UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level

MARK SCHEME for the November 2005 question paper

ENVIRONMENTAL MANAGEMENT
(HYDROSPHERE AND BIOSPHERE)

8291/02 Paper 2

Maximum raw mark 80

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the November 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

Answer all questions in section A and choose one question from section B.

Section A

1 (a) Fig. 1.1 shows water withdrawals for domestic, agricultural and industrial use within the major continental regions. Water withdrawals are given as a volume and as a percentage of the potential water supply for each region. e.g. World water withdrawal totals 3000 cu.km which amounts to 9% of the amount available.

Describe the withdrawals and the potential supply of water for Asia, Europe and Africa.

- **Asia** 1700cu/km, 14% of potential
- **Europe** withdrawals 600/650 cu/km, 9% of potential
- **Africa** 2/3cu/km, 3/4% of potential **[3]**

(b) Fig. 1.2 shows how regions of the world are likely to be vulnerable to a scarcity of water in 2025.

Using Fig. 1.2 and Fig. 1.1, suggest why certain areas of the world are likely have:

- **a high vulnerability to water scarcity in 2025**
  ref to areas of high aridity or unreliable rainfall e.g. Africa low withdrawals and %.areas of very high population with high withdrawals Asia
- **a low vulnerability to water scarcity in 2025**
  MEDC's North America, Australia, UK. Europe has high withdrawals and high potential provision. Canada and Australia low population and low % USA although withdrawals are high so are reserves **[6]**

2 marks for each of the two reasons:
- differences in volume
- differences in usage within countries

(c) Fig. 1.3 contains information on water management within the Colorado Basin and its effects upon water discharge and sediment discharge at point A on the map.

(i) Describe the pattern of water management of the Colorado River Basin.

Dams with reservoirs e.g. Hoover Dam and Lake Mead (9 schemes)
Canals aimed at diversions and flood control
Out of basin schemes to supply water elsewhere
Inter/intra state projects

Full marks for four brief points or 2 × 2 for two well developed points. **[4]**

(ii) Explain the impact of the Colorado water management scheme upon water and sediment discharge at point A on the map.

There are two graphs and marks can be awarded on a 4/3 or 3/4 basis. Candidates may combine the two.

Water Discharge

- a progressive reduction over time and in a downstream direction
- dams hold back water and release smaller amounts than they conserve
- water is removed from the basin for out of basin usage
- water is used in areas local to the dams and reservoirs e.g. Las Vegas
- very little water reaches the Gulf of California

Sediment Discharge

- dams act as sediment traps
- the volume of sediment carried downstream decreases
- little sediment reaching its delta(estuary) **[7]**

Total [20]

2 (a) All organisms need a source of energy to live.

(i) Photosynthesis is described by the equation
$6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$
Use the equation to explain the process of photosynthesis.

Carbon dioxide plus water in the presence of light and chlorophyll to give carbohydrates and oxygen **[4]**

(ii) Why is photosynthesis important in a food web?

Autotrophic primary producers tap solar energy/beginning for food webs/and forms a source of energy for consumers **[2]**

(iii) Why is photosynthesis connected to the gaseous composition of the atmosphere?

Plants use carbon dioxide/extract it from the atmosphere **[2]**

(b) Many areas of the world are experiencing deforestation. Explain how deforestation might lead to:

(i) a reduction in animal diversity.

Plant growth declines/loss of ecosystem and animals **[2]**

(ii) local climatic change.

Drier due to altered albedo/lower evapotranspiration rates cause changes to rainfall patterns **[2]**

(iii) soil erosion.

Bare soil/crusting/heavy storms lead to sheetwash and gullying **[2]**

(iv) changes to aquatic ecosystems.

Increases in river sediment/leaching from soils alters rivers then lakes **[2]**

(v) a reduction in soil fertility.

Leaching/removal of humus/accumulation of aluminum and iron **[2]**

(vi) changes to river discharge and flooding.

Increases in river sediment reduces channel capacity

Increase surface runoff causing sudden high discharge **[2]**

Total [20]

Section B (Answer one question from this section)

3 (a) Outline three different ways in which the oceans are important for life on earth.

Oceans are fundamental to the Earth's climatic systems and marine ecosystems provide people and other animals with food. Candidates should develop three reasons each of which is worth 3 marks (1 floating mark). There is a wide range to choose from and for 3 marks the answer must contain three well developed points. Answers can refer to:

- Scale or size. The oceans cover 71% of the earth's surface and contain 97% of its water
- Global fish production is the largest source of wild and domestic animal protein. Humans depend upon anchovy, herring etc.
- Oceans form unique ecosystems; there are problems associated with disturbance and overexploitation
- The ocean ecosystem is still largely unexplored and its workings unknown e.g deep ocean, Antarctic Ocean (krill)
- Oceans are easily polluted by oil spillage, rivers, plastics etc. Once disturbed will take time to recover
- They are major carbon/methane stores
- Ocean currents supply air masses/warm or cool land masses

Band 1 answers will give full consideration to three different ways. In each case a clear statement of the way should be followed by a description. (8 to 10 marks)

Band 2 answers may lack balance or although relevant produce short descriptions. Two descr*i*ptions are 7 max. On full description up to 4. (4 to 7 marks)

Band 3 answers may lack clarity about both the ways and descriptions. Answers may also be poorly balanced. (0 to 3 marks) **[10]**

(b) Outline the major sources and effects of marine pollution. Assess the effectiveness of measures aimed at reducing marine pollution.

Candidates need to identify the main sources of marine pollution and assess how effective various strategies aimed at reducing pollution have been.

Sources can include:

- Nutrients derived from runoff from sewage, forestry, farming, power plants, cars etc. Feeds algal blooms; decomposing algae deplete water of oxygen killing other marine life; releasing toxicants and kill marine life and poison people
- Sediments as runoff from mining, forestry, coastal mining, dredging. Can cloud water; impede photosynthesis; clog gills of fish
- Pathogens form livestock, sewage. Can contaminate coastal areas and seafood; spread cholera, typhoid etc.
- Oil: 46% from cars, heavy machinery, industry; 23% from oil tanker operations and other shipping; 13% from accidents. Low levels can kill larvae and cause disease in marine life; oil slicks kill marine and bird life; oil litters beaches

- Plastics through fishing nets, cargo, beach litter, industry and landfills. Discarded fishing gear still traps fish; other plastic debris traps marine life; litter on beaches is non-biodegradable

Solutions are closely tied to the issue and can include:

- Oil slicks. Attempts to control through International Regulations governing operational spillage, tanker safety. These are difficult to administer, accidents still occur, cannot legislate against terrorism or war
- Controls on the dumping of waste e.g. London and Oslo conventions. USA and UK still dump e.g. low level radio-active waste at 26 Pacific sites; plus examples like Sellafield. High and medium level radio-active waste is banned
- Seas such as the Black Sea with extreme eutrophication is subject to legislation controlling industrial and agricultural waste
- Cleaning rivers which feed into seas, e.g. Baltic Sea

The list is lengthy and there is not need for candidates to cover all aspects of this question

Band 1 answers should consider at least four distinct sources of pollution and be clear about its effects. Solutions will review the international nature of the issue and probably link with the source of pollution. Answers at this level should be evaluative

Band 3 answers will either give a number of issues brief coverage or one or two some detail. Effects and solutions of pollution may be general and evaluation brief

Band 4 answers should have relevance and are likely to be brief and non-evaluative **[30]**

4 (a) Fig. 4.1 depicts environmental problems caused by agricultural intensification. Describe <u>three</u> routes by which long-term productivity may be reduced.

Candidates need to interpret the flow chart, follow a set of arrows through to the reduction in productivity and provide some limited elaboration e.g.

Mechanisation – loss of hedgerows (larger fields) – loss of species diversity – long term productivity reduced

Animal and plant breeding – narrowing of the genetic base – reduction

Mechanisation – monocultures – increased use of pesticide – harm to species – loss of species diversity – reduction

For 8 to 10 marks there must be a balanced consideration of three paths and limited elaboration. All components of each path will be developed

For 4 to 7 marks there may be a poor balance and little elaboration

For 1 to 3 marks expect very brief answers which give the chart brief reference **[10]**

(b) Using examples you have studied describe and evaluate the conservation strategies which have been introduced to protect an area of ecological importance.

The aim of this question is to provide candidates with a conservation program or scheme of their personal choice. They have available, National Parks, Wildlife Parks, SSSI's, Wetlands, TRF, Lakes or Seas. Policies will relate closely to the area under discussion. The evaluation should assess features of success, failure or limitations. Answers should contain reference to:

- the area (e.g. Rondonia, Yosemite, Lake District, Serengeti, Coral Reefs etc; the scale is up to the candidate etc.) and why it is in need of conservation
- its designation as an area under conservation (national park etc.)
- management and strategies (stewardship, car parks, ecotourism, education, wardens etc.
- evaluation i.e. To what extent have the strategies been effective in conservation and restoration

Band 1 answers will have taken up the opportunity to develop a studied area and should consider the points stated above in detail

Band 3 answers should contain a selected area but show limitations in the analysis of strategies and in making evaluations

Band 4 answers will have selected one or possible more examples but answers although relevant may outline the issue but be weak in both evaluation and developing a range of strategies **[30]**

5 (a) Figs. 5.1 and 5.2 illustrate <u>two</u> different models relating population growth to resources. Describe how the models offer different views on the way in which the population of an area may change over time.

There are two models depicted; 5.1 the Malthusian J curve, and 5.2 the optimistic views of Boserop

5.1 The J curve adjusts gradually to the carrying capacity. Population exceeds the carrying capacity then falls to stabilise for a short period. As conditions improve population growth takes place, only to exceed the carrying capacity. Each time the carrying capacity is exceeded there is an onset of starvation, disease etc. which causes the population to decline

5.2. The Boserop model assumes that an increase in population will stimulate and increase in food production and a nations carrying capacity. As demand for food increases it becomes an incentive to change technology. Her theory suggests that as population grows farming becomes more intensive. "necessity is the mother of invention"

For 8 to 10 marks there should be a balance treatment of each model with reference to the interaction of population growth and carrying capacity

For 4 to 7 marks there may be a poor balance and a lack of detail. Population growth and carrying capacity may be dealt with separately

For 1 to 3 marks there will be very scanty coverage of each model with 5.1 not being interpreted and the content of 5.2 repeated **[10]**

(b) In 1987 the Brundtland Commission defined sustainable development as

"development which meets the needs of the present without compromising the ability of future generations to meet their own needs"

Describe the policies and priorities which target sustainable development in a country or area of your choice. Give reasons to justify the extent to which they have they been achieved.

Hopefully candidates will choose a country they have studied, possibly their home country. Central to the question is sustainable development and the stem of the question should provide a suitable prompt. Candidates will deal with priorities and policies in a variety of ways and we should look towards flexibility in our assessment of essays

Sustainable Development does imply continuous economic growth, therefore:

- the need to conserve and use resources for energy; reduction in the use of fossil fuels and the development of alternative energy; energy conservation by homes, industry etc.
- the need to conserve soils yet continue to provide food (possibly more); new agrarian techniques; the green revolution
- conservation of metal ores through recycling and alternatives
- infrastructural developments including: government and administration, transport, finance, building
- environmental considerations including the conservation of land, ecosystems, landscapes etc.

Band 1 answers will focus upon their case study and be clear about the issues it faces and how policies have been prioritised. There should be a strong element of evaluation. The concept of sustainable development should be clearly understood and in the context of the area, evaluated

Band 3 answers will have a clear selection of a case study but may lack clarity on how it has prioritised its policies, and policies may have brief coverage. There should be some, in context evaluation of sustainability

Band 4 answers should be relevant but will have very brief coverage and be very poor on evaluation **[30]**

Generic Mark Scheme
This aims to provide a scheme for marking 30 mark answers in Section B. The marks are grouped into bands from which it should be possible to locate a mark. The assessment objectives outlined are developed out of the broad objectives for the examination and guideline for locating marks for essay

Criterion A demonstrates relevant knowledge and understanding applied to a range of issues and problems
Criterion B communicates clearly in a concise , logical and relevant way
Criterion C marshall evidence, draw conclusions and make evaluations

Balance of marks for 30 mark questions; Criterion A = maximum of 15
Criterion B = maximum of 5
Criterion C = maximum of 10

Band	Level Descriptors	Marks
Band 1	**The candidate demonstrates the following abilities where appropriate to:**	**25-30**
A	• select and use a very good range of accurate and appropriate knowledge; • integrate knowledge from a wide range of areas; • show a good understanding of the concepts involved; • make good use of knowledge derived from personal experience and study;	
B	• select and use a form and style of writing appropriate to purpose and complex subject matter with facility; • communicate complex ideas clearly and accurately, in a concise, logical and relevant way;	
C	• analyse issues and problems well and evaluate them appropriately; • develop complex reasoned arguments and draw sound conclusions on the evidence;	
Band 2	**The candidate demonstrates the following abilities where appropriate to:**	**19-24**
A	• select and use a good range of accurate and appropriate knowledge; • integrate knowledge from a wide range of areas; • show an understanding of the concepts involved; • demonstrate a range of awareness of personally derived and studied knowledge;	
B	• select and use a form and style of writing appropriate to purpose and complex subject matter; • communicate complex ideas clearly and accurately, in a concise, logical and relevant way;	
C	• analyse issues and problems and evaluate them competently; • develop complex reasoned arguments and draw conclusions on the evidence	
Band 3	**The candidate demonstrates the following abilities where appropriate to:**	**13-18**
A	• select and use a limited range of accurate and relevant knowledge; • integrate knowledge from a limited range of areas; • show an adequate understanding of the concepts involved; • demonstrate a limited range of awareness of personally derived and studied knowledge;	
B	• select and use a form and style of writing appropriate to purpose and subject matter; • communicate the ideas clearly and in a logical way	
C	• undertake some analysis of issues and problems and make a superficial evaluation; • develop arguments and draw conclusions;	
Band 4	**The candidate demonstrates the following abilities where appropriate to:**	**6-12**
A	• select and use some accurate and relevant knowledge; • integrate knowledge from a very limited range of areas; • show a modest understanding of the concepts involved;	
B	• select and use a limited style of writing, appropriate to purpose and subject matter; • communicate ideas with limited clarity;	
C	• demonstrate limited analysis of issues and problems with limited evaluation; • develop limited arguments and draw limited conclusions;	

Band 5	**The candidate demonstrates the following abilities where appropriate to:**	**1-5**
A	• select and use some relevant knowledge; • integrate knowledge from a very limited area; • show a restricted understanding of the concepts involved;	
B	When producing written communication: • select and use a very limited style of writing appropriate to purpose and subject matter • communicate with limited clarity;	
C	• undertake a very limited analysis of issues, problems and evaluation; • recognise some arguments and conclusions	