

ENVIRONMENTAL MANAGEMENT

Paper 8291/01

Paper 1

General comments

June 2009 has seen a 50% rise in the entry for the Environmental Management examination. Traditionally candidates have always found questions on the Lithosphere and Atmosphere more difficult than the Biosphere and Hydrosphere; this year was no exception. Although there were a significant number of excellent scripts a number of issues became very apparent in this session.

- Weaker candidates had little understanding of much of the basic vocabulary of environmental science and management. Terms such as: tectonic plate, seismic wave, troposphere, convection were not understood.
- Many candidates need to practice essay planning and writing; many essays were woefully short.
- Greater care needs to be given to the wording of questions. It is worthwhile for candidates to underline key elements of questions.
- It is vital that questions from past papers are used within the teaching programme and as part of a revision programme.

Section A

Question 1

Although this question was the better of the two questions in **Section A**, there is still some way to go before candidates reach the standards achieved in **Paper 2**. The topic of plate tectonics is not one that candidates find easy. Along with some excellent responses, a significant number of candidates showed a misunderstanding of some of the basic terminology and processes integral to the topic. Consequently **part (b)** was better answered than **part (a)**.

- (a) These questions sought to test candidates' understanding of some basic processes that underpin plate tectonics. Very few understood that the Earth's plates are in fact sections of the Earth's crust, or lithosphere, set in motion by convection currents. Many candidates did not seem to realise that tectonic plates can contain both ocean and continent and many confused these structures with plate boundaries. It follows that despite the arrows on Fig. 1.1 a significant number of candidates failed to identify the three types of plate boundary. Perhaps it is a matter of vocabulary but convergence and divergence were frequently confused and most candidates labelled the San Andreas Fault as a convergent boundary rather than transform or conservative; even sliding would have sufficed.

Explanations of volcanicity at boundary A were much better. Most candidates achieved two marks by mentioning plates moving apart and magma rising through the gap or fault. Not all achieved the third mark by outlining the building up of the volcanic mound.

- (b) Although much better answered, the first question on the tectonic process that triggered the Pakistan earthquake was less well answered than the remaining questions. Like **part (a)**, this indicated a lack of understanding of tectonic processes; this time convergence or subduction.

The remainder of this question was well answered. Most described the radiation pattern of seismic waves and provided some accurate interpretations of the photograph in Fig. 1.3. In fact some candidates wrote at great length about the difficulties facing relief organisations, sometimes beyond the information provided in the photograph. Weaker answers simply repeated the information contain in the question.

Question 2

For the majority of candidates this question formed their weakest answer. The atmosphere is a vital element of the Earth's environment. Not only are there concerns about global warming and ozone depletion but people are affected by day to day changes to the weather. Wind and rain are a product of physical interactions in the atmosphere and much time and money is spent in providing accurate weather forecasts. Furthermore the interactions of temperature and rainfall contribute to our ecosystems and biomes. Thus the atmosphere forms an important quarter of the syllabus. It needs to be carefully taught and candidates given practice in answering examination questions.

- (a) Like in **Question 1, part (a)** was concerned with the understanding of a relevant vocabulary. Approximately 30% of the candidates correctly identified two or three of the layers of the atmosphere. These were the stratosphere and mesosphere rather than the troposphere. Many candidates had clearly not studied nor remembered these names.

Describing the characteristics of layers Y and Z proved to be equally difficult. Whilst some did refer to ozone and temperature increase in the stratosphere with the exchange of ions and burning up of meteors in the mesosphere, many gave a simplistic description of pressure and altitude derived from Fig. 2.1.

For **part (iii)** very few candidates expressed an understanding of why, in the troposphere, temperatures decrease with altitude. Integral to this understanding is the storage and radiation of energy from the Earth's surface. Thus distance from the Earth's surface, the heat source and inability of thinner air to absorb energy are simple reasons; no candidate referred to air cooling as it expands.

- (b) This part was answered much better. Although very few correctly identified convectional rain, there were some accurate interpretations of Fig. 2.2. The evaporation and condensation processes illustrated in Fig. 2.2 had varied coverage and most candidates included heating – evaporation – air rising; only a minority continued to include the condensation/precipitation process.

The final part on the effects of the removal of vegetation is essentially about desertification. There were some good answers that related the removal of vegetation to lower evapo-transpiration rates resulting in less rainfall and aridity. Weaker answers simply stated there would be less rainfall but did not state why.

Section B

Candidates performed slightly better in **Section B** than **Section A**. Responses to **parts (a)** and **(b)** were varied and in most instances reflected the ability and motivation of the candidate. These questions are structured to have a 10-mark data response question as a lead in to a 30-mark discursive essay that should utilise a candidate's local knowledge or studied example. These questions therefore address the global spread of the candidate entry.

Question 3

- (a) Fig. 3.1 is just one method of classifying resources. Most answers related information and examples contained in the illustration. The best quality answers achieving 7 to 10 marks provide accurate amplifications of the diagram e.g. perpetual resources were described as constant and vital; renewable resources as a flow in nature and non-renewable resources as finite. These answers used the concept of time to explain the replacement period. Weaker answers did little more than repeat the content of Fig. 3.1.

- (b) In past examinations, questions on this topic have been concerned with the need to reduce our consumption of fossil fuels and take up alternative energy. However many nations see their short term and sometimes long term future as being dependent on the continued use of fossil fuels. Some years ago an Indian broadcaster criticised MEDCs by saying 'why should we discontinue the use of our vast reserves of coal...you've had your industrial revolution and now it is our turn'. This question invites candidates to assess whether or not nations should either maintain or increase their consumption of coal.

To varying degrees most answers took up the emphasis in the question. The best answers followed the question instructions and chose either MEDCs or LEDCs and followed a review of the

demand for and supply of fossil fuel with an assessment of whether or not it is viable to develop alternative energy. Less strong but relevant answers limited their references to coal and ignored oil and gas; some in this category attempted a comparison of each group of nations.

The weakest answers were either far too brief or went off the topic and dwelt on themes such as alternative energy with no assessment of fossil fuels.

Question 4

Surprisingly, this proved to be the slightly less popular **Section B** question. Atmospheric pollution has been a frequent question theme and one in which candidates have achieved high marks. Like **Question 3**, a 10 mark process based data response question was followed by a discursive 30 mark question. Rather than setting an orthodox essay, it was felt that candidates would engage better with a question that placed them in the role of an environmental official writing a structured report. Whilst answers to **part (a)** ranged from adequate to weak, the report in **part (b)** was generally of a high standard and occasionally very imaginative.

- (a) It was intended that answers would begin with a description of the acid deposition issue then move onto how and why controlling emission at the combustion stage is far more effective. Many quite successfully attempted this approach and although the three stages of combustion had varied consideration these candidates achieved between 7 and 10 marks. Weaker answers either concentrated on acid rain or drifted off into a description of how acid gases were emitted.
- (b) As stated this proved to be quite a successful question with candidates empathising with an issue of local concern. Exemplar material that ranged from agricultural waste in Florida to traffic in Kathmandu made for some interesting reading. The better answers were written in the context of a report and adopted the three part structure in the question; some candidates even gave themselves a fictional (I think) name. Other answers, frequently achieving lower marks, were more like traditional essays and only dealt with one or two instructions; invariably the causes of the atmospheric pollution.

Question 5

This question showed quite a wide variation in standards. Although the total marks were at times good, candidates did far better in **part (b)** than **part (a)**.

- (a) Interpretations of the photograph were not very good. Many candidates failed to relate the landslips or debris slopes to the cliff that is immediately above. Consequently most failed to mention the weathering and erosional factors that would have contributed to the landslips. Relating these two slope elements should have directed candidates to descriptions of frost action, loosely consolidated rocks and the gravitational movement of debris. These processes are encouraged by factors such as quarrying or possibly tectonic activity.

Although mining/quarrying was frequently mentioned, many candidates attempted to explain the landslide through such things as deforestation and agriculture. In many cases candidates seemed to ignore the photograph and wrote about the factors that generally contribute to slope failure. Although these answers received some credit they were self penalising due the absence of Fig. 5.1 references.

- (b) This part question was much better answered. The majority of candidates were able to select examples where human activity has contributed to slope instability and structured their answers according to the question. Exemplar material covered both agricultural and urban regions and for the most part remedial measures were appropriate to the examples chosen.

Many weaker answers either continued with or repeated the content of **part (a)**, thereby failing to give a specific example. Other weaker answers were often very general surveys of slope instability without reference to any examples.

Conclusion

Overall this paper proved to be an effective test of candidates' understanding of the Lithosphere and Atmosphere. There was a wide spread of marks that point to a clear differentiation according to ability and understanding of the subject. Most candidates used their time well by apportioning an equal input into each section of the paper and there were only a very small number of rubric errors.

Although the quality of written English was generally quite high there is a need for candidates to plan their answer before beginning the essay. Some essays were disjointed and some weaker candidates tended to wander off the subject of the essay. Unfortunately a significant number of essays were woefully short. It is important to remember that approximately 35 minutes should be allocated to the **Section B** essays. As a rough guide, in 35 minutes it should be possible to write at least 1.5 pages of A4 (dependent of course on the size of handwriting).

The requirement, particularly in essays, to utilise examples with which candidates are familiar continues to be a success. For those Centres who are new to this specification it is worth noting that questions will be set that enable candidates to use local knowledge and experience. Such knowledge can be gained from classroom teaching or indeed field work. It is quite apparent that many candidates make use of the research project in answering these essay questions; this is perfectly acceptable and makes for interesting reading.

ENVIRONMENTAL MANAGEMENT

Paper 8291/02

Paper 2

General comments

As in previous years, candidates find questions on the hydrosphere and biosphere more to their liking and the majority of research projects derive from this section of the specification. Although the majority of candidates performed better in this paper, some of the difficulties that arose in paper 1 also occurred in this paper.

- Many candidates were seemingly unable to define basic terms.
- Essays were occasionally unplanned and unstructured.
- Insufficient attention is often given to the wording of questions.
- Greater care is needed in referencing information from tables and illustrations.
- A minority of candidates wrote essays that were far too short to adequately answer the question.

These weaknesses frequently provided the discrimination between strong and weak candidates. There were however many positives. Where requested, excellent use was made of exemplar material with which the candidate had some personal knowledge; often from his/her local area. Many essays were well written, relevant to the question and interesting.

Section A

Question 1

This hydrosphere question was slightly less well answered than **Question 2**. Candidates found the first part of this question more difficult than the second part.

- (a) Most candidates had difficulties with this section. Few defined the water table as an upper level of saturation and an aquifer as a zone of porous rock that acted as a store of water. Explanations of porosity and impermeability frequently lacked reference to grain size, pore size and compaction. It follows that only a minority understood that the water table is variable; that it will be recharged from rainfall and infiltration.
- (b) This part was much better answered, with most candidates achieving at least 4 marks of the 8 available. Although only a small number recognised the geological controls on the artesian basin, Fig. 1.2 provided sufficient information, so parts (ii) and (iii) were generally reasonably well answered. Seepage and water pressure were frequently given as reasons for the springs and distance/time and various forms of water loss for why rainfall may not increase the pressure of water. In contrast part (iv) was poorly answered; few mentioned that the boreholes were there to extract water for human consumption.
- (c) Most candidates provided excellent responses to **part (c)**. Identifying one groundwater pollutant from industry and one from agriculture was fairly straightforward. There were some very thorough descriptions of eutrophication with most outlining the sequence: fertilisers – infiltration – nutrient rich water – algal blooms – loss of oxygen. Many candidates achieved the full 5 marks available and very few earned less than 3 marks.

Question 2

The vast majority of candidates seemed well versed on the topic of ecosystems via the content of science courses and the personal field and laboratory research projects. The majority of answers ranged from good to excellent. It was pleasing that there were few errors in defining terms and describing processes.

- (a) Nearly all candidates achieved at least one mark by referring either to an area of plants and animals or the content of an energy pyramid. For the additional mark it is necessary to mention the interaction or working together of biotic and abiotic factors or equivalent.
- (b) Few difficulties were encountered. Although nearly all stated the sun as the primary source of energy, some did select the producer stage. Although the majority achieved full marks for **part (b)**, many did overcomplicate their answer by wandering into the next part of the question. It was only necessary to outline the cycling of nutrients comprising:
producer - consumer – decomposer – nutrient pool –producer.
- (c) There were some excellent answers to this question containing very clear descriptions of the process of photosynthesis. The small number of weaker answers were from candidates who translated the equation without any explanation.
- (d) The four parts of this section involving the energy pyramid for a North American deciduous woodland were slightly less well answered. Although most were able to refer to either an energy level or a feeding level, very few candidates described both facets. Following from this, very few interpreted the question correctly and stated that there is a 90% decrease in stored energy as you move through each stage in the pyramid. It follows that, as less and less energy is transferred up the pyramid, fewer species can be supported.

The effects of the warming and drying of the climate points to the possible effects of global warming. Most candidates referred to the knock-on effects of the removal of the producer level but few mentioned different species contained in Fig. 2.2, and even fewer outlined other impacts such as competition between species and migration.

Section B

It was pleasing that the vast majority of candidates apportioned approximately half of their time to this section. These questions attracted almost equal numbers with little difference in quality of answers.

Question 3

The theme of this question was water pollution. The 10-mark lead-in to the essay required candidates to review some of the issues associated with identifying actual sources of pollution; always a problem. The 30-mark essay required candidates to assess the measure that can be used to reduce river pollution, with the hope that candidates would select examples with which they had some familiarity.

- (a) Although point and non-point sources are now accepted vernacular for describing sources of pollution it was felt necessary to provide the guidelines in Fig. 3.1. The importance being that much of the pollution afflicting the world is not only transferred but can be altered en-route.

There were some full and high quality answers that separated agricultural and urban pollution and with some degree of clarity described both sources. These answers moved beyond the content of Fig. 3.1 and with reference to the composition of pollutants, described in detail how they pollute the area close to the source and could be transferred. Weaker answers did little more than repeat the content of Fig. 3.1.

- (b) Good quality answers occurred where candidates selected a small number of examples from their local region and through these adhered to the two elements of the question i.e. description and assessment. With an entry ranging from Nepal to the USA, examples were varied in terms of causes, types, measures and levels of success. Most of the good quality answers achieving marks of 20 or more were well structured and relevant. Weaker answers were mostly poorly balanced and brief. They tended to dwell on the causes of pollution and leave the remedial measure to a short final paragraph.

Question 4

For many candidates **Question 4** was familiar territory. Although **part (a)** was concerned with the flow of nutrients in a tropical rain forest, the 30-mark essay enabled candidates to select any ecosystem they had studied in greater depth.

- (a) Nutrient flow diagrams such as Fig. 4.1 are an accepted method of illustrating the various flows and stores of nutrients in any ecosystem. They are also useful for comparing different ecosystems.

Whilst most candidates made a valiant attempt at the part question many came unstuck by only referring to aspects of disruption to the environment e.g. soil erosion, increased run-off etc., rather than changes to the flows and stores illustrated in Fig. 4.1. Very few outlined actual changes such as 'the biomass nutrient store would reduce, thereby making the flow of nutrient to the litter store less than before'.

- (b) As with **Question 3b**, the quality of answers varied according to the degree to which candidates referred to the requirements of the question i.e. the selection of an ecosystem or biome; the effects of human activity and the measures that have been, or might be, adopted to limit these effects. The selections ranging from the Tundra through to Tropical Rain Forest did not have any effect on the amount of material that could be used to satisfy the content of the question.

Marginally the best answers were from candidates who selected a relatively small region, e.g. a National Park or local forest, rather than regions as large as Amazonia or the Siberian Taiga. These better answers were specific about the nature of human impact, its effects on relevant biotic and abiotic interactions and the assessment of measures. Less secure answers were mostly poorly balanced and too brief with exploitation featuring more strongly than effects and remedial measures.

Some candidates made effective use of marine ecosystems. As before, the quality of these answers related to the scale of the example chosen, e.g. analyses of coral reefs were much better than whole oceans.

Question 5

This question of population pressures was quite popular and elicited almost the full range of marks.

The first section took up the optimistic scenario of population growth initially proposed by Esther Boserup. The second part had a different emphasis to past questions on population pressure in that its concerns were with either water or biological resources.

- (a) The quality of responses to the Boserup model depended upon whether or not the candidates elaborated upon the model. The optimism inherent in the model relies upon investment and improved agricultural technology. Some candidates did review developments in biotechnology like 'miracle rice' or the use of fertilisers and pesticides to improve food production.

Weaker answers either did little more than repeat the content of the model or deviated from the question by questioning the efficacy of the model.

- (b) This question focused upon the resolution of issues associated with population pressure (growth) on either water **or** biological resources; not both. Needless to say some answers were self-penalising as frequently both were described and assessed and some ignored the requirement to select either an LEDC or a MEDC.

To varying degrees most answers saw population as exerting pressures on food supply, increased pollution and frequently lost sight of water and biological resources. Where the correct focus was retained, candidates refereed to water supply and quality and the invasion, through economic development, of biological resources, such as woodland and marine ecosystems. High quality answers followed these points with an assessment of how the pressures might be reduced.

As before, the weakest answers were either too short or poorly balanced.

Conclusion

This examination fulfilled its requirement to test effectively both knowledge and understanding of the hydrosphere and biosphere. It was pleasing that the majority of candidates engaged well with the paper. Like other elements of this syllabus the quality of written English was of a high standard and the majority of essays were relevant and well structured. Although candidates performed better in **Paper 2**, the issues that arose are similar to **Paper 1**; the following bullet points are copied from the report on **Paper 1**.

- Weaker candidates had little understanding of much of the basic vocabulary of environmental science and management. Terms such as: tectonic plate, seismic wave, troposphere, convection were not understood.
- Many candidates need to practice essay planning and writing; many essays were woefully short.
- Greater care needs to be given to the wording of questions. It is worthwhile for candidates to underline key elements of questions.
- It is vital that questions from past papers are used within the teaching programme and as part of a revision programme.

ENVIRONMENTAL MANAGEMENT

Paper 8291/03
School Based Assessment

General comments

May 2009 has seen an entry from over 30 Centres from a wide geographical area. Although many Centres continue to enter small numbers of candidates the trend towards larger entries from individual Centres, sometimes in excess of 50 candidates, has continued. This has a number of effects:

- where the Centre entry is small, candidates find little difficulty in finding original topics
- however with a larger entry there are often several candidates with the same project topic and title; whilst this can lead to copying it also enables candidates to undertake group field work
- large entries also raises internal assessment issues such as: an increased burden of monitoring candidates' work, meeting deadlines and achieving an accurate rank order of candidates' work.

The quality of this year's reports was of a high standard with very few achieving less than 16 marks out of 40 and more than usual achieving 30 to 34 marks out of 40. Noticeably, as the majority of reports did not contain a clear evaluation or an input of statistical methods, very few candidates achieved marks in the range 36 to 40.

It is still the case that the best reports derive from the collection and collation of primary data obtained from either field investigations or laboratory work. Increasingly so, a significant number of candidates rely on secondary data, invariably obtained from the Internet. Care should be taken to avoid plagiarism as well as blatant copying and pasting; fortunately the latter only applies to a small number of candidates.

It is important that candidates are made fully aware of the requirements of this School based assessment. Written reports should be between 1500 and 2000 words in length, ideally structured into the four stages of scientific method i.e. introduction, methods (justified), results and analysis, conclusion and evaluation. The better reports derive their balanced structure by using these stages as section or chapter headings. This model of scientific method can be used to provide a check on how well the project is progressing and candidates should be asking of themselves:

- will my hypothesis or question actually yield viable results
- are my methods realistic, practical and relevant; do they include data recording, collation and presentational techniques
- are the results and analyses fully representative of the methods referred to in the previous section
- does my conclusion, sum up and relate my results to the original hypothesis or question
- have I evaluated my work in terms of both its successful features and its limitations; what can be done to improve my work?

Comments on assessment criteria

Skill C1

The majority of candidates performed well in this skill area.

The introductory section should accommodate skills C1a and C1b. Whatever the order, the question/hypothesis should be accompanied by a clear explanation of its underpinning principles. Although this should only accommodate about 250/300 words, some candidates spent too much time on this part, to the extent that it dominated their report.

This introduction leads into the methods section of the report. Most good quality research requires the formulation of a plan detailing research sites, equipment, expected data and how it will be collated and presented. Not all candidates question whether or not their developed plan will actually be effective in

testing their hypothesis or answering their question. Like the introduction, this section needs to consist of no more than 250/300 words.

The better projects achieved these goals, whilst weaker reports did not specify the details of their topic and were unclear about how it should be investigated.

Skill C2

Based on the sample I received, I found this skill area somewhat disappointing and for many candidates below the standard of previous years. Whilst a small number justifiably achieved high marks in criteria *a to d*, a significant number lost marks on data presentation and accuracy and very few utilised statistical tools to analyse their data. The majority of candidates achieved credit for the general organisation of their work and the quality of written communication.

A disappointing feature of some reports was the mismatch between the specified methods and the presentation of related results. For many, greater clarity could have been obtained through a number of graphs, tables and photographs. Frequently, presented data was either absent or submerged within a mass of descriptive text. In some other instances, although a graph or photograph was present, it did not receive any description nor analysis, i.e. it was decorative rather than integral to the analysis. High quality reports made use of figure references, thus diagrammatic material was integrated with written analysis.

Skill C3

This final skill area forms an important feature of almost any scientific investigation. For the Environmental Management syllabus it comprises three sections. In this session candidates coped reasonably well with C3a and *b* but frequently ignored *c*.

The better reports contained a detailed summative conclusion that utilised results to assess the original hypothesis; these correctly received 2 marks. However a significant number of candidates failed to refer to their data and therefore only scored 1 mark. As skill area *b* also crops up in the analysis of results, as long as there was reference to environmental and management principles, many candidates were able to achieve 2 marks for this criterion.

Very few candidates attempted an evaluative assessment of their work. This needs to include a brief survey of those things that went well and not so well i.e. success and limitations.

Conclusion

It is pleasing that Centres and their candidates are engaging so enthusiastically with this element of the Environmental Management examination. The rationale behind its inclusion in the syllabus is to give candidates the opportunity to research a topic of their own choice that falls within the broad content area of the syllabus. The wide global dispersal of Centres almost dictates the wide selection of topics. As in previous sessions the better topics and final reports are derived from locally based research; ideally these should utilise primary data.

Those candidates who rely on secondary data, particularly the Internet, do need to take care. Reports based on such derived data can be rambling and without structure. Prior to using the web or texts, candidates should carefully research the background to their topic; decide upon a central theme and the nature of the data they will require. It seems that many simply surf the World Wide Web, then copy and paste as much information they can obtain; the resultant report can become a disjointed pruning of this information. Ideally secondary information should lend support to field or laboratory research.

For the first time, this session was marred by some administrative issues and all Centres should make themselves fully aware of the assessment and recording procedures. Although most errors can be rectified, this can be time consuming and in a worst case scenario contribute to an inaccurate moderation of a research report. The main issues that arose this year were:

- more than one Centre failed to return the MS1 form
- half and even quarter marks were recorded on the candidate record card and transferred to the summary mark sheet and MS1
- credit was sometimes given for elements not present in the research report, particularly for criteria C2e and C3c

- based on their total entry, some Centres sent insufficient projects for moderation (**all** reports for an entry of less than 10, a sample of **10** for an entry of between 10 and 49, **15** for an entry in excess of 50 etc.)
- the best and/or worst reports were not always included in the sample
- some Centres submit their moderation sample very late; these do need to be posted by the end of April in order to arrive at CIE's offices by the 1st May
- some projects did not receive CIE approval.

Although these comments refer to a small number of Centres it is important that CIE moderation procedures are efficiently undertaken for the benefit of Centres and their candidates. Many thanks to all teachers and assessors concerned with this examination for the hard work that so obviously takes place in order to satisfy the needs of this section of the Environmental Management examination.