

Scheme of Work

Cambridge
O Level

Cambridge O Level Environmental Management

5014

For examination from 2019



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Introduction

This scheme of work has been designed to support you in your teaching and lesson planning. Making full use of this scheme of work will help you to improve both your teaching and your learners' potential. It is important to have a scheme of work in place in order for you to guarantee that the syllabus is covered fully. You can choose what approach to take and you know the nature of your institution and the levels of ability of your learners. What follows is just one possible approach you could take and you should always check the syllabus for the content of your course.

Suggestions for independent study (**I**) and formative assessment (**F**) are also included. Opportunities for differentiation are indicated as **Extension activities**; there is the potential for differentiation by resource, grouping, expected level of outcome, and degree of support by teacher, throughout the scheme of work. Timings for activities and feedback are left to the judgement of the teacher, according to the level of the learners and size of the class. Length of time allocated to a task is another possible area for differentiation.

Guided learning hours

Guided learning hours give an indication of the amount of contact time you need to have with your learners to deliver a course. Our syllabuses are designed around 130 hours for Cambridge O Level courses. The number of hours may vary depending on local practice and your learners' previous experience of the subject. The table below gives some guidance about how many hours we recommend you spend on each topic area. The topics can be taught in any order.

Topic	Suggested teaching time
1 Rocks and minerals and their exploitation	It is recommended that this unit should take about 13 hours.
2 Energy and the environment	It is recommended that this unit should take about 14 hours.
3 Agriculture and the environment	It is recommended that this unit should take about 16 hours.
4 Water and its management	It is recommended that this unit should take about 16 hours.
5 Oceans and fisheries	It is recommended that this unit should take about 9 hours.
6 Managing natural hazards	It is recommended that this unit should take about 23 hours.

Topic	Suggested teaching time
7 The atmosphere and human activities	It is recommended that this unit should take about 17 hours.
8 Human population	It is recommended that this unit should take about 9 hours.
9 Natural ecosystems and human activities	It is recommended that this unit should take about 13 hours.

Resources

The up-to-date resource list for this syllabus, including textbooks endorsed by Cambridge, is listed at www.cie.org.uk. Endorsed textbooks have been written to be closely aligned to the syllabus they support, and have been through a detailed quality assurance process. As such, all textbooks endorsed by Cambridge for this syllabus are the ideal resource to be used alongside this scheme of work as they cover each learning objective.

Teacher Support

Teacher Support <https://teachers.cie.org.uk> is a secure online resource bank and community forum for Cambridge teachers, where you can download specimen and past question papers, mark schemes and other resources. We also offer online and face-to-face training; details of forthcoming training opportunities are posted online. This scheme of work is available as PDF and an editable version in Microsoft Word format; both are available on Teacher Support at <https://teachers.cie.org.uk>. If you are unable to use Microsoft Word you can download Open Office free of charge from www.openoffice.org

Websites

This scheme of work includes website links providing direct access to internet resources. Cambridge International Examinations is not responsible for the accuracy or content of information contained in these sites. The inclusion of a link to an external website should not be understood to be an endorsement of that website or the site's owners (or their products/services).

The website pages referenced in this scheme of work were selected when the scheme of work was produced. Other aspects of the sites were not checked and only the particular resources are recommended.

How to get the most out of this scheme of work – integrating syllabus content, skills and teaching strategies

We have written this scheme of work for the Cambridge Environmental Management 5014 syllabus and it provides some ideas and suggestions of how to cover the content of the syllabus. We have designed the following features to help guide you through your course.

Learning objectives help your learners by making it clear the knowledge they are trying to build. Pass these on to your learners by expressing them as ‘We are learning to / about...’.

Suggested teaching activities give you lots of ideas about how you can present learners with new information without teacher talk or videos. Try more active methods which get your learners motivated and practising new skills.

Syllabus ref	Learning objectives	Suggested teaching activities
2.1 Fossil fuel formation	<ul style="list-style-type: none"> describe the formation of the fossil fuels: coal, oil and gas 	<p>Introduction: learners watch a short video clip: ‘Why are fossil fuels important?’ http://bpes.bp.com – search for ‘Fossil fuels resources’.</p> <p>Learners draw labelled diagrams to highlight similarities and differences between the formations of coal and oil/natural gas. Possible resource: YouTube video introducing fossil fuels and their formation. www.youtube.com – search ‘Formation of fossil fuels. Earth: the operators’ manual’.</p> <p>Learners write down one reason on wipe boards or paper why fossil fuels are important and then share with whole class (F).</p> <p>Extension: Use the internet/textbooks to research why burning fossil fuels is an environmental concern, e.g. www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data (I).</p>
	<p>Identify the following energy resources as renewable or non-renewable:</p> <ul style="list-style-type: none"> – non-renewable: fossil fuels, nuclear power using uranium – renewable: biofuels (bioethanol, biogas) 	<p>Learners produce a mind map of the renewable and non-renewable energy resources and how each of the energy resources is used to generate electricity.</p> <p>This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (F).</p> <p>Possible resources: www.eia.gov – search ‘What is energy? Explained’ for a summary of renewable and non-renewable resources www.need.org – search ‘Secondary energy infobook’ www.world-nuclear.org – search ‘nuclear power’ www.ufl.edu – search ‘biogas’ www.windpower.org – search ‘wind power’ www.geothermalpower.is – search ‘geothermal power’ nationalgeographic.org – search ‘Education: hydro’ solarfactsheet.com – search ‘Secondary solar factsheet’ renewable-energy-news.info – search for ‘wind power’</p>

Extension activities provide your more able learners with further challenge beyond the basic content of the course. Innovation and independent learning are the basis of these activities.

Suggested teaching activities give you lots of ideas about how you can present learners with new information without teacher talk or videos. Try more active methods which get your learners motivated and practising new skills.

Past Papers, Specimen Papers and **Mark Schemes** are available for you to download at:

<https://teachers.cie.org.uk>

Using these resources with your learners allows you to check their progress and give them confidence and understanding.

Formative assessment (F) is on-going assessment which informs you about the progress of your learners. Don’t forget to leave time to review what your learners have learnt, you could try question and answer, tests, quizzes, ‘mind maps’, or ‘concept maps’. These kinds of activities can be found in the scheme of work.

1 Rocks and minerals and their exploitation

Syllabus ref	Learning objectives	Suggested teaching activities
1.1 Formation of rocks	<ul style="list-style-type: none"> state and explain the formation and characteristics of named igneous, sedimentary and metamorphic rocks describe and interpret the rock cycle 	<p>Introduce the topic by looking at samples of igneous, sedimentary and metamorphic rock for learners to observe the key characteristics and differences. If possible, look at samples of granite and basalt, limestone, sandstone, shale, marble and slate. This could be small samples of rock or buildings in the local neighbourhood. Learners could be given a key to the characteristics of each type of rock and then categorise the samples into rock type (I).</p> <p>Chocolate rock cycle: using chocolate to 'create' sedimentary, metamorphic and igneous chocolate. <i>Safety: check for potential allergies to chocolate amongst learners.</i> In www.geolsoc.org.uk/ – search for 'chocolate rock cycle'.</p> <p>Interactive rock cycle, such as in www.learner.org/ – search for 'rock cycle'.</p> <p>Extension: Learners produce photo/image board of rock types near their homes.</p> <p>Use wipe boards for 'quick fire' quiz on main characteristics of the three rock types and the rock cycle (F).</p>
1.2 Extraction of rocks and minerals from the Earth	<ul style="list-style-type: none"> describe the following methods of extraction of rocks and minerals from the Earth: <ul style="list-style-type: none"> – surface mining <ul style="list-style-type: none"> ▪ opencast / open-pit / open-cut / strip mining – subsurface mining <ul style="list-style-type: none"> ▪ deep mining / shaft mining discuss the factors that affect the decision to 	<p>Learners research the two types of mining (I). A possible resource is www.greatmining.com/ – search for 'Surface mining' and 'Underground mining'.</p> <p>Learners study images of surface and subsurface mines and further categorise the images as opencast, open-pit, open-cut, strip mines, deep mines, shaft mines.</p> <p>Learners develop their map interpretation skills by describing the distribution of coal mines shown on a map, using www.gov.uk/government/organisations/the-coal-authority – search for 'Coal Authority interactive map viewer'</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	extract rocks and minerals	<p>or www.mapsofworld.com/ – search for ‘world coal deposits’.</p> <p>Learners look at a photograph of the location of a quarry or quarries and identify the pros and cons of its site and possible mineral extraction. Possible resources are www.alamy.com/ – search for ‘quarry’ – or www.morgantucker.co.uk/projects/glensanda-quarry</p> <p>Extension: Learners summarise the key factors in issues related to mining for Kazakhstan. In www.un.org/development/desa/en/ search for ‘The report on mining for UNCS D 18’.</p> <p>In http://pubs.usgs.gov/sir/2012/5188/sir2012-5188.pdf look at the graphs of metal prices and the significant events that affect the prices over a 40-year period. Learners summarise the results for one metal, for the annual average price over the 40-year period shown, and explain the changes in price as a result of the significant events suggested for the metal. Extension: Are there other factors that could affect the price of the metal chosen (I)?</p>
1.3 Impact of rock and mineral extraction	<ul style="list-style-type: none"> • describe and explain the environmental, economic and social impacts of rock and mineral extraction <ul style="list-style-type: none"> – loss of habitat – noise, water, land, air, visual pollution – management of waste – employment opportunities – improvements in local/national economy – improvements in facilities and infrastructure 	<p>Learners investigate environmental impacts of mining in https://www.worldatlas.com/articles/what-is-the-environmental-impact-of-the-mining-industry.html</p> <p>Summarise the positive and negative social aspects of mining.</p> <p>Suggested resource: https://www.csr.uq.edu.au/media/docs/1194/acarp-c22029-managing-cis-projectreport2015.pdf</p> <p>Extension: Devise a suitable questionnaire that finds out local people’s views on a proposed sulfur mine.</p> <p>Learners produce a mind map of the possible impacts of rock and mineral extraction. This can be expanded upon after learning objective 1.4. This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (F).</p>
1.4 Managing	• describe and evaluate	Watch a video on how a mine in Canada is dealing with the safe disposal of a waste product in

Syllabus ref	Learning objectives	Suggested teaching activities
the impact of rock and mineral extraction	<p>strategies for restoring landscapes damaged by rock and mineral extraction</p> <ul style="list-style-type: none"> – safe disposal of mining waste – land restoration: soil improvement, bioremediation, tree planting – making lakes and nature reserves – using as land fill sites 	<p>www.youtube.com/ – search for ‘Education-reclamation and rehabilitation-videos-06’.</p> <p>Learners investigate a case study of a successfully reclaimed mining site, such as in http://cornerstonemag.net – search for ‘Ereen Mine, Mongolia’ (I).</p> <p>Extension: Learners write a development plan for a rock extraction mine that is due to close in three years.</p>
1.5 Sustainable use of rocks and minerals	<ul style="list-style-type: none"> • define sustainable resource and sustainable development • describe and evaluate strategies for the sustainable use of rocks and minerals <ul style="list-style-type: none"> – increased efficiency of the extraction of rocks and minerals – increased efficiency of the use of rocks and minerals – the need to recycle rocks and minerals • legislation 	<p>Learners produce a PowerPoint presentation on sustainable resources and sustainable development. www.bbc.co.uk/schools/gcsebitesize/ – search for ‘sustainable use of resources’. Work in groups or individually (I).</p> <p>Introduction: learners watch short YouTube clip on glass recycling. Summarise why we should recycle glass. www.youtube.com – search for ‘Sibleco glass recycling film’.</p> <p>Learners produce a mind map on how to recycle different materials. A useful resource is www.recycling-guide.org.uk/ (F).</p> <p>Class debates the pros and cons of recycling – learners are ‘given’ an opinion that they have to argue the case for. Possible resource: www.conserve-energy-future.com/ – search for ‘advantages and disadvantages of recycling’.</p> <p>Extension: Write a case study looking at the development, impact and management of a mine.</p> <p>Possible resources: www.oxfam.org.au/what-we-do/mining/impacts-of-mining/ – scroll for ‘Oxfam reports’ and select one of the mining reports or news article about limestone quarrying http://news.bbc.co.uk/1/hi/england/derbyshire/4856654.stm</p>

Past and specimen examination papers

Specimen papers and mark schemes are available to download at <https://teachers.cie.org.uk>

1.2 Extraction of rocks and minerals from the Earth – Specimen Paper 5014/01 **Q2(a)(b)**

1.4 Managing the impact of rock and mineral extraction – Specimen Paper 5014/02 **Q1(d)(e)**

1.5 Sustainable use of rocks and minerals – Specimen Paper 5014/01 **Q2(c)**

2 Energy and the environment

Syllabus ref	Learning objectives	Suggested teaching activities
2.1 Fossil fuel formation	<ul style="list-style-type: none"> describe the formation of the fossil fuels: coal, oil and gas 	<p>Introduction: learners watch a short video clip: 'Why are fossil fuels important?' http://bpes.bp.com – search for 'Fossil fuels resources'.</p> <p>Learners draw labelled diagrams to highlight similarities and differences between the formations of coal and oil/natural gas. Possible resource: YouTube video introducing fossil fuels and their formation. www.youtube.com – search 'Formation of fossil fuels. Earth: the operators' manual'.</p> <p>Learners write down one reason on wipe boards or paper why fossil fuels are important and then share with whole class (F).</p> <p>Extension: Use the internet/textbooks to research why burning fossil fuels is an environmental concern, e.g. www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data (I).</p>
2.2 Energy resources and the generation of electricity	<ul style="list-style-type: none"> classify the following energy resources as non-renewable or renewable: <ul style="list-style-type: none"> non-renewable: fossil fuels, nuclear power using uranium renewable: biofuels (bioethanol, biogas and wood), geothermal power, hydro-electric power, tidal power, wave power, solar power, wind power 	<p>Learners produce a mind map of the renewable and non-renewable energy resources and how each of the energy resources is used to generate electricity.</p> <p>This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (F).</p> <p>Possible resources: www.eia.gov – search 'What is energy? Explained' for a summary of renewable and non-renewable resources www.need.org – search 'Secondary energy infobook' www.world-nuclear.org – search 'nuclear power' www.ufl.edu – search 'biogas' www.nrdc.org – search 'wind power' www.onpower.is – search 'geothermal power' http://nationalgeographic.org – search 'Education: hydroelectric' www.need.org – search 'Secondary solar factsheet' www.alternative-energy-news.info – search for 'wind power', 'solar power', 'wave power'.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<ul style="list-style-type: none"> • describe how each of these energy resources is used to generate electricity • describe the environmental, economic and social advantages and disadvantages of each of these energy resources 	<p>Learners annotate and label a diagram of an electricity power plant for each type of energy resource and summarise in a flow chart the key stages in the generation of electricity using each resource. Possible resource: www.electrical4u.com – search ‘electrical power generation’.</p> <p>Learners watch the clip and then compare values of energy use, recycling and carbon footprints from Poland and the UK or other EU countries. Learners present their findings in an information leaflet (I). www.bbc.co.uk/education – search ‘Environmental problems in Poland’.</p> <p>In groups, learners compare and contrast one renewable and one non-renewable resource and present their findings to the class. Possible resources: http://nationalgeographic.org – search ‘Hydroelectric and geothermal: benefits and drawbacks’ www.bbc.co.uk/education – search ‘Wind power vs nuclear power’.</p> <p>Extension: Learners imagine that the use of non-renewable resources has been made illegal. They write a ‘day in the life of...’ to describe the ways it would affect them (I).</p>
2.3 Energy demand	<ul style="list-style-type: none"> • describe and explain the factors affecting the demand for energy <ul style="list-style-type: none"> – domestic demand – industrial demand – transport – personal and national wealth – climate 	<p>Learners summarise the data for energy consumption by source and sector from a suitable data source, such as www.eia.gov – search ‘Energy explained, your guide to understanding’.</p> <p>www.nap.edu/ – search ‘What you need to know about energy’.</p> <p>Learner pairs role play by pretending to be:</p> <ul style="list-style-type: none"> • from a MEDC and LEDC • from a country in a hot and cold climate • living in a rural and urban location <p>and explain to each other their energy needs. At the end they should produce a summary of the differences and similarities for each role play (I).</p>

Syllabus ref	Learning objectives	Suggested teaching activities
2.4 Conservation and management of energy resources	<ul style="list-style-type: none"> • describe and explain strategies for the efficient management of energy resources <ul style="list-style-type: none"> – reducing consumption, such as using insulation, turning electrical devices off and using energy efficient devices and vehicles – energy from waste cooking oil – exploiting existing energy sources – education of people for energy conservation – transport policies • research and development of new energy resources <ul style="list-style-type: none"> – fracking 	<p>Learners produce a development plan for a small town on strategies for efficient management of energy resources. Possible resource: www.carbontrust.com/media/7385/ctv045_an_introduction_to_energy_management.pdf Learners undertake a survey of energy efficiency in their own homes and report back their findings.</p> <p>Extension: Learners estimate how much the school could save if all the lights in the building were energy efficient.</p> <p>Learners answer the following question: 'Fracking is the answer to our energy needs.' To what extent do you agree with this statement? (F)</p> <p>Possible resource: www.bbc.co.uk – search 'What is fracking and why is it controversial?'</p>
2.5 Impact of oil pollution	<ul style="list-style-type: none"> • describe the causes and impacts of oil pollution on marine and coastal ecosystems <ul style="list-style-type: none"> – causes: off-shore oil extraction, pipelines and shipping – impacts on 	<p>Learners do an experiment on what happens during an oil spill. This could include dipping feathers into the 'oil spill' to see the potential effect on birds. <i>Care should be taken when dealing with any oil products and an appropriate risk assessment must be carried out.</i> Possible resource: https://stemactivitiesforkids.com/2016/04/22/earth-day-stem-challenge/</p> <p>Give the learners a food chain and ask them: 'How would an oil spill affect this food chain?' This could be extended to: 'How would an oil spill affect a named ecosystem?' Learners could be given photographs of the ecosystem or organisms in the food chain as a stimulus.</p> <p>Learners write an article for a children's science magazine on the impact of a major oil spill (I). Possible resources:</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<p>ecosystems: birds, marine mammals, coral reefs, beaches</p>	<p>http://alaskafisheries.noaa.gov/oil www.environmentalpollutioncenters.org/oil-spill/.</p>
2.6 Management of oil pollution	<ul style="list-style-type: none"> • discuss strategies for reducing oil spills in marine and coastal ecosystems • discuss strategies for minimising the impacts of oil spills on the marine and coastal ecosystems <ul style="list-style-type: none"> – MARPOL (International Convention for the Prevention of Pollution from Ships) – double-hulled oil tankers – dealing with oil spills (booms, detergent sprays, skimmers) 	<p>Learners do an experiment on how to clean up an oil spill. This could be using a jug or spoon to act as a skimmer, a piece of string or chord to represent a boom and detergent to break the spill into smaller particles. Possible resource: www.amsa.gov.au/ – search for ‘Experiment to clean up an oil spill’. <i>Care should be taken when dealing with any oil products and an appropriate risk assessment must be carried out.</i></p> <p>Learners look at data for the number of major oil tanker spills compared with the quantity of seaborne oil trade and describe the data. Learners look at a graph of causes of large oil spills and summarise the data. Learners draw a bar graph of the top 20 major oil spills and the quantity of oil spilt.</p> <p>Possible data: www.itopf.com/knowledge-resources/data-statistics/statistics</p> <p>Learners imagine that they run an oil-spill clean-up company. They have just been told that an oil spill has occurred 20 miles off the coast of their country. What will they do? Possible resources: www.imo.org/en/Pages/Default.aspx – search ‘MARPOL’ http://oilspillboom.co.uk – search ‘oil booms’ www.itopf.com – search ‘dispersants’.</p> <p>Extension: Study the impact and management of an oil pollution event.</p> <p>Watch YouTube documentary at www.youtube.com – search ‘The Exxon Valdez oil spill’.</p>

Past and specimen examination papers

Specimen papers and mark schemes are available to download at <https://teachers.cie.org.uk>

- 2.1 Fossil fuel formation – Specimen Paper 5014/01 **Q7(a)** and June 2013 0680/11**Q5(a)**
- 2.4 Conservation and management of energy resources – Specimen Paper 5014/01 **Q7(e)**
- 2.5 Impact of oil pollution – Specimen Paper 5014/01 **Q7(c) to (d)**

3 Agriculture and the environment

Syllabus ref	Learning objectives	Suggested teaching activities
3.1 Soil composition	<ul style="list-style-type: none"> • describe and explain the composition of soils <ul style="list-style-type: none"> – composition: mineral particles, organic content (living plants, animals, microorganisms and their dead remains), air and water – particle size: sand, silt, clay 	<p>Watch a YouTube clip on the composition of soil: www.youtube.com/ – search ‘Soil and soil dynamics’ (Bozeman Science).</p> <p>Learners study examples of different samples of soil (I). Possible resource: www.rhs.org.uk – search ‘soil types’.</p> <p>Learners do simple experiment of composition of soils. Possible resource: www.youtube.com/ – search ‘The soil profile – kids science experiments’ (Champak World).</p> <p>Use pie graphs or divided bar graphs to show the different percentages of sand, clay and silt for soils of different textures. Possible resources: www.fao.org – search ‘soil composition’ http://organiclifestyles.tamu.edu – search ‘soil’.</p> <p>Extension: Investigate an exposed soil horizon in local area and include a labelled sketch of its main features.</p>
3.2 Soils for plant growth	<ul style="list-style-type: none"> • describe soils as a medium for plant growth • describe the differences between a sandy and clay soil <ul style="list-style-type: none"> – mineral ions: <ul style="list-style-type: none"> nitrogen as nitrate ions (NO_3^-), phosphorus as phosphate ions (PO_4^{3-}), potassium as potassium ions (K^+) – organic content – pH 	<p>Learners conduct soil pH testing using pH probe or indicator paper. Possible resource: www.rhs – search for ‘Soil: understanding pH and testing soil’.</p> <p>Create a ‘Tarsia jigsaw’ for learners on the differences between a sandy and clay soil (F). Note: Tarsia is a free download available at: www.ideaseducation.co.uk/resources/Tarsia-guide.pdf</p> <p>Possible resource: http://agriculture.vic.gov.au – search ‘How do the properties of soils affect plant growth?’</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<ul style="list-style-type: none"> – air content – water content – drainage – ease of cultivation 	
3.3 Agriculture types	<ul style="list-style-type: none"> • describe the different types of agriculture <ul style="list-style-type: none"> – arable, pastoral and mixed – subsistence and commercial 	<p>Learners view images of different types of agriculture and classify them into arable, pastoral and mixed and then further classify into subsistence and commercial (F).</p> <p>Possible resources: www.bbc.co.uk/education – search for ‘farming in rural environments’ www.shutterstock.com/ for images of farming.</p> <p>Learners look at their local area and identify the type(s) of farming that takes place closest to their home (I).</p>
3.4 Increasing agricultural yields	<ul style="list-style-type: none"> • describe techniques used to increase agricultural yields <ul style="list-style-type: none"> – rotation – fertilisers – irrigation – insect control (insecticide and biological control), weed control (herbicide), fungi control (fungicide) – mechanisation – selective breeding of animals and plants – genetically modified organisms – controlled environments: greenhouses and hydroponics 	<p>Learners look at population growth statistics and discuss the question: ‘What does the population growth data mean in terms of agricultural needs?’</p> <p>Possible resource: www.fao.org – search for ‘Global agriculture towards 2050’.</p> <p>In groups, learners present a briefing document entitled ‘How to feed the world in 2050’ (I). www.fao.org – search for ‘How to feed the world in 2050’.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
3.5 Impact of agriculture	<ul style="list-style-type: none"> • describe and explain the impact of agricultural practices on the environment and people <ul style="list-style-type: none"> – overuse of insecticides and herbicides – overuse of fertilisers – mismanagement of irrigation causing salinisation and waterlogging – overproduction and waste – exhaustion of mineral ion content – soil erosion – cash crops replacing food crops 	<p>Select one negative impact of agricultural mismanagement to introduce this topic. Possible resource on Aral Sea: www.bbc.co.uk/news – search for ‘The disappearing Aral Sea’ and the short clip ‘Aral Sea – Duzbay’s story’.</p> <p>Learners then write a ‘day in the life’ of a farmer living in an area where the land has been mismanaged.</p> <p>Extension: Learners could read <i>Silent Spring</i> by Rachel Carson about the impact of overuse of the pesticide DDT (I).</p>
3.6 Causes and impacts of soil erosion	<ul style="list-style-type: none"> • describe the causes of soil erosion <ul style="list-style-type: none"> – removal of natural vegetation by over cultivation and overgrazing – water and wind erosion • describe and explain the impacts of soil erosion <ul style="list-style-type: none"> – loss of habitats – desertification – silting of rivers – displacement of people – malnutrition and famine 	<p>Watch a YouTube video explaining desertification. www.youtube.com/ – search for ‘Desertification’ (GoodPlanet).</p> <p>Show learners photographs of several different rural areas (for relief and land uses) and ask them to estimate how high the risks of soil erosion and desertification are. Possible resource: www.shutterstock.com/ for images of rural areas.</p> <p>Learners use a map to describe the distribution of hyper-arid land (very dry lands) that are at risk of desertification. Possible resource: www.greenfacts.org/en/index.htm – search for ‘Present-day drylands and their categories’.</p> <p>Learners use resources to produce notes on what causes desertification. They could compile a list of key glossary words for this topic to help with later revision, which form part of a ‘peer quick quiz’ the following lesson (F).</p> <p>Possible resources: www.un.org – search for ‘desertification day’ http://pubs.usgs.gov/gip/deserts/desertification/</p> <p>Extension: Prepare five interview questions to ask a soil expert that enable her to explain the causes of desertification. Learners should also prepare suitable answers (I).</p>

Syllabus ref	Learning objectives	Suggested teaching activities
3.7 Managing soil erosion	<ul style="list-style-type: none"> • describe and explain strategies to reduce soil erosion <ul style="list-style-type: none"> – terracing – contour ploughing – bunds – windbreaks – maintaining vegetation cover – addition of organic matter to improve soil structure – planting trees, mixed cropping, intercropping and crop rotation 	<p>Learners do experiments in soil erosion. Possible resources: www.lapappadolce.net/en – search ‘soil erosion experiment’ www.juliantrubin.com – search ‘soil erosion experiments’.</p> <p>Show learners images of soil erosion. Ask them to identify strategies for managing soil erosion and explain how these work (F). Possible resource: www.shutterstock.com/ for images of soil erosion strategies.</p> <p>Extension: Study an example where agriculture has had severe environmental consequences, including soil erosion, and strategies for the conservation of the soil. Possible resources: www.dartmoor.gov.uk – search ‘Erosion case study – Haytor’ www.mhhe.com/Enviro-Sci/CaseStudyLibrary/Topic-Based/CaseStudy_DustBowlDays.pdf on the Dust Bowls of 1930s America. www.youtube.com/ – search for ‘1950s documentary on the Dust Bowl’.</p>
3.8 Sustainable agriculture	<ul style="list-style-type: none"> • describe and explain strategies for sustainable agriculture <ul style="list-style-type: none"> – organic fertiliser (crop residue, manure) – managed grazing (livestock rotation) – crop rotation – use of pest resistant and drought resistant varieties of crops – trickle drip irrigation – rainwater harvesting 	<p>Learners could be given the task: ‘You are an elder in your village council and you have been asked to explain to your community how the village’s farming methods could become more sustainable. Prepare a presentation to explain to the village farmers how to adopt sustainable farming practices.’ (I)</p> <p>Possible resources: http://asi.ucdavis.edu/ – search ‘Sustainable agriculture activity guides’ www.leafuk.org/leaf/home.eb – search ‘Simply sustainable soils’.</p> <p>Extension: Learners research how to create a composter for household food waste. http://asi.ucdavis.edu/ – search ‘Sustainable agriculture activity guides – compost’.</p>

Past and specimen examination papers

Specimen papers and mark schemes are available to download at <https://teachers.cie.org.uk>

3.2 Soils for plant growth – Specimen Paper 5014/02 **Q1(g)**

3.5 Impact of agriculture – Specimen Paper 5014/02 **Q1(f)**

4 Water and its management

Syllabus ref	Learning objectives	Suggested teaching activities
4.1 Global water distribution	<ul style="list-style-type: none"> describe the distribution of the Earth's water <ul style="list-style-type: none"> oceans fresh water: ice sheets and glaciers, ground water, atmosphere, lakes and rivers 	<p>Learners are given data of the percentage distribution of the Earth's water and asked to draw bar graphs or divided bar graphs of the data and also to complete a suitable key.</p> <p>Possible resource: www.usgs.gov – search 'Where is Earth's water?'</p>
4.2 The water cycle	<ul style="list-style-type: none"> describe and interpret the water cycle <ul style="list-style-type: none"> precipitation, surface run-off, interception, infiltration, through-flow, ground water flow, transpiration, evaporation and condensation 	<p>Learners view animated diagram of water cycle.</p> <p>Possible resources: http://earthguide.ucsd.edu/ – search 'water cycle' https://pmm.nasa.gov/education/interactive/animated-water-cycle</p> <p>Learners complete a diagram of the water cycle, either by filling in the process gaps or creating their own (F).</p> <p>Possible resource: www.metoffice.gov.uk – search 'Water cycle for kids'.</p> <p>Learners create their own water cycle. https://thewaterproject.org/ – search 'create a mini water cycle'.</p> <p>Quick quiz on the processes in the water cycle, with learners sharing their answers by writing on wipe boards or holding pieces of paper up so the educator can see their answers (F).</p>
4.3 Water supply	<ul style="list-style-type: none"> describe the sources of fresh water used by people <ul style="list-style-type: none"> aquifers, wells, rivers, reservoirs, desalination plants 	<p>Show images of each type of fresh water source. Learners categorise the images into the correct type of source (F).</p> <p>Possible resource for images: www.alamy.com/ or www.shutterstock.com/</p>
4.4 Water usage	<ul style="list-style-type: none"> describe the different ways in which fresh 	<p>Learners view the quantity of water consumed this year at www.worldometers.info – search 'water'.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<p>water can be used</p> <ul style="list-style-type: none"> – domestic, industrial, agricultural 	<p>Learners make a list of all the ways they use water at home. Are there any ways they think they could reduce the amount of water they use (I)?</p> <p>Possible resource: www.gracelinks.org/ – search ‘Indoor water use at home’.</p> <p>Learners look at water uses in the three sectors per country and use the data to produce pie charts or compare two countries’ usage.</p> <p>Possible resource: www.watersaving.com/en/ – search for ‘World map for water’.</p> <p>Extension: Learners read ‘The hidden water in everyday products’ at www.gracelinks.org/. What would their day be like if there was no water (I)?</p>
4.5 Water quality and availability	<ul style="list-style-type: none"> • compare the availability of safe drinking water (potable water) in different parts of the world <ul style="list-style-type: none"> – between water-rich and water-poor regions and the potential for water conflict – access to safe drinking water in urban and rural areas 	<p>Learners view the number of deaths caused by water-related diseases this year and the number of people with no access to a safe drinking water source: www.worldometers.info – search ‘water’.</p> <p>Learners look at a safe drinking water availability map and describe the distribution of non-potable water across the world.</p> <p>Possible resources: http://growingblue.com/ – search ‘The growing blue tool’, which shows data for water availability and water use.</p> <p>Extension: A report by the World Health Organisation and UNICEF, 2015, said that ‘more people in the world have a mobile phone than a toilet’. Learners should use this statement to comment on the availability of potable water around the world (I).</p>
4.6 Multipurpose dam projects	<ul style="list-style-type: none"> • describe and evaluate multipurpose dam projects <ul style="list-style-type: none"> – choice of site – environmental, economic and social impacts – sustainability 	<p>Learners should look at the structure of a dam and label the parts on a diagram.</p> <p>Possible resource: www.klickitatpud.com/ – search ‘Packwood Lake Hydro Project’.</p> <p>Case study: Learners study the impact of a multipurpose dam scheme. Possible resources: www.water-technology.net/ – search ‘The dams of the world technology’ and look for ‘Top 10 biggest dams’. www.arch.mcgill.ca/prof/sijkkes/arch374/winter2001/dbiggs/aswan.html – case study on the Aswan Dam www.internationalrivers.org/ – search for ‘A case study on the Manantali Dam Project (Mali, Mauritania, Senegal)’.</p> <p>Extension: A newspaper report says, ‘Dams are always good for local communities’. To what extent do you agree</p>

Syllabus ref	Learning objectives	Suggested teaching activities
		with this statement (F) ?
4.7 Water pollution and its sources	<ul style="list-style-type: none"> • describe the sources of water pollution <ul style="list-style-type: none"> – domestic waste, including sewage from urban and rural settlements – industrial processes – agricultural practices 	<p>Learners produce a mind map on the sources of water pollution. This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (I).</p> <p>Possible resource: www.water-pollution.org.uk – search ‘types of water pollution’ and ‘causes of water pollution’.</p>
4.8 Impact of water pollution	<ul style="list-style-type: none"> • describe and explain the impact of pollution of fresh water on people and on the environment <ul style="list-style-type: none"> – global inequalities in sewage and water treatment – risk of infectious bacterial diseases, typhoid and cholera – accumulation of toxic substances from industrial processes in lakes and rivers – bioaccumulation of toxic substances in food chains – the effect of acid rain on organisms in rivers and lakes – nutrient enrichment leading to eutrophication 	<p>Learners split into groups to produce a fact sheet on one aspect of safe drinking water and the possible risks of pollution on water. They should then present their findings to the class.</p> <p>Possible resources: www.who.int/en – search ‘factsheets/drinking water’ and choose the ‘Drinking water health topic’ link www.bbc.co.uk/education – search for ‘Water pollution and deforestation’, which has good information on eutrophication and indicator species for the levels of water pollution.</p> <p>Learners create revision cards for the impact of water pollution (F).</p>
4.9 Managing	<ul style="list-style-type: none"> • describe and explain strategies for improving 	<p>Case study: Learners study the causes, impact and management of pollution in a named body of water.</p> <p>Possible resources:</p>

Syllabus ref	Learning objectives	Suggested teaching activities
pollution of fresh water	water quality <ul style="list-style-type: none"> – improved sanitation – treatment of sewage – pollution control and legislation 	Case studies of the Ganga, India: http://www.who.int/water_sanitation_health/resourcesquality/wpccasestudy1.pdf https://healingearth.ijep.net/water/case-study-river-ganges http://www.greenpeace.org.uk – search ‘Hidden consequences: The unseen price of water pollution’.
4.10 Managing water-related disease	<ul style="list-style-type: none"> • describe the life cycle of the malaria parasite • describe and evaluate strategies to control malaria <ul style="list-style-type: none"> – antimalarial drugs, vector control, eradication • describe strategies to control cholera <ul style="list-style-type: none"> – safe drinking water (potable water) supply – boiling and chlorination 	Learners annotate a malarial parasite life cycle diagram. Possible resources: https://www.cdc.gov/ – search ‘malaria’ http://www.mmv.org/sites/default/files/uploads/images/malaria_and_medicines/posters_parasitelife.pdf http://www.who.int/malaria/data/en/ – search ‘Malaria’. Learners study maps of countries susceptible to malaria and describe the global distribution of malaria. Possible resources: http://www.who.int/malaria/data/en – search ‘World Malaria Report 2016’ http://www.who.int/malaria/data/en – search ‘malaria: country profiles’. Learners watch a WHO video clip on ‘Cholera – questions and answers’: http://www.who.int/mediacentre/factsheets/fs107/en/ Learners produce a health leaflet to advise people on how to avoid cholera (I). Extension: Approximately 10,000 people were killed by an outbreak of cholera following the 2010 Haiti earthquake. Read a news article about the causes of the outbreak, concerns about it and solutions to dealing with it. Summarise the report in 150 words or less. Possible resource: http://www.bbc.co.uk/ – search ‘Haiti after Hurricane Matthew: can a cholera epidemic be avoided?’

Past and specimen examination papers

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4.10 Managing water-related disease – Specimen Paper 5014/01 **Q3**

5 Oceans and fisheries

Syllabus ref	Learning objectives	Suggested teaching activities
5.1 Oceans as a resource	<ul style="list-style-type: none"> • outline the resource potential of the oceans <ul style="list-style-type: none"> – food, chemicals, building materials – wave/tidal energy – tourism – transport – potential for safe drinking water 	<p>Learners should brainstorm ideas for the resource potential of the oceans. The class can be split into groups to produce a PowerPoint presentation on an aspect of the oceans as a resource (I).</p> <p>Possible resources: www.oceanresource.co.uk/ www.oceansatlas.org/uses/en/</p>
5.2 World fisheries	<ul style="list-style-type: none"> • outline the distribution of major ocean currents <ul style="list-style-type: none"> – identify the position of major cold and warm ocean currents (names are not required) • explain the distribution of major marine fish populations <ul style="list-style-type: none"> – shallow water of continental shelves – cold and warm ocean currents • describe the El Niño Southern Oscillation (ENSO) phenomenon and its effects on fisheries along the Pacific coast of South 	<p>Learners use a world map to identify the world's major ocean fisheries and also identify the major ocean currents (I). The relationship between the major ocean fisheries and the presence of continental shelves and ocean currents can then be examined. This work could be presented as a large poster.</p> <p>Possible resources: www.weather.gov/srh/ – search 'jetstream ocean currents' http://arizonaenergy.org/Home/nea-esco_page.htm – search 'Water energy/The major ocean currents' www.seaaroundus.org/ – search for interactive graphs and maps www.theglobaleducationproject.org/earth/fisheries-and-aquaculture.php</p> <p>Watch animation of the ENSO phenomenon. Possible resources: http://oceanservice.noaa.gov/ – search 'ninonina' www.pmel.noaa.gov/el_nino/fish-distribution</p> <p>Learners produce 'true or false' quiz cards on the ENSO phenomenon (F).</p> <p>Learners look at the current status of the ENSO phenomenon and comment on when the next ENSO event is predicted.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	America	<p>Possible resource: www.climate.gov/ – search ‘El Nino status’.</p> <p>Extension: Imagine you catch fish for a living. Write a diary entry during an El Niño year and explain how your fishing has been affected (I).</p> <p>Possible resource: www.climate.gov/ – search ‘What is El Nino in a nutshell?’</p>
5.3 Impact of exploitation of the oceans	<ul style="list-style-type: none"> • describe and explain the impact of exploitation of fisheries <ul style="list-style-type: none"> – overfishing of marine species – effect on target and bycatch species • describe how farming of marine species reduces the exploitation of fisheries 	<p>Introduce the topic by reading an article on the exploitation of fisheries or watch a short clip on overfishing.</p> <p>Possible resources:</p> <p>Articles: www.bbc.com/future/story/20120920-are-we-running-out-of-fish www.ft.com/ – search ‘World fish stocks declining faster than feared’ http://wwf.panda.org/ – search ‘unsustainable fishing’.</p> <p>Video clips: www.youtube.com/ – search ‘will the ocean run out of fish?’ www.bbc.co.uk/education – search ‘Why have fish stocks decreased in the North Sea?’</p> <p>Look at data for fish catches. Learners could describe the trend in over-exploited stocks or top producer countries based on catch or how the world fish catch has changed over 50 years.</p> <p>Possible resources: http://worldoceanreview.com/en/ – search ‘State of fisheries worldwide’ www.earth-policy.org/indicators/C55/fish_catch_2002 – search ‘Eco-economy indicators/Fish catch’.</p> <p>Learners create their own marine food chain that includes fish. What will happen to the food chain if the fish population decreases because of overfishing?</p> <p>Watch a YouTube clip on fish farming as an introduction. www.youtube.com/ – search ‘indoor fish farming in Bangladesh’ or ‘Fish farming in California’ or ‘How it’s made: fish farming’ (the latter clip looks at how fish farmers use artificial fertilisation on their farms).</p> <p>Extension: Learners write a short report on the pros and cons of fish farming (I) by studying an example of farming of a marine species, including the source of food, pollution from waste and impact on the natural habitat.</p> <p>Possible resource: http://advocacy.britannica.com/blog/advocacy/ – search ‘pros and cons of fish farming’.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
5.4 Management of the harvesting of marine species	<ul style="list-style-type: none"> • describe, explain and evaluate strategies for management of the harvesting of marine species <ul style="list-style-type: none"> – net types and mesh size – other species-specific methods: pole and line – quotas – closed seasons – protected areas and reserves – conservation laws – international agreements (implementation and monitoring) 	<p>Learners watch a short video clip on sustainable fish stocks. Possible resources: www.msc.org/healthy-oceans/sustainable-fishing – search ‘Ensuring sustainable fish stocks’ and ‘What is the MSC?’ www.youtube.com/ – search ‘Partnering for sustainable fishing: Gambia red and black sole fishery’ or ‘Celebrating Fiji Albacore Tuna, an MSC certified sustainable fishery’.</p> <p>Learners discuss the question: ‘How can the authorities prevent unsustainable fishing activities?’ Each group should argue why their strategy is the most effective. Possible resources: www.bbc.co.uk/education – search ‘The impact of fishing in the Philippines’ www.sustainablefish.org/ www.msc.org/healthy-oceans/sustainable-fishing – search ‘Combating illegal fishing’.</p> <p>Case study: Learners draw on their study of topic 5 to produce a report on the resource potential, exploitation, impact and management of a marine fishery of their choice.</p> <p>Extension: Learners explain why the sustainable management of harvesting marine species is a global problem (I).</p>
Past and specimen examination papers		
<p>Specimen papers and mark schemes are available to download at https://teachers.cie.org.uk</p> <p>5.3 Impact of exploitation of the oceans – Specimen 5014/01 Q9(a) and (b) 5.3 Impact of exploitation of the oceans and 5.4 Management of the harvesting of marine species – Specimen 5014/02 Q2(a) and (c) 5.4 Management of the harvesting of marine species – Specimen 5014/01 Q9(c)</p>		

6 Managing natural hazards

Syllabus ref	Learning objectives	Suggested teaching
6.1 Earthquakes and volcanoes	<ul style="list-style-type: none"> • describe the structure of the Earth <ul style="list-style-type: none"> – crust, mantle and core • describe and explain the distribution and causes of earthquakes and volcanoes <ul style="list-style-type: none"> – global pattern and structure of plates – plate movement: constructive, destructive and conservative • understand magnitude and the Richter scale 	<p>Learners watch an introductory video clip on the structure of the Earth. Possible resource: www.youtube.com/ – search ‘Layers of the Earth’ by fozzils1, which sets the topic to a ‘layers of the Earth’ song.</p> <p>Introduce the topic by looking at clips or photographs of volcanoes. Possible resource: www.volcanodiscovery.com/ – search ‘live volcano webcams’.</p> <p>Learners create their own earthquakes and volcanoes. Possible resources: Earthquakes: www.geo.mtu.edu/UPSeis/why.html www.iris.edu/hq/ – search ‘How can you model earthquakes in the classroom?’</p> <p>Volcanoes: http://www.sciencekids.co.nz/experiments/vinegarvolcano.html</p> <p>Learners look at a map of current active volcano locations and describe their distribution. Possible resource: www.volcanodiscovery.com/ – search ‘volcano map’.</p> <p>Learners label plate movement diagrams of constructive, destructive and conservative plates. http://earthquake.usgs.gov/ – search ‘Learn’.</p> <p>Learners research the meaning of ‘magnitude’ and ‘Richter scale’ (I). http://earthquake.usgs.gov/ – search ‘Measuring the size of an earthquake’.</p> <p>Learners look at data for significant earthquakes that have been recorded over the past 30 days. Use a map with plate boundaries shown to plot the location of these earthquakes. Possible resource: http://earthquake.usgs.gov – click on one of the events on the ‘Latest earthquakes’ map and then click on the event title at the bottom left of the map to see more information. Finally, click on the ‘Regional information’ map for a link to a ‘Map of tectonic summary region’.</p>

Syllabus ref	Learning objectives	Suggested teaching
		<p>Extension: Learners create a fully labelled cross-section of the Earth, either a poster or a model (F)(I).</p> <p>Extension: Learners look at the difference between magnitude and intensity of earthquakes. Learners read a description of an earthquake experience and have to determine the intensity of the earthquake. https://earthquake.usgs.gov/learn/topics/mag-intensity/ - intensity</p>
6.2 Tropical cyclones	<ul style="list-style-type: none"> • describe and explain the distribution and causes of tropical cyclones (storms, hurricanes and typhoons) <ul style="list-style-type: none"> – between 5° and 20° north and south of the Equator, ocean surface temperature of at least 27°C and ocean depth of at least 60m 	<p>Learners research what causes a cyclone and produce an information factsheet for primary school students (I).</p> <p>Possible resource: www.ga.gov.au/ – search ‘what causes a cyclone?’</p> <p>Create your own ‘virtual’ hurricane. Possible resource: www.nhc.noaa.gov/outreach/games/canelab.htm</p> <p>Change the course of a ‘virtual’ hurricane by changing conditions. www.nhc.noaa.gov/outreach/games/movncane.htm</p>
6.3 Flooding	<ul style="list-style-type: none"> • describe and explain the causes of flooding <ul style="list-style-type: none"> – heavy rainfall, prolonged rainfall, snowmelt – land relief – saturated soil, compacted soil – deforestation, cultivation and urbanisation – storm surges, tsunamis – rise in sea level through climate change 	<p>Watch a YouTube clip on flash flooding. www.youtube.com/ – search ‘Boscastle, flash flood’, which hit a small town in Cornwall, UK, in 2004. www.bbc.co.uk/news – search ‘17/08/2004’, click on ‘BBC Six O’Clock News’ and then click on the clip ‘Why did Boscastle flood?’</p> <p>Watch a news report on the Japanese earthquake that caused the devastating tsunami in 2011. www.bbc.co.uk/news – search ‘Japan earthquake: tsunami hits north-east’.</p> <p>Learners produce a mind map on the possible causes of flooding. This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (F).</p> <p>Possible resource for up-to-date flooding issues: http://floodlist.com/</p>

6.4 Drought	<ul style="list-style-type: none"> describe and explain the causes of drought <ul style="list-style-type: none"> lack of rain caused by prolonged high pressure effect of El Niño Southern Oscillation (ENSO) and La Niña on ocean temperatures and evaporation effect of climate change 	<p>In groups, learners create a quiz on the causes of drought (F) and then swop their quiz with another group.</p> <p>Possible resources: http://drought.unl.edu/ http://weather.about.com/od/drought/f/droughts.htm www.weatheronline.co.uk/reports/wxfacts/Drought.htm www.bbc.co.uk/education – search ‘Human activities causing drought’ http://drought.unl.edu/ – search ‘ENSO and forecasting’.</p>
6.5 The impacts of natural hazards	<ul style="list-style-type: none"> describe and explain the impacts of natural hazards on people and the environment <ul style="list-style-type: none"> tectonic events: damage to buildings and infrastructure, fire, tsunamis, landslides, loss of farmland and habitats, water-related disease, loss of life, trauma, financial losses tropical cyclones: flooding, loss of life, financial losses, damage to buildings and infrastructure, loss of crops and habitats, water-related disease flooding: loss of life, loss of livestock, loss of crops, damage to buildings and 	<p>Learners compare two earthquakes and the impact they had on people and the environment. http://earthquake.usgs.gov – search ‘A comparison of two Bay Area earthquakes: 1989 v. 1906’.</p> <p>Learners summarise the impact of droughts for a community. www.bbc.co.uk/education – search ‘Living without water in the Sahara Desert’.</p> <p>Learners compare the death rates from cyclones in different countries and suggest reasons for these differences. www.who.int/bulletin/volumes/90/2/11-088302/en/ features data on death rates from Bangladesh and compares the death rate with other countries.</p> <p>Learners should create mind maps for the impact of each natural hazard. This can be achieved on paper or electronically on a free app, such as http://mindmapfree.com/ or www.edrawsoft.com/freemind.php or other suitable software or app (F).</p> <p>Extension: Write a diary entry entitled ‘The day after the floods’.</p> <p>Possible resource: http://gideonmendel.com/ – click on ‘Drowning world’ and then on ‘The water chapters’ or ‘Floodlines’. Watch Gideon Mendel’s ‘The water chapters’ video or ‘Floodlines’, which feature snapshots of communities from around the world and people affected by flooding.</p>

	<p>infrastructure, contamination of drinking water supplies, water-related disease, financial losses</p> <ul style="list-style-type: none"> – drought: death of organisms, water sources dry up, decline in crop yields, starvation, increased soil erosion, desertification, decrease in air quality, increased risk of wildfires 	
<p>6.6 Managing the impacts of natural hazards</p>	<ul style="list-style-type: none"> • describe and evaluate the strategies for managing the impacts of natural hazards before, during and after an event <ul style="list-style-type: none"> – tectonic: monitoring and warning, land use zoning, structure of buildings, disaster preparation (plans, drills, emergency supplies and emergency rescue teams), evacuation, rebuilding of damaged areas, international aid – tropical cyclones: monitoring and warning, structure of buildings, disaster preparation 	<p>Case study: Compare and contrast the strategies for managing the impacts of tectonic events between a named more economically developed country (MEDC) and a named less economically developed country (LEDC).</p> <p>Possible resource: http://nationalgeographic.org/ – search ‘natural disasters’ for an overview of the topic.</p> <p>Learners select either a tropical storm, flood or drought and summarise the possible strategies that could be used to manage the impact of this natural disaster.</p> <p>Extension: Learners could extend this summary by producing a report on how successful they think these strategies were for a named natural disaster (I).</p>

	<p>(plans, drills, emergency supplies and emergency rescue teams), evacuation, emergency shelters, rebuilding of damaged areas, international aid</p> <ul style="list-style-type: none"> – flooding: monitoring and warning, use of storm hydrographs (run-off, through-flow, ground water flow), shelters, rescue, rebuilding of damaged areas, flood management techniques – drought: monitoring, emergency water supplies, water conservation, increase water supply (dams and reservoirs, wells, use of aquifers, water transfer, desalination, rainwater harvesting), international aid 	
6.7 Opportunities presented by natural hazards	<ul style="list-style-type: none"> • describe and explain the opportunities presented by natural hazards to people <ul style="list-style-type: none"> – flooding: deposition of silt on farmland 	<p>Introduce the benefits of living near a volcano by watching a short video clip. Possible resource: www.youtube.com/ – search ‘What’s it like living near a volcano?’ (New China TV) or ‘Mexico’s biodiversity: “living near the Tacaná”’ (DW).</p> <p>Introduce the benefits of living near a volcano by watching a short video clip.</p>

	<ul style="list-style-type: none"> – volcanoes: fertile soils, extraction of minerals, geothermal energy resources 	<p>Possible resource: www.youtube.com/ – search ‘Fertility of the Nile – Nile – BBC’ (BBC Earth).</p> <p>Learners could present the case ‘for and against’ flooding and living near a volcano and link topic 6.7 with topic 6.5 (I).</p> <p>Possible resources: Flooding http://nationalgeographic.org/encyclopedia/silt/ – search ‘silt’ www.worldwildlife.org/ecoregions/pa0904</p> <p>Volcanoes www.geography-site.co.uk/ – click on ‘Physical/Volcanoes and volcanics’ and ‘Why live near a volcano?’</p>
Past and specimen examination papers		
<p>Specimen papers and mark schemes are available to download at https://teachers.cie.org.uk</p> <p>6.1 Earthquakes and volcanoes – Specimen 5014/01 Q5(a) and (b) 6.2 Tropical cyclones and 6.6 Managing the impacts of natural hazards – Specimen 5014/01 Q6(a) and (b) 6.3 Flooding and 6.7 Opportunities presented by natural hazards – Specimen 5014/02 Q1(b)</p>		

7 The atmosphere and human activities

Syllabus ref	Learning objectives	Suggested teaching activities
7.1 The atmosphere	<ul style="list-style-type: none"> • describe the structure and composition of the atmosphere <ul style="list-style-type: none"> – troposphere, stratosphere, mesosphere, thermosphere – nitrogen, oxygen, carbon dioxide, argon, water vapour – the ozone layer • describe the natural greenhouse effect 	<p>Watch Felix Baumgartner's space jump from an altitude of 39.045m. Possible resource: www.youtube.com/ – search 'Felix Baumgartner stratosphere jump'.</p> <p>Learners prepare a poster on the structure of the atmosphere that includes the names of the different regions, their heights and temperature trend. The chemical composition should be drawn as a pie chart with a suitable key. www.geocoops.com/structure-of-the-atmosphere.html https://climate.ncsu.edu/edu/Structure https://climate.ncsu.edu/edu/Composition</p> <p>Learners research the natural greenhouse effect and answer the question: 'What would happen to the Earth without the natural greenhouse effect?' They could present their findings as a short report (I). Possible resource: www.bgs.ac.uk/discoveringGeology/climateChange/CCS/greenhouseEffect.html There are lots of good images comparing the natural and man-made greenhouse effect, which it may be useful to introduce at this point, such as at www.environnet.in.th/en/archives/1241</p>
7.2 Atmospheric pollution and its causes	<ul style="list-style-type: none"> • describe and explain the causes of atmospheric pollution, with reference to: <ul style="list-style-type: none"> – smog – acid rain – ozone layer depletion – enhanced greenhouse effect ▪ smog: volatile organic compounds 	<p>Watch a video clip on smog. www.youtube.com/ – search 'What can Beijing learn from Los Angeles pollution problem?'</p> <p>Learners look at data about the Singapore Haze. They could look at historical and current data and use the recommended exposure charts to work out the quality of the air. Possible resource: www.haze.gov.sg/</p> <p>Watch a video clip on the ozone layer and ozone layer depletion. A common misconception is that global warming and ozone depletion are caused by the same source. Learners often find the concept of stratosphere 'good' ozone and low-level 'bad' ozone confusing. This is a good opportunity to address both misconceptions. Possible resources:</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<p>(from industrial processes), vehicle emissions, impact of temperature inversion</p> <ul style="list-style-type: none"> ▪ acid rain: sulfur dioxide and oxides of nitrogen ▪ ozone layer depletion: action of chlorofluorocarbons (CFCs) ▪ enhanced greenhouse effect: greenhouse gases (carbon dioxide, water vapour and methane) 	<p>www.youtube.com/ – search ‘The Antarctic ozone hole – from discovery to recovery, a scientific journey’ (UN Environment) and ‘Ozzy Ozone’ (TVE Asia Pacific), an animated cartoon of ozone depletion.</p> <p>www.epa.gov/ – search ‘ozone hole’.</p> <p>Look at data that show the extent of ozone depletion. Learners should examine data that show both concentration of ozone and areas of depleted ozone; both data types are often referred to as an ozone hole.</p> <p>www.esrl.noaa.gov/ – search ‘South Pole ozone hole’</p> <p>www.theozonehole.com/</p> <p>https://vimeo.com/104321114 – ‘The Antarctic ozone hole’ video by Patrick Cullis.</p> <p>Look at data that show the increase in carbon dioxide levels over the past 100 years and increase in global temperatures.</p> <p>www.ncdc.noaa.gov/ – search ‘Temperature change and carbon dioxide change’.</p> <p>https://www.science.org.au/curious/earth-environment/enhanced-greenhouse-effect</p>
7.3 Impact of atmospheric pollution	<ul style="list-style-type: none"> • describe and explain the impact of atmospheric pollution <ul style="list-style-type: none"> – smog: effects on human health – acid rain: acidification of bodies of water, effects on fish populations, damage to crops and vegetation, damage to buildings – ozone depletion: higher levels of ultraviolet radiation reaching the Earth’s surface, increased 	<p>For each atmospheric pollution type, learners should produce an A4 page ‘Key Facts’ summary sheet on the impact of each atmospheric pollution type (F).</p> <p>Smog: www.youtube.com/ – search ‘The Great Smog of 1952 in London’ or ‘Smog in China: Beijing is extremely uncomfortable’ (Guardian Explainers).</p> <p>Acid rain: https://www.epa.gov/acidrain Learners do acid rain experiments. http://www.scienceforkidsclub.com/acid-rain-experiment.html</p> <p>Ozone depletion: Watch the ‘slip slop slap’ cartoon that is used in Australia to encourage people to avoid sun exposure. www.sunsmart.com.au/ – search ‘Slip! Stop! Slap! Original SunSmart campaign’.</p> <p>Climate change: http://climate.nasa.gov/effects/ www.metoffice.gov.uk/ – search ‘what is climate change?’ and ‘Impacts of climate change’.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<p>rates of skin cancer and cataracts, damage to vegetation</p> <ul style="list-style-type: none"> – climate change: melting of ice sheets, glaciers and permafrost; rise of sea-level; flooding and loss of land; forced migration 	
7.4 Managing atmospheric pollution	<ul style="list-style-type: none"> • describe and explain the strategies used by individuals, governments and the international community to reduce the effects of atmospheric pollution <ul style="list-style-type: none"> – reduction of carbon footprint – reduced use of fossil fuels – energy efficiency – carbon capture and storage – transport policies – international agreement and policies – CFC replacement – catalytic converters – flue-gas desulfurisation – taxation – reforestation and 	<p>Learners think of as many different ways they can to reduce their carbon footprint and they suggest one way they will try to reduce their carbon footprint over the course of a week (I).</p> <p>Possible resource: https://carbonfund.org – search ‘reduce’.</p> <p>Learners could write a ‘day in the life without the use of fossil fuels’. How would this affect their daily lives?</p> <p>Learners could write a quiz on carbon capture and storage, which they ‘test’ each other on.</p> <p>Possible resource: www.globalccsinstitute.com/ – search ‘understanding carbon capture and storage’.</p> <p>Learners research the top five most influential international agreements and policies that tackle atmospheric pollution and compare their five choices as a group.</p> <p>Invite the chemistry teacher to give a short talk on CFCs and their replacements. The lesson could cover why CFCs were a problem and how their replacements are considered less harmful to the ozone layer.</p> <p>Possible resource: http://theozonhole.com/cfc.htm</p> <p>Learners produce a flow diagram of how a catalytic converter works.</p> <p>Possible resource: www.gcsescience.com/index.html – search ‘catalytic converters’.</p> <p>Learners summarise why removing sulfur dioxide from exhaust gases of fossil fuel power plants is needed.</p> <p>Possible resource: http://powerplantstechnology.blogspot.co.uk/ – search ‘Flue gas desulfurization’.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	afforestation	<p>Learners explain the differences between reforestation and afforestation. Possible resources: www.differencebetween.com/difference-between-afforestation-and-reforestation/ www.earthtimes.org/encyclopaedia/environmental-issues/deforestation/</p> <p>Extension: Learners answer the question: ‘Why is managing atmospheric pollution a global problem?’ Extension: Learners could research alternative methods of transport that avoid using fossil fuels.</p>
Past and specimen examination papers		
<p>Specimen papers and mark schemes are available to download at https://teachers.cie.org.uk</p> <p>7.2 Atmospheric pollution and its causes – Specimen 5014/01 Q1(a) 7.3 Impact of atmospheric pollution – Specimen 5014/01 Q1(b) 7.4 Managing atmospheric pollution – Specimen 5014/01 Q1(c)</p>		

8 Human population

Syllabus ref	Learning objectives	Suggested teaching activities
8.1 Human population distribution and density	<ul style="list-style-type: none"> identify where people live in the world <ul style="list-style-type: none"> – population density – population distribution 	<p>Learners look at a world population clock and population by country. Plot a bar graph for 10 countries, including the learner's own country. A double y-axis could be used and area of country could be plotted next to population. Learners could comment on the two sets of data.</p> <p>Possible resource: www.worldometers.info/ – see 'Current World Population' and click on the '+' to show more information. You can find 'population by country' by clicking on the 'World Population' link and then choosing 'Population by country' in the World Population Sections area.</p> <p>Learners view a world map of population density and describe the data.</p> <p>Possible resource: Internet search for 'world population density'.</p>
8.2 Changes in population size	<ul style="list-style-type: none"> describe and explain the growth curve of populations <ul style="list-style-type: none"> – lag, exponential (log), carrying capacity describe and explain the changes in human population <ul style="list-style-type: none"> – birth and death 	<p>Learners do a practical investigation by observing a population increase in microbes. Consider asking a biology teacher to support the teaching of this lesson. Before doing any experiment in handling microbial material you must have carried out a risk assessment in accordance with your local rules and regulations.</p> <p>Possible resource for the experiment and links to safe handling of microbes: www.nuffieldfoundation.org/ – search 'Microbes all around us'.</p> <p>Learners make a glossary of key population terms. www.prb.org/ – click on 'Publications/Lesson plans/Glossary of demographic terms'.</p> <p>Learners label a typical population curve.</p> <p>Possible resource: www.s-cool.co.uk/ – search 'populations'.</p> <p>Watch a short YouTube video on world population growth through time by the American Museum of Natural History. www.youtube.com/ – search 'Human population through time'.</p> <p>Learners produce 'true or false' cards on the factors affecting population density (F).</p> <p>Possible resource: www.bbc.co.uk/education/levels/z98jmp3 – click on 'Geography/GCSE Geography/Human geography/Population and migration/Population distribution and density'.</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<p>rates</p> <ul style="list-style-type: none"> – factors affecting birth and death rates – factors affecting migration 	<p>Case study: Learners investigate the population of a country of species. Possible resources: Population growth in Mumbai: www.coolgeography.co.uk/ – click on ‘GCSE/Urban issues and challenges/Mumbai, causes of growth’ The population of the American bison: www.nature.com/scitable/knowledge – click on ‘Population ecology/An introduction to population growth’.</p> <p>Extension: Learners find out about the ‘Gaia hypothesis’ (I). Possible resources: www.gaiatheory.org/overview/ Watch an interview of James Lovelock, who proposed the Gaia hypothesis: www.youtube.com/ – search ‘Gaia hypothesis – James Lovelock’ Read <i>Gaia: A New Look at Life on Earth</i> by James Lovelock.</p>
8.3 Population structure	<ul style="list-style-type: none"> • describe population structure in MEDCs and LEDCs <ul style="list-style-type: none"> – population pyramids 	<p>Learners look at population pyramids for MEDCs and LEDCs and interpret the data. Possible resources: www.populationpyramid.net/ www.cia.gov/library/publications/the-world-factbook/ – click on a country and click on ‘People and society’, then scroll to view the population pyramid.</p>
8.4 Managing human population size	<ul style="list-style-type: none"> • evaluate strategies for managing human population size <ul style="list-style-type: none"> – family planning – improved health and education – national population policies – pronatalist or antinatalist 	<p>Watch a news report on Lagos that highlights some of the problems that growing populations can cause. www.youtube.com/ – search ‘[Channel 4 News] Population explosion causes poverty crisis’.</p> <p>Case study: Learners investigate how a country is managing its population size. Possible resources: www.worldwatch.org/ – search ‘Nine population strategies’ www.japanfs.org/en/news/archives/news_id034953.html – search ‘depopulation of society in Japan’ www.bbc.co.uk/ – search ‘How Ethiopia slowed its population growth’ http://geography.about.com/ – search ‘China’s one child policy’.</p> <p>Learners produce a report on the success of a named country’s population strategies (I). It should include:</p> <ul style="list-style-type: none"> • the population pyramid and what this tells us about the country’s population • what strategies have been used to manage the country’s population size • how successful these strategies have been • suggestion for alternative strategies the country could use. <p>Extension: Read <i>The Limits to Growth: The 30-year Update</i> by Donella Meadows, Jorgen Randers and Dennis Meadows (I).</p>

Past and specimen examination papers

Specimen papers and mark schemes are available to download at <https://teachers.cie.org.uk>

8.1 Human population distribution and density – Specimen 5014/01 **Q8(c)(i)** and Specimen 5014/02 **Q1(a)(i)**

8.2 Changes in population size – Specimen 5014/01 **Q8(a), (b)** and **(c)(ii)**

9 Natural ecosystems and human activities

Syllabus ref	Learning objectives	Suggested teaching activities
9.1 Ecosystems	<ul style="list-style-type: none"> • define the terms ecosystem, population, community, habitat and niche • describe the biotic (living) and abiotic (non-living) components of an ecosystem <ul style="list-style-type: none"> – biotic: producers, primary, secondary and tertiary consumers, decomposers – abiotic: temperature, humidity, water, oxygen, salinity, light, pH • describe biotic interactions <ul style="list-style-type: none"> – competition, predation and pollination • describe the process of photosynthesis <ul style="list-style-type: none"> – state the word equation and the importance of chlorophyll • describe the process of respiration 	<p>Create a 'Tarsia jigsaw' for learners on the key terms in this topic (F). Note: Tarsia is a free download available at www.ideaseducation.co.uk/resources/Tarsia-guide.pdf</p> <p>Play an 'ecosystem game'. Possible resources: http://gamequarium.com/ecology.html has a wide variety of possible games and activities. http://illinois.pbslearningmedia.org/ – search 'Feed the dingo'.</p> <p>Learners create a PowerPoint presentation on the components of an ecosystem (I). Possible resource: http://sciencebitz.com/ – search 'biotic and abiotic'.</p> <p>Watch a short clip on photosynthesis and respiration. Possible resources: www.bbc.co.uk/education/subjects – search 'photosynthesis and respiration'. www.saps.org.uk/ – search 'Animation – respiration and photosynthesis'.</p> <p>Learners produce a poster on the two processes of photosynthesis and respiration (F).</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<ul style="list-style-type: none"> describe energy flow using food chains, food webs and trophic levels describe and explain ecological pyramids based on numbers and energy describe the carbon cycle 	<p>Learners create their own online food web. www.scholastic.com/teachers/student_activities – search ‘Build a food web: an endangered ecosystems activity’ (I).</p> <p>Give learners examples of food webs and food chains. They should identify the trophic levels and the producers and consumers and any decomposers (F). Possible resource: Internet search for ‘examples of food webs’ or ‘food chains’.</p> <p>Learners look at pyramids of number, biomass and energy and interpret the data. They should label the trophic levels and identify the levelled producers and consumers (F). Possible resources: www.scienceaid.co.uk/biology/ecology/ – search ‘food chains and energy’ www.rspb.org.uk/ – search ‘pyramids of numbers’.</p> <p>Learners label a carbon cycle diagram or create their own (I)(F). Possible resources: https://scied.ucar.edu/ – search ‘carbon cycle’ www.esrl.noaa.gov/ – search ‘carbon cycle’.</p>
9.2 Ecosystems under threat	<ul style="list-style-type: none"> describe and explain causes and impacts of habitat loss <ul style="list-style-type: none"> causes: the drainage of wetlands, intensive agricultural practices, deforestation impacts: loss of biodiversity and genetic depletion, extinction 	<p>Watch a YouTube clip on wetland drainage. www.youtube.com/ – search: ‘More than water is lost with drained wetlands’ (Ducks unlimited Canada) ‘Drainage story of wetland’ (Melbourne Water) ‘Bill Nye The Science Guy: Wetlands’.</p>
9.3 Deforestation	<ul style="list-style-type: none"> describe and explain the causes and impacts of deforestation 	<p>Learners look at a map of deforestation and describe the data. Possible resources: www.globalforestwatch.org/ – search ‘GFW interactive map’ www.livescience.com/ – search ‘Vanishing forests: New Map Details Global Deforestation’ and click on</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<ul style="list-style-type: none"> – causes: timber extraction and logging, subsistence and commercial farming, roads and settlements, rock and mineral extraction – impacts: habitat loss, soil erosion and desertification, climate change, loss of biodiversity and genetic depletion 	<p>‘interactive map’.</p> <p>Learners look at images of deforestation. www.nationalgeographic.com/environment/ – search ‘Photo gallery: rain forest deforestation’. www.shutterstock.com/search/deforestation</p> <p>In groups, learners discuss the possible impacts of deforestation. Each group then report their ideas to the rest of the class (I).</p> <p>Possible resource: www.worldwildlife.org/threats/deforestation</p> <p>Case study: Look at the causes and impacts of deforestation in a named area. Extension: Watch a video clip on Palau about preserving coral reefs. http://illinois.pbslearningmedia.org/ – search ‘Coral reefs: feeding and protecting us Nature works everywhere’. Summarise the impact of coral reef destruction (I).</p>
9.4 Managing forests	<ul style="list-style-type: none"> • describe and explain the need for the sustainable management of forests <ul style="list-style-type: none"> – growing forests act as carbon sinks and mature forests act as carbon stores – role in water cycle – prevention of soil erosion – biodiversity as a genetic resource – food, medicine and industrial raw materials – ecotourism 	<p>Look at a country or region’s approach to sustainable management of forests. Possible resource: www.bbc.co.uk/education – search ‘Sustainable management of the forest’ and ‘Sustainable planting and industry in a forest environment’ for a look at the Karkonosze National Park in Poland.</p> <p>Learners do one of four activities based on sustainable forests. https://www.forestryengland.uk/article/forests-the-future-climate-change-ks3</p> <p>Extension: Learners design an advertising brochure for a forest ecotourism company, which explains how the company is eco-friendly.</p>
9.5 Measuring and	<ul style="list-style-type: none"> • describe and evaluate methods for estimating biodiversity 	<p>Learners do practical experiments in biodiversity.</p> <p>Pitfall traps:</p>

Syllabus ref	Learning objectives	Suggested teaching activities
managing biodiversity	<ul style="list-style-type: none"> – pitfall traps, pooters, quadrats and transects – random and systematic sampling <ul style="list-style-type: none"> • apply sampling techniques to unfamiliar situations • evaluate national and international strategies for conserving the biodiversity and genetic resources of natural ecosystems <ul style="list-style-type: none"> – sustainable harvesting of wild plant and animal species – sustainable forestry/agroforestry – national parks, wildlife/ecological reserves and corridors 	<p>www.eiu.edu/index.php – search ‘Schoolyard pitfall trap experiment’.</p> <p>Pooters: www.amentsoc.org/ – search ‘Make a pooter activity for kids’.</p> <p>Quadrats: www.saps.org.uk/ – search ‘Questions about quadrats’. www.youtube.com/ – search ‘quadrat sampling’.</p> <p>Transects: www.saps.org.uk/ – search ‘Ecology practical 2: The distribution of species across a footpath’.</p> <p>Random and systematic sampling: www.rgs.org/HomePage.htm – search ‘sampling techniques’ www.nuffieldfoundation.org/ – search ‘Biodiversity in your backyard!’ www.saps.org.uk/ – search ‘Ecology practical 1: Measuring abundance and random sampling’ www.saps.org.uk/ – search ‘Ecology practical 3: abundance and random sampling at Waun Las Nature Reserve, Wales’.</p> <p>Learners research one national or international strategy and present their findings to the class (I) and produce a quick quiz for other learners (F).</p> <p>Each learner should produce an A4 summary of each strategy.</p> <p>Possible resources: Sustainable harvesting: http://onnaturemagazine.com/sustainable-harvesting www.forestharvest.org.uk/Sustainable.htm www.iucn.org/ – search sustainable harvesting.</p> <p>National parks: www.npansw.org.au/index.php/campaigns/ – click on ‘National parks, national priority’ and then click on ‘Why are national parks important?’</p>

Syllabus ref	Learning objectives	Suggested teaching activities
	<ul style="list-style-type: none"> – extractive reserves – world biosphere reserves – seed banks – role of zoos and captive breeding – sustainable tourism and ecotourism 	<p>http://falconwoodgcsegeography.weebly.com/ – search ‘A UK national park case study’.</p> <p>http://wwf.panda.org/ – search ‘national parks’.</p> <p>Extractive reserves: http://archive.unu.edu/unupress/unupbooks/80906e/80906E07.htm http://cmsdata.iucn.org/downloads/rubber_story.pdf on the Chico Mendes Extractive Reserve</p> <p>World biosphere reserves: http://wwf.panda.org/ – search ‘biosphere reserves’. http://www.unesco-mab.org.uk/uk-reserves.html https://www.niagaraescarpment.org/index.php?option=com_content&view=article&id=6&Itemid=28</p> <p>Seed banks: www.bgci.org/resources/Seedbanks/</p> <p>Zoos and captive breeding: http://wwf.panda.org/ – search ‘captive breeding’.</p> <p>Ecotourism: Watch a video clip on sustainable interactions with sharks. http://illinois.pbslearningmedia.org/ – search ‘Osprey Reef shark feed: life on the reef’.</p> <p>Case study: Look at the conservation of a named species or of a named biosphere reserve.</p>
Past and specimen examination papers		
<p>Specimen papers and mark schemes are available to download at https://teachers.cie.org.uk</p> <p>9.1 Ecosystems – Specimen 5014/01 Q4(a) and (b) 9.5 Measuring and managing biodiversity – Specimen 5014/01 Q4(c)</p>		

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