionosphere/stratosphere' to describe what the conditions on Earth would be like if any of these important layers were missing.	1 hour	P3
4 Free radicals	Learners could re-cap electron structure, in terms of reactivity and complete the lesson element, 'Free Radicals'. Following this the tutor could give the learners the leaflet 'Explore free radicals - from material science to biology' http://www.freeradical.org.au/attachments/DL_2010.pdf to read. The learners could work in groups to take a section of the leaflet to research further, so for example one group would take surface coatings, another climate change and so on. Learners could use the findings of their research and knowledge of free radicals to create an information leaflet for the general public. This could include what free radicals are, how they occur and their application.	45 minutes	M3
5 Weather within the troposphere 	Learners could watch a weather report such as one found on the BBC website http://www.bbc.co.uk/weather/. Learners could be given the instructions found here http://mjksciteachingideas.com/climate.html where an empty baby food jar is filled with red dyed hot water and one with cold blue dyed water. The red dyed jar is placed on top of the blue dyed jar for learners to see convection currents for themselves which they carry out. If possible learners could film themselves demonstrating this as a lesson for other learners. The tutor could use this for a basis for a discussion on how weather systems occur. As an alternative the tutor could give the learners a structured research task to find out how the troposphere causes weather changes. The learners could use this research to write a plan for a weather report to be shown by the BBC.	1 hour	P3/M3
6 Processes within the troposphere	The learners could create a script for a learning video clip to be submitted to BBC Class Clips on processes within the troposphere to include greenhouse gases, respiration and photosynthesis. They would need to research these processes to gain the information. They could produce a storyboard alongside their script containing images of scenes they would use in the video clip. Learners could then create the video clip which could be uploaded to the school's VLE/MLE.	1 hour	P3/M3

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
7 Comparing the Earth's atmosphere to other planets 	Learners could be given profiles of series of bacteria, these could be made up by the tutor to be able to survive in different conditions, eg extreme temperatures, using different gases for gas exchange, being resistant to radiation etc. Learners must research the conditions of each planet in the solar system and match the bacteria to the planet it is most likely to survive on and justifying their choices. Once learners have done this and have a good idea of the conditions on each planet they could write an article for a space magazine explaining what effect having an atmosphere has on surface temperature and predict the earth's temperature if there were little or no atmosphere. This should also include an explanation of the natural greenhouse effect with diagrams to help explain how this works.	1 hour	P3
8 Development of the atmosphere 	Learners could watch the video clip http://www.youtube.com/watch?v=hx9CBrejFCA&list=PLA91D37E416C975B2&index=14 which explains in detail how the atmosphere developed and then use the linked worksheet found here http://www.tes.co.uk/teaching-resource/AQA-C1-7-Storyboard-of-the-Atmosphere-and-39-s-Evolution-6307562/ which provides learners with a space to draw pictures to summarise the development of the atmosphere. As the activity is quite simple so to stretch learners they could write a paragraph on each section for which the tutor could provide keywords for learners to include.	1 hour	P4
9 Evolution of the Earth's atmosphere	Learners could could complete the worksheet titled 'Evolution of Earth's atmosphere' http://www.tes.co.uk/teaching-resource/Evolution-of-Earth-s-atmosphere-6050664/ where they work in small groups and have to have to arrange statements in the chronological order they think the atmosphere developed. The tutor could ask learners to move around the groups, seeing how other learners have ordered the statements and writing on a piece of A3 paper any they think the group have got incorrect. Once all of the groups have got back to their work they can read the advice written from other groups and see if they wish to re-order their statements.	1 hour	P4

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
10 Evidence for the early atmosphere 	The learners could begin by using data found here http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/earth/earthsatmosphererev3.shtml to draw a pie chart showing the composition of gases in the early atmosphere. The tutor could ask learners how they think scientists know the composition of the early atmosphere when it was before life began. After a discussion the tutor could simplify the table found here http://volcanoes.usgs.gov/hazards/gas/index.php and give to learners. It shows three volcanoes and the gases that have been released during eruption. The tutor could refer back to the previous work done on the development of the atmosphere and ask learners how the table of data shows the likely composition of the early atmosphere. The tutor could then ask learners to independently research how data from ice cores can help model the early atmosphere. They could give them a series of questions to answer for their research such as, 'how to scientists obtain ice cores?', 'how far back do ice cores go?' and 'what do ice cores show about the early atmosphere?'. The tutor could direct learners to specific websites such as http://earthobservatory.nasa.gov/Features/Paleoclimatology_IceCores/	1 hour	M3/D2
11 The scientists who collect the data	Learners could research the work of scientists who collect data. They may write 'a day in the life' type articles to explain what such scientists do and what their jobs involve. The following websites may be a starting point for their research: http://www.nhm.ac.uk/nature-online/environmental-change/measuring-climate-change/ice-cores/index.html http://phys.org/news/2013-10-scientists-ice-core-west-antarctica.html and http://earthobservatory.nasa.gov/Features/Paleoclimatology_IceCores/	1 hour	M3/D2

LEARNING OUTCOME 3 – KNOW HOW WASTE TREATMENT METHODS CAN BE USED TO MINIMISE THE ENVIRONMENTAL IMPACT OF A CHEMICAL PROCESS

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
3 Understand the importance of the hydrosphere for supporting human life.	P5 identify ways the hydrosphere supports human life	M4 describe the composition of sea water and how useful products are extracted from sea water	
	P6 outline how and why water is treated before and after use	M5 explain why it is necessary to treat water before and after use and why it is important to economise on the amount of water we use	

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
1 How the hydrosphere supports human life	To introduce the importance of the hydrosphere for supporting human life learners could watch the video 'Hydrosphere' http://www.youtube.com/watch?v=h6y18NaLO2g. The learners could use the information from the video to write descriptions of what we use the hydrosphere for, leading to a group discussion. Learners could then rank the uses of the hydrosphere in order they think are most important to life. For the use they rank the lowest the learners could be given a 'what if...' scenario. For example, if a learner has ranked hydropower the lowest in terms of importance, the tutor could question how energy will be generated when fossil fuels run out, or if a learner has ranked sewage disposal as the lowest the tutor could ask what they suggest we should do with the sewage. This activity can develop learners understanding of the uses of the hydrosphere and that each one is important. Following this the tutor could give the learners an incomplete diagram of the water cycle to label to assess prior knowledge. To begin with the tutor could ask learners to label it and write descriptions of each process on their own. If they are struggling to remember the tutor could give the learners some information or key words to help them complete it. There are many downloadable water cycles available for free or the tutor could use this example http://www.enchantedlearning.com/geology/label/watercycle/ to produce their own.	1 hour	P5
2 Elements in water	Learners could start this section of the unit by looking at tables showing the ions in sea water and the labels from bottles of mineral water. The learners may think about the elements the water contains and how the elements 'got into' the water. This could lead into a discussion of how water is continuously cycled in the Water Cycle.	20 minutes	M4

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
3 Elements in sea water	Learners could research the uses of some of the elements in sea water. Learners could look at chlorine-based products, such as bleaches and toilet cleaners, and consider their uses as well as the safety implications of their labelling and storage. The learners could present their research as a briefing sheet aimed at fellow learners.	1 hour	P5/M4
4 Salt from sea water	Learners could be given a table showing the elements found in sea water and compare this to bottles of mineral water. Learners could discuss how they think minerals get into seawater and relate this back to rocks and the water cycle. Learners could then carry out the practical where they are given a sample of seawater (real or if not possible made by lab technicians) and they must first filter it to remove any solid particles and then evaporate it to sea that salt crystals remain. Learners could be given a sample of sodium chloride to compare their salt crystals to. Learners could then carry out tests on the two salts to provide evidence that they are the same, eg investigating melting point, observing the structure through a hand lens or microscope, solubility in water and conductivity. This could then be extended to stretch learners by giving them the example of rocks high up on mars and elements such as chlorine found in the flat basins and ask learners to explain how they could have got there. The article 'Trickle of Salt Water on Mars' http://news.discovery.com/space/alien-life-exoplanets/mars-salt-water-surface-110804.htm contains some useful information about water on mars.	1 hour	M4
5 Separating sea water	The tutor could use the periodic table and table of common ions to explain to learners what ions are and how they are formed. Learners could carry out the electrolysis of brine. To test the products they would hold some damp litmus paper over the positive electrode to see it bleached and collect hydrogen gas in a test tube at the negative electrode which they could test with a lighted splint and could test the solution with universal indicator to show it is an alkali. Another way of observing the electrolysis of brine can be found here http://www.rsc.org/learn-chemistry/resource/res00000735/colourful-electrolysis?cmpid=CMP00000813. This activity uses universal indicator to show changes and learners must make careful observations and use their prior knowledge to explain the changes. Following the practical they could label a diagram of the equipment and answer questions using a worksheet such as this one http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6050751. The tutor could ask learners to identify the distinctive smell of chlorine gas and to think where they have smelled this before.	45 minutes	M4

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
6 Products of electrolysis 	Learners could be given the scenario of a company wanting to utilise sea water but needing to find out if it is worth setting up a plant extracting elements from sea water. Learners could carry out independent research into the use of sea water as a raw material and present their findings to the company in the form of a report. The report could include what elements are extracted, what they are used for, in what industry and how likely the company is to be able to sell the products based on how widely they are used.	1 hour	M4
7 Water for drinking	The tutor could display photographs of different water sources such as a tap, a river and the sea and ask learners which one they would rather drink from. They are most likely to choose the tap and then the tutor could ask them to justify their choice. The learners then research water borne diseases and produce a report/leaflet/blog for NGOs working in sub-Saharan Africa alerting them to the problems associated with not drinking clean water..	45 minutes	P6
8 Treating drinking water 	Learners could visit a water treatment plant, most water companies offer this to learners and some are free of charge. Each water company has its own educational resources. Alternatively the tutor could give learners the task of teaching this topic to a younger audience. The tutor could use the resources found here http://www.livingandlearningwithwater.com/english/investigating-water/clean-water.html where learners could watch the first video called how we clean water to see how this may be presented to younger learners. The learners could be given the task of producing a resource to accompany the video for younger learners to use. This could be a flow chart to show the stages for treating water that they will have seen on the video and they could include a diagram space for a caption and descriptions which the younger learners would need to match up. To stretch learners they could also include an explanation of why each stage is important.	1-2 hours	P6/M5

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
9 Water use and saving water	Learners could make a blog or a photo diary to show their water use and quantity of waste water produced in a typical day. Many websites have tables of data to show typical volumes used in standard activities such as taking a bath, shower or flushing the toilet. They may find out about new technologies for economising on water use, such as re-using 'grey water' to flush toilets.	1 hour	P6/M5
10 Chlorination 	Learners could be given a world map and a list of cholera, typhoid and dysentry outbreaks over the last decade. The World Health Organisation has details on this: http://www.who.int/csr/don/archive/disease/typhoid_fever/en/ http://www.who.int/gho/epidemic_diseases/cholera/en/ and http://www.who.int/csr/don/archive/disease/acute_watery_diarrhoeal_syndrome/en/. They can colour in areas on the map that have had outbreaks to highlight them. This could then lead to a discussion on why the outbreaks happen where they do and not in developed countries. Learners could then annotate their maps to explain why the diseases happen in terms of risks from contaminated drinking water and how they can be prevented. The WHO website gives all of this information. As an alternative the tutor could give learners the data found here http://www.prb.org/Publications/Articles/2005/CleanWatersHistoricEffectonUSMortalityRatesProvidesHopeforDevelopingCountries.aspx for diarrhoea and typhoid and ask learners to present the information as a graph. The learners could be asked to discuss why they think the mortality rates changed and then asked to predict what they think the before chlorination and after chlorination mortality rates would be for cholera based on what they have learned. Learners could then summarise the benefits of chlorination in a paragraph. The website here also provides interesting facts to support this topic http://www.wateraid.org/uk/what-we-do/the-crisis/statistics	60 minutes	P6/M5
11 Water economy	Learners could begin by completing an online water use audit such as the one found here http://www.livingandlearningwithwater.com/english/home-audit.html. The learners can then use the results from this to plan how to save water and to then calculate how much this will save. The tutor could present four headings to the class, 'water availability', 'water processing', 'water waste', 'energy requirements' and ask learners to work in small groups to come up with reasons why water should be saved relating to each of the four headings. The tutor could collect feedback as a whole class, after which learners could produce a leaflet on saving water with facts, tips to save and reasons it is important. To stretch learners they could include a comparison of a developed country water consumption and a developing country water consumption and explain why there is a difference in terms of access and chemically treated so as not to carry disease.	1 hour	M5

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
12 Sewage	The learners could use the resource found here http://www.euwfd.com/html/sewage_treatment.html to research how sewage is treated. Learners could be asked to create a presentation to explain how sewage is treated to provide drinking water. Learners could work in small groups and either all do a full presentation or each group be given a different focus of sewage treatment such as preliminary treatment, primary treatment or sludge treatment and then present their section to the whole group. Learners would make notes on whichever part they had not researched themselves.	45 minutes	P6/M5

LEARNING OUTCOME 4 – UNDERSTAND HOW WE EXTRACT AND USE RESOURCES IN THE LITHOSPHERE, HYDROSPHERE, ATMOSPHERE AND BIOSPHERE, AND THE LONG-TERM EFFECTS ON THE EARTH

Learning Outcome The learner will:	Assessment Criteria The learner can:	Merit	Distinction
4 Understand how we extract and use resources in the lithosphere, hydrosphere, atmosphere and biosphere, and the long-term effects on the Earth.	P7 summarise information and research data about how a named natural resource is extracted and used	M6 discuss the effects on the Earth of the longterm extraction and use of the natural resource	D3 evaluate the sustainability of the use of the natural resource and outline future developments that are needed to ensure sustainability

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
1 Case study 	"One way of starting this part of the unit would be to introduce the idea of the Gaia Principle which discusses the Earth as behaving as a single organism http://www.gaiatheory.org/overview/. This leads to the idea that we are responsible for ensuring that our use of the Earth as a resource for commodities does not disrupt the natural cycling of resources within the Earth. Learners then look at a specific example of the way that humans exploit one of the Earth's natural resources and evaluate the effect that this exploitation has on the longer term future of the Earth. This part of the unit could be managed as an individual research project or as a tutor led study. Learners may choose to carry out original research. For example, if learners choose to study the extraction and use of a metal such as iron, they could take a photo diary of its use, visit a local car dealership, collect data about the scale of iron extraction and use or visit a scrap dealer to take a photo diary. The study could then be presented as a commentary on their research. Alternatively, learners could do their research based on websites. It may be advisable to provide some structure or writing frames to support learners in their research.	4-6 hours	P7/M6/D3
2 Copper and the environment 	The tutor could give the learners three environmental areas to research, water, air and land based on Kennecott Copper Mine. The website can be found here http://www.kennecott.com/environment and contains details of their impact on the environment in the three ways listed above. Once learners have an overview of how copper extraction affects the environment and ways in which Kennecott and it's owner Rio Tinto counteract any adverse environmental effects they could convert the information found to create a newspaper report on Kennecott. They could include mock interviews with Kennecott staff and local people. As an alternative if video cameras are available earners could create a documentary style video of the environmental impact of the Kennecott copper mine.	1 hour	P7/M5

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
3 Extraction of copper 	Although the tutor can choose to give learners an independent research project for the case study, the activities in this LO guide learners through the example of copper mining. To introduce learners to the stages involved in copper mining it can be modelled in the laboratory. This will give learners an overview of the different processes involved in mining copper which may make it easier to relate later parts of the LO to such as energy requirements and waste. The tutor could give the learners a practical on extracting copper from malachite with instructions found here http://www.nuffieldfoundation.org/practical-chemistry/extracting-metals-rocks after which they would weigh the copper obtained to enable them calculate the yield. Learners could then carry out electrolysis of copper as a practical where they connect an impure copper strip to the positive electrode and a pure copper strip to the negative electrode and measure the mass before and after the experiment. Following this the learners could use the resource found here http://www.tes.co.uk/ResourceDetail.aspx?storyCode=6050769 which is a worksheet calculating the percentage yield of copper from both the reduction and electrolysis experiment and using sample costs to enable learners to calculate the cost of producing copper and comparing it to the length of time and purity of copper obtained. Once learners have completed this the learners could watch the video 'From ore to more' http://www.kennecott.com/content/educator-resources#prettyPhoto/0/ which summarises how copper is extracted commercially. Learners could compare how they extracted copper and the purity they obtained to the examples in the video.	1 -2 hours	P7
4 Energy in extracting copper	The tutor could re-cap how copper is extracted and present these as stages to the learners as pictures on an A3 piece of paper, this could include mining with a picture of blasts or rocks, transporting with a picture of trucks, heating with a picture of a smelter and electrolysis. In small groups the learners could have a set of statements, this could include providing heat, fuel for transporting, electricity for the purification and heat/electricity involved in production of chemicals needed and the learners would put the statements where they think the energy was used, adding their own if they think of any more. To stretch learners they could not be given statements but write their own ideas about where energy is used. The tutor could check the answers to make sure learners have got the correct energy uses and then ask learners to say how they think a large company could reduce their energy usage. Once learners have listed some ways the tutor could give learners a printout of Kennecott's energy page found here http://www.kennecott.com/energy#acc-head-0 and learners could compare their suggestions with what they already do and give them a star rating for energy usage.	45 minutes	P7/M6

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
5 Copper importance 	Learners could be given the challenge of using the internet to find as many uses of copper as they can in a given time, for example 20 minutes. The tutor could give learners headings as clues to structure the search or to stretch learners not give them clues. To further stretch learners the tutor could give the learners an extra challenge of finding a fact about copper products that no one else in the class finds to encourage them to research further and look for unusual uses of copper. This will lead learners to understand the varied uses of copper. Once learner's time is up the uses of copper can be collated on a whiteboard. The tutor could ask the learners what properties of copper make it so widely used and link these to the uses. Learners could carry out a practical to investigate the electrical and thermal conductivity of copper by connecting an ammeter into a circuit using copper wire, taking the reading and then using wires made from other metals to enable comparison and for thermal conductivity setting several metal rods of the same length and diameter, clamping one end above a bunsen burner and on the other end using petroleum jelly to attach drawing pins. The time take for the pin to fall off each metal would be recorded. As an alternative the tutor could give learners cards with pictures of the uses of copper on and other cards with properties on and learners would match them up before carrying out a circus of activities investigating the properties of copper such as the experiments described above.	90 minutes	P7
6 Copper wastage 	The tutor could use the SAPS resource 'How Science Works - Copper Pollution from Mines' http://www.saps.org.uk/secondary/teaching-resources/135-how-science-works-copper-pollution-from-mines to investigate copper pollution on plants. It contains a PowerPoint that can be adapted, experiment instructions and diagrams to enable set up, sample data to support learners, photographs of the practical and an imitation science article to put the practical into context for learners of a collapsed mine causing plants to die. Following the practical learners could research if there are any effects on human health from copper contaminated water. The learners could then use the collapsed mine story as a case study and write a persuasive letter to the a copper mining company highlighting the issues of copper contamination on plants and health and asking them to reduce their copper pollution.	1 hour	P7/M6

Suggested content	Suggested Activities	Suggested timings	Links to Assessment Criteria
7 Sustainability of copper 	Learners could listen to http://www.bbc.co.uk/worldservice/documentaries/2008/11/081112_world_without_copper.shtml which explains what life would have been like without copper. Following this the learners could discuss how life might be different in the future if copper were to run out. The tutor could put learners into groups and set up stations with information on issues of sustainability such as renewability, land use, energy consumption etc. This could be text, pictures or data. The groups would get a set amount of time at each station, eg two minutes and have to summarise the information before moving on. Once all learners have visited each station the tutor could ask learners to contribute information to a paragraph on each section of sustainability. Each learner should contribute until a detailed paragraph is formed and then learners can write this down.	1 hour	D3
8 Future considerations of copper	The tutor could ask learners what could be done if copper ore runs out. The obvious solution that learners will come up with is to recycle copper and the tutor could demonstrate that this is viable option by showing learners how many scrap metal collectors there are locally. Learners could research the stages of recycling copper. Following this the tutor could give the activity 'Phytoremediation and phytomining: a practical activity' http://www.saps.org.uk/secondary/teaching-resources/822-phytoremediation-and-phytomining-a-practical-activity where learners can investigate a new method of extracting copper, phytomining. This method can clean up copper contamination as well as providing a source of copper. It uses indian mustard and grows it hydroponically measuring copper and absorption. This activity can highlight the new and innovative ways in which copper can be extracted.	1 hour	D3

CONTACT US

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