

**MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers**

8291 ENVIRONMENTAL MANAGEMENT

8291/13

Paper 1, 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.

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

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Section A

Answer **all** questions in the section.

- 1 (a) Table 1.1 contains details of sources and types of atmospheric pollution commonly found in urban areas. Complete the table by adding the appropriate sources and types to the empty boxes. [3]

Table 1.1

source	type
incinerators	dioxins
coal fired power stations	sulphur dioxide, carbon dioxide nitrogen oxides
motor vehicles & boilers fires	carbon monoxide
power stations and heating systems and car exhausts	nitrogen oxides

- (b) Ground level ozone is a secondary pollutant produced in urban areas. Fig.1.1 illustrates how it is formed.

- (i) What is meant by the term *secondary pollutant*? [1]

a substance, non-hazardous on release that becomes hazardous after chemical reactions in the environment

- (ii) Suggest why ground level ozone is more of a problem on sunny days. [2]

the reaction between nitrogen oxides and hydrocarbons requires sunlight

- (iii) Explain why concentrations of ground level ozone can also be found in rural, traffic-free areas. [2]

winds transport (1 mark) the ozone into neighbouring rural areas (1 mark)

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(c) Fig. 1.2 and Fig. 1.3 show buildings in a cross section through a city.

- (i) Draw a line (—) onto Fig. 1.2 to show the shape of the atmospheric pollution zone when there is no wind. [2]

a curved line peaking at the city centre (1 mark) and lowest in the rural areas (1 mark);
a straight line over the city centre (1 mark)

- (ii) Draw a line (—) onto Fig. 1.3 to show the shape of the atmospheric pollution zone when the wind direction is from west to east. [2]

a curved asymmetrical line peaking to the east of the city centre (1 mark), rising gently in the west and dropping steeply to the east (1 mark), a straight line to the east of the city (1 mark)

(d) Fig. 1.4 is a map showing levels of nitrogen oxides (NO_x) polluting the atmosphere in a district in the city of Prague.

- (i) Describe the distribution in atmospheric pollution shown in Fig. 1.4 and suggest two reasons for this distribution. [6]

- areas of high pollution are along main roads and closer to the city centre (2 marks)
 - whilst suburban areas closer to non-urban districts have less pollution (2 marks)
- 1 mark for each of two points from below. These points may be integrated into a single analysis.
- the greater the density of traffic the greater the pollution
 - high density buildings and narrow roads trap pollution
 - cleaner air drifts across rural areas

- (ii) Outline one way in which the design of an inner city area would assist in keeping atmospheric pollution in the streets at a low level. [2]

Credit 1 mark for the way and 1 mark for its elaboration: possible inclusions are: wider streets allowing dispersal; more trees and vegetation offering a barrier and cleaner air; traffic management; cleaner vehicle engines

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- 2 (a) (i) **Using Fig. 2.1, describe how the location of the Earth's continental plates has changed over the last 225 million years.** [3]

Credit one mark for each stage:

225 million years ago: united super-continent of Pangaea containing plate rifts;

135 million years ago: split and outward movement: some might refer to Laurasia and Gondwanaland

Present: Pacific closing and other oceans opening about oceanic rifts; thus the present positions of the continents

Credit valid alternatives e.g. ocean floor spreading

- (ii) **Describe how either palaeo-magnetism or palaeontology can provide supporting evidence for the changes evident in Fig. 2.1.** [3]

Credit three relevant points with one mark.

Palaeomagnetism utilises the orientation of iron particles (1 mark) in dated rocks (1 mark); this is related to the current location of the continent (1 mark) to find its former position; candidates might refer to the speed of plate movement; some the shift in the Earth's magnetic field.

Palaeontology is easier: some fossils (of short life span and wide distribution) are found on a number of continents (1 mark); continents containing similar or identical assemblages can then be linked together (1 mark); many fossils originate from distinctive environments thereby enabling connections to be mapped or linked (1 mark).

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(b) The San Andreas Fault in California is a transform or strike slip-fault. Fig. 2.2 shows some surface features produced by the San Andreas Fault. Fig. 2.3 shows the location of different types of seismic activity along the San Andreas Fault.

(i) State one piece of evidence from Fig. 2.2 that suggests the type of fault movement is horizontal rather than vertical. [2]

juxtaposition or ridges each side of the fault; river diversion; absence of a difference in altitude; absence of features typical of convergence and diversion; some might suggest a matching of ridges (bottom left with top right).

(ii) State one piece of evidence from Fig. 2.2 that suggests that earthquakes are frequent occurrences along this section of the fault. [2]

the 'clean' appearance of the fault indicates that movements prevent the obscuring of the fault-line by eroded debris. The ridges each side of the fault are fresh (caused by frictional crinkling).

Do not expect technical answers.

(iii) Fig. 2.3 shows that the nature of plate movement divides the San Andreas Fault into a creeping section, a transitional section and a locked section.

- Suggest how and why earthquake activity in the locked section of the fault would differ from that in the creeping section.

Credit 2 points each with one mark.

creeping sections move gradually or continuously so that pressures are released and earthquakes less severe; locked sections are prone to sudden and violent movement.

- Suggest why Parkfield is a good location for studying earthquake activity along the San Andreas Fault. [4]

Parkville lies between a creeping section and a locked section thus a variety of earthquakes can be researched plus mild earthquake activity is frequent and can be studied.

(c) Fig. 2.4 shows the frequency of seismic activity along the San Andreas Fault over a period of time. One dot is used to record one seismic event. Where many events are recorded over a short period, the dots merge to produce a more continuous form of shading.

Describe how seismological evidence, such as that shown in Fig. 2.4, can be used in the prediction of earthquake activity at different places along the San Andreas Fault. [6]

Fig. 2.4 contains information on the depth and frequency of earthquakes (2 marks).

The seismic gaps are where there is an absence or less seismic activity (2 marks).

Earthquakes are likely in the gaps; thus San Francisco and south of Parkville are likely locations.

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Section B

Answer **one** question from this section.

- 3 (a) Fig. 3.1 shows changes to estimated global temperatures, atmospheric carbon dioxide concentration and sunspot activity between 1855 and 2010. Briefly assess the extent to which sunspot activity and carbon dioxide concentration can be regarded as contributors to global warming. [10]

Notionally credit carbon dioxide with 6 marks (2/3 for description and 3/2 for assessment) and sunspots with 4 marks (2+2).

Carbon dioxide: CO₂ and temperature closely align; temperatures although fluctuating do not markedly increase until 1920, steady in the 1940s to 50s before rising steeply to their present levels. This relates to the 'western' industrial revolution followed by that of the LEDCs from the 1960s. These industrial revolutions involved the burning of fossil fuels and releasing greenhouse gases.

Sunspot activity has a less clear correlation with temperature change. Sunspot activity fluctuates until the 1960s, rising until the mid 1990s then falls. Therefore a loose early correlation is followed by no correlation. This brings into question the contribution made by sunspot activity to global warming.

8 to 10 mark answers should have a balance of detail, use data (be it descriptive) from the graph and be evaluative.

4 to 7 mark answers will be more descriptive and weak in one element.

1 to 3 mark answers will be brief, unclear and descriptive.

- (b) With reference to examples from More Economically Developed countries (MEDCs) and Less Economically Developed Countries (LEDCs), assess the difficulties in achieving agreement on reducing levels of atmospheric carbon dioxide. [30]

Beginning with the Rio protocol, followed by Kyoto then Bali, formal agreements on carbon dioxide level have occurred but not necessarily followed up. Some argue that agreed reduction targets have been difficult if not impossible to achieve; many nations requested and achieved concessions and rich nations bullied and sometimes bribed themselves into secure positions; carbon trading was one aspect of this. However it is easy to get emotional about this and the question has the following requirements:

- reference to protocols and evidence of protocols not being successful
- a little on the carbon dioxide issue including triggering methane emissions.
- reference to how MEDCs and LEDCs have coped with their targets
- arguments, for and against, a reduction in fossil fuel usage
- arguments for and against the development of alternative energy sources
- other measures such as at the personal level reducing our carbon footprint, reducing deforestation.

Band 1 answers should fully enter the debate through assessing protocols and linking them with how LEDCs and MEDCs are tackling the problem. References to fossil fuels and alternative energy should occur at this level. (25 to 30)

Band 3 answers may lack clarity in assessing protocols and either lack the balance of detail needed or give the question superficial coverage. (13 to 18)

Band 4 answers will probably dive into alternative energy and express limited knowledge of Kyoto. Exemplar material will be weakly developed. (6 to 12)

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4 (a) Suggest three reasons for the distribution of soil degradation shown in Fig. 4.1. [10]

Candidates need to give three reasons with 3/4 marks for each to a maximum of 10. Credit 1 mark for correctly identifying a reason and 2/3 for its elaboration.

The general pattern is:

- that the areas of highest population density have the most degraded soils
- very degraded soils are in semi-arid (Sahel) and overpopulated regions (Sahel and India)
- degraded soils are in less densely populated areas of MEDCs (France, Germany) as well as undeveloped areas (Central Africa, Argentina)
- stable soils generally in areas that cannot or have not been developed for agriculture (Tundra).

8–10 mark answers will contain three well developed reasons.

4–7 mark answers will contain either 2 developed reasons or correct identifications with weak reasons.

1–3 mark answers will contain one developed point or up to three poor developments.

(b) With reference to examples with which you are familiar, assess the extent to which agricultural land is used in an environmentally sustainable way. [30]

The question is broader than a simple analysis of soil management. Agricultural practices do not always consider long term effects on the environment and frequently agricultural practices do not adjust to changing conditions such as increases in the demand for food. The environmental effects of agriculture will vary according to the examples chosen and their climate.

The question requirements are:

- the selection of suitable examples
- an analysis of common agricultural practices (shifting cultivation, slash and burn, intensive rice cultivation, extensive or intensive mechanised farming .. the selection varies according the nation
- the adverse effects of agriculture on the environment, deforestation, soil degradation, salinisation following irrigation, soil erosion
- the positive effects might involve education and planning or might be inherent to the agricultural practice, e.g. shifting cultivation can permit development of secondary climax vegetation, agroforestry restricts deforestation and allows farming, controlled grazing on marginal land (prairies) maintains soils and pasture, terracing of rice paddies restricts soil erosion.
- answers should contain some assessment of the practice and the environment.

Band 1 answers should, according to example, consider all the expected requirements. There will be a good input of detail and the idea of a sustainable environment considered and assessed. (25 to 30)

Band 3 answers will select suitable examples but the answers may only include at least two of the question requirements; these may be briefly or superficially developed. (13 to 18)

Band 4 answers may be weak in the selection of examples. The analysis will be brief and lack clarity on environmental sustainability. (6 to 12)

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5 (a) Using examples for each, distinguish between renewable, non-renewable and recyclable resources. [10]

There should be a straightforward assessment of the three types of resources. Credit 3 marks for each with one floating mark for any one of the three. With renewable and non-renewable resources there should be reference to resources other than energy.

Renewable resources are a flow in nature and in the short term will renew. In the shortest period wind, water, solar and in the longer term forests relate to energy. Fish, soil and land are other forms of renewable resources.

Non-renewable are those that once used cannot be replaced except in the span of geological time. These include fossil fuels as well as most minerals, hard wood, rocks and land.

Recyclable resources are those that once used can be manufactured into a different or the same product; this includes glass, metals (aluminium, iron), paper, food into compost, etc.

8–12 mark answers should be well balanced and for each contain a detailed description and example.

4–7 mark answers may have weak balance (2 developed) or lack detail/examples.

1–3 mark answers may have one developed type or be lacking in all three.

(b) We live in a world of increasing population and universal demands for high standards of living. In the light of this statement assess the environmental arguments for replacing non-renewable resources with renewable and recyclable resources. [30]

A broad essay that develops out of part (a). The focus of the question is the probable need to replace finite non-renewable resources with renewable and recyclable resources. Answers should focus on the environmental benefits rather than the purely economic or social.

The question requirements are:

- to assess the case for reducing the use of non-renewable resources; fossil fuels have a limited life, non-urban land is being built on, soils are being degraded, quarries are replacing rainforest and some species are near extinction
- to assess the case for renewable resources including cleaner energy sources, careful forest management
- to assess the case for recyclable resources in terms of conserving stocks of woodland, minerals (metal ores) and soils as well as conserving the environment, e.g. land, areas of outstanding beauty and ecology.

Band 1 answers will be well balanced in developing an assessment of all three resources. Answers at this level should contain effective assessments by comparing the use of different resources. There should be strong references to the environment. (25 to 30)

Band 3 answers will either be superficial in coverage or poorly balanced by giving more attention to one or two of the resources. References to the environment may be brief or superficial. (13 to 18)

Band 4 answers although relevant are likely to be brief, some poorly balanced and without any evaluation. (6 to 12)

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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 guidelines 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; 	