CAMBRIDGE
International Education

Syllabus

Cambridge IGCSE™

Environmental Management 0680

Use this syllabus for exams in 2027, 2028 and 2029.
Exams are available in the June and November series.
Exams are also available in the March series in India.

Version 1

For the purposes of screen readers, any mention in this document of Cambridge IGCSE refers to Cambridge International General Certificate of Secondary Education.

Cambridge Pathway

Why choose Cambridge?

We work with schools worldwide to build an education that shapes knowledge, understanding and skills. Together, we give learners the confidence they need to thrive and make a positive impact in a changing world.

As part of the University of Cambridge, we offer a globally trusted and flexible framework for education from age 3 to 19, informed by research, experience, and listening to educators.

With recognised qualifications, high-quality resources, comprehensive support and valuable insights, we help schools prepare every student for the opportunities and challenges ahead.

Qualifications that are recognised and valued worldwide

From the world's top-ranked universities to local higher education institutions, Cambridge qualifications open doors to a world of opportunities.

Setting a global standard

With over 160 years of experience in delivering fair, valid and reliable assessments to students worldwide, we offer a global, recognised performance standard for international education.

Your path, your way

Schools can adapt our curriculum, high-quality teaching and learning resources and flexible assessments to their local context. Our aligned offer helps Cambridge schools support every learner to reach their potential and thrive.

Learning with lasting impact

Cambridge learners build subject knowledge and conceptual understanding, and develop a broad range of skills, learning habits and attributes to help make them ready for the world.

Improving learning outcomes through data-led insight and action

Our trusted baseline and diagnostic assessments, together with our insights and evaluation service, help schools turn data into knowledge and actionable insights, to inform teaching decisions and improve learner outcomes.

Bringing together a community of experts

We bring together the collective knowledge of experts and our diverse community of educators worldwide, supporting them to learn from one another and share ideas and information.

Tackling the climate crisis together

We believe that education is key to tackling the climate crisis. Together with Cambridge schools, we can empower young people with the skills and knowledge to take action on climate change, helping them be ready for the world.

School feedback: 'We think the Cambridge curriculum is superb preparation for university.'

Feedback from: Christoph Guttentag, Dean of Undergraduate Admissions, Duke University, USA

Contents

Important: Changes to this syllabus

For information about changes to this syllabus for 2027, 2028 and 2029, go to page 48.

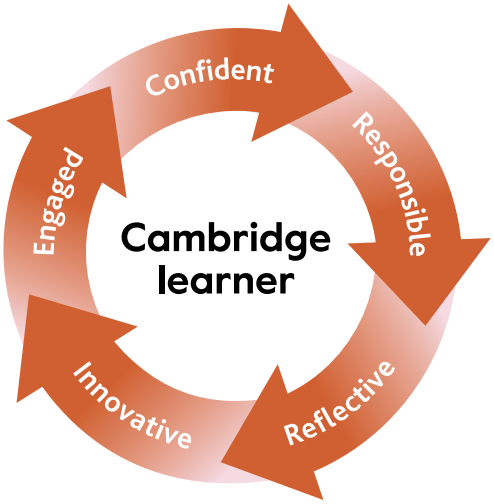
1 Why choose this syllabus?

Key benefits

Cambridge IGCSE is the world's most popular international qualification for 14 to 16 year olds, although it can be taken by students at any age. Taught by over 5000 schools in 150 countries, it is tried, tested and trusted.

Students can choose from 70 subjects in any combination, including 30 languages.

Our programmes promote a thorough knowledge and understanding of a subject and help to develop the skills learners need for their next steps in education or employment.



Cambridge IGCSE Environmental Management develops a set of transferable skills including handling data, planning fieldwork, using the scientific method and applying knowledge and understanding of scientific facts and concepts to solve problems. Learners develop relevant attitudes, such as concern for accuracy and precision, objectivity, integrity, enquiry, initiative and inventiveness. They acquire the essential scientific skills required for progression to further studies or employment.

Our approach in Cambridge IGCSE Environmental Management encourages learners to be:

confident, interested in learning about science and the environment, questioning ideas and using scientific language to communicate their views and opinions

responsible, working methodically and safely when working alone or collaboratively with others and developing an appreciation of responsibilities towards the community and the environment

reflective, learning from their experiences and interested in environmental issues that affect the individual, the community and the wider world

innovative, solving unfamiliar problems confidently, creatively and with new technology

engaged, keen to develop scientific skills, being curious about scientific principles and their application in the world and their impacts on the environment.

School feedback: 'The strength of Cambridge IGCSE qualifications is internationally recognised and has provided an international pathway for our students to continue their studies around the world.'

Feedback from: Gary Tan, Head of Schools and CEO, Raffles Group of Schools, Indonesia

Qualifications that are recognised and valued worldwide

Cambridge qualifications prepare and equip learners with the skills they need to thrive at university and beyond. The world's best higher education institutions recognise our qualifications and value the critical thinking skills, independent research abilities and deep subject knowledge that Cambridge learners bring.

We continually work with universities and colleges in every part of the world to ensure that they understand and accept our qualifications. Cambridge IGCSE provides a springboard to the Cambridge Advanced stage, as well as other post-16 routes. The combination of knowledge and skills in Cambridge IGCSE Environmental Management gives learners a solid foundation for further study. Candidates who achieve grades A* to C are well prepared to follow a wide range of courses including Cambridge International AS Level Environmental Management.

Many universities require a combination of Cambridge International AS & A Levels and Cambridge IGCSEs or equivalent to meet their entry requirements.

UK ENIC, the national agency in the UK for the recognition and comparison of international qualifications and skills, has carried out an independent benchmarking study of Cambridge IGCSE and found it to be comparable to the standard of the GCSE in the UK. This means students can be confident that their Cambridge IGCSE qualifications are accepted as equivalent to UK GCSEs by leading universities worldwide.

Learn more at **www.cambridgeinternational.org/recognition**

School feedback: 'Cambridge IGCSE is one of the most sought-after and recognised qualifications in the world. It is very popular in Egypt because it provides the perfect preparation for success at advanced level programmes.'

Feedback from: Managing Director of British School of Egypt BSE

Supporting teachers

We believe education works best when teaching and learning are closely aligned to the curriculum, resources and assessment. Our high-quality teaching support helps to maximise teaching time and enables teachers to engage learners of all backgrounds and abilities.

We aim to provide the following support for each Cambridge qualification:

- Syllabus
- Specimen question papers and mark schemes
- Specimen paper answers
- Schemes of Work
- Example candidate responses
- Past papers and mark schemes
- Principal examiner reports for teachers

These resources are available on the School Support Hub at **www.cambridgeinternational.org/support**, our secure online site for Cambridge teachers. Your exams officer can provide you with a login.

Additional teaching & learning resources are also available for many syllabuses and vary according to the nature of the subject and the structure of the assessment of each syllabus. These can include ready-built lesson materials, digital resources and multimedia for the classroom and homework, guidance on assessment and much more. Beyond the resources available on the Schools Support Hub, a wide range of endorsed textbooks and associated teaching and learning support are available from Cambridge at **www.cambridge.org/education** and from other publishers. Resources vary according to the nature of the subject and the structure of the assessment of each syllabus.

You can also contact our global Cambridge community or talk to a senior examiner on our discussion forums.

Sign up for email notifications about changes to syllabuses, including new and revised products and services, at **www.cambridgeinternational.org/syllabusupdates**

Professional development

Find the next step on your professional development journey.

- **Introduction courses** – An introduction to Cambridge programmes and qualifications. For teachers who are new to Cambridge programmes or new to a specific syllabus.
- **Focus on Teaching courses** – These are for teachers who want to explore a specific area of teaching and learning within a syllabus or programme.
- **Focus on Assessment courses** – These are for teachers who want to understand the assessment of a syllabus in greater depth.
- **Marking workshops** – These workshops help you become more familiar with what examiners are looking for, and provide an opportunity to raise questions and share your experiences of the syllabus.
- **Enrichment Professional Development** – Transform your approach to teaching with our Enrichment workshops. Each workshop focuses on a specific area of teaching and learning practice.
- **Cambridge Professional Development Qualifications (PDQs)** – Practice-based programmes that transform professional learning for practicing teachers. Available at Certificate and Diploma level.

For more information visit **www.cambridgeinternational.org/support-for-teachers**

Supporting exams officers

We provide comprehensive support and guidance for all Cambridge exams officers.
Find out more at: **www.cambridgeinternational.org/eoguide**

2 Syllabus overview

Aims

The aims describe the purposes of a course based on this syllabus.

The aims are to enable students to:

- acquire scientific knowledge and understanding of scientific theories and practice
- develop knowledge of a variety of environmental contexts and apply appropriate scientific knowledge and theories to those contexts
- communicate effectively and clearly, using appropriate terminology and scientific conventions
- understand the significance of climate change, including the knowledge and skills required to address climate-related challenges at local, national and global levels
- evaluate strategies to manage the impacts of environmental issues in the context of sustainability needs and climate change action
- develop a range of fieldwork skills, including working safely with consideration for habitats and organisms being studied
- use scientific data and evidence to solve problems and discuss the limitations of scientific methods and the impact this could have on decisions
- develop a sense of awareness and consideration for the welfare of the environment and all organisms and how they might be protected
- develop an interest in environmental management through the discovery of strategies, their impacts and ability to manage climate change that could inspire further study.

We are an education organisation and politically neutral. The contents of this syllabus, examination papers and associated materials do not endorse any political view. We endeavour to treat all aspects of the exam process neutrally.

Content overview

The syllabus is divided into seven topics that have been designed to develop an understanding of both the natural and human environment.

1 Natural resources
2 Land
3 Water
4 The atmosphere and human activities
5 Ecosystems, biodiversity and fieldwork
6 Natural hazards
7 Human population

Every Cambridge school has the opportunity to deliver climate education that shapes knowledge, understanding and skills, and gives learners the confidence to thrive and make a positive impact in our changing world. This Cambridge IGCSE Environmental Management syllabus has been designed to help schools do this.

Faculty feedback: 'Understanding how and why our climate is changing and providing the knowledge and skills to explore the challenges plays a key role in every student's education.'

Feedback from: Dr Amy Munro-Faure, Head of Education and Student Engagement of Cambridge Zero

Assessment overview

All candidates take two papers. Candidates will be eligible for grades A* to G.

All candidates take:

Paper 1 1 hour 45 minutes

Principles of Environmental Management 50%

80 marks

This paper consists of short-answer and structured questions with extended response questions based on source material.

Externally assessed

and:

Paper 2 1 hour 45 minutes

Environmental Management in Context 50%

80 marks

This paper consists of short-answer, data processing and analysis, and extended response questions based on source material.

Externally assessed

Information on availability is in the **Before you start section.**

Assessment objectives

The assessment objectives (AOs) are:

AO1 Knowledge with understanding

Candidates should be able to demonstrate knowledge and understanding of:

- phenomena, facts, definitions, concepts and theories
- vocabulary, terminology and conventions
- strategies for managing the environment locally, regionally and globally.

Subject content defines the factual material that candidates may be required to recall and explain.

Candidates will also be asked questions that require them to apply this material to familiar and unfamiliar contexts and to apply knowledge from one area of the syllabus to another.

AO2 Handling information and problem-solving

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

- locate, select, organise and present information from a variety of sources
- translate information and evidence from one form to another
- manipulate numerical and other data
- interpret data, identify patterns and describe relationships
- solve problems, including some of a quantitative nature.

Questions testing these skills may be based on information and contexts that are unfamiliar to candidates, requiring them to apply the principles and concepts from the syllabus to a new situation, in a logical, deductive way.

AO3 Investigation skills and making judgements

Candidates should be able to:

- plan fieldwork investigations and how to do them safely
- evaluate methods, identify limitations and suggest improvements to fieldwork investigations
- suggest reasoned explanations for phenomena, patterns and relationships
- make reasoned judgements and form conclusions based on evidence.

Questions testing these skills may be based on information and contexts that are familiar or unfamiliar to candidates, requiring them to apply the principles and concepts from the syllabus to a new situation, in a logical, deductive way.

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 %
AO1 Knowledge with understanding	43
AO2 Handling information and problem-solving	30
AO3 Investigation skills and making judgements	27
Total	100

Assessment objectives as a percentage of each component

Assessment objective	Weighting in components %	
	Paper 1	Paper 2
AO1 Knowledge with understanding	55	30
AO2 Handling information and problem-solving	30	30
AO3 Investigation skills and making judgements	15	40
Total	100	100

3 Subject content

This syllabus gives you the flexibility to design a course that will interest, challenge and engage your learners. Where appropriate you are responsible for selecting subject contexts to support your learners' study. These should be appropriate for the learners' age, cultural background and learning context as well as complying with your school policies and local legal requirements.

Detailed specific examples

Teachers should use detailed specific examples from a variety of environmental contexts when teaching this course. Teachers could choose an example from their home country or world region to make this course as relevant to learners and their local context as possible.

Named detailed specific examples are not included in this syllabus. This gives teachers freedom in selecting examples which are most suitable for their candidates.

Sustainability should also be considered when teaching the subject content, especially when studying management strategies and techniques.

1 Natural resources

1.1 Formation of rocks

1.1.1 Describe the formation of named igneous, sedimentary and metamorphic rocks, limited to:
- (a) igneous: granite and basalt
- (b) sedimentary: limestone, sandstone and shale
- (c) metamorphic: marble and slate.

1.1.2 Describe and interpret the rock cycle, limited to:
- (a) weathering
- (b) erosion
- (c) transportation
- (d) sedimentation
- (e) compaction
- (f) cementation
- (g) crystallisation
- (h) deposition.

1.1.3 Define permeability as the ability of water to pass through the pore spaces of rock and soil.

1.1.4 Classify rocks as permeable and impermeable, limited to:
- (a) permeable: most sedimentary rocks (limestone and sandstone)
- (b) impermeable: igneous, metamorphic and some sedimentary rocks (shale).

1.2 Extraction of rocks, ores and minerals

1.2.1 Define an ore as rock containing minerals and metals.

1.2.2 Describe the methods of extracting rocks, ores and minerals from mines, limited to:

(a) surface extraction: opencast, open-pit, open-cut and strip mining
(b) subsurface extraction: deep mining and shaft mining
(c) biological extraction: phytomining and bioleaching.

1.2.3 Describe the factors that affect the decision to extract rocks, ores and minerals, limited to:

(a) exploration
(b) geology
(c) accessibility and terrain
(d) quantity and quality of deposit (ore grade)
(e) climate
(f) environmental impact assessment
(g) supply and demand
(h) cost and profit.

1.2.4 Describe and explain the environmental, economic and social impacts of extracting rocks, ores and minerals, limited to:

(a) loss of habitat and biodiversity
(b) air, land, noise, visual and water pollution
(c) water usage
(d) waste management
(e) changes in employment opportunities
(f) local and national economies
(g) facilities and infrastructure.

1.2.5 Describe strategies for managing landscapes damaged by extracting rocks, ores and minerals, limited to:

(a) land restoration: replacement of overburden, soil improvement, bioremediation and tree planting
(b) repurposing land: landfill, lakes, recreation and nature reserves.

1.2.6 Discuss the benefits and limitations of strategies for managing landscapes damaged by extracting rocks, ores and minerals.

1.3 Sustainable management of rocks, ores and minerals

1.3.1 Define a finite resource as a natural resource that is used up at a faster rate than it is replaced.

1.3.2 Define sustainable management of resources as the use of strategies that ensure the needs of the present are met without compromising the ability of future generations to meet their own needs.

continued

1.3 Sustainable management of rocks, ores and minerals continued

1.3.3 Describe sustainable management strategies for rocks, ores and minerals, limited to:

(a) reduce and reuse
(b) recycling: accessibility, ease and education
(c) increased efficiency of extraction
(d) avoiding resource depletion
(e) legislation
(f) enforcement
(g) use of alternative materials.

1.3.4 Discuss the benefits and limitations of sustainable management strategies for rocks, ores and minerals.

1.4 Energy resources

1.4.1 Describe the formation of fossil fuels, limited to:

(a) coal
(b) petroleum (oil)
(c) natural gas (methane).

1.4.2 Classify energy resources as renewable (non-finite) and non-renewable (finite), limited to:

(a) renewable (non-finite): biofuels (bioethanol, biomass, biogas and wood), geothermal power, hydro-electric power, tidal power, wave power, solar power and wind power
(b) non-renewable (finite): fossil fuels and nuclear power using uranium.

1.4.3 Describe how the energy resources in 1.4.2 are used to generate electricity.

1.4.4 Discuss the benefits and limitations of the energy resources in 1.4.2.

1.4.5 Describe and explain the factors affecting demand for energy, limited to:

(a) transport
(b) personal and national wealth
(c) climate
(d) human population size
(e) industry
(f) disruption to supply
(g) unreliable supply
(h) scarcity of resources.

1.5 Conservation and management of energy resources

1.5.1 Describe strategies for the management of energy resources, limited to:

(a) reducing consumption
(b) insulation
(c) energy-efficient devices including vehicles and electrically propelled vehicles
(d) exploiting existing energy resources
(e) education on energy conservation
(f) transport policies
(g) battery storage
(h) development of new energy resources.

1.5.2 Describe the development of new energy resources, limited to:

(a) blue hydrogen fuel: produced from natural gas
(b) green hydrogen fuel: produced using renewable resources
(c) ground source heat pumps: transfer of heat from the ground for heating
(d) air source heat pumps: transfer of heat from the air for heating.

1.5.3 Discuss the benefits and limitations of strategies for the management of energy resources.

1.6 Fracking

1.6.1 Define fracking as the extraction of natural gas or petroleum from shale rock by hydraulic fracturing.

1.6.2 Discuss the benefits and limitations of fracking.

2 Land

2.1 Soils and crop growth

2.1.1 Describe the composition of soils, limited to:

(a) mineral particles: sand, silt and clay
(b) organic content: living organisms (plants, animals, fungi and bacteria) and organic matter from decomposition
(c) gases
(d) water.

Knowledge of percentage composition of soils is **not** required.

continued

2.1 Soils and crop growth continued

2.1.2 Describe how the composition of soils is important for crop growth, limited to:

(a) mineral particles: sand, silt and clay

(b) nutrient content: organic content and inorganic ions (nitrogen as nitrate ions NO_3^-, phosphorus as phosphate ions PO_4^{3-}, potassium as potassium ions K^+)

(c) pH: acidic, neutral and alkaline

(d) pore spaces

(e) gas content

(f) water content and drainage

(g) ease of cultivation.

2.1.3 Explain why loam soils are a good medium for crop growth, limited to:

(a) ideal combination of mineral particles and pore spaces

(b) retains moisture

(c) contains organic content and inorganic ions

(d) allows excess water to drain

(e) easy to cultivate.

2.1.4 Define weather as the day-to-day conditions of the atmosphere in a location.

2.1.5 State that some areas of the world experience wet seasons and dry seasons that impact crop growth.

2.1.6 Describe and interpret conditions suitable for the optimum rate of photosynthesis and crop growth, limited to:

(a) length of growing season

(b) optimum weather conditions

(c) daylight hours.

2.2 Food production and crop yield

2.2.1 Describe the different types of agriculture, limited to:

(a) arable, pastoral and mixed

(b) subsistence and commercial

(c) intensive

(d) monoculture.

2.2.2 Define sustainable food production as the production of sufficient food for the present generation using methods that ensure future generations can grow food from the same land.

continued

2.2 Food production and crop yield continued

2.2.3 Describe and explain strategies to increase food production and crop yield, limited to:

(a) mixed cropping, intercropping and crop rotation

(b) improved methods of irrigation: trickle/drip irrigation, rainwater harvesting and automated watering systems

(c) mechanisation

(d) genetically modified organisms: changing the genetic material of an organism by removing, changing or inserting individual genes to give favourable characteristics

(e) controlled environments: greenhouses, hydroponics and aeroponics

(f) managed grazing: livestock rotation

(g) urban farming

(h) agroforestry

(i) inorganic NPK fertilisers

(j) organic fertilisers: crop residue, manure and mulch

(k) chemical control of pests (pesticides): insect control (insecticide), weed control (herbicide) and fungus control (fungicide)

(l) biological control of pests.

2.2.4 Describe and explain the impacts of unsustainable agricultural practices on the environment and people, limited to:

(a) overproduction of food: food wastage

(b) food shortages: cash crops (coffee, cotton, soya beans and palm oil) and biofuel crops replacing food crops

(c) mismanagement of irrigation: soil erosion, salinisation and water logging

(d) overuse of pesticides: pesticide resistance, pest resurgence and impacts on pollinators

(e) overuse of fertilisers: leaching into water sources, nutrient enrichment and eutrophication

(f) exhaustion of nutrients in soils: organic content and inorganic ions

(g) removal of natural vegetation: deforestation, overcultivation and overgrazing

(h) monoculture and intensification: soil and water pollution, loss of biodiversity

(i) soil erosion: loss of topsoil and nutrients.

2.3 Soil erosion

2.3.1 Describe the causes of soil erosion, limited to:

(a) unsustainable agricultural practices

(b) deforestation

(c) farming on steep slopes

(d) bare soil

(e) wind and water erosion.

continued

2.3 Soil erosion continued

2.3.2 Describe the impacts of soil erosion, limited to:

(a) silting of rivers
(b) desertification
(c) mass movement: landslides, rockslides and mudslides
(d) loss of habitats and biodiversity
(e) reduction in crop yield
(f) malnutrition and famine
(g) displacement of people.

2.3.3 Describe and explain strategies to reduce soil erosion, limited to:

(a) terracing: reduces movement of soil and surface run-off
(b) contour ploughing: reduces surface run-off
(c) bunds: reduces surface run-off, reduces wind speed and wind erosion
(d) wind breaks: protects crops, reduces wind speed and wind erosion
(e) maintaining vegetation cover: roots bind the soil, vegetation reduces surface run-off and absorbs water
(f) addition of organic matter: improves soil structure.

3 Water

3.1 Water sources and supply

3.1.1 Describe and interpret the water cycle, limited to:

(a) stores: salt water (oceans) and fresh water (ice sheets and glaciers, ground water, atmosphere and lakes and rivers)
(b) transfers: precipitation, interception, surface run-off, infiltration, through-flow, ground water flow, transpiration, evaporation and condensation.

3.1.2 Describe the sources of fresh water used by people, limited to:

(a) atmosphere: rain and snow
(b) surface water: rivers, lakes and reservoirs
(c) ground water: aquifers and wells
(d) oceans: desalination plants.

3.1.3 Identify the world's oceans: Pacific, Atlantic, Indian, Southern and Arctic.

3.1.4 Define potable water as water that is safe to drink.

3.1.5 Describe the stages in water treatment to make water potable, limited to:

(a) screening
(b) sedimentation
(c) filtration
(d) chlorination.

continued

3.1 Water sources and supply continued

3.1.6 Compare the availability of potable water in different parts of the world, limited to:

(a) water-rich and water-poor regions

(b) urban and rural regions

(c) global inequalities in water availability and sewage treatment.

3.1.7 Describe the process of desalination, limited to:

(a) distillation: water heated until it boils, salt remains in the liquid, steam is pure water, steam is cooled and condensed to form potable water

(b) reverse osmosis: water is put under high pressure, passed through a membrane, membrane allows water molecules to pass through but stops most ions and other molecules.

3.1.8 Discuss the benefits and limitations of desalination.

3.1.9 Describe the uses of a multipurpose dam, limited to:

(a) flood control

(b) hydro-electric power

(c) irrigation

(d) storage of water

(e) transport

(f) recreation

(g) tourism

(h) fish farming.

3.1.10 Discuss the benefits and limitations of a multipurpose dam.

3.2 Water pollution

3.2.1 Describe the sources of water pollution, limited to:

(a) domestic waste

(b) sewage

(c) plastic waste

(d) industrial processes

(e) agricultural practices.

3.2.2 Describe and explain the impacts of water pollution on people and on the environment, limited to:

(a) risk of infectious bacterial diseases: cholera

(b) accumulation of toxic substances from industrial processes

(c) bioaccumulation of toxic substances in a single organism over time

(d) biomagnification of toxic substances as they increase in concentration as they are passed up a food chain

(e) the effect of acid rain on organisms in rivers and lakes

(f) leaching and nutrient enrichment from organic content and inorganic ions leading to eutrophication.

continued

3.2 Water pollution continued

3.2.3 Describe strategies for improving water quality, limited to:

(a) improved sanitation

(b) treatment of sewage

(c) pollution control and legislation.

3.3 Water-related diseases

3.3.1 Describe how mosquitoes spread malaria, limited to:

(a) female *Anopheles* mosquitoes as the vector

(b) malaria *Plasmodium* parasite transmitted to humans when bitten by an infected mosquito

(c) the malaria parasite is transmitted to non-infected mosquitoes when they feed on the blood of infected humans.

3.3.2 Describe strategies to control malaria, limited to:

(a) personal protection: nets, insect repellent, vaccination and antimalarial drugs

(b) vector control: cover or drain breeding areas, spraying large areas with insecticides, sterilise male mosquitoes and biological control.

3.3.3 Describe strategies to control cholera, limited to:

(a) handwashing

(b) adequate sanitation and sewage treatment

(c) potable water supply: boiling and chlorination

(d) vaccination.

3.3.4 Discuss the benefits and limitations of strategies to control water-related diseases.

3.4 Marine aquaculture

3.4.1 Describe and explain the impacts of exploitation of marine species, limited to:

(a) overfishing and overharvesting of marine species

(b) effect on target and bycatch species

(c) effect on food chains.

3.4.2 Define marine aquaculture as the farming of marine species in captivity, limited to:

(a) fish

(b) crustaceans

(c) seaweeds.

Knowledge of specific species is **not** required.

continued

3.4 Marine aquaculture continued

3.4.3 Describe and explain the impacts of marine aquaculture, limited to:

(a) reduced exploitation of natural fisheries
(b) increased food supply for humans
(c) risk of escape
(d) risk of disease
(e) local food webs
(f) nutrient enrichment from waste
(g) energy usage
(h) source of food for farmed species.

3.4.4 Describe and explain strategies for the management of the harvesting of marine species, limited to:

(a) limits on size of boat and overall net size
(b) increased mesh size of nets
(c) sustainable methods: pole and line
(d) quotas
(e) closed seasons
(f) limited number of fishing days
(g) protected areas
(h) conservation laws
(i) international agreements: implementation and monitoring.

3.4.5 Discuss the benefits and limitations of strategies for management of the harvesting of marine species.

3.5 Oil pollution

3.5.1 Describe the causes of oil pollution on marine and coastal ecosystems, limited to:

(a) off-shore and on-shore oil extraction
(b) pipelines
(c) shipping
(d) cleaning of tanks at sea
(e) refineries.

3.5.2 Describe the impacts of oil pollution on marine and coastal ecosystems, limited to the effects on:

(a) birds
(b) marine mammals
(c) fish
(d) crustaceans
(e) seaweeds
(f) coral reefs
(g) beaches.

Knowledge of specific species is **not** required.

continued

3.5 Oil pollution continued

3.5.3 Describe strategies for oil spill prevention in marine and coastal ecosystems, limited to:
- (a) MARPOL (International Convention for the Prevention of Pollution from Ships)
- (b) double-hulled oil tankers
- (c) risk assessments
- (d) regular maintenance.

3.5.4 Describe strategies for minimising the impacts of oil spills on marine and coastal ecosystems, limited to:
- (a) improved navigation systems for ships
- (b) booms and sorbents
- (c) detergent sprays
- (d) skimmers
- (e) controlled burning.

3.6 Plastic pollution

3.6.1 Describe conventional plastics as plastics made from fossil fuels that are generally non-biodegradable.

3.6.2 Describe bioplastics as plastics that can be biodegradable or non-biodegradable and are fully or partly made from biological raw materials rather than from fossil fuels.

3.6.3 Describe biodegradable plastics as plastics that:
- (a) are designed to decompose in water or soil
- (b) are decomposed by the action of bacteria and fungi into water, biomass and gases (carbon dioxide and methane)
- (c) decompose at different rates depending on biotic and abiotic factors.

3.6.4 Describe non-biodegradable plastics as plastics that break down over a long period of time.

3.6.5 Describe microplastics as plastics that are:
- (a) less than 5 mm in length
- (b) formed when larger plastics break down
- (c) used in commercial products.

3.6.6 Describe and explain the impacts of plastic pollution on marine ecosystems, limited to:
- (a) visual pollution
- (b) entanglement
- (c) risk of being mistaken for food by marine animals
- (d) bioaccumulation and biomagnification.

continued

3.6 Plastic pollution continued

3.6.7 Describe and explain strategies for managing the impacts of plastic pollution, limited to:

(a) alternative packaging
(b) avoiding single-use plastics
(c) safe disposal
(d) recycling
(e) legislation and enforcement.

4 The atmosphere and human activities

4.1 The atmosphere

4.1.1 Describe the structure and composition of the atmosphere, limited to:

(a) the names and relative order of the layers: troposphere, stratosphere, mesosphere and thermosphere
(b) the location of the ozone layer in the lower stratosphere
(c) percentage composition of clean air: 78% nitrogen, 21% oxygen, carbon dioxide, argon and water vapour.

4.1.2 Define climate as the weather conditions in a location based on the weather over many years.

4.1.3 Describe the natural greenhouse effect, limited to:

(a) solar radiation passes through the Earth's atmosphere
(b) some solar radiation is absorbed by the land and oceans, heating the Earth
(c) some solar radiation is reflected back into space
(d) some solar radiation is absorbed and re-emitted back to the Earth's surface by greenhouse gases and clouds
(e) this natural process warms the Earth enough to support life.

4.2 Climate change

4.2.1 Define a greenhouse gas as a gas that absorbs radiation and emits the energy as thermal (heat) energy.

4.2.2 State that carbon dioxide (CO_2), water vapour (H_2O) and methane (CH_4) are greenhouse gases.

4.2.3 Describe the causes of increased concentrations of greenhouse gases in the atmosphere, limited to:

(a) combustion of fossil fuels: releases carbon dioxide
(b) agriculture: digestion by cattle, manure decomposition and rice fields release methane
(c) deforestation: reduces removal of carbon dioxide by photosynthesis
(d) changes in land use: wetland drainage releases methane
(e) cement manufacture: calcium carbonate (limestone) is heated to produce calcium oxide (lime) and releases carbon dioxide
(f) increasing human population and increased energy usage: releases carbon dioxide.

continued

4.2 **Climate change** continued

4.2.4 Describe and explain the effects from increased concentrations of greenhouse gases in the atmosphere leading to the enhanced greenhouse effect, limited to:

(a) greenhouse gases absorb solar radiation causing global warming

(b) global warming can result in climate change.

4.2.5 Describe and explain the impacts of climate change, limited to:

(a) increase in temperature of Earth's surface

(b) increase in temperature of ocean surface (knowledge of ENSO, El Niño and La Niña is **not** required)

(c) melting of ice sheets, glaciers and permafrost leading to a rise in sea level

(d) ocean acidification due to increased concentrations of carbon dioxide in the atmosphere

(e) disruption to food chains

(f) change in biodiversity

(g) loss of habitat

(h) forced migration of humans and other animals

(i) increased frequency and severity of extreme weather events leading to flooding and loss of land, drought and wildfires

(j) change in crop yields

(k) increased pest outbreaks and invasive species

(l) food shortages.

4.2.6 Describe strategies for reducing carbon footprints to limit the impacts of climate change, limited to:

(a) reduced use of fossil fuels

(b) make more sustainable food choices: plant-based diet, seasonal food, buy locally produced foods

(c) reduction in livestock farming

(d) reduction in number of children per woman

(e) increase in energy efficiency

(f) reforestation and afforestation

(g) carbon sequestration: capture, remove and store carbon dioxide

(h) transport policies

(i) international agreements and policies

(j) taxation

(k) research and climate models

(l) use of artificial intelligence (AI) to predict the impacts of climate change and develop strategies to reduce the impacts of climate change.

4.2.7 Define climate change adaptation as altering behaviour, practices and infrastructure to adapt to the impacts of climate change.

continued

4.2 Climate change continued

4.2.8 Describe climate change adaptation strategies, limited to:

(a) crops that resist warmer, drier or wetter conditions

(b) improve flood defences

(c) legislation about building near coasts and on floodplains

(d) building design and materials.

4.2.9 Discuss the benefits and limitations of strategies to manage the impacts of climate change.

4.3 Acid rain

4.3.1 Describe the formation of acid rain, limited to:

(a) sulfur dioxide from combustion of fossil fuels which contain sulfur compounds

(b) sulfur dioxide from volcanic gases

(c) oxides of nitrogen when nitrogen from the atmosphere reacts with oxygen in the high temperature of vehicle engines

(d) sulfur dioxide and oxides of nitrogen react with oxygen and water vapour in the atmosphere to form acid rain.

4.3.2 Describe the impacts of acid rain, limited to:

(a) acidification of bodies of water

(b) reduced fish populations

(c) effect on aquatic food webs

(d) acidification of soils

(e) damage to crops and vegetation: plant defoliation and reduced crop yields

(f) damage to buildings.

4.3.3 Describe strategies to manage the impacts of acid rain, limited to:

(a) flue-gas desulfurisation to remove sulfur dioxide by reacting with calcium carbonate or calcium oxide

(b) catalytic converters to remove oxides of nitrogen

(c) transport policies.

4.3.4 Discuss the benefits and limitations of strategies to manage the impacts of acid rain.

4.4 Ozone depletion

4.4.1 State that chlorofluorocarbons (CFCs) in aerosols and refrigerants are the cause of ozone depletion in the ozone layer.

4.4.2 Describe the impacts of ozone depletion, limited to:
- (a) higher levels of solar radiation reaching the Earth's surface
- (b) increased rates of cancer and cataracts
- (c) damage to vegetation resulting in reduced crop yields.

4.4.3 Describe strategies to manage the impacts of ozone depletion, limited to:
- (a) international agreement and policies
- (b) CFC ban and alternatives to CFCs
- (c) safe disposal of CFCs.

4.4.4 Discuss the benefits and limitations of strategies to manage the impacts of ozone depletion.

5 Ecosystems, biodiversity and fieldwork

5.1 Ecosystems

5.1.1 Describe the components of an ecosystem, limited to:
- (a) habitat
- (b) species
- (c) population
- (d) community
- (e) niche
- (f) prey
- (g) predator
- (h) apex predator.

5.1.2 Describe the biotic and abiotic components of an ecosystem, limited to:
- (a) biotic (living): producers, primary, secondary and tertiary consumers and decomposers
- (b) abiotic (non-living): temperature, water, oxygen, carbon dioxide, salinity, light, pH.

5.1.3 Describe biotic interactions, limited to:
- (a) native and invasive species
- (b) competition
- (c) predation
- (d) pollination.

continued

5.1 **Ecosystems** continued

5.1.4 Describe pollination, limited to:

(a) the transfer of pollen from an anther to a stigma

(b) insect pollination by an insect pollinator

(c) wind pollination

(d) pollination leads to fertilisation followed by seed and fruit formation.

Knowledge of the structure and naming of flower parts are **not** required.

5.1.5 Describe the process of photosynthesis and the importance of chlorophyll, limited to:

(a) synthesis of glucose using carbon dioxide and water

(b) sunlight as the source of energy

(c) chlorophyll to capture light energy

(d) word equation: carbon dioxide + water → glucose + oxygen.

5.1.6 Describe and interpret energy flow using food chains, food webs and trophic levels, limited to:

(a) 10% of energy is passed between trophic levels (producer, primary consumer, secondary consumer and tertiary consumer)

(b) energy lost during life processes: movement, respiration, digestion and excretion.

5.1.7 Describe, interpret and explain ecological pyramids based on numbers and energy.

5.1.8 Describe the process of aerobic respiration, limited to:

(a) break down of glucose in the presence of oxygen to release energy, with carbon dioxide and water as waste products

(b) word equation: glucose + oxygen → carbon dioxide + water.

5.1.9 Describe the carbon cycle, limited to:

(a) photosynthesis

(b) respiration

(c) feeding

(d) decomposition

(e) formation of fossil fuels

(f) combustion.

5.2 Forest ecosystems

5.2.1 Describe and explain the causes of deforestation, limited to:

(a) logging and timber extraction
(b) subsistence and commercial farming
(c) roads and settlements
(d) rock, ore and mineral extraction
(e) hydro-electric power stations
(f) climate change.

5.2.2 Describe and explain the impacts of deforestation, limited to:

(a) habitat loss
(b) loss of biodiversity
(c) soil erosion and desertification
(d) silting and flooding
(e) global warming
(f) changes to rainfall patterns
(g) genetic depletion.

5.2.3 Define sustainable management of forests as balancing the needs of the environment, wildlife and humans while conserving forests for future generations.

5.2.4 Describe and explain the need for the sustainable management of forests, limited to:

(a) climate regulation: trees act as carbon sinks and stores
(b) role in water cycle: interception, water uptake, transpiration and surface run-off
(c) flood control
(d) prevention of soil erosion
(e) genetic resource
(f) food, medicine and raw materials
(g) opportunities for recreation, ecotourism and education.

5.3 Managing biodiversity

5.3.1 Describe strategies for conserving the biodiversity and genetic resources of natural ecosystems, limited to:

(a) sustainable harvesting of wild plant and animal species
(b) sustainable forestry
(c) national parks and reserves
(d) wildlife corridors
(e) seed banks
(f) zoos and captive breeding
(g) ecotourism
(h) international cooperation against animal trade
(i) regulation of trade in vulnerable and endangered species
(j) classifying organisms in terms of their threat level: threatened, endangered and extinct.

5.3.2 Discuss the benefits and limitations of strategies for conserving the biodiversity and genetic resources of natural ecosystems.

5.4 Fieldwork investigations

5.4.1 Describe how the scientific method can be applied to the collection of reliable data, limited to:

(a) suggest aims and hypotheses
(b) plan scientific methods: sampling strategies, sampling techniques, questionnaires, surveys, pilot studies
(c) measured and control variables
(d) independent and dependent variables
(e) use of repeats and replicates
(f) record data
(g) analyse data
(h) identify and process anomalies
(i) form conclusions.

5.4.2 Describe sample strategies, limited to:

(a) random sampling
(b) systematic sampling.

5.4.3 Discuss the benefits and limitations of sampling strategies in 5.4.2 for measuring the populations of species.

continued

5.4 Fieldwork investigations continued

5.4.4 Describe sampling techniques for measuring the populations of species, limited to:
- (a) pitfall traps
- (b) pooters
- (c) sweep nets
- (d) quadrats
- (e) transects
- (f) aerial photography and drones
- (g) automated sampling.

5.4.5 Discuss the benefits and limitations of sampling techniques for measuring the populations of species.

6 Natural hazards

6.1 Earthquakes and volcanoes

6.1.1 Describe the structure of the Earth, limited to:
- (a) crust
- (b) mantle
- (c) core.

6.1.2 Identify the Earth's continents: Africa, Antarctica, Asia, Europe, North America, Oceania and South America.

6.1.3 Describe and explain the distribution of earthquakes and volcanoes, limited to:
- (a) tectonic plates and their movement
- (b) hotspots.

6.1.4 Describe how convection currents in the mantle result in plate movements that cause earthquakes and the formation of volcanoes, limited to:
- (a) divergent or constructive plate boundaries: plates move apart causing volcanic activity and earthquakes
- (b) convergent or destructive plate boundaries: subduction of one plate beneath another causing earthquakes and a line of volcanoes
- (c) conservative plate boundaries: plates slide past each other causing earthquakes.

6.1.5 Describe the features of earthquakes, limited to:
- (a) release of energy
- (b) focus
- (c) epicentre
- (d) magnitude: Moment Magnitude Scale.

continued

6.1 **Earthquakes and volcanoes** continued

6.1.6 Describe the features of volcanic eruptions, limited to:
- (a) magma rising to the surface to form lava
- (b) ash
- (c) gases: water vapour, carbon dioxide and sulfur dioxide
- (d) acid rain
- (e) volcanic bombs
- (f) pyroclastic flows.

6.1.7 Describe and explain the impacts of tectonic events on people and the environment, limited to:
- (a) damage to buildings and infrastructure
- (b) loss of crops, livestock and habitats
- (c) evacuation of people and livestock
- (d) fire
- (e) tsunamis
- (f) landslides
- (g) contamination of drinking-water supplies
- (h) water-related disease
- (i) financial losses
- (j) human health.

6.1.8 Describe strategies for managing the impacts before, during and after a tectonic event, limited to:
- (a) monitoring and warning
- (b) land use zoning
- (c) structure of buildings
- (d) disaster preparation (plans, drills, emergency supplies and emergency rescue teams)
- (e) evacuation
- (f) shelters
- (g) rebuilding of damaged areas
- (h) international aid.

6.1.9 Discuss the benefits and limitations of strategies for managing the impacts before, during and after a tectonic event.

6.1.10 Describe and explain the opportunities provided by volcanoes to people, limited to:
- (a) fertile soils
- (b) extraction of minerals
- (c) building materials
- (d) geothermal power
- (e) tourism.

6.2 Tropical cyclones

6.2.1 Describe the location and conditions needed for the formation of a tropical cyclone, limited to:

(a) tropical cyclones: storms, hurricanes and typhoons
(b) form between 5° and 30° latitude north or south of the Equator
(c) ocean temperature of at least 27 °C
(d) ocean depth of at least 60 m.

6.2.2 Describe and explain the impacts of tropical cyclones on people and the environment, limited to:

(a) damage to buildings and infrastructure
(b) loss of crops
(c) livestock and habitats
(d) evacuation of people and livestock
(e) flooding
(f) landslides
(g) contamination of drinking-water supplies
(h) water-related disease
(i) financial losses
(j) human health.

6.2.3 Describe strategies for managing the impacts before, during and after a tropical cyclone, limited to:

(a) monitoring and warning
(b) structure of buildings
(c) disaster preparation (plans, drills, emergency supplies and emergency rescue teams)
(d) evacuation
(e) shelters
(f) rebuilding of damaged areas
(g) international aid.

6.2.4 Discuss the benefits and limitations of strategies for managing the impacts before, during and after a tropical cyclone.

6.3 Flooding

6.3.1 Describe and explain the causes of flooding, limited to:

(a) land relief
(b) saturated soil, compacted soil and soil erosion
(c) deforestation, agricultural practices and urbanisation
(d) climate change: rise in sea level and increase in extreme weather events
(e) storm surges and tsunamis.

6.3.2 Describe and explain the impacts of flooding on people and the environment, limited to:

(a) damage to buildings and infrastructure
(b) loss of crops
(c) livestock and habitats
(d) evacuation of people and livestock
(e) landslides
(f) contamination of drinking-water supplies
(g) water-related disease
(h) financial losses
(i) human health.

6.3.3 Describe strategies for managing the impacts before, during and after flooding, limited to:

(a) monitoring and warning
(b) land use zoning
(c) structure of buildings
(d) disaster preparation (plans, drills, emergency supplies and emergency rescue teams)
(e) evacuation
(f) shelters
(g) rebuilding of damaged areas
(h) international aid.

6.3.4 Discuss the benefits and limitations of strategies for managing the impacts before, during and after flooding.

6.3.5 Describe and explain the opportunities provided by flooding to people, limited to:

(a) deposition of nutrient-rich silt on farmland
(b) recharge of surface water and ground water stores.

6.4 Drought

6.4.1 Define a drought as a period of dry weather that is longer or more severe than normal.

6.4.2 Describe and explain the causes of drought, limited to:

(a) lack of rain

(b) climate change: increase in global temperatures and increase in extreme weather events.

6.4.3 Describe and explain the impacts of drought on people and the environment, limited to:

(a) water sources dry up

(b) loss of crops, livestock and habitats

(c) soil erosion

(d) desertification

(e) death of organisms

(f) famine

(g) increased risk of wildfires

(h) decrease in air quality

(i) financial losses

(j) human health.

6.4.4 Describe strategies for managing the impacts before, during and after a drought, limited to:

(a) monitoring and warning

(b) emergency water supplies

(c) water conservation

(d) increasing water supply (dams and reservoirs, use of aquifers and wells, desalination and rainwater harvesting)

(e) international aid.

6.4.5 Discuss the benefits and limitations of strategies for managing the impacts before, during and after a drought.

7 Human population

7.1 Human population density, distribution and structure

7.1.1 Describe where people live in the world in terms of population density and population distribution, limited to:

(a) sparsely populated places contain few people and densely populated places contain many people

(b) population density: the number of people living in an area, usually measured in people per km^2

(c) population distribution: how people are spread over an area.

7.1.2 Interpret population pyramids to describe population structure, limited to:

(a) young and elderly dependent population

(b) working population

(c) female and male population.

continued

7.1 Human population density, distribution and structure continued

7.1.3 Describe the income groups the World Bank uses to classify the economies of different countries, limited to:
- (a) low-income countries (LICs)
- (b) middle-income countries (MICs)
- (c) high-income countries (HICs).

7.1.4 Compare the population structure of an LIC and an HIC.

7.2 Human population size

7.2.1 Describe and explain the factors that affect changes in human populations, limited to:
- (a) birth rates: children per woman
- (b) death rates: life expectancy
- (c) migration: emigration, immigration and push and pull factors
- (d) rural and urban migration
- (e) urbanisation.

7.2.2 Describe the impacts of human population growth, limited to:
- (a) informal urban settlements
- (b) megacities
- (c) availability of resources
- (d) energy usage
- (e) sanitation
- (f) water supply
- (g) management of waste
- (h) availability of land
- (i) facilities and infrastructure
- (j) air, land, light, noise, visual and water pollution
- (k) traffic congestion
- (l) changes in employment opportunities.

7.3 Managing human population size

7.3.1 Describe strategies for managing human population size, limited to:
- (a) access to contraception
- (b) population policies: pro-natalist and anti-natalist
- (c) access to education
- (d) access to healthcare
- (e) control of migration.

7.3.2 Discuss the benefits and limitations of strategies for managing human population size in 7.3.1.

4 Details of the assessment

All candidates take two papers.

Paper 1 – Principles of Environmental Management

Written paper, 1 hour 45 minutes, 80 marks

This paper consists of short-answer and structured questions with extended response questions based on source material.

This paper tests assessment objectives AO1, AO2 and AO3.

Candidates should answer **all** questions.

Externally assessed.

Paper 2 – Environmental Management in Context

Written paper, 1 hour 45 minutes, 80 marks

This paper consists 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 source material to help illustrate issues of environmental management and fieldwork investigations.

This paper tests assessment objectives AO1, AO2 and AO3.

Candidates should answer **all** questions.

Externally assessed.

Fieldwork requirements

Fieldwork is an important part of the Environmental Management syllabus and should be fully integrated throughout the teaching of the course. All fieldwork investigations should be thoroughly risk assessed.

Candidates' understanding of investigation skills and making judgements (AO3) are assessed in both familiar and unfamiliar contexts. Fieldwork enables candidates to develop these skills.

The fieldwork that candidates do during their course should:

- provide learning opportunities enabling candidates to develop the skills they need to carry out investigative work
- reinforce the learning of the theoretical subject content of the syllabus
- instil an understanding of the relationship between fieldwork and theory in the scientific method
- be enjoyable, contributing to the motivation of the candidates.

The subject content for fieldwork is in sub-topic 5.4 and lists sampling strategies and sampling techniques for measuring populations of species that candidates should be familiar with.

These are, however, the minimum requirements for fieldwork. Opportunities for the practice of investigation skills through fieldwork should be provided throughout the course of study.

Candidates should be able to:

- plan fieldwork investigations and do them safely
- suggest an aim or testable hypothesis based on scientific understanding
- identify the independent and dependent variables
- identify control variables that should be kept constant
- describe how and explain why variables should be kept constant
- suggest an appropriate number and range of values for the independent variable
- suggest the most appropriate apparatus, sampling technique and sampling strategy and justify the choices made
- describe the scientific method for an investigation, including a suitable control where appropriate
- identify risks and suggest safety precautions
- identify apparatus from diagrams or descriptions
- draw, complete or label diagrams of apparatus
- explain the use of common techniques and apparatus
- select the most appropriate apparatus, sampling technique and sampling strategy for the task and justify the choices made
- describe and explain hazards and safety precautions
- describe and explain techniques used to ensure the accuracy of observations and data
- describe how to record the results of an investigation
- take sufficient observations or measurements, including repeats and replicates where appropriate
- record observations and measurements systematically, for example in a suitable table or tally using appropriate units
- describe how to process the results of an investigation to form a conclusion
- process data, including calculations or graph plotting, using a calculator as appropriate
- present data graphically

- analyse and interpret observations and data, including data presented graphically
- use interpolation and extrapolation graphically to determine a gradient or intercept
- form conclusions based on observations and data with appropriate explanation and justification
- evaluate the quality of observations and data, identifying any anomalous results and taking appropriate action
- evaluate sampling techniques and sampling strategies, including the use of a control
- identify sources of error
- suggest possible improvements to apparatus, sampling techniques and sampling strategies.

Fieldwork apparatus

Candidates should have access to the following required fieldwork apparatus:

- hand lens
- humidity/moisture meter
- light meter
- metre ruler
- pH meter
- pitfall trap
- pooter
- quadrat: open frame and grid
- 30 cm ruler
- sweep net
- transect: long tape measure or string
- tray for hand-sorting.

Safety during fieldwork

Teachers should make sure that they do not contravene any school, education authority or government regulations. Responsibility for safety matters rests with centres.

Particular care should be taken with fieldwork. Teachers should ensure that this work is thoroughly risk assessed.

Further information can be found from the following UK associations, publications and regulations.

Associations

CLEAPSS is an advisory service providing support in practical science and technology.
www.cleapss.org.uk

Publications

CLEAPSS Laboratory Handbook, updated 2015 (available to CLEAPSS members only)

CLEAPSS Hazcards, 2019 update of 2016 edition (available to CLEAPSS members only)

UK regulations

Control of Substances Hazardous to Health Regulations (COSHH) 2002 and subsequent amendment in 2004
www.legislation.gov.uk/uksi/2002/2677/contents/made
www.legislation.gov.uk/uksi/2004/3386/contents/made

A brief guide may be found at
www.hse.gov.uk/pubns/indg136.pdf

Mathematical requirements

It is expected that these requirements will be covered as part of a mathematics curriculum at this level of study.

Calculators may be used in all parts of the exam.

Number

- add, subtract, multiply and divide
- use decimals, fractions and ratios
- calculate and use percentages and percentage change
- calculate the mean and range of a set of values
- understand and use the symbols: =, <, >
- use standard form (scientific notation)
- express answers to an appropriate or given number of significant figures
- express answers to an appropriate or given number of decimal places
- round answers appropriately
- make approximations and estimates to obtain reasonable answers

Algebra

- substitute physical quantities into a given formula

Geometry and measurements

- understand the units of time, mass, length, volume, area, concentration and arbitrary units
- understand the meaning of angle, curve, circle, radius, diameter, area, circumference, perimeter, square, rectangle and diagonal
- use the equation for the area of a rectangle
- use the equation for the volume of a rectangular block
- understand scale diagrams and the use of the scale line

Graphs, charts, tables, maps and photographs

- draw graphs, charts and tables from data
- interpret maps
- identify key information from photographs
- interpret population pyramids, line graphs, scatter graphs, bar charts, divided bar charts, pie charts and histograms
- determine the gradient and intercept of a graph
- recognise and use direct and inverse proportion
- recognise positive and negative correlation
- give direction in terms of an 8-point compass, e.g. north, north-east
- recognise and use latitude and longitude in degrees on a map

Presentation of data

Taking and recording readings

- A measurement or calculated quantity must be accompanied by a correct unit, where appropriate.
- Each column of a table should be headed with the observation or physical quantity and the unit where appropriate, e.g. time/s. The solidus (/) is to be used for separating the quantity and the unit in tables, graphs and charts.
- Units should not be included with data in the body of a table.
- Data should be recorded to the appropriate number of significant figures.

Graphs

- The column headings of a correctly headed table can be directly transferred to the axes of a constructed graph.
- A graph should be drawn with a sharp pencil.
- Each axis should be labelled with the observation or physical quantity and the unit where appropriate, e.g. time/s.
- 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).
- Unless instructed otherwise, 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.
- Points on the graph should be clearly marked as crosses (x) or encircled dots (ʘ) of appropriate size.
- Each data point should be plotted to an accuracy of one half of one of the smallest squares on the grid.
- A best-fit line or 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, a roughly even distribution of points either side of the line over its entire length is expected. Points that are clearly anomalous should be ignored when drawing the best-fit line.
- A best-fit line or curve should only be drawn if there is good reason to believe that the intermediate values can be predicted.
- Candidates should be able to take readings from the graph by interpolation or extrapolation and indicate on the graph how they determined the reading.
- Data values should be read from a graph to an accuracy of one half of the smallest square on the grid.

Drawings

- Drawings should be drawn using a sharp pencil to give fine lines that are clear and unbroken.
- Label lines should be drawn with a ruler and touch the object or feature labelled.

Charts

- Pie charts are generally used to show proportionality or percentages. They should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Data categorised as 'other' should also be plotted in rank order. Pie charts should preferably contain no more than six sectors.
- Bar charts, including divided bar charts, should be drawn for categorical or discrete data. They should be made up of bars of equal width that do **not** touch.
- Histograms should be drawn for continuous data. They should start at zero and have bars that touch.

Further guidance can be found in the following publications:

ASE, The Language of Mathematics in Science: A Guide for Teachers of 11–16 Science (2016).

ASE, The Language of Mathematics in Science: Teaching Approaches (2016).

www.ase.org.uk/mathsinscience

Conventions (e.g. signs, symbols, terminology and nomenclature)

Candidates are expected to be familiar with the nomenclature in the syllabus.

The syllabus and question papers conform with accepted international practice. In particular, the following document, produced by the Association for Science Education (ASE), should be used as a guideline.
Signs, Symbols and Systematics: The ASE Companion to 16–19 Science (2000)

Decimal markers

In accordance with current ASE convention, decimal markers in examination papers will be a single dot on the line. Candidates are expected to follow this convention in their answers.

Numbers

Numbers from 1000 to 9999 will be printed without commas or spaces. Numbers greater than or equal to 10 000 will be printed without commas. A space will be left between each group of three digits, e.g. 4 256 789.

Variables

Independent variables are the variables that are changed in a scientific experiment by the scientist. Changing an independent variable may cause a change in the dependent variable.

Dependent variables are the variables that are observed or measured in a scientific experiment. Dependent variables may change based on changes made to the independent variables.

Units

To avoid any confusion concerning the symbol for litre, the equivalent quantity, the cubic decimetre (dm^3), will be used in place of *l* or litre.

In fieldwork, candidates will be expected to use SI units or, where appropriate, units approved for use with the SI (e.g. minute). A list of SI units and units approved for use with the SI may be found in the SI brochure at **www.bipm.org**.

The use of imperial/customary units such as the inch and degree Fahrenheit are not acceptable and should be discouraged. In all examinations, where data is supplied for use in questions, candidates will be expected to use units that are consistent with the units supplied and should not attempt conversion to other systems of units unless this is a requirement of the question.

Command words

Command words and their meanings help candidates know what is expected from them in the exams. The table below includes command words used in the assessment for this syllabus. The use of the command word will relate to the subject context.

Command word	What it means
Calculate	work out from given facts, figures or information
Compare	identify/comment on similarities and/or differences
Define	give precise meaning
Describe	state the points of a topic/give characteristics and main features
Determine	establish an answer using the information available
Discuss	write about issue(s) or topic(s) in depth in a structured way
Explain	set out purposes or reasons/make the relationships between things clear/say why and/or how and support with relevant evidence
Give	produce an answer from a given source or recall/memory
Identify	name/select/recognise
Justify	support a case with evidence/argument
Plot	mark point(s) on a graph
Predict	suggest what may happen based on available information
Show (that)	provide structured evidence that leads to a given result
Sketch	make a simple freehand drawing showing the key features, taking care over proportions
State	express in clear terms
Suggest	apply knowledge and understanding to situations where there are a range of valid responses in order to make proposals/put forward considerations

5 What else you need to know

This section is an overview of other information you need to know about this syllabus. It will help to share the administrative information with your exams officer so they know when you will need their support. Find more information about our administrative processes at **www.cambridgeinternational.org/eoguide**

Before you start

Previous study

We recommend that learners starting this course should have studied a broad curriculum such as the Cambridge Lower Secondary programme or equivalent national educational framework.

We do not expect learners starting this course to have previously studied environmental management.

Guided learning hours

We design Cambridge IGCSE syllabuses to require about 130 guided learning hours for each subject. This is for guidance only. The number of hours a learner needs to achieve the qualification may vary according to each school and the learners' previous experience of the subject.

Availability and timetables

All Cambridge schools are allocated to one of six administrative zones. Each zone has a specific timetable. Find your administrative zone at **www.cambridgeinternational.org/adminzone**

You can view the timetable for your administrative zone at **www.cambridgeinternational.org/timetables**

You can enter candidates in the June and November exam series. If your school is in India, you can also enter your candidates in the March exam series.

Check you are using the syllabus for the year the candidate is taking the exam.

Private candidates can enter for this syllabus. For more information, please refer to the *Cambridge Guide to Making Entries*.

Combining with other syllabuses

Candidates can take this syllabus alongside other Cambridge International syllabuses in a single exam series. The only exceptions are:

- Cambridge O Level Environmental Management (5014)
- syllabuses with the same title at the same level.

Cambridge IGCSE, Cambridge IGCSE (9–1) and Cambridge O Level syllabuses are at the same level.

Group awards: Cambridge ICE

Cambridge ICE (International Certificate of Education) is a group award for Cambridge IGCSE. It encourages schools to offer a broad and balanced curriculum by recognising the achievements of learners who pass exams in a range of different subjects.

Learn more about Cambridge ICE at **www.cambridgeinternational.org/cambridgeice**

Making entries

Exams officers are responsible for submitting entries. We encourage them to work closely with you to make sure they enter the right number of candidates for the right combination of syllabus components. Entry option codes and instructions for submitting entries are in the *Cambridge Guide to Making Entries*. Your exams officer has access to this guide.

Exam administration

To keep our exams secure, we produce question papers for different areas of the world, known as administrative zones. We allocate all Cambridge schools to an administrative zone determined by their location. Each zone has a specific timetable.

Some of our syllabuses offer candidates different assessment options. An entry option code is used to identify the components the candidate will take relevant to the administrative zone and the available assessment options.

Support for exams officers

We know how important exams officers are to the successful running of exams. We provide them with the support they need to make entries on time. Your exams officer will find this support, and guidance for all other phases of the Cambridge Exams Cycle, at **www.cambridgeinternational.org/eoguide**

Retakes

Candidates can retake the whole qualification as many times as they want to. Information on retake entries is at **www.cambridgeinternational.org/retakes**

Language

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

Accessibility and equality

Syllabus and assessment design

At Cambridge we recognise that our candidates have highly diverse socio-economic, cultural and linguistic backgrounds, and may also have a variety of protected characteristics. Protected characteristics include special educational needs and disability (SEND), religion and belief, and characteristics related to gender and identity.

We follow accessible design principles to make our syllabuses and assessment materials as accessible and inclusive as possible. We review language accessibility, visual resources, question layout and the contexts used in questions. Using this approach means that we give all candidates the fairest possible opportunity to demonstrate their knowledge, skills and understanding.

Access arrangements

Our design principles aim to make sure our assessment materials are accessible for all candidates. To further minimise barriers faced by candidates with SEND, illness or injury, we offer a range of access arrangements and modified papers. This is the principal way in which we comply with our duty to make 'reasonable adjustments', as guided by the UK Equality Act 2010.

Important:

Requested access arrangements should be based on evidence of the candidate's barrier to taking an assessment and should also reflect their normal way of working. This is explained in section 1.3 of the *Cambridge Handbook* **www.cambridgeinternational.org/eoguide**

- For Cambridge to approve an access arrangement, we need to agree that it constitutes a reasonable adjustment and does not affect the security or integrity of the assessment.
- Details of our standard access arrangements and modified question papers are available in section 1.3 of the *Cambridge Handbook* **www.cambridgeinternational.org/eoguide**
- Centres are expected to check the availability of access arrangements and modified question papers at the start of the course. All applications should be made by the deadlines published in section 1.3 of the *Cambridge Handbook* **www.cambridgeinternational.org/eoguide**
- Contact us at the start of the course to find out if we can approve an access arrangement that is not included in the list of standard access arrangements.
- Candidates who cannot access parts of the assessment may be able to receive an award based on the parts they have completed.

After the exam

Grading and reporting

Grades A*, A, B, C, D, E, F or G indicate the standard a candidate achieved at Cambridge IGCSE.

A* is the highest and G is the lowest. 'Ungraded' means that the candidate's performance did not meet the standard required for grade G. 'Ungraded' is reported on the statement of results but not on the certificate.

In specific circumstances your candidates may see one of the following letters on their statement of results:

- Q (PENDING)
- X (NO RESULT).

These letters do not appear on the certificate.

On the statement of results, Cambridge IGCSE is shown as INTERNATIONAL GENERAL CERTIFICATE OF SECONDARY EDUCATION (IGCSE).

On certificates, Cambridge IGCSE is shown as International General Certificate of Secondary Education.

How students and teachers can use the grades

Assessment at Cambridge IGCSE has two purposes:

1 to measure learning and achievement

The assessment confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus.

2 to show likely future success

The outcomes help predict which students are well prepared for or likely to be successful in a particular course or career.

The outcomes help students choose the most suitable course or career.

Changes to this syllabus for 2027, 2028 and 2029

The syllabus has been reviewed and revised for first examination in 2027.

You must read the whole syllabus before planning your teaching programme.

Changes to syllabus content	• The syllabus aims have been updated. • Subject-specific learner attributes have been introduced. Subject content • The topic headings have been renamed and subject content restructured. • The wording of some sub-topics and bullet points within the sub-topics has been updated for clarity and to improve the logical order of teaching. • New sub-topics have been added – 1.3 Sustainable management of rocks, ores and minerals, 1.6 Fracking, 3.6 Plastic pollution and 5.4 Fieldwork investigations. • New sub-topic heading 4.2 Climate change. • Deleted sub-topics – Sustainable use of rocks and minerals, Oceans as a resource, World fisheries, Ecosystems under threat and Selective breeding has been removed from the sub-topic Increasing agricultural yields. • Recommended case studies have been removed from the syllabus. • Terminology has been updated or new terminology included that is specific to climate change and the environment. • The Details of the assessment section has been updated and further explanation has been provided. This includes the addition of fieldwork requirements, a list of fieldwork apparatus and mathematical requirements and the presentation of data guidance has been updated. • A list of command words has been included which replaces the previous glossary of terms.

Changes to assessment (including changes to specimen papers)	Assessment objectives • The wording of the assessment objectives has been updated. • The weightings for the assessment have changed. The weightings of AO1 Knowledge with understanding and AO3 Investigation skills and making judgements have increased. The weighting for AO2 Handling information and problem-solving has decreased. Paper 1 • The title of the paper has changed to Principles of Environmental Management. • Sections have been removed from the question paper. • The style of the last question has changed: see the new specimen papers and mark schemes. • Practical method-based questions are no longer assessed in Paper 1. Paper 2 • The title of the paper has changed to Environmental Management in Context. • The single-country context has been removed. • Practical method-based questions are limited to Paper 2.

In addition to reading the syllabus, you should refer to the updated specimen assessment materials. The specimen papers will help your students become familiar with exam requirements and command words in questions. The specimen mark schemes show how students should answer questions to meet the assessment objectives.

Any textbooks endorsed to support the syllabus for examination from 2027 are suitable for use with this syllabus.

Syllabuses and specimen materials represent the final authority on the content and structure of all of our assessments.

With a Customer Services team available 24 hours a day, 6 days a week, and dedicated regional teams supporting schools in 160 countries, we understand your local context and are here to guide you so you can provide your learners with everything they need to prepare for Cambridge IGCSE.

Quality management

We are committed to providing exceptional quality. In line with this commitment, our quality management system for the provision of international education programmes and qualifications for students aged 5 to 19 is independently certified as meeting the internationally recognised standard, ISO 9001:2015.
Learn more at **www.cambridgeinternational.org/about-us/our-standards/**

School feedback: ‘While studying Cambridge IGCSE and Cambridge International A Levels, students broaden their horizons through a global perspective and develop a lasting passion for learning.’

Feedback from: Zhai Xiaoning, Deputy Principal, The High School Affiliated to Renmin University of China

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