

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level

MARK SCHEME for the November 2005 question paper

**ENVIRONMENTAL MANAGEMENT
(LITHOSPHERE AND ATMOSPHERE)**

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 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.

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

Section A

1 (a) Fig.1.1 is a framework used for depicting different types of mass movement on slopes.

(i) Write the labels L, M and S on Fig 1.1 to show appropriate positions for the processes mudflow, landslide and soil creep.

Mudflow (M) = middle top, Landslide (L) = bottom right, Soil creep (S) = bottom middle/left. [3]

(ii) Explain the role of water in the movement of material on slopes.

Water acts as a lubricant facilitating a sliding movement. (1)
 Particles are separated and lifted also facilitating movement. (1) [2]

(iii) Distinguish between flows and slides of material on slopes. [2]

Flows are lubricated slower at the base than top due to friction. (1)
 Slides are dry with equal velocity throughout the mass so friction is overcome. (1)

(iv) Give two reasons why landslides occur.

Accumulation of rock debris on slopes (frost action etc). (1)
 Rocks overcome friction due to the mass accumulated, steepness or set off by tectonic activity.(1) [2]

(b) The following news extract and photograph contain information on the Sarno mudslides of 1998.

(i) What is a mudslide?

A highly lubricated movement of fine grained material on moderately steep or indeed gentle slopes. [1]

(ii) Describe the sequence of events which caused the Sarno mudslides.

Clearance of vegetation by fires. (1)
 Exposure of the soil to the weather.(1)
 Torrential rain onto a steep slope. (1)
 Gravitational movement of a high lubricated mass. (1) [4]

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(iii) **Outline the management strategies that could be adopted to reduce:**

- **the likelihood of future mudslides.**
- **the damage and loss of life caused by such mudslides.**

Award a maximum of 4 marks for either bullet point.

Future landslides can be avoided by maintaining a vegetation cover with fire breaks, slope barriers, diversion channels.

Future damage can be prevented by: building away from danger areas, warnings and alarms, coordinated rescue strategies etc.

[6]

TOTAL [20]

2 (a) Fig. 2.1 shows the vertical structure of the Earth's atmosphere.

(i) Name zones A and B and boundary line C.

A = Troposphere.

B = Stratosphere.

C = Tropopause.

[3]

(ii) Why do most weather processes take place within zone A?

Contains most of the atmosphere's mass, water vapour and dust.

Due to differential heating air moves between zones of high and low pressure.

Water vapour produces precipitation. Dust and salt act as hygroscopic nuclei.

Vertical movements occur in the lower atmosphere.

[3]

(iii) Why do temperatures decrease with altitude within zone A?

The reduction in atmospheric pressure.(1)

Fewer molecules per unit volume to absorb energy (1)

or as pressure reduces, energy is used to move molecules apart.

[2]

(iv) Explain why stratospheric ozone is important.

It filters out ultra-violet radiation.(1)

Protects life on earth.(1)

Causes warming of the stratosphere thus influences troposphere temperatures.

Or the effects of its depletion.

[2]

(b) Fig. 2.2 shows the Earth's energy budget

(i) Describe the pattern inputs and outputs of energy shown in Fig 2.2.

Award marks on the basis of 2/3 or 3/2 for inputs and outputs.

Candidates should stress incoming solar energy, reflection and absorption and radiated energy, reflection by the earth, clouds oceans and snow/ice.

[5]

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- (ii) **Describe and explain how an increase in the accumulation of atmospheric carbon dioxide and methane in the troposphere may alter the energy budget shown in Fig 2.2.**

Without stating it, this question is looking at the greenhouse effect.

Recognition of the greenhouse effect and global warming. (1)

Carbon dioxide and methane are variable gasses and can increase or decrease.(1)

Trapping of long-wave radiation. (1)

Reduces the losses to space from 64%. (1)

Increases surface temperatures. (1)

[5]

TOTAL [20]

Section B (Answer one question from this section)

- 3 (a) **Describe the trends shown in the list in table 3.1 which gives the number of deaths from some natural disasters.**

Tables of Natural Disasters are often depicted in this way and for this question candidates are expected to pick out various trends or patterns in the statistics.

The main features of the table are:

- Earlier disasters have a much higher fatality rate.
- LEDC'S have more fatalities than MEDC's.
- Multiple disasters (earthquake +landslip), Volcano + tsunamis have more fatalities.
- Atmospheric/weather events often have fewer fatalities.
- Densely populated areas in LEDC's have more fatalities.

For 8 to 10 marks there should be detailed development of at least three trends.

For 4 to 7 marks, one or two patterns well developed or brief lists.

For 1 to 3 marks, some listing but although some relevant points, confused and brief.

[10]

- (b) **Describe and explain the causes, effects and human response to one major tectonic or climatic event you have studied. Evaluate the strategies which are aimed at reducing the impact of similar events in the future.**

Candidates are at liberty to develop their own examples/case studies to answer this question and section (a) should be a suitable prompt. The question requires reference to the causes at a natural process, its local and perhaps regional effect, the short term responses and the long term strategies which aim to alleviate the impacts of such events.

Tectonic events include earthquakes (which can be linked to landslips and tsunamis) and volcanic events (linked with tsunamis, atmospheric repercussions, sediment flows etc).

Atmospheric events can include major weather conditions such as Hurricanes/tropical cyclones/tropical storms (linked with storm surges, flooding). Tornadoes and Drought and more localized conditions such as smog, photochemical smog lightning etc. Due to their localized nature such answers may be self-penalizing as they require in-depth knowledge of the event.

Band 1 answers should develop the case study in depth, reveal a full understanding of the relevant physical processes, provide information on the impact of the event and be able to evaluate the effectiveness of the long and short term strategies.

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Band 3 answers will develop the case study, but the answer may lack depth and be weak on the necessary evaluation.

Band 4 answers should have some relevance but may show little or no evaluation and a poor understanding of the other elements of the question. [30]

4 (a) Describe and explain the distinct weather conditions which might occur at places A, B, and C in Fig. 4.1.

The question is concerned with relief rainfall and the three parts comprise:

- A** Warm moist air is forced to rise – cools – condensation – cloud and precipitation. (3)
- B** Air passes over the hill or mountain - wind speed increases as air is forced over - continuation of cloud and precipitation. (3)
- C** Air descends – adiabatic heating – reduces humidity – clear skies – warmer and dry.(3)

There is 1 floating mark.

For 8 to 10 marks there must be full consideration of each stage.

For 4 to 7 marks there will be limited coverage of the three stages possible missing out on explanations or a poor balance.

Band 3 answers may make brief reference to relief rainfall and the rain shadow but display very little understanding of adiabatic heating and condensation processes. [10]

(b) What methods are employed to make long-term and short-term weather forecasts? Why is weather forecasting important and not always as accurate as we would like?

The use of long-term and short-term forecasting is standard terminology. Long-term weather forecasts extend over period of weeks or months and are less accurate than short-term forecasts. Candidates will have different ideas about what is meant by long and short-term and therefore some flexibility in marking is desirable.

Methods include:

Global coverage reports: ships, land stations, aircraft, satellites, balloons, weather stations. These provide information on air masses, weather systems, cloud cover, temperatures, extreme events etc. Upper and lower atmospheric conditions can be plotted. Their value is in collecting data so that weather patterns can be determined and short-term forecasts made with some accuracy. Computers refine the data, produce models and make forecasting easier.

Meteorologists are experts trained to monitor and interpret data for general use. They will use and create computer models and can generally provide accurate 6/7 day forecasts.

Long term forecasts are less accurate simply because it is difficult to determine such events over a long period. General forecasts based on past records, weather trends or patterns and models are often made.

Weather forecasting is important for farmers, travel (aircraft, ships, motorists) tourists, the general public; having important social and economic relevance.

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They can however lack accuracy:

- weather can change over a short period (winds change direction, weather systems accelerate or decelerate, local relief).
- forecasting may be inaccurate.
- models and long term patterns may no longer apply (climatic change).
- chaos theory. Weather conditions are sensitive to small changes in initial conditions e.g. a small reduction in temperature in one place could initiate a hurricane elsewhere.

Band 1 answers should be well balanced in all parts of the question: express an understanding of how weather forecasts are made; their value; and what makes them, sometimes, inaccurate.

Band 3 answers will not contain the breadth of knowledge of forecasting techniques but will probably be quite strong on importance and inaccuracy.

Band 4 answers at the top end should have some relevance but will lack detail and make very general statements about forecasting techniques and their value. [30]

- 5 (a) **What is meant by the term *acid precipitation*? Describe and explain the distribution of acid precipitation across Europe, as shown in Fig. 5.1.**

Acid precipitation refers to rain or snow, containing unusually high percentages of sulphur dioxide and nitrous oxides. pH values as low as 1.5 and 2.0 have been recorded. Some good candidates may distinguish between local particulate deposition and more distant deposition. (up to 4 marks)

The map of Europe provides data of the effects of the spread of acid precipitation from its source areas.

Source areas lie within the industrial zone of western and central Europe.

Prevailing westerly winds carry the acid precipitation across Europe to the NE and East .

High levels of acidity are recorded over Scandinavia, and Eastern Europe.

Western fringes of Europe have low acidity readings as the air is clean.

[up to 7 marks for description and explanation (3/4 or 4/3)].

For 8 to 10 marks both parts should be answers in the detail given above.

For 4 to 7 marks expect some lack of detail of acid precipitation processes and the reasoning behind its diffusion across Europe.

For 1 to 3 marks there may be a lack of understanding about what acid precipitation actually is, and why it spreads. [10]

- (b) **Describe the effects of acid precipitation upon both urban and non-urban areas. Outline and evaluate the measures which have recently been undertaken to control pollution from acid precipitation.**

Hopefully section (a) will provide a suitable prompt for this question and candidates should be able to draw upon local experience.

The consequences of acid precipitation are to be seen in both urban and non-urban areas (rural, forested and water).

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Urban Effects:

- High levels of sulphur dioxide and nitrous oxides in industrial cities in Europe, N America, China etc.
- London smogs.
- Human health: respiratory disease, increased mortality.
- Heavy metal cations: cadmium, nickel, lead, can reach human populations.
- Accelerate corrosion of metals (iron used in construction).
- Chemical erosion of buildings, particularly limestone, marble and calcareous sandstones.
- Acidification of lakes and ponds in urban areas.

Non Urban effects:

- Effects upon vegetation/defoliation of trees/poor tree health.
- Disruption to local ecosystems.
- Increases soil acidity/leaching of soil chemicals.
- Agricultural effects: reduces crop quality and quantity, effects pastures.
- Aquatic environments. Lakes, rivers, ponds acidify with long term ecological effects.

Controls have been more effective in MEDC's than LEDC's.

- Adding lime to lakes tackles the symptoms not the cause.
- Removal of sulphur from coal prior to usage or using coal with low sulphur content.
- Cleaner alternative energy.
- International agreements and target setting.
- Although the problem is being solved in many MEDC'S it is spreading to newly industrialised countries.

Band 1 answers should address the three components of the question and express a clear understanding of the impact of acid rain upon both urban and rural areas. These answers should be evaluative of measures undertaken to control acid precipitation.

Band 3 answers may lack balance, review few problems and be weak in evaluation.

Band 4 answers at the top end will have relevance but show weaknesses in understanding and illustrative examples. There will be little or no evaluation.

[30]

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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 	