

**MARK SCHEME for the May/June 2010 question paper
for the guidance of teachers**

8291 ENVIRONMENTAL MANAGEMENT

8291/21

Paper 21, maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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

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Section A

Answer *both* questions from this section

- 1 (a) Fig. 1.1 is a model depicting how a plant succession might be affected by human disturbance.

- (i) Define the terms *plant succession* and *climatic climax community*. [4]

Plant succession: 1 mark for a clear detailing of a progressive adaptation of plants and their soils (1) to the climate and environment of an area (1)/or equivalent. (2)

Climatic climax community an ultimate stage (1) whereby the vegetation and soils are fully adapted to the climatic conditions of an area. (2)

- (ii) Explain how human activities would, in time, produce a *plagioclimax plant community*. [2]

Award 1 mark for how human activity might arrest a succession or alter a climax community; subsequently a new community (less mature or adapted) occupies and matures in the area affected i.e. the plagioclimax. (1 mark)

Credit valid alternatives that might develop exemplars.

- (b) Describe and explain *two* different effects deforestation might have on the area shown in Fig. 1.2. [4]

Two marks are to be awarded for each of two effects in which one mark is for identifying an effect and the second for a correct elaboration.

Effects could include: loss of biodiversity, loss of habitats, slope instability, rivers flooding, aesthetic. (2)

- (c) Fig. 1.3 shows losses and gains of forested land for continental areas in the period 2000 to 2005.

- (i) Compare the change in forested land for the continental areas shown in Fig. 1.3. [3]

For 3 marks answers must contain reference to losses and gains. One mark should be allocated to each of three points and award a max of 2 if there is no use of data:

- Africa and South America have the largest losses at around 4 million hectares each
- North/Central America and Oceania have smaller losses of 0.3 million hectares each
- Europe and Asia show gains of 0.6 and 1 million hectares.

- (ii) Outline *one* ecological reason for the change in forest cover shown in Europe. [1]

Answers must relate to ecology e.g. restore ecosystems, maintain biodiversity, habitats.

- (iii) Outline *one* economic reason for the change in forest cover in South America. [1]

Economic reasons for losses include: commercial (cattle, mining, soya, biofuels), resettlement programmes, commercial forestry. No credit for natural causes.

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- (d) *Silviculture is “the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis”.*
(Dictionary of Forestry 1998)

Fig. 1.4 shows two methods of managing forests in a sustainable way.

- (i) Select *one* method from Fig. 1.4 and justify why it can achieve a sustainable management of forest. [4]

Credit well developed points with two marks or brief points with one mark.
One mark for an expression of sustainability.
Three marks for the justification.

- (ii) Give *one* reason why you rejected the other method shown in Fig. 1.4. [1]

The rejected method should in the view of the candidate offer less sustainability than the other.

[Total: 20]

- 2 (a) Rivers can become polluted with a variety of substances derived from many different sources.

- (i) Complete Table 2.1 below by matching the following list of pollutants with the correct source. Use each pollutant *once* only. [5]

Award one mark for each.

source of pollution	pollutant
agriculture	nitrates
quarrying	sand
shopping centres	litter
domestic pollution from dwellings	detergents
roads	hydrocarbons

- (ii) Explain why some of these sources can lead to storm water pollution. [2]

Credit one mark for the two linked points: most of the pollutants indicated in Fig. 2.1 collect at the source (= 1); storms wash the substances into the river and higher river velocity washes them down stream (= 1).

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- (b) A pipe carrying pollution into a river had an adverse effect on the ecology of the river close to the pipe outlet as well as downstream. Research into the pollution of the river from the pipe produced the results shown in Table 2.2. The river was being polluted from the pipe at the time the research was undertaken.

site	B.O.D/mg l ⁻¹		pH		Suspended solids/mg l ⁻¹	
	level	Legal limit	level	Legal limit	Level	Legal limit
A 5 m upstream of pipe	0.2	≤ 5	8.3	6–9	< 10	≤ 25
B pool directly beneath the pipe	52.5	n/a	10.25	n/a	25	n/a
C 120 metres downstream from the pipe	6.8	≤ 5	10.05	6–9	37	≤ 25

B.O.D. = biological oxygen demand in milligrams of oxygen per litre of river water

n/a = limits not applicable to actual discharge, only the receiving water

pH = a measurement of acidity: 7 is neutral, < 7 is acid, > 7 is alkaline.

- (i) Describe the biological, chemical and physical qualities of the river water at site A. [3]

A Before the source of pollution therefore relatively unpolluted (= 1); all three are within the legal limits (8.3 is fairly alkaline), suspended load 20; and BOD 0.2 (= 1), low microorganism population.

- (ii) Describe the river water quality at B and explain the effects this would have on organic life in the river at this point. [4]

Answers should divide into description (2 marks) and explanation (3 marks).

Descriptions should focus on the reduction to the quality of the river. For two marks use must be made of the data; without data credit up to 1 mark.

Explanations involve 3 features: increased pollution at the pipe outlet (= 1) is shown by BOD at 52.5 refers to the amount of dissolved oxygen utilised by microorganisms, therefore the higher the measure the less available for organisms and the more polluted the river (= 1 mark), higher alkinity derived from pipe effluent (pH = 10.25) (= 1 mark) combine to kill microorganisms and fish.

- (iii) Explain the reduction to the BOD recorded at site C compared to site B. [2]

The movement of pollutants 120 metres downstream causes the pollution to diffuse and BOD to reduce to a more healthy level;

Award one mark for a brief statement and two for a developed point.

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- (iv) Suggest *one* reason why the amount of suspended solids has increased at point C. [2]

The river continues to receive sediment from the local urban or agricultural environment (= 1); fine sediment remains in suspension (= 1).

- (v) Describe *one* environmental effect this type of pollution may have on areas further downstream from point C. [2]

One effect needs to be briefly outlined; one mark for a brief statement and one for its elaboration. This can include:
continued pollution and loss of water quality, eutrophication, dead zones in lakes and seas, effects on marine life.

[Total: 20]

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Section B

Choose *one* question from this section

- 3 (a) Fig. 3.1 shows worldwide trends in the populations of terrestrial, freshwater, and marine species. The value of 100 for 1970 is used as a benchmark index. Describe the trends shown in Fig. 3.1 and suggest a reason for each of these trends. [10]

Notionally credit 4 marks for the description and 6 marks for the reasons. The final mark should be derived from the bands.

Descriptions should include the overall reduction in all three, with the slow decline from 1970 giving way to an increased rate of reduction (= 1). Freshwater species show the biggest fall (= 1) followed by marine species with a slight recovery after 2000 (= 1). Terrestrial species are steady until 1995, then decline (= 1).

Reasons should emphasise human exploitation, climatic change and pollution that affects each group.

Terrestrial: increases in agricultural land, deforestation, exploitation, climatic change.

Freshwater: pollution, eutrophication, fishing.

Marine: overfishing, pollution (e.g. dead zones).

8–10 marks for a clear description of each trend and a minimum of one fully justified reason for each group.

4–7 marks for descriptions that may lack clarity or omit one group. Three reasons may lack development or two may be described.

1–3 marks for weak or brief answers that although having some relevance may be superficial, weak in description with limited reasoning.

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- (b) With reference to examples you have studied, describe and assess two strategies that are used to conserve species and maintain biodiversity. [30]**

This is quite an open-ended question giving candidates the opportunity to develop their own studied examples. Although conservation of species and sustaining biodiversity are interwoven they can also be separated e.g. national parks and safari parks are useful for biodiversity whilst zoos may be used to support an endangered species.

Answers should encompass: the identification of studied examples that are illustrative of the need for the required strategies. In terms of species conservation this could be within an area or for specific species e.g. Snow Leopards, Whales. Maintaining biodiversity can be a lot broader and could refer to deforested areas, agricultural expansion or natural events such as droughts.

Conserving species can take place in National Parks and Safari parks or be attempted through legislation imposed on: hunting, poaching, buildings, industry and agriculture etc. However greater control is derived from zoos and re-introducing species into their natural habitats.

Maintaining biodiversity is more the province of National Parks, SSSIs (UK) and broader regional conservation in which ecological interactions occur. Projects such as the Eden Project (UK) go part of the way.

Band 1 Answers will use appropriate examples and contain a good balance of the two parts of the question. The answers will be well articulated with an appropriate balance of detail. Information and assessments will relate to the chosen examples .
[25–30]

Band 3 Answers should include appropriate examples but the detail of the answer may be loosely linked. The answer may lack balance with conservation having better treatment than maintaining biodiversity or vice versa. Assessments may be weakly developed.
[13–18]

Band 4 Answers will be relevant but brief in detail. Descriptions of conservation and maintaining biodiversity are likely to be loosely linked with the examples and assessments weakly developed.
[6–12]

[Total: 40]

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- 4 (a) Use Fig. 4.1 to explain how the natural environment and human activity combine to produce the annual extreme flooding experienced in Bangladesh. [10]

The diagram contains a lot of information requiring the candidates to distinguish and draw linkages between human activity and the natural environment.

The natural environment includes: monsoons, hurricanes, low lying delta/flood plain and snow melt.

Human activity includes: deforestation increasing surface runoff and increased silting that encourages flooding, irrigation deprives the delta of sediment leading to erosion of the delta rather than sediment accumulation.

8–10 marks Candidates will specify both sets of factors and draw linkages between them.

4–7 marks At least one aspect of each set will be described but linkages will be weak. Expect elements of the answer to be poorly developed.

1–3 marks Answers will be brief, lack development of points and linkages between human activity and natural factors will be poor or absent.

- (b) Strategies for managing rivers serve a number of purposes. Using examples, assess the measures that are undertaken to maintain a sustainable supply of water as well as to control flooding. [30]

A sustainable supply of water can refer to quality and quantity. Through the use of examples both aspects of water management should be considered.

Sustainable supplies refer to water conservation schemes such as reservoirs, desalination and ground water management as well as measures to maintain a clean supply of water.

Controlling flooding overlaps with dams and reservoirs but also includes river management such as levees, dredging channels, straightening river courses.

Assessments should mention socio-economic effects, knock-on effects on the physical environment and can be positive and negative.

Band 1 Answers will use appropriate examples and contain a good balance of the two parts of the question. The answers will be well articulated with an appropriate balance of detail. Information and assessments will relate to the chosen examples. [25–30]

Band 3 Answers should use appropriate examples but the detail of the answer may be loosely linked. The answer may lack balance with water supply have better treatment than flood controls or vice versa. Assessments may be weakly developed and be purely negative or positive. [13–18]

Band 4 Answers will be relevant but brief in detail. Descriptions of water supply management and flood control are likely to be loosely linked and lacking detail. Examples and assessments poorly developed. [6–12]

[Total: 40]

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- 5 (a) Explain how the over-exploitation of whales and krill from the oceans surrounding Antarctica might affect the marine food web shown in Fig. 5.1. [10]**

The question targets the current environmental issue of exploitation of the southern oceans. Answers need to focus upon the top and bottom of the food web.

Krill at the primary consumer level almost supply the whole of the food web and their extraction immediately deprives seals, birds, fish and squid of food.

The loss of food for penguins and leopard seals is leading to a reduction in population possibly extinction or migration. At the top of the food web toothed whales (carnivorous) and other whales lose their food supply and migrate.

Loss at the top of the food web is complex. The loss of toothed whales will enable leopard seals and penguins to increase but that could adversely affect the population of fish, birds etc. The loss of baleen and sperm whales would enable the population of krill to increase.

The more perceptive students will recognise the complexity of the issue and may argue that controls on exploitation at both the top and bottom will achieve ecological stability.

8–10 marks Answers will consider both ends of the food web and how the secondary levels will respond. Top quality answers may point to the complexity of the issue.

4–7 marks Answers may either lack detail on knock-on effects or have a bias towards either end of the food web.

1–3 marks Answers may list or repeat aspects of the food web and be uncertain about feeding habits within a food web.

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(b) Assess the roles of pressure groups and governments in the conservation of endangered marine species. [30]

Marine conservation is often complex. Conservation strategies are the product of actions by individual nations within territorial waters and agreements between nations in international waters.

By individual nations: conservation areas e.g. The Great Barrier reef is a World Heritage Site and National Park, nations can impose fishing limits, pollution prevention; zoos and aquaria conserve specific species.

International Agreements: The Rio protocol had concerns for sustainability in marine environments; international fishing quotas aim to raise fish populations; international legislation of pollution from shipping.

Pressure groups such as greenpeace prompt action e.g. Japanese whaling.

Band 1 Answers will use appropriate examples of marine conservation and contain a good balance of the contribution by governments and pressure groups. The answers will be well articulated with an appropriate balance of detail. Assessments should link with the information in the essay and contain both positive and negative points. [25–30]

Band 3 Answers should use appropriate examples but the detail of the answer may be loosely linked. The answer may lack balance with either governments or pressure groups dominating the answer. Assessments may be weakly developed and be purely negative. [13–18]

Band 4 Answers should be relevant but likely to be brief in detail. Descriptions of government action and the role of pressure groups are likely to be very brief and lacking detail. Examples and assessments poorly developed. [6–12]

[Total: 40]

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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 are 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. 	

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Band 3	The candidate demonstrates the following abilities where appropriate to:	13–18
A	<ul style="list-style-type: none"> select and use some 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 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	<p>When producing written communication:</p> <ul style="list-style-type: none"> 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. 	