

MARK SCHEME for the June 2005 question paper

8291 ENVIRONMENTAL MANAGEMENT

8291/02 Paper 2 (Hydrosphere and Biosphere), maximum 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*.

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

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Grade thresholds for Syllabus 8291 (Environmental Science) in the June examination.

| | maximum mark available | minimum mark required for grade: | | |
|-------------|------------------------|----------------------------------|----|----|
| | | a | b | e |
| Component 2 | 80 | 57 | 49 | 33 |

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

June 2005

GCE AS LEVEL

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 8291/02

ENVIRONMENTAL MANAGEMENT

Paper 2 (Lithosphere and Atmosphere)

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Section A

Answer all questions in this section.

1 Fig. 1.1 shows the transfers and stores within the global hydrological cycle.

(a) (i) Identify components A, B and C in Fig 1.1. [3]

A = Evapotranspiration or transpiration

B = Precipitation

C = Groundwater

(ii) Describe how water is lost from the land. [3]

The diagram identifies three.

- Evapotranspiration
- Rivers
- Groundwater flow

As they are identified on the diagram a brief description of the route is needed.

For a list credit to a maximum of one mark.

(iii) Explain the processes by which water is returned to the land. [3]

An explanation should include:

- water comes from evapotranspiration and evaporation from bodies of water
- condensation and precipitation
- water is transported by winds over the land

There are other valid points some of which are components of the above and each distinct and relevant point should be credited with one mark.

(iv) Name and describe one atmospheric process which would cause either a long term increase or long term decrease in the volume of water stored in the oceans. [3]

Credit 1 mark for the name and 2 marks for the description.

The processes can lead to either global increases or decreases in temperature. Global warming, natural cycles (even Malankovich), ice ages.

(b) Fig. 1.2 shows a geological structure in which water is stored naturally.

(i) Name the geological structure shown in Fig. 1.2. [1]

Syncline or Aquifer.

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- (ii) Explain why urban and rural areas would find such structures a useful source of water. [20]

Synclinal aquifers provide a natural reservoir of water, replenished through rainfall with water under natural pressure (2 marks).

Porous rocks act as a natural filter permitting a clean supply for urban or rural use (2 marks).

Credit 2 well developed points with 2 marks.

- (ii) Describe how the water contained in such structures as Fig. 1.2 can become polluted. [3]

Credit 1 mark for a correct identification then 2 marks for two descriptive points.

Industrial contamination/urban waste/ground water contamination farming (fertilisers, pesticides etc.).

- 2 (a) Fig 2.1 shows part of a food web for an English woodland ecosystem. [20]

- (i) Explain the term *foodweb*. [2]

Two described points needed.

A complex series of food chains. (1)

Organisms interact or interconnect with each other. (1)

- (ii) Give one example, from Fig. 2.1 of: [3]

- a **primary producer** = trees and vegetation
- a **primary consumer** = insects, larvae, caterpillars
- a **detritivore** = woodlice, millipedes

- (iii) How would the ecosystem be affected by a reduction in the population of foxes? [2]

Reduction in foxes would lead to a proliferation of their prey (1) and reduction of lower levels. (1)

- (iv) Fig. 2.2 shows a pyramid of biomass for the woodland ecosystem.

- Why does the biomass decrease at each trophic level? [2]

The transfer of energy to each level each level is inefficient.

Consumers require more energy from the lower level

e.g. 100 kg of grass for 10 kg of rabbit which support 1 fox.

- (b) Fig. 2.3 shows the effects of the farming system of bush following upon an area of rain forest.

- (i) Describe one way in which the ecosystem would be affected by the clearance of the primary forest. [2]

Removal of primary producers (TRF)/loss of TRF biomass/initial replenishment of soil nutrients and later losses.

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- (ii) Explain the changes which would be taking place to the soil and vegetation cover between stages 2 and 4 in Fig. 2.3.

Soils quality progressively reduces with loss of nutrients/loss of original vegetation cover except scattered woodland/loss of wildlife.

Fallow period permits slow recovery through seral stages (grass – bushes, shrubs to secondary forest).

Slow recovery of soils and nutrient cycling and humification takes place.

Credit each of these stages with 1 floating mark.

- (iii) Outline two ecological differences between the secondary forest in stage 4 and the primary forest in stage 1. [2]

Characteristics of areas that have been cleared for cultivation.

The woodland does not retain its climax features with reduced fauna and flora. It is a seral stage on the way back to a climax community.

- (iv) What would be the impact of an increase in the human population in an area similar to that depicted in Fig. 2.3? [3]

The system survives if there is sufficient virgin land for people to migrate to.

Population pressure leads to overcultivation/shorter fallow periods and cultivation of plots which have not recovered. (2)

Ultimately soil and land degradation. (1)

[20]

Section B (Choose one question from this section)

- 3 (a) The Aral Sea is located in the lowlands of Turan, occupying land in the Republics of Kazakhstan and Uzbekistan. From ancient times it was known as an oasis. Traders, hunters, fishers, and merchants populated this fertile site littered with lagoons and shallow straits that characterised the Aral landscape.

Use Fig 3.1 to suggest reasons for the changes which have taken place to the surface area of the Aral Sea. [10]

Candidates should refer to the reduction to 30% of its former surface area in a 40 year period. (2 marks)

The need for irrigation along the Syr-Darya and Amu-Darya rivers plus the canal which diverts water to the Kara-Kum Canal. (4 marks)

As it is a basin of inland drainage such diversion of water deprives the Aral Sea of water. (2 marks).

High summer temperatures and low annual rainfall mean high rates of evaporation thereby reducing even further the supply of water. (2 marks).

For 8 to 10 marks all points should be integrated into a detailed explanation.

For 4 to 7 marks expect relevance but answers which either lack details or integration of data.

For 1 to 3 marks expect brief lists or very generalised answers lacking specific information.

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- (b) For one named environment with which you are familiar, describe and explain the methods that have been used to conserve and restore its ecosystems.

To what extent have these methods been successful?

There are three elements to this question, namely, conservation, restoration and an evaluation. Candidates can choose environments with which they are familiar either through study or personal experience. The Aral Sea is not valid as it has not undergone any conservation nor restoration.

Candidates should name their environment (local name or region) then refer to some or all of the following:

- the nature and scale of the issue
- conservation research
- conservation area designation (e.g. national park, nature reserves)
- management strategies
- replanting and controls of logging etc.
- conservation education
- evaluation (either within sections or at the end)

Obviously the precise form of restoration and conservation will depend upon the choice the candidate makes.

Band 1 answers should consider the broad range of points given above and their evaluation refer to success and failure.

Band 3 answers must be relevant but expect details on perhaps two strategies, generalised comment, listing and poor evaluation.

Band 4 answers at the top end should have relevance but may be short, lack detail and have little evaluation.

- 4 (a) **Suggest how human activity can introduce changes to the supply and quality of water within the drainage basin shown in Fig 4.1.** [10]

The picture contains a lot of information and, for full marks, candidates should refer to at least two likely changes to supply and two for quality. Reference to one aspect award a maximum of 6.

Supply includes the dam and reservoir, tidal barrage, extraction for industry, domestic and agriculture.

Quality includes detrimental effects from farming, urban waste, industry and boats.

For 8 to 10 marks clear reference to at least two of each with detail on how quality and supply may change.

For 4 to 7 marks there may be limited reference, a lack of detail or a poor balance.

For 1 to 3 marks there will be severe limitations, little detail and confusion about quality and supply.

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- (b) With reference to one or more rivers you have studied, describe and evaluate strategies that have been adopted for the long and short term management of pollution and flooding.

The question requires reference to both pollution and flooding; either or both rural and urban areas can be chosen. In both cases the causes of the issue are important to the answer as is the evaluation of the management strategies. Management strategies may include:

Flood prevention:

- levees or raised banks - effective in containing water but increase rates of erosion downstream and can be eroded. The Mississippi levees failed in 1993
- dams and water storage - costly and problems of silting/damage
- afforestation reduces runoff and slows flood water - effective but long term
- straightening rivers is effective but increases velocity with possible downstream consequences - costly
- river research and modeling - leads to effective planning
- river monitoring - important in prediction and warning
- good evaluation will mention building away from flood plains and allowing rivers to flood. Flood plains naturally absorb flood water, so why build on them or contain them

River Pollution

- identification and location of the issue - industrial (warm water, toxics), domestic, agricultural, imported, accidents
- policies to guarantee drinking water, reduce toxicity, restore ecosystem, a coordinated strategy
- safety and cutting accidental discharges
- reducing by legislation of priority toxic wastes
- encourage restoration of side channels and ecologically important reaches
- improved warning systems
- controls on chemical fertilisers/pesticides - organic farming
- placing limits on the temperature of water discharged from power stations and manufacturing processes

Band 1 answers should express detailed knowledge of their case study(ies), location, issues and management policies. Good evaluation of degrees of success/failure along with difficulties of implementation.

Band 3 answers may concentrate upon the issue rather than resolving it. There may be a lack of clarity about various strategies or simply limited development.

Band 4 answers that warrant a pass should have relevance but expect very limited coverage and generalisations about the causes of pollution and how to manage it.

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- 5 (a) In 1972 the Club of Rome published its landmark report, *Limits to Growth*, which dramatically predicted the inevitable collapse of civilisation unless economic growth was halted immediately.

Some predictions made in the report are summarised in Fig. 5.1.

Outline one reason why you would agree with the predictions made in Fig. 5.1 and one reason why you would disagree with its predictions. Give an example in each case. [10]

For full marks there must be a balance between agreement and disagreement. Although the Club of Rome predictions came under severe criticism many of its predictions have recently attained more respect.

Arguments for can include: we are only part way through the 100 year track; population growth is still exponential; a large number of countries with very low GDP are at a critical level (Pakistan, Bangladesh, Sub-Saharan Africa), there are several major environmental issues (global warming, drought, climatic change); some fossil fuels will be at a critical level (oil and natural gas).

Arguments against can include: despite exponential population growth life expectancy is longer; there is a mal-distribution of food not a shortage; there is no shortage of essential minerals; few resources have turned out to be essential as demand and availability adjust; we now utilise resources better; sustainability is dynamic not static.

For marks of 8 to 10 there must be a balance between agreement and disagreement supported with evidence from the graph and current trends.

For 4 to 10 marks expect a poor balance with agreement easier to find than disagreement. There should however be relevance.

For 1 to 3 marks expect a few creditable points without the evaluation the question requires.

- (b) Using examples with which you are familiar, describe and evaluate the strategies that have been adopted to achieve a more sustainable use of agricultural land whilst increasing food production. [30]

Sustainable agriculture can occur in both MEDC's and LEDC's

In more developed countries it can involve; diversified farming, low input-output farming, and organic farming.

- crop rotation allowing recovery and natural fertilisation
- on-farm waste recycling
- weed control by mulching, crop rotation
- pest and disease control using less nitrogen, rotating crops
- better animal welfare
- intercropping
- reduced energy and fertiliser leading to less intensive farming
- fewer agrochemicals
- smaller fields and restoration of hedgerows

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In Less Economically Developed Countries, there is a greater priority to increase food production in societies with much higher rural densities of population.

- many of the strategies for MEDC's apply (crop rotation, weed control, fertilisers, agrochemicals, intercropping, animal welfare)
- increased food production can include: the green revolution; high yield varieties of rice, wheat and corn; education etc.
- agriculture also becomes more sustainable if there is lower or more stable demand.. Therefore population growth needs attention

Band 1 answers should fully utilise case studies, be well balanced, relevant and evaluate degrees of success or failure.

Band 3 answers may make general reference to the case studies, be loose on sustainable farming and evaluation.

Band 4 answers should have some relevance but are weak on detail.

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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 have been developed out of the broad objectives for the examination and guideline for locating marks for essays.

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. marshals evidence, draws conclusions and makes 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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: | |
| A | <ul style="list-style-type: none"> select and use a 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> select and use a limited range of accurate and relevant knowledge; integrate knowledge from a very limited range of areas; show a modest understanding of the concepts involved; | |
| B | <ul style="list-style-type: none"> select and use a limited style of writing, appropriate to purpose and subject matter; communicate ideas with limited clarity; | |
| C | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> select and use some relevant knowledge; integrate knowledge from a very limited area; show a restricted understanding of the concepts involved; | |
| B | <ul style="list-style-type: none"> When producing written communication: select and use a very limited style of writing appropriate to purpose and subject matter communicate with limited clarity; | |
| C | <ul style="list-style-type: none"> undertake a very limited analysis of issues, problems and evaluation; recognise some arguments and conclusions | |