

SYLLABUS

Cambridge O Level
Environmental Management
5014

For examination in June and November 2019, 2020 and 2021

Please check the syllabus page at www.cie.org.uk/olevel to see if this syllabus is available in your administrative zone.

What has changed in Cambridge O Level Environmental Management 5014 for 2019, 2020 and 2021?

The syllabus has been revised for first examination in 2019. You are strongly advised to read the whole syllabus before planning your teaching programme.

Changes to syllabus content

The syllabus content has been revised and reorganised. A brief summary of the changes is given below:

- The matrix structure, previously defined by each of the Earth's spheres, has been removed to create a more logical structure.
- The syllabus content is now presented within the following topic areas:
 - 1 Rocks and minerals and their exploitation
 - 2 Energy and the environment
 - 3 Agriculture and the environment
 - 4 Water and its management
 - 5 Oceans and fisheries
 - 6 Managing natural hazards
 - 7 The atmosphere and human activities
 - 8 Human population
 - 9 Natural ecosystems and human activities
- Each topic has bullet points for each learning objective, and further guidance and exemplification.
- Example case studies have been identified in the syllabus content.

Changes to assessment

- The syllabus aims have been updated.
- The assessment objectives (AOs) have been revised. The new assessment objectives are:
 - AO1** Knowledge and understanding
 - AO2** Information handling and analysis
 - AO3** Investigation skills and making judgements
- There are changes to the assessment objective weightings in the syllabus.
- The assessment now consists of two compulsory papers:
 - Paper 1 Theory, 1 hour 45 minutes, 80 marks
 - Paper 2 Management in context, 1 hour 45 minutes, 80 marks

In addition to reading the syllabus, teachers should refer to the updated specimen papers.

Any textbooks endorsed to support the syllabus for examination from 2019 are suitable for use with this syllabus.

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1. Introduction

1.1 Why choose Cambridge?

Cambridge International Examinations prepares school students for life, helping them develop an informed curiosity and a lasting passion for learning. We are part of Cambridge Assessment, a department of the University of Cambridge.

Our international qualifications are recognised by the world's best universities and employers, giving students a wide range of options in their education and career. As a not-for-profit organisation, we devote our resources to delivering high-quality educational programmes that can unlock learners' potential.

Our programmes and qualifications set the global standard for international education. They are created by subject experts, rooted in academic rigour and reflect the latest educational research. They provide a strong platform for learners to progress from one stage to the next, and are well supported by teaching and learning resources.

Every year, nearly a million Cambridge learners from 10 000 schools in 160 countries prepare for their future with an international education from Cambridge.

Cambridge learners

Our mission is to provide educational benefit through provision of international programmes and qualifications for school education and to be the world leader in this field. Together with schools, we develop Cambridge learners who are:

- **confident** in working with information and ideas – their own and those of others
- **responsible** for themselves, responsive to and respectful of others
- **reflective** as learners, developing their ability to learn
- **innovative** and equipped for new and future challenges
- **engaged** intellectually and socially, ready to make a difference.

Recognition

Cambridge O Level is internationally recognised by schools, universities and employers as equivalent in demand to Cambridge IGCSE® (International General Certificate of Secondary Education). There are over 700 000 entries a year in nearly 70 countries. Learn more at www.cie.org.uk/recognition

Support for teachers

A wide range of materials and resources is available to support teachers and learners in Cambridge schools. Resources suit a variety of teaching methods in different international contexts. Through subject discussion forums and training, teachers can access the expert advice they need for teaching our qualifications. More details can be found in Section 2 of this syllabus and at www.cie.org.uk/teachers

Support for exams officers

Exams officers can trust in reliable, efficient administration of exams entries and excellent personal support from our customer services. Learn more at www.cie.org.uk/examsofficers

Our systems for managing the provision of international qualifications and education programmes for learners aged 5 to 19 are certified as meeting the internationally recognised standard for quality management, ISO 9001:2008. Learn more at www.cie.org.uk/ISO9001

1.2 Why choose Cambridge O Level?

Cambridge O Levels have been designed for an international audience and are sensitive to the needs of different countries. These qualifications are designed for learners whose first language may not be English and this is acknowledged throughout the examination process. The Cambridge O Level syllabus also allows teaching to be placed in a localised context, making it relevant in varying regions.

Our aim is to balance knowledge, understanding and skills in our programmes and qualifications to enable students to become effective learners and to provide a solid foundation for their continuing educational journey.

Through our professional development courses and our support materials for Cambridge O Levels, we provide the tools to enable teachers to prepare learners to the best of their ability and work with us in the pursuit of excellence in education.

Cambridge O Levels are considered to be an excellent preparation for Cambridge International AS & A Levels, the Cambridge AICE (Advanced International Certificate of Education) Diploma, Cambridge Pre-U, and other education programmes, such as the US Advanced Placement program and the International Baccalaureate Diploma programme. Learn more about Cambridge O Levels at www.cie.org.uk/cambridgesecondary2

Guided learning hours

Cambridge O Level syllabuses are designed on the assumption that learners have about 130 guided learning hours per subject over the duration of the course, but this is for guidance only. The number of hours required to gain the qualification may vary according to local curricular practice and the learners' prior experience of the subject.

1.3 Why choose Cambridge O Level Environmental Management?

Cambridge O Level Environmental Management is accepted by universities and employers as proof of knowledge and understanding of issues concerning sustainable development and how the Earth's resources are used. Learners studying this syllabus:

- draw upon disciplines such as biology, Earth science, geography, economics and demographics
- consider the interdependence of the Earth's natural systems and how people use natural resources
- examine the impact of development on the environment considering issues such as environmental pollution and resource depletion
- explore ways in which we may change the nature of future development to make it more sustainable.

Environmental Management is concerned not only with the impact of humans on the planet but also with the patterns of human behaviour necessary to preserve and manage the environment in a self-sustaining way. Study is linked to the areas of new thinking in environmental management, environmental economics and the quest for alternative technologies. Case studies allow candidates to obtain a local as well as a global perspective.

Environmental Management recognises that human behaviour towards the environment is guided by the survival needs, perceptions and values of people. Underlying the syllabus there is a recognition that cultural, social and political attitudes directly influence the economy of nature. A core principle of the syllabus is that sustainability will only be achieved by changes in the ways in which people think and make decisions. A course in Environmental Management therefore calls upon learners to be participants in defining the future of their world.

Prior learning

Learners beginning this course are not expected to have studied Environmental Management previously.

Progression

Cambridge O Levels are general qualifications that enable learners to progress directly to employment, or to proceed to further qualifications in another subject area or at a higher level, requiring more specific knowledge, understanding and skills.

Candidates who are awarded grades A* to C in Cambridge O Level Environmental Management are well prepared to follow courses leading to Cambridge International AS Level Environmental Management, or the equivalent.

1.4 How can I find out more?

If you are already a Cambridge school

You can make entries for this qualification through your usual channels. If you have any questions, please contact us at info@cie.org.uk

If you are not yet a Cambridge school

Learn about the benefits of becoming a Cambridge school at www.cie.org.uk/startcambridge. Email us at info@cie.org.uk to find out how your organisation can register to become a Cambridge school.

2. Teacher support

2.1 Support materials

You can go to our public website at www.cie.org.uk/olevel to download current and future syllabuses together with specimen papers or past question papers, examiner reports and grade threshold tables from one series.

For teachers at registered Cambridge schools a range of additional support materials for specific syllabuses is available online from Teacher Support, our secure online support for Cambridge teachers.

Go to <https://teachers.cie.org.uk> (username and password required). If you do not have access, speak to the Teacher Support coordinator at your school.

2.2 Endorsed resources

We work with publishers providing a range of resources for our syllabuses including print and digital materials. Resources endorsed by Cambridge go through a detailed quality assurance process to make sure they provide a high level of support for teachers and learners.

We have resource lists which can be filtered to show all resources, or just those which are endorsed by Cambridge. The resource lists include further suggestions for resources to support teaching. See www.cie.org.uk/i-want-to/resource-centre for further information.

2.3 Training

We offer a range of support activities for teachers to ensure they have the relevant knowledge and skills to deliver our qualifications. See www.cie.org.uk/events for further information.

Further teacher support for Cambridge O Level Environmental Management (5014)



This O Level syllabus shares content with IGCSE Environmental Management (0680). For further support see the Teacher Support site page for IGCSE Environmental Management (0680). You will find additional resources which are useful and relevant to O Level Environmental Management (5014) teachers such as past papers, Example Candidate Responses and Teacher forums. Textbooks for this IGCSE should also be equally useful for the O Level course.

3. Syllabus overview

3.1 Content

The syllabus is divided into nine topics which have been designed to develop an understanding of both the natural and the human environment:

- 1 Rocks and minerals and their exploitation
- 2 Energy and the environment
- 3 Agriculture and the environment
- 4 Water and its management
- 5 Oceans and fisheries
- 6 Managing natural hazards
- 7 The atmosphere and human activities
- 8 Human population
- 9 Natural ecosystems and human activities

3.2 Assessment

Candidates for Cambridge O Level Environmental Management take **two** compulsory components.

Component		Weighting
<p>Paper 1 Theory</p> <p>The paper will consist of two sections:</p> <p>Section A Short-answer and structured questions. (20 marks)</p> <p>Section B Short-answer and extended response questions based on related source material. (60 marks)</p> <p>80 marks</p> <p>Externally assessed.</p>	1 hour 45 minutes	50%
<p>Paper 2 Management in context</p> <p>A written paper consisting of short-answer, data processing and analysis, and extended response questions based on source material. Candidates will be expected to make use of information from the source material to help illustrate issues of environmental management.</p> <p>80 marks</p> <p>Externally assessed.</p>	1 hour 45 minutes	50%

Availability

This syllabus is examined in the June and November examination series.

This syllabus is available to private candidates.

Cambridge O Levels are normally available to Centres in Administrative Zones 3, 4 and 5. Each administrative zone has a specific timetable.

From 2020 this syllabus is not available in all these administrative zones. To find out about the availability visit the syllabus page at www.cie.org.uk/olevel

Detailed timetables are available from www.cie.org.uk/timetables

Combining this with other syllabuses

Candidates can combine this syllabus in an examination series with any other Cambridge syllabus, except:

- syllabuses with the same title at the same level.

Please note that Cambridge O Level, Cambridge IGCSE and Cambridge IGCSE (9–1) (Level 1/Level 2 Certificate) syllabuses are at the same level.

4. Syllabus aims and assessment objectives

4.1 Syllabus aims

The aims below describe the educational purposes of a course in Environmental Management for the Cambridge O Level examination. They are not listed in order of priority.

The aims are to enable candidates to acquire:

- knowledge of natural systems which make life possible on Earth
- an understanding that humans are part of these systems and depend on them
- an appreciation of the diverse influences of human activity on natural systems
- an awareness of the need to manage natural systems
- an understanding of sustainable development to meet the needs of the present, without compromising the ability of future generations to meet their own needs
- a sense of responsibility and concern for the welfare of the environment and all organisms
- an awareness of their own values concerning environmental issues
- an awareness of the values of others
- a willingness to review their own attitudes in the light of new knowledge and experiences
- a sound basis for further study, personal development and participation in local and global environmental concerns.

4.2 Assessment objectives

The assessment objectives (AOs) are:

AO1 Knowledge and understanding

AO2 Information handling and analysis

AO3 Investigation skills and making judgements.

AO1 Knowledge and understanding

Candidates should be able to demonstrate knowledge and understanding, in familiar and unfamiliar contexts, of:

- 1 phenomena, facts, definitions, concepts and theories
- 2 vocabulary, terminology and conventions
- 3 technological applications with their social, economic and environmental implications.

AO2 Information handling and analysis

Candidates should be able, in words or using other forms of presentation (e.g. graphical or numerical), in familiar and unfamiliar contexts, to:

- 1 locate, select, organise and present information from a variety of sources
- 2 translate information and evidence from one form to another
- 3 manipulate numerical data
- 4 interpret and evaluate data, report trends and draw inferences.

A03 Investigation skills and making judgements

Candidates should be able, in familiar and unfamiliar contexts, to:

- 1 plan investigations
- 2 identify limitations of methods and suggest possible improvements
- 3 present reasoned explanations for phenomena, patterns and relationships
- 4 make reasoned judgements and reach conclusions based on qualitative and quantitative information.

4.3 Weighting for assessment objectives

The approximate weightings allocated to each of the assessment objectives (AOs) are summarised below.

Assessment objectives as a percentage of the qualification

Assessment objective	Weighting in IGCSE %
A01 Knowledge and understanding	40
A02 Information handling and analysis	35
A03 Investigation skills and making judgements	25

Assessment objectives as a percentage of each component

Assessment objective	Weighting in components %	
	Paper 1	Paper 2
A01	40	40
A02	40	30
A03	20	30

5. Syllabus content

5.1 Case studies

The curriculum gives teachers the opportunity to select their own case studies to illustrate the content. Teachers should select appropriate examples where specified.

The same case study can be used to illustrate more than one topic as long as it gives candidates the opportunity to study an example of appropriate content.

Candidates are encouraged to integrate appropriate information from their case studies into their answers.

5.2 Expected knowledge

Candidates should be able to identify and name the world's continents and oceans:

- Africa, Antarctica, Asia, Europe, North America, Oceania and South America
- Atlantic Ocean, Pacific Ocean, Indian Ocean, Arctic Ocean and Southern Ocean.

Topic	Candidates should be able to:	Further guidance and exemplification
1 Rocks and minerals and their exploitation		
1.1 Formation of rocks	<ul style="list-style-type: none"> • describe and interpret the rock cycle • state and explain the formation and characteristics of named igneous, sedimentary and metamorphic rocks 	<ul style="list-style-type: none"> • igneous: granite and basalt • sedimentary: limestone, sandstone and shale • metamorphic: marble and slate
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 – subsurface mining • discuss the factors that affect the decision to extract rocks and minerals 	<ul style="list-style-type: none"> • opencast/open-pit/open-cut/strip mining • deep mining/shaft mining • exploration • geology • accessibility • environmental impact assessment • supply and demand

Topic	Candidates should be able to:	Further guidance and exemplification
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
1.4 Managing the impact of rock and mineral extraction	<ul style="list-style-type: none"> describe and evaluate strategies for restoring landscapes damaged by rock and mineral extraction 	<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 landfill sites
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
Case study: <ul style="list-style-type: none"> Study the development, impact and management of a mine including land restoration after the mine has closed. 		
2 Energy and the environment		
2.1 Fossil fuel formation	<ul style="list-style-type: none"> describe the formation of the fossil fuels: coal, oil and gas 	
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: fossil fuels, nuclear power, biofuels, geothermal power, hydro-electric power, tidal power, wave power, solar power, wind power 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 	<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

Topic	Candidates should be able to:	Further guidance and exemplification
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
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 research and development of new 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 fracking
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 ecosystems: birds, marine mammals, coral reefs, beaches
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>Case study:</p> <ul style="list-style-type: none"> Study the impact and management of an oil pollution event. 		

Topic	Candidates should be able to:	Further guidance and exemplification
3 Agriculture and the environment		
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
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: nitrogen as nitrate ions (NO_3^-), phosphorus as phosphate ions (PO_4^{3-}), potassium as potassium ions (K^+) organic content pH 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
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
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

Topic	Candidates should be able to:	Further guidance and exemplification
3.6 Causes and impacts of soil erosion	<ul style="list-style-type: none"> describe the causes of soil erosion describe and explain the impacts of soil erosion 	<ul style="list-style-type: none"> removal of natural vegetation by over cultivation and overgrazing water and wind erosion loss of habitats desertification silting of rivers displacement of people malnutrition and famine
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 wind breaks maintaining vegetation cover addition of organic matter to improve soil structure planting trees, mixed cropping, intercropping and crop rotation
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>Case study:</p> <ul style="list-style-type: none"> Study an example where agriculture has had severe environmental consequences including soil erosion and strategies for the conservation of the soil. 		
4 Water and its management		
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
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
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
4.4 Water usage	<ul style="list-style-type: none"> describe the different ways in which fresh water can be used 	<ul style="list-style-type: none"> domestic, industrial, agricultural

Topic	Candidates should be able to:	Further guidance and exemplification
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
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
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
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
4.9 Managing pollution of fresh water	<ul style="list-style-type: none"> describe and explain strategies for improving water quality 	<ul style="list-style-type: none"> improved sanitation treatment of sewage pollution control and legislation
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 describe strategies to control cholera 	<ul style="list-style-type: none"> antimalarial drugs, vector control, eradication safe drinking water (potable water) supply boiling and chlorination
<p>Case studies:</p> <ul style="list-style-type: none"> Study the impact of a named multipurpose dam scheme. Study the causes, impact and management of pollution in a named body of water. 		

Topic	Candidates should be able to:	Further guidance and exemplification
5 Oceans and fisheries		
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
5.2 World fisheries	<ul style="list-style-type: none"> outline the distribution of major ocean currents explain the distribution of major marine fish populations describe the El Niño Southern Oscillation (ENSO) phenomenon and its effects on fisheries along the Pacific coast of South America 	<ul style="list-style-type: none"> identify the position of major cold and warm ocean currents (names are not required) shallow water of continental shelves cold and warm ocean currents
5.3 Impact of exploitation of the oceans	<ul style="list-style-type: none"> describe and explain the impact of exploitation of fisheries describe how farming of marine species reduces the exploitation of fisheries 	<ul style="list-style-type: none"> overfishing of marine species effect on target and bycatch species
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>Case studies:</p> <ul style="list-style-type: none"> Study the resource potential, exploitation, impact and management of a marine fishery. Study an example of farming of marine species, including the source of food, pollution from waste and impact on the natural habitat. 		

Topic	Candidates should be able to:	Further guidance and exemplification
6 Managing natural hazards		
6.1 Earthquakes and volcanoes	<ul style="list-style-type: none"> describe the structure of the Earth describe and explain the distribution and causes of earthquakes and volcanoes understand magnitude and the Richter scale 	<ul style="list-style-type: none"> crust, mantle and core global pattern and structure of plates plate movement: constructive, destructive and conservative
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
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
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

Topic	Candidates should be able to:	Further guidance and exemplification
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 infrastructure, contamination of drinking water supplies, water-related disease, financial losses 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
6.6 Managing the impacts of natural hazards	<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 (plans, drills, emergency supplies and emergency rescue teams), evacuation, emergency shelters, rebuilding of damaged areas, international aid 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

Topic	Candidates should be able to:	Further guidance and exemplification
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 volcanoes: fertile soils, extraction of minerals, geothermal energy resources
<p>Case studies:</p> <ul style="list-style-type: none"> 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). Study the strategies for managing the impacts of a tropical storm or flood or drought. 		

Topic	Candidates should be able to:	Further guidance and exemplification
7 The atmosphere and human activities		
7.1 The atmosphere	<ul style="list-style-type: none"> • describe the structure and composition of the atmosphere • describe the natural greenhouse effect 	<ul style="list-style-type: none"> • troposphere, stratosphere, mesosphere, thermosphere • nitrogen, oxygen, carbon dioxide, argon, water vapour • the ozone layer
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 	<ul style="list-style-type: none"> • smog: volatile organic compounds (from industrial processes), vehicle emissions, impact of temperature inversion • 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)
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 rates of skin cancer and cataracts, damage to vegetation • 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 afforestation
Case study: <ul style="list-style-type: none"> • Study the causes, impact and management of a specific example of atmospheric pollution. 		

Topic	Candidates should be able to:	Further guidance and exemplification
8 Human population		
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
8.2 Changes in population size	<ul style="list-style-type: none"> describe and explain the growth curve of populations describe and explain the changes in human populations 	<ul style="list-style-type: none"> lag, exponential (log), carrying capacity birth and death rates factors affecting birth and death rates factors affecting migration
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
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
Case study:		
<ul style="list-style-type: none"> Study the strategies a named country or region has used to manage population size. 		
9 Natural ecosystems and human activities		
9.1 Ecosystems	<ul style="list-style-type: none"> define the terms <i>ecosystem</i>, <i>population</i>, <i>community</i>, <i>habitat</i> and <i>niche</i> describe the biotic (living) and abiotic (non-living) components of an ecosystem describe biotic interactions describe the process of photosynthesis describe energy flow using food chains, food webs and trophic levels describe and explain ecological pyramids based on numbers and energy describe the process of respiration describe the carbon cycle 	<ul style="list-style-type: none"> biotic: producers, primary, secondary and tertiary consumers, decomposers abiotic: temperature, humidity, water, oxygen, salinity, light, pH competition, predation and pollination state the word equation and the importance of chlorophyll state the word equation
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

Topic	Candidates should be able to:	Further guidance and exemplification
9.3 Deforestation	<ul style="list-style-type: none"> describe and explain the causes and impacts of deforestation 	<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
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
9.5 Measuring and managing biodiversity	<ul style="list-style-type: none"> describe and evaluate methods for estimating biodiversity 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"> pitfall traps, pooters, quadrats and transects random and systematic sampling sustainable harvesting of wild plant and animal species sustainable forestry/agroforestry national parks, wildlife/ecological reserves and corridors extractive reserves world biosphere reserves seed banks role of zoos and captive breeding sustainable tourism and ecotourism
<p>Case studies:</p> <ul style="list-style-type: none"> Study the causes and impacts of deforestation in a named area. Study the conservation of a named species. Study a named biosphere reserve. 		

6. Appendix

6.1 Glossary of terms used in science papers

This list is neither exhaustive nor definitive. The glossary has been deliberately kept brief, not only with respect to the number of terms included, but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend, in part, on its context.

- 1 *Define* (the term(s)...) is intended literally, only a formal statement or equivalent paraphrase being required.
- 2 *What do you understand by/What is meant by* (the term(s)...) normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.
- 3 *State* implies a concise answer with little or no supporting argument (e.g. a numerical answer that can readily be obtained 'by inspection').
- 4 *List* requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified this should not be exceeded.
- 5 (a) *Explain* may imply reasoning or some reference to theory, depending on the context. It is another way of asking candidates to give reasons. The candidate needs to leave the examiner in no doubt why something happens.
(b) *Give a reason/Give reasons* is another way of asking candidates to explain why something happens.
- 6 *Describe* requires the candidate to state in words (using diagrams where appropriate) the main points. *Describe* and *explain* may be coupled, as may *state* and *explain*.
- 7 *Discuss* requires the candidate to give a critical account of the points involved.
- 8 *Outline* implies brevity (i.e. restricting the answer to giving essentials).
- 9 *Predict* implies that the candidate is expected to make a prediction not by recall but by making a logical connection between other pieces of information.
- 10 *Deduce* implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information.
- 11 *Suggest* is used in two main contexts, i.e. either to imply that there is no unique answer (e.g. in chemistry, two or more substances may satisfy the given conditions describing an 'unknown'), or to imply that candidates are expected to apply their general knowledge of the subject to a 'novel' situation, one that may be formally 'not in the syllabus' – many data response and problem solving questions are of this type.
- 12 *Find* is a general term that may variously be interpreted as *calculate*, *measure*, *determine*, etc.
- 13 *Calculate* is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.
- 14 *Measure* implies that the quantity concerned can be directly obtained from a suitable measuring instrument (e.g. length using a rule, or mass using a balance).
- 15 *Determine* often implies that the quantity concerned cannot be measured directly but is obtained from a graph or by calculation.
- 16 *Estimate* implies a reasoned order of magnitude statement or calculation of the quantity concerned, making such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.
- 17 *Sketch*, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct, but candidates should be aware that, depending on the context, some quantitative aspects may be looked for (e.g. passing through the origin, having an intercept).
In diagrams, *sketch* implies that simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear exposition of important details.

6.2 Mathematical requirements

Calculators may be used in all parts of the examination.

Candidates should be able to:

- add, subtract, multiply and divide
- use averages, decimals, fractions, percentages, ratios and reciprocals
- use standard notation, including both positive and negative indices
- understand significant figures and use them appropriately
- recognise and use direct and inverse proportion
- draw charts and graphs from given data
- interpret charts and graphs
- determine the gradient and intercept of a graph
- select suitable scales and axes for graphs
- make approximate evaluations of numerical expressions
- understand the meaning of angle, curve, circle, radius, diameter, circumference, square, rectangle and diagonal.

6.3 Gathering of data

Candidates should be able to:

- formulate aims and hypotheses
- design questionnaires that can be oral or written to gain information from an individual or a group of individuals (consideration should be given to factors influencing the successful design of questionnaires, e.g. layout, format of questions, the appropriate wording of questions and the number of questions. The practical considerations of conducting a questionnaire, e.g. the sampling methods, pilot survey and location of survey should also be discussed)
- design a simple experiment using suitable controls
- understand and evaluate random and systematic sampling techniques.

6.4 Presentation of data

The solidus (/) is to be used for separating the quantity and the unit in tables, graphs and charts, e.g. time / s for time in seconds.

(a) Tables

- Each column of a table should be headed with the physical quantity and the appropriate unit, e.g. time/s.
- The column headings of the table can then be directly transferred to the axes of a constructed graph.

(b) Graphs

- Unless instructed otherwise, the independent variable should be plotted on the x -axis (horizontal axis) and the dependent variable plotted on the y -axis (vertical axis).
- Each axis should be labelled with the physical quantity and the appropriate unit, e.g. time/s.
- The scales for the axes should allow more than half of the graph grid to be used in both directions, and be based on sensible ratios, e.g. 2 cm on the graph grid representing 1, 2 or 5 units of the variable.
- The graph is the whole diagrammatic presentation, including the best-fit line when appropriate. It may have one or more sets of data plotted on it.
- Points on the graph should be clearly marked as crosses (x) or encircled dots (⊙).
- Large 'dots' are penalised. Each data point should be plotted to an accuracy of better than one half of each of the smallest squares on the grid.
- A best-fit line (trend line) should be a single, thin, smooth straight-line or curve. The line does not need to coincide exactly with any of the points; where there is scatter evident in the data, Examiners would expect a roughly even distribution of points either side of the line over its entire length. Points that are clearly anomalous should be ignored when drawing the best-fit line.
- The gradient of a straight line should be taken using a triangle whose hypotenuse extends over at least half of the length of the best-fit line, and this triangle should be marked on the graph.

(c) Numerical results

- Data should be recorded so as to reflect the precision of the measuring instrument.
- The number of significant figures given for calculated quantities should be appropriate to the least number of significant figures in the raw data used.

(d) Pie charts

- These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie charts should preferably contain no more than six sectors.

(e) Bar charts

- These should be drawn when one of the variables is not numerical. They should be made up of narrow blocks of equal width that do **not** touch.

(f) Histograms

- These are drawn when plotting frequency graphs with continuous data. The blocks should be drawn in order of increasing or decreasing magnitude and they **should** touch.

7. Other information

Equality and inclusion

Cambridge International Examinations has taken great care in the preparation of this syllabus and assessment materials to avoid bias of any kind. To comply with the UK Equality Act (2010), Cambridge has designed this qualification with the aim of avoiding direct and indirect discrimination.

The standard assessment arrangements may present unnecessary barriers for candidates with disabilities or learning difficulties. Arrangements can be put in place for these candidates to enable them to access the assessments and receive recognition of their attainment. Access arrangements will not be agreed if they give candidates an unfair advantage over others or if they compromise the standards being assessed.

Candidates who are unable to access the assessment of any component may be eligible to receive an award based on the parts of the assessment they have taken.

Information on access arrangements is found in the *Cambridge Handbook* which can be downloaded from the website www.cie.org.uk/exams/officers

Language

This syllabus and the associated assessment materials are available in English only.

Grading and reporting

Cambridge O Level results are shown by one of the grades A*, A, B, C, D or E, indicating the standard achieved, A* being the highest and E the lowest. 'Ungraded' indicates that the candidate's performance fell short of the standard required for grade E. 'Ungraded' will be reported on the statement of results but not on the certificate. The letters Q (result pending), X (no result) and Y (to be issued) may also appear on the statement of results but not on the certificate.

Entry option codes

To maintain the security of our examinations, we produce question papers for different areas of the world, known as 'administrative zones'. Where the component entry option code has two digits, the first digit is the component number given in the syllabus. The second digit is the location code, specific to an administrative zone. Information about entry option codes can be found in the *Cambridge Guide to Making Entries*.

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