ENVIRONMENTAL MANAGEMENT

Paper 8291/01

Lithosphere and Atmosphere

General comments

This session 58 candidates from 14 Centres set the Paper 1 examination. The global spread of the entry contributed to a wide variation in question responses and choice within ***Section B*** of the paper. This first paper, examined the Lithosphere and the Atmosphere, posed more difficulties than in previous sessions and as a consequence average marks were slightly lower. There was no overall pattern to candidate performance as some performed well in ***Section A*** whilst others did well in ***Section B***.

It was pleasing that the vast majority of candidates put a lot of effort into answering the question paper. Most candidates used their time well and seemingly gave each section an equal amount of time. A small number of candidates, mainly from Centres that are new to this syllabus spent too much time on ***Section A*** and failed to write essays of sufficient substance for ***Section B***. It is important that candidate are given practice in answering full examination questions and, in particular, practice writing essays. There was one rubric error in which the candidate answered all questions in ***Section B***.

Comments on specific questions

Section A

Question 1

This question focused upon the impact of human activity upon the atmosphere by examining candidates knowledge of stratospheric ozone depletion, global warming and acid rain. As candidates have in the past confused these terms, each part of the question contained relevant data in the form of equations and diagrams. Thus, whilst it was necessary for candidates to recall information there was much to analyse in order to provide a focus. Although for a significant number of candidates this proved to be a successful strategy, many still managed to confuse the effects of ozone depletion with global warming.

(a) Those candidates who described each of the equations in part **(i)**, generally, achieved the 3 marks available. Marks were lost by either making very general statements about the splitting of O_3 or indeed elaborating upon the effects of ozone depletion rather than its causes. A significant number did not answer this question.
Descriptions of the changing form of the hole in the ozone layer over the Antarctic generally focused upon size and shape and most candidates achieved the 2 marks available.
Responses to the effects of ozone depletion on people and agriculture were mixed. Most accurately referred to people contracting cancer or cataracts but failed to mention that increases in uv radiation decreases rates of photosynthesis in plants.

(b) This section on global warming proved to be the weakest part of **Question 1**. Having identified at least one of the greenhouse gases (usually carbon dioxide) most answers went on to state that they trapped heat. Only a small number mentioned that incoming short-wave radiation passed through the atmosphere to heat the Earth's surface and that it is the outgoing long-wave radiation that is trapped.
The final part of this section targeted the idea that it is a perfectly natural occurrence for climates to have warmed and cooled in the past (recent human activity has introduced enhanced global warming). Unfortunately some candidates described current events rather than mentioning the ice age or past climatic fluctuations.

(c) This final section was concerned with acid rain. The vast majority of candidates made good use of Fig. 1.3 and mentioned smoke and dry deposition at site A and acid precipitation at site B. Most were able to describe the effect of acid rain upon buildings or lakes or woodland.

Question 2

Responses to this question on volcanicity were quite varied with marks almost covering the range. Its objectives were to examine the background to volcanic activity and provide candidates with a well-publicised case study. High marks were achieved by candidates who coupled a good understanding of tectonics with the ability to manage the data contained in Fig. 2.2.

(a) Candidates found distinguishing between magma and lava much more straightforward than the processes operating at constructive and destructive plate boundaries. Parts **(i)**, **(iii)** and **(iv)** were concerned with process and features at each of these plate boundaries.
Approximately half the entry recognised that boundary A was destructive and boundary B was constructive. Fewer were able to describe the process of subduction and melting at A and that at B, magma rose to the surface thereby adding to the Earth's crust. It should have followed that the lava produced at A were of an acidic type whilst those at B were basic lavas; reference to degrees of viscosity or chemical composition were also credited. The final part of ***Section A*** was better answered with mid-ocean ridges and faults being the more common choice.

(b) Most candidates made good use of the data on the Mount Etna 2001 eruption. Parts **(i)** and **(ii)** were better answered than **(iii)** and **(iv)**.
The data in Fig. 2.2 enabled easy identification of at least 3 of the different types of volcanic activity and there was plenty of evidence to predict the route taken by the 2001 eruption. Part **(iii)** of this section required some detailed scrutiny of Fig. 2.2 to reveal, the destruction of the cable car and parts of the road network. These two factors point to a disruption to the local economy; particularly tourism.
Part **(iv)** proved to be an effective discriminator between weak and strong candidates. Each of the three items enable a volcanic eruption to be predicted. The combination of: increased seismic activity is indicative of small earthquakes; the rhythmic pattern of seismic waves points to moving magma; rising magma can cause a volcano to bulge; and increased emissions of carbon dioxide and sulphur relate to new magma within the volcano. Only a small number of candidates referred to these points.

Section B

Unfortunately there was one candidate who did not follow the rubric in this section. **Question 3** was the least popular with **Question 5** being the most popular.

Question 3

(a) To a certain extent the data contained in Table 3.1 might have been a little daunting for some candidates. Unfortunately an environmental impact assessment needs to be in this detail as it itemises important information. As the points contained in the table quite clearly itemised and described a wide range of environmental data, candidates were able to make a fairly straightforward choice that invariably elicited good answers; the most popular selection being: atmospheric pollution, ecological damage and changes to the physical landscape.

(b) Although part **(a)** of this question was included as a prompt for part **(b)**, it was less well answered. Most candidates were able to include valid material on the environmental issues associated with mining but answers were sometimes spoilt through the absence of a stated area and an evaluation of relevant restoration strategies. Some answers were weakened by either being too brief or being very generalised.

Question 4

Although a moderately popular question the quality of answers covered the whole range from poor to excellent. Part **(b)** posed fewer difficulties than part **(a)**.

(a) As stated some candidates found describing three ways in which satellite have made a contribution to understanding weather and climate, rather difficult. The question was not concerned with different types of satellites and the images they produce. Instead, by using cloud directions, cloud type and cloud coverage, satellite images can be used to plot and predict:

- day to day weather patterns
- longer term weather forecasts

- natural hazards such as hurricanes
- broad climatic conditions.

Additionally, satellite images have provided us with data on upper atmospheric processes features such as holes in the stratospheric ozone layer.

(b) Atmospheric pollution proved to be a topic with which the candidates seemed to have some familiarity. Consequently there were some excellent accounts of the causes, types and effects of urban and industrial atmospheric pollution. These points are important to understanding the strategies that can be used to reduce such pollution. Better answers combined knowledge of the different forms of atmospheric pollution with related reduction strategies and use examples (often local) to support their analysis. Very few got onto evaluating the level of success of these methods.

Question 5

Although not the best answered this was the most popular question in ***Section B***

(a) A relationship between climate and soils was depicted in Fig. 5.1. For a north to south transect across Eastern Europe, average temperature and rainfall data was correlated with soils and associated biomes. Nearly all candidates were able to quote the data in Fig. 5.1 and therefore gain some marks. Only a small number were able to describe the inter-relationships between the three components. Each of the soil types are a product of the interaction between climate and vegetation.

(b) Unfortunately many candidates dived head-first into a description of the way in which over-farming and deforestation contribute to landscape degradation. It would have been much better to begin with a definition of the term soil erosion and how it can be initiated or enhanced by human activity. Most candidates were able to supply some strategies for reducing/preventing soil erosion and the best answers made use of local examples.

Conclusion

In general the level of attainment for this paper was quite high. For many candidates the responses to data in the form of maps, diagrams or tables were accurate and the more discursive sections involving essays, well done. There is still a need for candidates to plan their longer answers so that each component of a question is answered; most essay question fall into three or four parts. Linked with this point is the need for candidates to practice short and long answer questions well before the examination. This should become increasingly possible as Centres build up their stock of past papers.

Finally it is worth stating that a joy of this syllabus is the opportunity it gives Centres and their candidates to develop local case studies. Such exemplar is familiar to the candidates and they should be encouraged to use it within the examination.

ENVIRONMENTAL MANAGEMENT

Paper 8291/02

Biosphere and Hydrosphere

General comments

Candidates found this paper more accessible than **Paper 1** which continues the tradition of the earlier Environmental Science syllabus that questions on the Biosphere and Hydrosphere elicited more knowledgeable answers than those based on the Atmosphere and Lithosphere.

There was little difference in performance between ***Sections A*** and ***B***. The better candidates did well in all questions and weaker candidates fared less well. The majority of candidates timed their work well and noticeably many left sufficient timed to write quite lengthy ***Section B*** essays.

Comments on specific questions

Section A

Question 1

This question examined various aspects of the Hydrosphere part **(a)** was concerned with interactions within the global hydrological cycle and part **(b)** with factors relating to water in its solid state. Inevitably part **(b)** contained some linkages with the atmospheric processes associated with climatic change.

(a) Candidates experienced few difficulties in understanding the operation of the global hydrological cycle and using its terminology. Overall parts **(i)**, **(iii)** and **(iv)** were better answered than **(ii)** and **(v)**.

Whilst most candidates fully understand that evaporation involves the conversion of liquid water into a gas, they were less certain about transpiration. For the latter many candidates simply mentioned the loss of water from plants rather, the loss of moisture through pores or stomata on leaves. Fig. 1.1 proved to be a useful stimulus and few candidates achieved less than full marks for parts **(iii)** and **(iv)**.

In contrast many candidates did not provide the correct answers to the calculations in part **(ii)**. Although both calculations total 496, this needed to be expressed as 496 × 1000 km^3. In part **(v)** very few candidates recognised that the flow of 40,000 km^3 from land to sea maintained the balance in the global cycle by equalising precipitation and evaporation form oceans and land.

(b) For the most part candidates managed some complex data quite well. There were good descriptions of a fluctuating pattern with the difference between the troughs and the peaks increasing towards the present day. This was then backed up with accurate references to warm and cold periods and most indicating that the next major climatic event should be a cold period or ice age. Most weaker candidates achieved some marks in these parts.

(c) This proved to be an effective discriminator between the weak and strong candidates. Whilst nearly all candidates recognised the strong positive correlation between the troughs and peaks for carbon dioxide and temperatures very few were able to provide explanations. All this required was reference to warm periods tied to increases in the greenhouse gas, carbon dioxide. This has the effect of trapping radiated long wave radiation thereby causing a rise in temperature. The opposite applies to a reduction in carbon dioxide. A significant number of candidates still confuse global warming with ozone depletion.

Question 2

This topic usually forms the most popular topic and best answered question across both written pap 2006 proved to be no different with marks ranging from 10 to 20.

(a) Although there were a small number of very weak definitions of a biome and correct links drawn between climate and biome, most responses to both parts were of a high standard.

(b) Whilst for nearly all candidates parts **(i)**, **(ii)** and **(iii)** were well answered, only two candidates achieved the 3 marks available in **(iv)**. As in previous sessions this year's candidates were well versed in net primary productivity, photosynthesis and ecosystems. However in the final part **(iv)** most missed the point about climatic change.

(c) Again, this was well answered. Candidates were able to use their knowledge of photosynthesis to accurately interpret Fig. 2.2. The only feature of the graph that some candidate omitted was both extensions of the line levelled off after the initial ascent.

Section B

Question 3 on water resources proved to be the most popular and successful choice. Questions 4 and 5 were less popular and attracted about the same number of candidates. Although a significant number of candidates allowed about 45 minutes for this section a minority did spend too long on ***Section A*** and wrote very short answers for ***Section B***.

Question 3

This proved to be a straightforward question that tested some currently important issues. Answers were generally well organised with answers that firstly described three of the causes of the current water shortages followed by an assessment of water supply projects. A popular question that elicited a wide range of marks.

(a) Most candidates attempted three distinct descriptions of existing water resources, population growth and changing weather patterns. The question did require reference to the mismanagement of water resources due to each of these factors. The majority coped well with the first two factors and less well with changing weather patterns where reference to how mankind has adapted to recent change was needed.

(b) This topic appealed to those candidates who had revised their case studies and paid attention to the question requirements. High quality answers were generally well balance and made effective use of exemplars such as The Three Gorges, Aral Sea, Aswan and local desalinisation projects were developed. Weaker answers were generalised, too short and made no reference to actual water supply schemes. A significant weakness in some essays was to describe either the advantages or the damaging effects of water supply projects; thereby losing the required balance needed in this question.

Question 4

This question was moderately well answered by a small number of candidates. Apart from a small number of extremely good answers, most responses to Question 4 comprised a general outline in ***Section A*** with ***Section B*** essays either too short or containing major omissions.

(a) There were a couple of excellent interpretations of the food web contained in Fig. 4.1. These answers reviewed the interactions in the food web and accurately described the transfer of energy between trophic levels. Other answers were a little disappointing. There was a tendency for some candidates to describe a simple food chain; seemingly oblivious to the interactions contained in a web. Some other answers describe a generic food web or chain without any reference to Fig. 4.1.

(b) Again answers to this part proved to be a little disappointing. To varying degrees of quality most essays quite capably describe a chosen ecosystem with some analysis of the negative effects of human activity. Here deforestation, over-farming and urban development were the more popular choices. Unfortunately human activity can also be positive and these effects were invariably ignored.

Question 5

Contrary to fears that the complexity of the data in Fig. 5.1 might put candidates off, this ques… generally well answered. The data contained in Fig. 5.1 provided a useful prompt for the ***Section B*** es…

(a) Nearly all candidates who attempted this question made a worthwhile attempt. Stronger answers elaborated upon the degrees of change between each region with clear reference to the extent of pollution reduction for each zone between 1975 and 1995. These answers mentioned general trends as well as specific details in the reductions in chemical pollution. Weaker answers tended to concentrate upon general trends.

(b) Where sufficient time had been allocated to this final part of the examination most candidates did reasonably well. There were some excellent descriptions of the causes and effects of uncontrolled and untreated sewage disposal into rivers and industrial spillages. The major weakness in nearly all answers was the failure of candidates to describe the difficulties that are frequently encountered in managing river pollution.

Conclusion

It is only really necessary to reiterate points made within the report for Paper 1. It is quite impressive that candidates from such a diverse range of countries are coping so well with the new examination structure. All earlier fears that to impose an essay would be unfair have been unfounded. Candidates do seem to welcome the opportunity to develop their own ideas and make use of case studies with which they have some familiarity.

There is still some need for all centres to give their candidates practice in answering full examination papers. This should become easier as centres build up their stock of past papers.

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Paper 8291/03
Individual Research Report

General comments

The Environmental Management syllabus is now into its second year with many Centres now making adjustments to meet the requirements of the syllabus. This session has seen a marked increase in both the number of candidates and Centres. A possible consequence of this increase in popularity has been a greater variance in both the quality of the projects and their assessment

The general standard of the research reports was quite high with the majority of Centres following the assessment criteria. As with the previous examinations there were a wide variety of topics. These ranged from localised studies of water pollution, industrial pollution urban environments, and slope instability through to ecological studies. Once again where a local topic was taken up the report proved to be more succinct, used primary data and often achieved high marks. Unlike previous sessions a small number of Centres submitted project reports that had either not received CIE approval or that the Examiner's comments on the proposal form had been ignored. Projects from these Centres tended to be extremely general and candidates did not research topics that would yield the data needed in skill areas C1 and C2.

Internal assessment between centres showed some variation. Centres are reminded that the assessment criteria descriptors in the syllabus should be used in the Centre based assessment and recording of marks. Although the majority of Centres were accurate in their assessment, some gave credit where none was due; notable instances being:

- hypotheses or questions although absent were credited;
- an expression of knowledge underpinning the hypothesis or question becomes difficult if either or both are not clearly stated at the start;
- in which case marks were sometimes given to data not present in the project;
- if the project does not contain data (or results) then the conclusion has nothing to refer to.

As indicated the majority of Centres are to be congratulated on their internal assessment of reports. Careful use was made of the assessment criteria and any adjustments made as a result of external moderation were to produce a commonality of standards. This is easily achieved when Centres assess their candidates' work accurately and consistently.

Comments on specific assessment criteria

Skill C1: Research and Planning

This skill area showed some variation in quality. Most candidates satisfied sections *a* and *b* by providing a central question or hypothesis supported by a high quality explanation. Approximately half the entry included a detailed plan that outlined research procedures and equipment. Unfortunately many candidates did not include a description and justification of the methods to be used and consequently found achieving marks in section *d* difficult to achieve.

Once the question or hypothesis is established the remainder of C1 should follow on. It is important that candidates present a clear methodology that is not over complicated and provide information on relevant field and/or laboratory techniques, the data will be collected and how it will be presented and analysed. Topics involving field study should use appropriate equipment and not ignore the need for accurate recording and the allocation of time to obtain results and complete the work. I wonder how many candidates give their research methods a trial run prior to beginning the detailed work. The explanation and justification of the methods need not be lengthy and should provide the basis for the collection and presentation of data; sometimes it is worthwhile writing a draft of this section prior to starting the research; it can always be modified at a later date.

Skill C2: Data collection and presentation

This skill area contained a wide variety of marks. Higher marks were obtained by candidates who d... the ability to collect, record and clearly present their data. This was best achieved by combining a var... techniques including: graphs, tables, field sketches and photographs. By the careful selection of a realis... preferably local scale topic, candidates can be encouraged to collect relevant data and taught to present it in a variety of ways. Whilst statistics can be obtained from secondary resources, field techniques such as questionnaires, transects, pollution counts, environmental impact assessments etc. all yield quantitative data that can be collated and presented in order to test hypotheses or answer questions.

The vast majority of project reports were well organised, relevant and a pleasure to read. It is skill sections *c* and *d* that came to the rescue of the small number of candidates who focused on very general topics and ignored the need for manageable data.

There is a case for candidates to avoid using their conclusions (skill C3) for the descriptions and explanation of their data. If careful use is made of figure references, the analysis of the data can be incorporated into a section or chapter titled 'Results and Analysis'. The use of statements such as ' reference to Fig. 1 show that...' or 'the data in Fig. 1 can be explained by...' , often results in a succinct written report that is economical in its use of words. This can also have the effect of making the conclusion more of a summing up in which verification or otherwise of the initial hypothesis is stated.

Skill C3: Conclusions and evaluation.

This section proved to be the weakest part of some reports. The paucity of research data in many reports meant that conclusions could not be adequately supported and there were insufficient results to describe and explain environmental trends and patterns (Skill C2 c and d). Unlike previous sessions very few reports contained evaluative assessments of the projects limitations and levels of success. There were some excellent research reports in which all criteria in Skill 3 were completely satisfied. The concluding sections to these report clearly demonstrated the candidates' ability to objectively review their results, draw together concluding statements and critically assess their research: all integral to good scientific method.

Concluding remarks.

For most Centres it is a matter of developing and expanding the range of research topics available to their candidates. Where, as in this session, topics of a very general nature were studied it is important to advise candidates of the need to look at areas of research of a more localised nature. Indeed at a very early stage make an assessment of whether or not the topic will yield sufficient results to satisfy the assessment criteria in the syllabus. It is important that candidates are fully aware of how their work will be assessed. As this syllabus does permit teachers to give guidance to their candidates on the project without of course, doing it for them. I believe that an important feature of this Environmental Management syllabus is the encouragement it gives to review local issues and the opportunity to undertake some local field-work.

It is relevant to repeat some of the concluding comments from the November 2005 report. A positive feature of past research reports has been the use that candidate's make of a local project with which the School or college has close contact. An environmental monitoring project on the River Plate in Argentina and a college managed conservation area in Zimbabwe are good examples of where candidates have successfully developed their work.

As we move away from the Environmental Science mindset it is to be hoped that issues that have an environmental management emphasis will come to the fore with topics chosen from each of the syllabus modules. Whilst topics selected from the biosphere and hydrosphere feature are the more popular choice it would be pleasant to see the atmosphere and lithosphere featuring more strongly.

Finally it is worthwhile reminding Centres that a simple structure for these written projects is su... standard model for scientific research.