

MARK SCHEME for the October/November 2006 question paper

8291 ENVIRONMENTAL MANAGEMENT

8291/01 Paper 1, 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 instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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 grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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

CIE is publishing the mark schemes for the October/November 2006 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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Section A
(Answer all questions to this section)

1 (a) Fig. 1.1 is a simple classification of resources.

(i) Define the terms non-renewable and renewable resource. [2]

Non-renewable resources such as fossil fuels are finite and once used cannot be replaced. e.g. fossil fuels = 1 mark.

Renewable resources occur as a flow in nature and whilst being used will constantly be replaced. e.g. water and wind = 1 mark.

Credit 'mirrored statements with a maximum of one mark.

(ii) Name an example of a non-renewable resource that would be used to provide for each of the following: [3]

- *electricity*. coal, oil, natural gas = 1 mark
- *road construction*. stone, sand, oil, bitumin = 1 mark
- *a car body*. iron ore = 1 mark

(iii) Identify a renewable resource that could be used to provide electricity. [1]

Water, wind, solar, wood (qualified e.g. Sweden Denmark).

Briefly explain how this resource could be used to provide electricity. [1]

A brief statement is needed for one mark.
e.g. force of wind to turn blades/turbines for electricity.

(b) Fig.1.2 shows the consumption of resources in rich and poor nations. Describe how the consumption of resources in rich nations is different from that in poor nations. [3]

Award 3 marks for each of the two categories: rich and poor (1/2 or 2/1).

Rich nations consume >80% of paper, cars.
80% to 40% of electricity, total energy, meat <50% fish and <20% cereals.
Poor nations are always low but increase towards a 20% share of cereals.

(c) Fig. 1.3 shows trends in world energy consumption of different energy sources.

(i) Describe the trends in the consumption of energy shown in Fig 1.3. [2]

The question asks for trends that should then refer to general rather than specific patterns. Award one mark for fuels and one mark for consumption.

- Fossil fuels increase from 1970 to 2025 with coal from 52 to 110, gas from 45 to 120 and oil the highest 100 to 250
- each of the above remain higher than renewable and nuclear energy
- renewable energy shows slow increase from 8 to 20
- nuclear energy shows a steady increase until 2005 then declines.
- the possible non-growth in nuclear energy.

(ii) Suggest two reasons why the consumption of natural gas will exceed that of coal from 2005. [2]

Declining reserves in MEDC's and LEDC's = 1 mark.
Global environmental concerns (pollution/greenhouse gases) = 1 mark.

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(iii) Why is it likely that renewable and nuclear energy consumption will remain relatively low?

Renewable sources produce relatively smaller quantities of electricity and are expensive = 1 mark
Nuclear energy is also expensive and there are safety issues = 1 mark.

(iv) Outline two possible environmental consequences of a continuation in these trends in energy consumption. [4]

Award 2 marks for each of two points.
Increases in pollution and global warming with its impact upon climatic change. These could be separated but each needs a full description. = 2
Fossil fuels are finite and cannot be replaced within a short time span.
Developments in renewable energy are occurring more rapidly in MEDC'S thereby enabling a cleaner environment; in LEDC's it is slow and their reliance upon fossil fuel maintains a dirty environment. = 2
Reference to physical hazards such as oil spills; mining issues etc can be credited but must contain supporting arguments.

[Total for Question 1: 20 marks]

2 (a) Fig. 2.1 shows a summer anticyclonic weather system that developed over the west coast of the USA.

(i) Insert the values 1016 mb and 1000 mb in their correct locations in Fig. 2.1. [2]

One mark for each correct isobar position.

(ii) Insert arrows at points W and X on Fig. 2.1 to show the horizontal direction of air movement in this anticyclone. [2]

W is to anticlockwise and slightly into the cyclonic system (ENE).
X is also anticlockwise just south of west. (one mark for each).

(iii) Describe the weather conditions that would be associated with this summer anticyclone. [3]

Summer anticyclones receive descending air which warms adiabatic ally. Conditions are likely to be: clear skies due no condensation nor precipitation; warm to hot conditions with cloudless skies; wind speed low or still conditions. Credit one mark for each point.
It is possible the some answers will describe 'anticyclonic gloom', if so then credit one mark for each of; descending air, a temperature inversion, rising air condensing to form cloud.

(iv) Why are such weather systems relatively stable? [2]

Descending air produces high pressure = 1 mark.
Less stable air is blocked out high pressure remains for a longer time = 1 mark.

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(b) Fig.2.2 shows the weather conditions and atmospheric pollution over Los Angeles during a summer anticyclone.

(i) Describe the possible cause of the smog resting over Los Angeles.

Urban pollution (domestic, traffic and industry) = 1 mark.

Moist air from the Pacific can cause fog = 1 mark.

Particulates become hygroscopic nuclei and encourage condensation = 1 mark.

Award up to full marks for references to photochemical smog. Do not credit details relevant to part (ii).

(ii) Why does the atmospheric pollution over Los Angeles have difficulty in escaping under anticyclonic conditions? [3]

This returns to the stable conditions of an anticyclone. Polluted air cannot escape because:

with onshore breezes air is trapped between the sea and the mountains;

descending air prevents any polluted air from rising;

the stable air conditions enable a progressive build-up of urban pollution.

(iii) Identify and explain two effects of such pollution within urban areas. [5]

Award marks on the basis 2/3 or 3/2. Each effect should identify an effect and a process.

Photochemical smog (conversion of hydrocarbons and nitrogen oxide into nitrogen dioxide) causes eye irritation, coughing or bronchial complaints.

High concentrations of particulates from burning fossil fuels cause smog; people suffer from respiratory failure.

Acid deposition (occasional pH recordings of <3), can cause cement and bricks to rot, kill vegetation

[Total for Question 2: 20 marks]

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Section B

(Choose **one** question from this section)

- 3 (a) **Fig. 3.1 shows how precipitation and temperature affect the type and rate of rock weathering. Describe how temperature and precipitation affect the type and rate of rock weathering in Fig.3.1.**

[10]

Fig 3.1 relates types and rates of rock weathering to climate (Peltier model). There are three areas where weathering is most active:

1. Warm moist areas where chemical weathering dominates. High temperatures and humidity encourage rapid hydration, carbonation, solution etc and produce a deep regolith.
2. More temperate conditions encourage a combination of chemical weathering. Warm temperatures enable chemical process to operate but at slower rates than in the tropics. Moisture and temperatures fluctuation above and below 0⁰C causing freeze-thaw or frost action.
3. Mechanical weathering dominates cooler areas. Lower temperatures slow chemical processes but alternate freezing and thawing enable very active frost action.

Candidates may opt to move around the chart and should be awarded up to 10 marks as long as the interaction of temperature and precipitation are satisfied.

Award 8 to 10 marks for well balanced answers that bring out the interaction of temperature and moisture of all 3 categories accounting for different rates and types of weathering. Award 4 to 7 marks for answers that are relevant but are either poorly balanced or are brief on processes. If up to 2 of the content indicators are mentioned award a maximum of 7 marks.

Award 1 to 3 marks for brief answers which may wander aimlessly around the chart. Answers in this category will clearly lack an understanding of weathering processes and may gain credit for identifying positions on the chart.

- (b) **With reference to examples you have studied outline the causes and effects of land instability. How might such hazards be managed?**

[30]

The question is concerned with the factors that render land unstable and liable to movement. Such instability can be triggered by natural and human factors and includes:

Natural Processes: dry and wet mass movements on sloping land, cliffs (inland and coastal), rivers, volcanic activity and earthquakes.

Human Activity: building construction, road and rail (cuttings) and agriculture.

Whilst the effects of these movements often involves loss of life/homes/other buildings other effects include: soil erosion, gullyng and loss of land.

Candidates should select more than one example and outline both the cause and effects of the instability. Cause needs reference to the characteristics of the unstable surface (gradient, degree of lubrication), thickness and composition of weathered surface, surface processes, ice, rivers, wind etc.), the trigger mechanism (human activity, earthquakes, waves) and its effects.

The management strategies must be linked to the hazard. These strategies need coordination, planning and investment and can include: aforestation, slope reinforcement (revetments, gabions etc), improved agricultural practice, slope drainage or even doing nothing and moving people.

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Band 1 answers should contain two developed or one very well developed examples: the latter with reference to a variety of different hazards. The causes and effects of the hazard and for each with related management strategies should have full coverage.

Band 3 answers may lack balance between cause, effect and management. Other answers may be weak on processes and management strategies with descriptions rather than analysis.

Band 4 At the top of this band the answer should be relevant. However answers are likely to be brief, possibly list material and be superficial.

[Total for Question 3: 40 marks]

- 4 (a) **Fig.4.1 shows how the weather conditions in a valley may change between late afternoon and early morning the next day. Describe and explain the changes to the weather conditions between late afternoon and early morning shown in Fig.4.1.** [10]

This question is concerned with the localised weather events of anabatic (upslope or up-valley) and katabatic (down slope or down valley).

The ideal conditions for anabatic winds are warm sunny conditions with the valley sides or slopes receiving high rates of insolation. Under these conditions; valley sides are warmed, pressure is reduced and air drawn in from nearby lowland areas. With the head of the valley being enclosed this can lead to strong up valley winds. Early morning valley floor fog or mist may rise to form pockets of cloud.

Katabatic winds may be common in the same valley and form during the night. Night-time slope radiation causes temperatures on the valley sides to drop and the dense cold air may drain down to the valley floor. A cold flow of air may move out of the valley or dependent upon local conditions the cold air may collect to form a 'frost hollow'. Fog form due to cold air causing condensation. Low level cloud of fog is maintained by a temperature inversion.

For 8 to 10 marks answers should be well balance and each part contain reference to: temperatures, pressure, air movement, valley shape and general weather conditions.

Answers credited with 4 to 7 marks should be relevant and may be poorly balanced (maximum of 6 for one condition). Other answers will lack the interaction of processes which produce up and down valley air movement.

Award 1 to 3 marks for answers which repeat the data in Fig 4.1 without displaying any understanding of the atmospheric processes.

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(b) With reference to examples you have studied or experienced, describe the characteristics and effects of tropical cyclones. Assess the extent to which the effects of such weather hazards can be reduced.

According to current terminology tropical cyclones can be regarded as tropical storms or hurricanes (typhoons, willy-willies). Tropical storms have winds from 63 to 120kph whilst in hurricanes speeds in excess of 120kph are recorded; hurricanes are graded on a scale from 1 to 5. Although they may be spawned by hurricanes the question is not about Tornadoes.

Small-scale weather disturbances along the inter-tropical convergence can enlarge into tropical depressions with wind rotating. These can gain energy from the warm ocean and become tropical storms. In both the Atlantic and Pacific these storms move from east to west.

Characteristic features must include:

Cyclonic structure with an extremes of low pressure,
A spiralling swirls of cloud and strong winds (200kph)
A central 'eye' which is calm.

The system moves at speeds of 5 to 15 kph.

Locations beyond 5 degrees to the north or south of the equator.

Mainly affecting the Eastern coasts of continents

To become a hurricane the following is important:

- a location over the sea where sea surface temperatures exceed 27⁰C providing the initial heat energy, the moisture that produces cloud and rain, a friction free surface allowing a rapid and continuous supply of warm moist air into the vortex
- a location 5⁰ north or south of the equator. The coriolis effect causes the air to rotate; to close to the equator the storm will weaken as there is no coriolis force.
- normally on the western side of oceans as descending tropical air is weaker in these regions.
- the presence of upper air rotation which spreads outwards thereby sucking air into the hurricane

Effects include: storm damage to buildings etc, storm surge causing flooding, intense rain, all leading to loss of life, economy, disease etc.

Minimising the impact of such storms involves: prediction of strength/speed/route, evacuation, rescue and relief. Nobody has come with a mechanism for stopping them; in fact with global warming they are getting worse.

Band 1 answers should provide a full description of the characteristic features of hurricanes. There should be reference to locations and conditions for development Answers should outline the weather conditions of a passing hurricane and the effects they have on the human and natural landscape. Answers should describe and evaluate both prediction methods and damage limitation.

Band 2 answers may well be clear about the structure of hurricanes, the weather associated with them and their effects; but lack clarity on their formation. Answers at this level may be weak on evaluation and damage limitation.

Band 4 answers will vary from those at the higher end that are relevant and brief to those that clearly have little understanding of hurricane processes.

[Total for Question 4: 40 marks]

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- 5 (a) Describe and explain two ways in which a natural process can cause environmental degradation in rural areas.

Candidates should choose two ways and confine their answer to rural areas. Natural processes can include flooding, erosion, weather hazards, and climatic change. Answers should:

Identify two ways which can affect rural areas. = 1 mark

The description must contain two clear features of the degradation = 1 mark.

The explanation should be concerned with processes and two linked points. = 1 mark

Award 8 to 10 marks for answers which fulfil the required points for two ways.

Award 4 to 7 marks for poorly balanced answers and those lacking in the above points.

Award 1 to 3 marks for answers which possibly identify a form of degradation but fail to deliver the required description and explanation.

- (b) Using named examples with which you are familiar, outline how the growth of urban areas may affect the environment of their surrounding regions. [30]

Answers dealing with MEDC's will differ to LEDC's. The question is concerned with how the growth of an urban area puts pressure upon the human and natural environment of its surrounding region.

For an MEDC urban region this could include:

Loss of agricultural land, woodland, green belt and land degradation; affecting the natural aspect of vegetation, biodiversity and land.

The relocation of industry, ring roads etc leading to an increase in traffic having similar effects plus pollution to both air and water

The human environment could relate to the rural economy, heritage and culture.

In MEDC's the rate of urban expansion has been recent and rapid with urban authorities unable to cope. Thus although the same pressures as occur in MEDC'S will occur there are the added problems of shanty towns, overcropping and grazing for food production leading to soil erosion, litter, water pollution. The loss of farmers to urban areas can also lead to a decline in the rural economy and environmental degradation.

Band 1 answers should select more than one example to illustrate the pressures urban expansion places upon rural areas. Answers should be balanced by considering both the human and natural environment.

Band 3 answers although relevant and with named examples possibly provide detail of the process of urban growth but dwell upon a limited number of effects; other answers may be poorly balanced.

At Band 4 expect answers that are brief, poorly coordinated and expressed but do contain some relevance to the question

[Total for Question 5: 40 marks]

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. marshal 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	<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:	13-18
A	<ul style="list-style-type: none"> 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	<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 some 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	When producing written communication: <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 	