CAMBRIDGE
International Examinations

Cambridge International AS & A Level

SYLLABUS

Cambridge International AS Level Environmental Management

8291

For examination in June and November 2017, 2018 and 2019

Cambridge Advanced

Version 1

Changes to syllabus for 2017, 2018 and 2019

This syllabus has been updated, but there are no significant changes.

You are advised to read the whole syllabus before planning your teaching programme.

Contents

1. Introduction

1.1 Why choose Cambridge?

Cambridge International Examinations is part of the University of Cambridge. We prepare school students for life, helping them develop an informed curiosity and a lasting passion for learning. 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 set the global standard for international education. They are created by subject experts, are rooted in academic rigour, and provide a strong platform for progression. Over 10 000 schools in 160 countries work with us to prepare nearly a million learners for their future with an international education from Cambridge.

Cambridge learners

Cambridge programmes and qualifications develop not only subject knowledge but also skills. We encourage Cambridge learners to be:

- **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 International AS and A Levels are recognised around the world by schools, universities and employers. The qualifications are accepted as proof of academic ability for entry to universities worldwide, although some courses do require specific subjects.

Cambridge AS and A Levels are accepted in all UK universities. University course credit and advanced standing is often available for Cambridge International AS and A Levels in countries such as the USA and Canada.

Learn more at **www.cie.org.uk/recognition**

1.2 Why choose Cambridge International AS and A Level?

Cambridge International AS and A Levels are international in outlook, but retain a local relevance. The syllabuses provide opportunities for contextualised learning and the content has been created to suit a wide variety of schools, avoid cultural bias and develop essential lifelong skills, including creative thinking and problem-solving.

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. Cambridge International AS and A Levels give learners building blocks for an individualised curriculum that develops their knowledge, understanding and skills.

Schools can offer almost any combination of 60 subjects and learners can specialise or study a range of subjects, ensuring a breadth of knowledge. Giving learners the power to choose helps motivate them throughout their studies.

Cambridge International A Levels typically take two years to complete and offer a flexible course of study that gives learners the freedom to select subjects that are right for them.

Cambridge International AS Levels often represent the first half of an A Level course but may also be taken as a freestanding qualification. The content and difficulty of a Cambridge International AS Level examination is equivalent to the first half of a corresponding Cambridge International A Level.

Through our professional development courses and our support materials for Cambridge International AS and A 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 International AS and A Levels have a proven reputation for preparing learners well for university, employment and life. They help develop the in-depth subject knowledge and understanding which are so important to universities and employers.

Learners studying Cambridge International AS and A Levels have opportunities to:

- acquire an in-depth subject knowledge
- develop independent thinking skills
- apply knowledge and understanding to new as well as familiar situations
- handle and evaluate different types of information sources
- think logically and present ordered and coherent arguments
- make judgements, recommendations and decisions
- present reasoned explanations, understand implications and communicate them clearly and logically
- work and communicate in English.

Guided learning hours

Cambridge International A Level syllabuses are designed on the assumption that learners have about 360 guided learning hours per subject over the duration of the course. Cambridge International AS Level syllabuses are designed on the assumption that learners have about 180 guided learning hours per subject over the duration of the course. This is for guidance only and 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 International AS Level Environmental Management?

Cambridge International AS Level Environmental Management is accepted by universities and employers as proof of knowledge and understanding of the key issues affecting the environment on a variety of scales. Through their study, candidates gain lifelong skills and awareness including:

- a knowledge of environmental processes and the impacts of societies on the environment
- the scientific principles that underpin issues of sustainability and environmental management
- the causes of key issues affecting the environment as well as possible ways of managing these
- the pressures which impact on the environment and potential solutions to these.

The syllabus is designed to encourage learning through suitable case studies, both local and global. The syllabus provides a good foundation for further study of Environmental Science and Management or related subjects in higher education. It is suitable for candidates of various ages, backgrounds and nationalities and contributes towards general education and lifelong learning.

Candidates do not need to have studied environmental science/management before taking this course. The course is designed to attract candidates with a good scientific background along with an awareness of broad environmental matters. A good foundation for the course would be a combination of some, but not necessarily all of the following: biology, geography, general science, physics, chemistry, environmental science and management.

Prior learning

We recommend that candidates who are beginning this course should have previously completed a Cambridge O Level or Cambridge IGCSE course in Environmental Management or Geography, but a foundation based within the sciences is sufficient. The most important attribute is to possess an interest in the subject matter of environmental science and management, and a concern and/or commitment to issues that arise in managing the Earth's environment.

Progression

Cambridge International AS Level Environmental Management provides a suitable foundation for further courses in this and related subjects. It is also suitable for candidates intending to pursue careers or further study in Environmental Management, or as part of a course of general education.

1.4 Cambridge AICE (Advanced International Certificate of Education) Diploma

Cambridge AICE Diploma is the group award of the Cambridge International AS and A Level. It gives schools the opportunity to benefit from offering a broad and balanced curriculum by recognising the achievements of candidates who pass examinations in different curriculum groups.

Learn more about the Cambridge AICE Diploma at **www.cie.org.uk/aice**

1.5 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

We send Cambridge syllabuses, past question papers and examiner reports to cover the last examination series to all Cambridge schools.

You can also go to our public website at **www.cie.org.uk/alevel** to download current and future syllabuses together with specimen papers or past question papers and examiner reports from one series.

For teachers at registered Cambridge schools a range of additional support materials for specific syllabuses is available from Teacher Support, our secure online support for Cambridge teachers. Go to **http://teachers.cie.org.uk** (username and password required).

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 ensure 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.

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.

3. Syllabus content at a glance

The content of this syllabus is designed to encourage a broad, thought provoking study of the environment, focusing on key issues in its management for sustainability.

- It includes sections on:
  - the lithosphere including plate tectonics and management of its consequences, weathering, soils and mass movements and their management, management of resources including energy resources and land
  - the atmosphere including the impact of its structure on weather and climate and management of the consequences of weather, atmospheric pollution and its management
  - the hydrosphere including sustainable management of water in the context of the water cycle and human activity as well as water pollution and its management
  - the biosphere including ecology of biomes and the effect of human activity, conservation and restoration of ecosystems as well as human population growth and sustainability.
- In each case there is a focus on environmental issues and their management at local, regional and global levels in less economically developed countries (LEDCs) and more economically developed countries (MEDCs).
- Issues such as global warming, industrial pollution, the impacts of rapid population growth and urbanisation are balanced with successful environmental management strategies such as National Park creation, sensitive urban design as well as management and development for sustainability.
- Key questions are used to help structure the teaching of the assessed content.
- Notes for guidance are included to help teachers to exemplify and deliver appropriate teaching programmes.

4. Assessment at a glance

All candidates take:

Paper 1	1 hour 30 minutes	Paper 2	1 hour 30 minutes
Lithosphere and Atmosphere Paper 1 is divided into two sections. Section A: short answer questions based on sets of data, diagrams or extracts. Section B: Candidates choose one essay question from a choice of three. Each essay question is in two parts. Questions will be drawn from parts of the syllabus not covered in Section A. 80 marks This paper will be weighted at 40% of the final total mark.		**Hydrosphere and Biosphere** Paper 2 is divided into two sections. Section A: short answer questions based on sets of data, diagrams or extracts. Section B: Candidates choose one essay question from a choice of three. Each essay question is in two parts. Questions will be drawn from parts of the syllabus not covered in Section A. 80 marks This paper will be weighted at 40% of the final total mark.	

and:

Paper 3	Centre-based assessment
Coursework Candidates produce a research report of about 2000 words covering an issue arising during their course of study. The report may focus on a local, regional or global issue. It may be based on secondary source material and/or internet data, although the use of primary sources and field data collection should be undertaken where practicable. Proposals for Coursework topics must be submitted to Cambridge in advance. 40 marks This paper will be weighted at 20% of the final total mark.	

Availability

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

This syllabus is not available to private candidates.

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

Centres in the UK that receive government funding are advised to consult the Cambridge website **www.cie.org.uk** for the latest information before beginning to teach this syllabus.

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.

5. Syllabus aims and assessment objectives

5.1 Syllabus aims

Through following this syllabus, candidates should:

1. develop a knowledge of the Earth's natural systems and the effects of human activity on these systems
2. be challenged to think about important environmental problems which face the world today
3. understand that solutions to environmental issues are not easy to find
4. recognise that the environment is an important social and political issue
5. understand that while environmental issues can be debated by government, non-government and scientific organisations, there is an important role for individuals in thinking about these issues and in considering solutions.

The syllabus will address a number of basic issues which are included as learning objectives:

- people are affected by, and respond to natural phenomena in many different ways
- rapid human growth is the fundamental environmental issue
- the sustainable use of resources is fundamental to all solutions
- human beings affect the environment of the whole planet, thus the importance of a global perspective
- urban environmental issues need to be given an important focus.

5.2 Assessment objectives and their weightings

There are three assessment objectives in Cambridge International AS Level Environmental Management.

AO1: Knowledge and understanding
Candidates will be expected to demonstrate knowledge and understanding of:

1. the important environmental issues facing the world in the 21st century (within the confines of the syllabus)
2. environmental patterns of organisation, causality and process
3. policies and mechanisms for managing the environment at local, regional and global levels
4. critical and supportive evaluations of environmental management policies
5. relevant scientific phenomena, facts, laws, definitions, concepts and theories, with use of scientific vocabulary, terminology and conventions (including symbols, quantities and units) relevant to the content of the syllabus.

AO2: Handling information and problem solving
Candidates should be able to:

1. locate, select and organise relevant information from a variety of data sources and communicate it clearly
2. describe, interpret and offer explanations for data and information presented in the form of tables, graphs, maps, photographs and illustrations
3. manipulate numerical, graphical and other data
4. use information to identify patterns, report trends and draw inferences.

AO3: Enquiry and investigation
Candidates should be able to:

1. formulate hypotheses and predictions on the basis of observations and prior research (including plan, select appropriate apparatus/materials and carry out experiments in order to test their hypothesis or prediction)
2. make accurate observations and measurements and record these in an appropriate form (e.g. graphs, tables, diagrams, etc.) and use statistical tools to analyse their data
3. assess the reliability of their data and identify ambiguities
   - make deductions and formulate conclusions based on their data
   - evaluate the validity of their method
   - discuss the implications of findings in terms of the effect on the environment
   - value judgements of individuals, organisations and self.

The table below shows the approximate weightings for each of the assessment objectives:

Assessment objective	Weighting
AO1: Knowledge with understanding	45%
AO2: Handling information and problem solving	35%
AO3: Enquiry and investigation	20%

The allocation of marks is shown below according to the different papers.

Assessment objectives	Papers 1 and 2 Section A		Papers 1 and 2 Section B	Paper 3 Coursework
	Question 1	Question 2	Question 3, 4 or 5	
AO1	15	15	60	
AO2	25	25	20	
AO3	–	–	–	40

Papers 1 and 2 have identical mark allowances as the papers have a similar format.

The mark allowances for Papers 1 and 2 are doubled, as they are totalled across both papers.

6. Syllabus content

This syllabus defines the 'environment', by reference to the four traditional subdivisions of the global environment:

- The **lithosphere** or the upper mantle of rock and crust, that forms the tectonic plates upon which the continents lie.
- The **atmosphere** or the gaseous shell outside these two non-living components.
- The **hydrosphere** or the body of water, present as ice, liquid water or water vapour.
- The **biosphere** or the living organisms that have established themselves in the other three spheres.

The syllabus recognises that human population growth has become the dominant factor producing environmental change. Since the majority of humans now live in cities, issues related to the growth of urban and industrial areas and the impact of rapid population growth are an important aspect of the syllabus.

Environmental management is concerned with both local and global issues and with the various ways in which societies, governments and economic activity (industry, agriculture and urban areas) use, misuse and attempt to manage both local and global environments. Whilst environmental management can often be presented in a negative light by emphasising pollution, exploitation and misuse, it is important to give recognition to the positive ways in which we manage our environment. Thus, issues such as global warming, industrial pollution and the impact of rapid population growth need to be balanced with others like the creation of National Parks, sensitive urban design and sustainable management/development.

The syllabus reflects a contemporary concern with sustainable management. Through their study of environmental management, it is hoped that candidates will learn to appreciate that the exploitation of the environment has often had a negative impact and that we should aim for a sustainable management of resources.

The syllabus focuses on environmental issues and their management at local, regional and global levels and is organised in three sections:

- **Key Questions:** These identify major aspects of the syllabus, but are not intended as a prescriptive teaching programme
- **Content**
- **Notes for Guidance:** These offer some examples of the type of topics which are suitable and other suggestions for teachers.

Examination questions will be derived from the **Content** column. Candidates should show knowledge and understanding of the points listed in the Content column(s) and be able to handle information and solve problems relating to these points.

The lithosphere		
Key Question	**Content**	**Notes for Guidance**
1 What are the key elements of the structure of the Earth?	The internal structure of the Earth including the characteristics of the core, mantle, asthenosphere and the difference between oceanic and continental crust. How seismic wave data provides evidence of Earth structure. Plate tectonics: the major plates, convection currents; ocean floor spreading; destructive, constructive and conservative plate boundaries. Post-Pangaea plate movement supported by evidence derived from paleomagnetism, palaeontology and geological fit.	Global evidence; mapping the Earth's plates, fossil record including dinosaurs, coal measures. Examples chosen from two contrasting regions, e.g. The Atlantic with its mid-ocean ridge and evidence drawn from neighbouring continents with the Pacific. Case studies of a major volcanic eruption, a major earthquake; these studies can be combined with studies in Key Question 2.
2 What natural hazards are derived from plate movement and how are they managed? What strategies can be employed to limit damage and loss of life?	Earthquakes (e): cause, process and effect; measurement by magnitude and intensity; frequency; different impacts in countries with contrasting levels of economic development. Volcanoes (v): types of eruption and their effects, contrasting explosive acid types with basaltic eruptions. Examples to be chosen from, e.g. Pinatubo, Etna or Unzen. Hazards: to include tsunamis, landslides, ground deformation, volcanic ash, lava and hot ash clouds (nuee ardentes). Strategies for analysing such natural hazards in countries with contrasting levels of economic development and may include: historic records (e,v), frequency (e,v), seismic evidence (e,v), tilt metres (v), chemical analysis (v), building design (e), and rescue and aid (e,v).	This section can be taught through in-depth case studies of earthquake and volcanic activity in countries with contrasting levels of economic development. Examples: Earthquakes, e.g. Mexico City (1985), Armenia (1988), Loma Prieta (1989), Mt. St. Helens (1989), Kobe (1995), Colombia (1999), Aceh (2007), Sumatra (2009). Measurements using the Richter scale and Mercalli scale. Volcanic eruptions, e.g. Ruapehu (1965, 1975, 1995), Mt. Unzen (1991), Pinatubo (1999), Montserrat (1995), Etna (2001), Grimsvotn Jokulhaup (glacial burst) (1996).
3 What natural and man-made processes contribute to different types and causes of mass movement on slopes? How are mass movements on steep and gentle slopes managed?	Rock weathering processes including mechanical and chemical processes and the accumulation of debris on slopes. Associated rock types to include igneous, sedimentary and metamorphic. Causes of mass movement: flows and slides including rock falls, landslides, earth slumps, soil creep, solifluction, mudflows and rotational slumping. Human influences include deforestation and building. Slope management policies including slope angle reduction, afforestation, drainage and surface protection. Sudden mass movements such as landslides are frequently triggered by human activity or natural events.	A theoretical introduction backed up by a case study, e.g. Hong Kong, Rio de Janeiro, Sarno in Southern Italy, Himalayan Foothills, Sumatra (2009).
4 What are the major causes of soil deterioration and erosion and how can they be prevented?	Soil formation and characteristics including texture, biotic, abiotic components and idealised soil profiles characteristic of moist and arid conditions in temperate and tropical areas. Soil erosion and deterioration through agriculture, deforestation, grazing, salinisation and compaction. Management strategies involving the sustainable use of soils for agriculture. Studies should use examples from countries with contrasting levels of economic development.	Case studies where possible should be local or text derived; e.g. Southern England, Himalayan foothills, USA Dustbowl. Soil profiles to include: temperate podzols and brown earths, tropical laterites and rainforest soils.
5 What pressures have human activity placed upon the resources of the lithosphere? How can these resources be managed sustainably for future generations?	The nature of renewable, non-renewable, alternative and recyclable resources. Energy resources in countries with contrasting levels of economic development, including demand and the depletion of resources in MEDCs; LEDC priorities in the use of fossil fuels; the depleting of reserves of fossil fuels. Strategies to include sustainable use of fossil fuels through developing renewable resources and conserving energy. Land as a resource under pressure from urban sprawl and economic developments. The management of areas of outstanding natural beauty; conservation areas/National Parks.	Examples should include non-renewable resources (coal, oil and natural gas) and renewable resources (water – HEP, tide and waves, wind and solar energy). Case studies contrasting the policies of one MEDC (e.g. Germany) with a LEDC (e.g. India). Strategies may be illustrated by contrasting the policies of two countries or by using resources; e.g. wind, water and nuclear energy in France with coal in India. Pressure from urban sprawl can be illustrated through examples such as Sao Paulo, Mumbai, London, Tokyo, Paris, Buenos Aires and Lagos.

The atmosphere		
Key Question	**Content**	**Notes for Guidance**
1 What are the structural components of the atmosphere and why is it important to understand their characteristics?	The structure of the atmosphere to include troposphere, stratosphere, mesosphere and thermosphere (ionosphere). Each zone described in terms of composition, temperature and variations in air density. The interaction of incoming and outgoing radiation within the troposphere and stratosphere; 'the Earth's energy budget'. The importance of the troposphere for weather and human activity.	Reference can be made to models of atmospheric structure, evidence from research (balloons) etc. Ozone and the absorption of UV radiation. The absorption of visible radiation by the Earth's surface; emission of thermal infra-red radiation and absorption by tropospheric gases.
2 What is the pattern of air movement in the troposphere and how does it influence regional climates and local weather? What methods are employed to forecast weather patterns?	Variations in global insolation. Regions of high and low pressure. Global and local wind systems. The effects of land relief and ocean currents. The location and characteristic features of the major climatic regions to include equatorial, tropical desert, savannah and monsoon, warm temperate climates and Sub-Arctic (as for the biomes in the biosphere module). The formation, characteristics and effects of anticyclones (high pressure systems), temperate frontal depressions and tropical cyclones (hurricanes). Weather forecasting in relation to these weather conditions.	The Earth's temperature and pressure distribution/seasonal variations. The study of climatic regions can be linked with the biomes included in the biosphere module. Traditional text-based studies or student investigations. The use of weather charts, satellite data in forecasting and recording weather data (visual and infra-red photography). Relevant case studies to illustrate hurricanes and causes and effects of drought.
3 How does human activity adversely affect the atmosphere?	The principal sources, composition and effects of atmospheric pollution including: • CFCs and their role in stratospheric ozone depletion. • Carbon dioxide and methane and the enhanced greenhouse effect; to include predicted and possible climatic effects of global warming. • Sulfur dioxide and nitrogen and the formation of acid rain including effects upon buildings, lakes, rivers and soils. • Ground level ozone derived from nitrogen oxides, volatile organic compounds and sunlight. • Noise derived primarily from traffic and industry. • The patterns of urban pollution across urban areas including: smog (both smoke and photochemical), pollution plumes and reasons for different levels of pollution within urban areas.	Examples from the Antarctic and Northern Hemisphere. The likely impact of global warming on raising sea levels, increased storm intensity, climatic change. Where possible use local examples. There is an opportunity to link industrial pollution with Key Question 5 in the lithosphere module. Emissions from industrialised countries and transference to other countries. Reference can be made to studies in the UK and Sweden (1980s), London, Athens, Beijing and Los Angeles.
4 How can atmospheric pollution be controlled and what are the problems involved with the local and global management of atmospheric pollution?	Reducing emissions through cleaning flue gases, alternative energy, afforestation, CFC free domestic appliances, sprays etc. The use of alternative sources of energy including wind, water and nuclear energy. International controls/protocols, recognising that pollution crosses international boundaries. The background to the difficulties in achieving a broad agreement in the reduction of atmospheric pollution. Strategies for managing the reduction of noise in urban areas.	Reference to controls on CFC emissions; examples: from countries with contrasting levels of economic developments, Kyoto and Buenos Aires (1998) and Rio de Janeiro (1992) meetings and the problems in achieving agreement. Afforestation and the use of alternative energy sources. Reference to examples such as a LEDC and a MEDC to illustrate problems in controlling industrial pollution. Wherever possible, local studies offer better opportunities for studying the causes and effects of urban pollution including: noise, carbon monoxide and ground level ozone.

The hydrosphere		
Key Question	**Content**	**Notes for Guidance**
1 How is water stored and transferred globally and locally?	The main storage zones of water and the percentages of water held in each, e.g. the global and local hydrological cycles, rising sea levels and coastal inundation. The effects of agriculture, industry and domestic usage upon natural supplies of water. How human activity in the form of urban development, deforestation and agriculture may cause rivers to flood. The local water cycle includes evaporation, precipitation, interception, run-off, infiltration and groundwater. Groundwater stores are to include the features of natural aquifers: confined, unconfined and perched.	The global (closed) system in conjunction with the more localised open system, which could be a local drainage basin. It is possible to undertake the local element of this study through field work. Examples of natural aquifers can be on a small local scale or of the scale of the Australian Basin.
2 What has been the impact of human activity on the quantities of water in natural stores?	The impact of climatic change and global warming on sea and ice volumes. The impact of rising sea levels, both in the past as with ice ages and currently through the increased likelihood of flooding in low-lying areas. The impact of agriculture and the supply of water for industrial and domestic use upon natural supplies of water. The interaction between growth in population and water supply in countries with contrasting levels of economic development.	Emphasis on the fragility of the global climate with reference to both falling (past) and rising sea levels (current and future). Diminishing water supplies as a result of agriculture could include the Aral Sea, Prairies, Australian Artesian Basin. Shortages due to urban and industrial demand may include Mexico City, Middle East, London Basin. There is an opportunity to research local water supplies and supply.
3 How can water supply be sustained and what are the environmental consequences of the artificial storage of water?	The management of water supply on a local and regional scale, including disparities in water resources, the demand for water and the supply of water. Dams, barrages and reservoirs. Advantages: water supply recreation, power, environment and local climate. Disadvantages: cost, silting, socio-economic and environmental. Water supply in arid countries to include groundwater and desalinisation.	Examples chosen from contrasting areas such as USA (Colorado), China (Three Gorges), Nigeria or Ghana. Examples of desalinisation in Persian Gulf states, Malta. Case studies should compare and contrast: • countries with contrasting levels of economic development • areas with a plentiful natural supply of water with drought affected regions.
4 How does human activity lead to the pollution of water stores and how can this form of pollution be managed?	Pollution of groundwater by metals, nutrients, and organic compounds. Nutrient enrichment and eutrophication of lakes and rivers; the main sources of eutrophication and its effects. The impact of sewage disposal upon rivers, lakes and seas and the main health and environmental problems associated with the disposal of sewage sludge. Marine pollution and effects on aquatic and bird life and on the coastal environment. Pollution of rivers and lakes by industrial spillage and river/lake pollution. Management via waste controls, local and regional policies.	Candidates may use local studies and link the examination requirements with the wide range of research projects on the topic. Other case studies could include the Rhine, Ganges, the Mediterranean Sea and oil tanker spillage.

The biosphere		
In this module, two contrasting ecosystems should be studied to a greater depth and should incorporate information from Key Questions 1, 2 and 3; ideally one of these studies can be based upon an area with which the students have some personal familiarity.		
Key Question	**Content**	**Notes for Guidance**
1 What are the major abiotic and biotic factors, which drive and influence the distribution of different ecosystems? What are the main components and characteristics of ecosystems and how are they structured?	The biotic and abiotic factors which control the distribution of the world's major biomes as listed in the notes for guidance. The characteristics of ecosystems in terms of their biotic and abiotic components (soil, temperature, rainfall, photosynthesis, net primary productivity, succession, biomass, biodiversity, trophic levels, food chains and webs, habitats and niches). The relationship between ecological pyramids, pyramid of numbers, biomass and energy. The interaction of these components to be illustrated through relative size of the flows and stores of nutrients between vegetation, litter and soil.	A survey of the global system followed by a study of the distribution of the following biomes: tropical rainforest, monsoon rainforest, tropical savannah, desert, temperate deciduous and high altitude and latitude tundra, including permafrost. Two contrasting case studies should be chosen from these. Whilst a biome can be considered a global scale ecosystem, ecosystems occur on a variety of scales within broad vegetation zones. Photosynthesis: its requirements and process. Photosynthesis and different wavelengths. The influence of light intensity and rainfall on plant productivity.
2 How has human activity both disrupted and destroyed ecosystems?	The impact of agriculture, deforestation, exploitation and fires upon terrestrial ecosystems. The formation of plagioclimaxes, arrested successions and loss of biodiversity. The effects of clearing tropical rainforest for industrial and agricultural use. The impact of commercial farming in MEDCs and LEDCs (with named examples) leading to the loss of local habitats. The influence of human activity upon marine ecosystems; including coastal waters, oceans and coral reefs.	This can extend to the previous examples chosen in Key Question 1. Examples could include: Amazonia, the Great Barrier Reef, the Galapagos Islands and areas that are local to the Centre.
3 What methods have been used to preserve, conserve, and restore ecosystems? To what extent have meetings between nations and pressure groups been important in highlighting environmental awareness and managing the biosphere?	Methods to include National Parks, afforestation, maintaining biological diversity through, e.g. pollution control, changing agricultural systems, ecotourism, forest conservation, wildlife management, and ecological islands. The impact of international protocols (e.g. Rio de Janeiro, Montreal, Kyoto and Bali) and research and pressure from groups such as the WWF. Sustainable development within conservation areas.	Case studies as appropriate or a survey of conservation and restoration of ecosystems with reference to a broader range of examples.
4 What has been the impact of population growth upon the resources of countries at contrasting levels of economic development?	Population, resources and carrying capacity: the population models of Malthus and Boserup. The concepts of overpopulation, underpopulation and optimum population. Policies aimed at resolving these issues include: sustainable and more productive farming methods in countries with contrasting levels of economic development; economic and social development; the sustainable provision of energy and industrial raw materials.	A study of the population models followed by contrasting case studies, e.g. Mauritius, India, UK. Examples can include China, UK or another European country and Canada or Australia. Agricultural improvements can be illustrated through the Green Revolution, biotechnology etc. More general economic and social development through case studies including a MEDC and a LEDC.

7. Coursework: guidance for Centres

7.1 General information

Candidates should produce a report of 1500–2000 words on an issue arising out of their course of study.

The report may focus on a local, regional, national or global issue. Whilst the issue may derive out of the traditional areas of environmental science, the report must contain an investigation and evaluation of the management issues associated with the topic. The research topic may be chosen from any part of the 4 units of this syllabus.

Whilst secondary source material is useful in providing background information, it is important that candidates use primary sources and collect field data. Candidates may use sources of information other than those obtained from field study; these may include the internet, the media, documented data from companies and organisations.

The report is also a test of a candidate's ability to confine their report to the word limit of 2000 words; over-long reports may contain too much extraneous material which may count against the candidate at final marking.

Candidates are expected to clearly identify an environmental management issue and then organise their report into the following stages of:

- An introduction identifying an issue expressed through a hypothesis or question.
- A methodology, which outlines the investigative avenues used for the study and justifies their use.
- A results and analysis section. This should form the main part of the study and contain data expressed through illustrative techniques such as pictorial (diagrams and photographs), tables and graphs. This illustrative material should be analysed through detailed descriptions and explanations.
- A conclusion which draws together the findings of the investigation.
- An evaluation of the study which assesses its success and/or shortcomings.

To ensure that they comply with the requirements of the syllabus, Centres must seek approval for project titles, in advance, from Cambridge. The approval form asks for candidate details, project title and a brief description for each candidate.

The deadlines and methods for submitting report proposals are in the *Cambridge Administrative Guide* available on our website.

The form must be submitted by email to Cambridge at cieopf@cie.org.uk. Syllabus number and Centre number should be clearly shown.

The form, and the instructions for completing it, may be downloaded from **www.cie.org.uk/samples**. The database will ask you for the syllabus code (i.e. 8291) and your Centre number, after which it will take you to the correct forms. Follow the instructions when completing each form.

It is the responsibility of teachers in the Centre to monitor the work undertaken by the candidates and make certain that the work complies with the syllabus. The report should be assessed by teachers in the Centre.

The deadlines and methods for submitting internally assessed marks are in the *Cambridge Administrative Guide* available on our website.

7.2 Example of a research report

Research topic: 'To what extent has industrial pollution of a nearby river been successfully controlled and reduced'?

Relation of topic to syllabus:

(a) The problem identified is the pollution of a river through industrial effluent and the extent to which industries manage their waste and river pollution has been reduced.

(b) This topic relates to waste management, the need to dispose of industrial waste materials and manage/reduce river pollution.

(c) Data sources might include:

- counting the variety of species at various points before and after the discharge point
- considering the different species present at these points
- testing samples of river water before and after the discharge point
- investigating the policies of contributing industries
- using local or internet data sources.

(d) Candidates should ascertain how much data they can collect and analyse in the time available to enable them to produce viable conclusions.

(e) The scale of the project should not be so small that valid data cannot be identified or that a variety of environments need to be examined. On the other hand, it should not be so big as to make the collection of data too time-consuming.

7.3 Assessment criteria for Coursework

There are three skills that will be assessed in the preparation of the report:

Skill	Description	Mark
C1	Research and planning	6
C2	Data collection and presentation	9
C3	Conclusion and evaluation	5

Mark schemes for assessment should be based on the following criteria:

Skill C1: Research and planning

(a) The hypothesis or question is clearly stated. 1 mark

(b) There is evidence of knowledge through a clear explanation of the principle underpinning the hypothesis or question. 2 marks

(c) The plan includes appropriate methods clearly explained. 2 marks

(d) The developed plan is effective at testing the hypothesis. 1 mark

Skill C2: Data collection and presentation

(a) Data observations are clearly presented in a suitable format. 2 marks

(b) Data is collected and recorded accurately and with an appropriate degree of precision. 2 marks

(c) The report is organised in a logical order of presentation (information, description, explanation, diagrams). 2 marks

(d) The quality of written communication. 2 marks

(e) Suitable statistical tools are used to analyse the data. 1 mark

Skill C3: Conclusions and evaluation

(a) Full conclusions are drawn, supported by reference to the data. 2 marks

(b) Knowledge of environmental and management principles are used to explain trends and patterns in own results. 2 marks

(c) There is an evaluative assessment of the report in terms of its limitations and level of success. 1 mark

This total of 20 marks will then be doubled to a mark out of 40.

Each Skill criterion is marked on a scale of 0 to 1 or 2, as follows:

2 = criterion fully met, 1 = criterion partly met, 0 = criterion not met at all.

or 1 = criterion met, 0 = criterion not met at all.

Recording candidates' marks

Candidates' marks must be recorded on the Individual Candidate Record Card produced by Cambridge. These forms, and the instructions for completing them, may be downloaded from **www.cie.org.uk/samples**. The database will ask you for the syllabus code (i.e. 8291) and your Centre number, after which it will take you to the correct forms. Follow the instructions when completing each form.

7.4 Moderation

All aspects of coursework will be moderated. Centres are expected to write their own Schemes of Assessment; these should comply with the syllabus aims and assessment objectives.

(a) Internal Moderation

When several teachers in a Centre are involved in internal assessment, arrangements must be made within the Centre for all candidates to be assessed to the same standard. It is essential that the marks for each skill assigned within different teaching groups (or classes) are moderated internally for the whole Centre entry. The Centre assessments will then be moderated externally by Cambridge.

The internally moderated marks for all candidates must be recorded on the Coursework Assessment Summary Form. This form, and the instructions for completing it, may be downloaded from **www.cie.org.uk/samples**. The database will ask you for the syllabus code (i.e. 8291) and your Centre number, after which it will take you to the correct form. Follow the instructions when completing the form.

(b) External Moderation

External moderation of internal assessment is carried out by Cambridge. Centres must submit candidates' internally assessed marks to Cambridge. The deadlines and methods for submitting internally assessed marks are in the *Cambridge Administrative Guide* available on our website.

Once it has received the marks, Cambridge will draw up a list of sample candidates whose work will be moderated (a further sample may also be requested), and will ask the Centre to immediately send the Coursework of these candidates together with Individual Candidate Record Cards and Coursework Assessment Summary Forms. These forms, and the instructions for completing them, may be downloaded from **www.cie.org.uk/samples**. For each candidate on the list, every piece of work which has contributed to the final mark should be sent to Cambridge.

If there are ten or fewer candidates, the Coursework that contributed to the final mark for **all** the candidates must be sent to Cambridge.

A further sample may be required and all record and supporting written work should be retained until after publication of results.

For more information about external moderation please consult the *Cambridge Handbook* and the *Cambridge Administrative Guide*.

Ideally, candidates should use loose-leaf A4 file paper for the Coursework. Original work is preferred for moderation, but authenticated photocopies can be sent if absolutely necessary.

Pieces of work should **not** be stapled together. Each piece of work should be clearly and securely labelled with:

- the Centre number
- the candidate's name and number
- the title of the report
- the skill being assessed
- a copy of the mark scheme used
- the mark awarded.

8. Appendix

8.1 Resource list

Author	Title	Date	Publisher	ISBN
Alma, P J	*Environmental Concerns*	1993	*Cambridge Social Biology Topics* Cambridge University Press	0521428696
Botkin, Daniel B and Keller, Edward A	*Environmental Science: Earth as a living planet*	2005	Wiley	047148816X
Byrne, Kevin	*Environmental Science*	2001	*Bath Advanced Science* Nelson Thornes	0174483058
Chrispin, J and Jegede, Francis	*Population, Resources and Development*	2000	Collins Educational	0003266516
Collard, Roy	*The Physical Geography of Landscape*	1988	Collins Educational	0003222853
Hayward, Geoff	*Applied Ecology*	1992	*University of Bath Science 16–19* Nelson Thornes	017448187X
Hyde, Paul and Reeve, Paul	*Essentials of Environmental Management*	2001	IOSH Services Ltd	0901357286
Kemp, David	*Exploring Environmental Issues, An Integrated Approach*	2004	Routledge, Taylor and Francis Group	0415268648
Nebel, Bernard J and Wright, Richard T	*Environmental Science: The Way the World Works* (4th ed.)	2001	Prentice Hall	0130325384
O'Hare, Greg and Sweeney, John	*The Atmospheric System*	1986	Oliver & Boyd	0050037420
Porteous, Andrew	*Dictionary of Environmental Science and Technology*	2008	Wiley	0470061952
Waugh, David	*Geography: an integrated approach* (4th ed.)	2009	Nelson Thornes	1408504073
Witherick, Michael et al	*Environment and People: an integrated course for A and AS Geography*	1995	Nelson Thornes	0748721207
Woodfield, Judith (editor)	*Ecosystems and Human Activity*	2000	Collins Educational	0003266524
Wright, Richard T and Nebel, Bernard J	*Environmental Science: Toward a Sustainable Future*	2007	Pearson Education	0132051362

Resources are also listed on Cambridge's public website at **www.cie.org.uk**. Please visit this site on a regular basis as the Resource lists are updated through the year.

Access to teachers' email discussion groups, suggested schemes of work and regularly updated resource lists may be found on the Cambridge Teacher Support website at **http://teachers.cie.org.uk**. This website is available to teachers at registered Cambridge Centres.

8.2 Mathematical requirements

Cambridge assumes that all candidates for Environmental Management are able to:

- perform calculations involving addition, subtraction, multiplication and division of numbers
- perform numerical work accurately and handle calculations so that significant figures are neither lost unnecessarily nor carried out beyond what is justified
- make approximate evaluations of numerical expressions (e.g. π^2 10) and use such approximations to check the magnitude of machine calculations
- express fractions as percentages and vice versa
- recognise and use expressions in decimal and standard form notation
- use tables or calculators to evaluate powers, roots, reciprocals, arithmetic means
- substitute physical quantities into equations using consistent units
- change the subject of an equation
- solve simple algebraic equations
- formulate simple algebraic equations as mathematical models of physical situations
- recognise and use the forms of expressions such as ab, a/b, x^n , x^{-n}
- comprehend the meanings of, and use the symbols/notations: <, >, =, /, α,
- calculate areas of right-angled and isosceles triangles, circumferences and areas of circles and volumes of rectangular blocks and cylinders
- test a relationship for direct proportionality graphically and numerically
- select appropriate variables and scales for plotting a graph, especially to obtain a linear graph of the form $y = mx + c$
- determine and interpret the slope and intercept of a linear graph
- choose by inspection a straight line that will serve as the 'least bad' linear model for a set of data presented graphically: use of scatter graphs and lines of best fit
- understand and use the area below a curve where this has physical significance.

8.3 Glossary of terms

It is hoped that the glossary (which is relevant only to science subjects) will prove helpful to candidates as a guide (i.e. it 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 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 *Explain* may imply reasoning or some reference to theory, depending on the context.

6 *Describe* requires the candidate to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena.

   In other contexts, *describe* should be interpreted more generally (i.e. the candidate has greater discretion about the nature and the organisation of the material to be included in the answer). *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 in the topic.

8 *Outline* implies brevity (i.e. restricting the answer to giving essentials).

9 *Predict* or *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. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question.

10 *Suggest* is used in two main contexts (i.e. either to imply that there is no unique answer or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may be formally 'not in the syllabus').

11 *Find* is a general term that may variously be interpreted as calculate, measure, determine, etc.

12 *Compare* is used to identify similarities.

13 *Contrast* is used to identify differences.

14 *Calculate* is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.

15 *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).

16 *Determine* often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula (e.g. relative molecular mass).

17 *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.

18 *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, asymptote or discontinuity at a particular value).

In diagrams, *sketch* implies that a simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear exposition of important details.

9. 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/examsofficers**

Language

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

Grading and reporting

Cambridge International A 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 results) and Y (to be issued) may also appear on the statement of results but not on the certificate.

Cambridge International AS Level results are shown by one of the grades 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 results) and Y (to be issued) may also appear on the statement of results but not on the certificate.

If a candidate takes a Cambridge International A Level and fails to achieve grade E or higher, a Cambridge International AS Level grade will be awarded if both of the following apply:

- the components taken for the Cambridge International A Level by the candidate in that series included all the components making up a Cambridge International AS Level
- the candidate's performance on these components was sufficient to merit the award of a Cambridge International AS Level grade.

For languages other than English, Cambridge also reports separate speaking endorsement grades (Distinction, Merit and Pass), for candidates who satisfy the conditions stated in the syllabus.

Entry 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 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 codes for your administrative zone can be found in the *Cambridge Guide to Making Entries*.

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