

ENVIRONMENTAL MANAGEMENT

Paper 8291/01

Lithosphere and Atmosphere

General comments

This session's increase in numbers was accompanied by an expansion of the range of marks out of 80 from 3 to 72, the majority of candidates achieving marks in the range 31 to 45. Although performances were quite varied they did tend to polarise according to the Centre. It was quite apparent that for some Centres marks were uniformly higher than they were for other Centres. Whilst many Centres are well acquainted with both the syllabus and the content and structure of the examination, there are a small number of Centres for whom it is new. It is vital that all participating Centres make themselves fully aware of the syllabus content and the examination.

Comments on specific questions

Section A

Question 1

This question focused upon slope processes and slope instability. Its early parts were mainly concerned with processes whilst the final section developed some case study material from the Himalayan foothills. Responses to this question were, in the main, of a good standard with marks ranging from 5 to 20.

- (a) This part was primarily concerned with an understanding of terms. Physical processes (mainly frost and exfoliation) and chemical processes (solution, hydration, hydrolysis, carbonation, etc) contribute to the weathered regolith that rests on slopes. Water and temperature are central to both sets of processes.
- (b) Part (b) focused upon a model of a slope comprising a cliff with weathered debris organised into fine and large sediments on a concave slope. The two related questions reviewed this distribution and the situations that would lead to slope instability.
 - (i) This was quite well answered by most candidates. Nearly all answers accurately located the fine sediment on the upper part of the slope with the large angular material at the bottom. Explaining this distribution proved to be more difficult. Only a small number referred to the interaction of mass, momentum and gravity as the reason for this distribution.
 - (ii) Answers to this part were quite disappointing. Most candidates provided a trigger mechanism for initiating a sudden mass movement of slope debris but failed to develop the point. Important factors such as lubrication, gradient, degree of compaction and impact were frequently ignored.
- (c) Having established a focus on slope processes it was hoped that the data obtained from research into slope failure in the Himalayan foothills would encourage strong answers. Although there were some very good interpretations of the data there was quite a large variation in marks.

The table related percentage soil loss to variations in slope angle and the percentage cover of vegetation. Good quality answers outlined the interaction of slope angle and vegetation, and capably considered low soil loss according to gradient and 90% vegetation cover, high soil loss on steeper non-vegetated slopes, and the contrast between the rice terraces. Answers in the 4 to 6 range either omitted some details from the table or wrote descriptions without any explanations. The weakest answers were either far too brief or did not understand the slope processes that would produce the patterns displayed in the data.

Question 2

It is a well known feature of environmental science and environmental management examinations that candidates find weather studies difficult. However, it is an important section of the syllabus and must therefore be examined. Furthermore, it is currently very topical. Disappointingly, this question was not well-answered, with candidates displaying little understanding of weather systems and processes.

- (a)(i)** Very few candidates expressed an understanding of high and low pressure. Full marks could have been achieved by stating that high and low air densities were a product of cool or warm temperatures or descending and ascending air. Examiners did not see a single reference to the weight of air over a given unit area, as expressed in a barometric measurement.
- (ii)** This was slightly better answered, particularly where candidates used land and sea breezes as an example. A large number recognised that air moved from areas of high pressure to areas of low pressure as occurs between anticyclones and cyclones. A significant number of candidates seemingly ignored the word horizontal and described vertical movements. The weakest answers had air moving between the northern and southern hemispheres or wrote nothing.
- (iii)** Answers were of a similar mixed quality to part **(ii)**. Although many candidates made some reference to the coriolis force, it was rarely supported with descriptions of how it would be deflected; to the right in the northern hemisphere and left in the southern. Significantly, in the past when a global map of air masses has been provided, answers to this type of question have been good; understanding is the key issue here.
- (b)** This part was concerned with passage of a frontal depression which is a common event in many parts of the world. As most of the information was contained in Figs. 2.1 and 2.2, this was almost purely a data response question. Factual recall was confined to explaining the weather processes.
- (i)** As this simply involved the transfer of 3 locations from Fig. 2.1 to Fig. 2.2 this question should have provided three easy marks for all candidates. The X-Y lines in each diagram were of the same length and the transfer could have been achieved by either direct observation or measurement. Most got it right and significant number either made partial or complete mistakes. The examiners would like to think that this was a result of carelessness rather than a lack of understanding.
- (ii)** Essentially this was a data response question involving the analysis of Figs. 2.1 and 2.2. Approximately 20% of the answers accurately described and explained the weather conditions of this weather system. The remainder achieved some marks through descriptions of Fig. 2.1 but were weak on explanations.
- The major weakness in many explanations lay in not appreciating the dynamic nature of these weather systems. Not only does air circulate into the system, but the meeting of warm and cold air causes the cold front to move towards the warm front, enables upward turbulence and rain, and the whole system drifts (in this case) towards the East.
- (iii)** Unfortunately very few candidates viewed barometric charts as actually depicting local weather conditions that persist for a relatively short period. Reference to such charts is useful as they locate short term conditions such as fronts, pressure, temperatures and rainfall.
- (iv)** For the majority of candidates this formed the best part of this question. There were some relevant descriptions of the use of satellites, balloons, past records and computer modelling.

Section B

For most candidates this single question option is proving to be a very positive feature of this paper. The part **(a)** for each question is proving to be a useful prompt for part **(b)**. Many candidates seem to enjoy developing their own exemplar material for environmental issues. There were very few instances of candidates answering more than one question from this section and the majority seemed to spend approximately half their time on this section. The three questions each attracted about the same number of candidates.

Question 3

- (a) This section was well-answered with the majority of candidates achieving between 5 and 10 marks. High marks were often achieved by candidates who developed a justified trend for each energy source; the best answers outlined how the trends interacted. Weaker answers invariably achieved 5 marks by describing the trend for each energy source.
- (b) This is a deceptively difficult question. Although the focus is on developing countries it cannot be satisfactorily answered without reference to the priorities of developed countries.

There were some full descriptions of the energy priorities of developing countries. These answers focus upon dependence on non-renewables because of cost, availability, technology and political factors. Whilst many answers stopped at this point some candidates correctly pointed out that many developing nations make use of renewable energy sources such as HEP, Solar Power and Bio fuels.

There were obvious contrasts and comparisons with developed nations. The most common approach was point out the economic, technological and environmental priorities developed countries possess in expanding their use of renewable resources. Good quality answers also pointed out why many developed countries were still dependent on non-renewable resources.

Although generally well-answered, the major discriminators between strong and weak answers lay in the candidates' ability to use studied examples, and evaluate the priorities of both groups of nations.

Question 4

This proved to be the least well-answered question in **Section B**, with candidates finding difficulties in both parts of the question.

- (a) Table 4.1 provided candidates with two sets of data on carbon dioxide emissions. Candidates were expected to draw out relationships between emissions per person (per capita) and for whole countries. There are five ways in which this relationship occurs:

- countries with high output per person and for the whole country e.g. USA, Russia and the UK
- countries with low output per person and high output for the whole country e.g. China and India
- countries with high output per person but low national output e.g. Canada and Iceland
- countries with low output per person and low national output e.g. Brazil and Nicaragua
- countries that occupied approximately the same position in both charts e.g. Japan, Poland

The best answers defined three ways and provided an effective justification in terms of the level of development and population size. Needless to say, weaker answers frequently failed to recognise the relationships or did not contain a justification.

- (b) Part (b) was in two parts, with an evaluation of the contribution of human activity to global warming followed by an assessment of the impact of global warming upon settlement and agricultural activity.

The vast majority of candidates did not distinguish between global warming as a natural process and the enhanced warming that is a product of human activity. It is pertinent to remind ourselves that global warming and cooling are natural processes that have operated almost throughout geological time. Enhanced global warming is a product of human activity during the past 200 years and has only recently become a major concern. However, many candidates did achieve valuable marks for their analysis of global warming.

The description and explanations of the impact of global warming were quite varied. Impacts upon agriculture can be tied in with climatic change, alterations to weather patterns and sea level change. Whilst it was not necessary for candidates to pick all impacts, the effects of drought and increasing temperatures should have been included in this analysis. Positive impacts could have included the possible poleward drift of crops (wheat, maize, 'mediterranean' crops) and negative impacts that drought has inflicted upon many parts of the world.

The effects of climatic change upon settlement should, and for many did, focus upon the loss of land due to rising sea levels. However, the places in which people live is also affected by other factors such as water supply, agriculture and food supply, disease and the incidence and intensity of weather hazards such as hurricanes and tornadoes.

The degree to which candidates picked up on these points became the discriminator between weak and strong answers. Top quality answers provided a good balance of both sections of the question. Weaker answers were often poorly balanced through either spending too much time on global warming, or leaving insufficient time to answer the **Section B** question.

Question 5

This tectonics question was answered reasonably well by most candidates. Questions involving volcanic activity and earthquakes are generally popular, and candidates are frequently well versed in related case studies. Although this was true of this year's question, there are still some misconceptions.

The pattern of damage from the December 2004 earthquake (Aceh) formed the theme for this 10 mark question. Candidates were required to assess the impact of tsunamis at three locations. Firstly, it must be stated that a significant number of candidates confused tsunamis with seismic waves.

Candidates found few difficulties in identifying site **A** as the one sustaining most damage, close proximity to the epicentre being the obvious answer. There was little confusion between site **B** and **C**. The contrast being that site **B** is sheltered by the Indian subcontinent, and that site **C** received stronger tsunamis as it has an uninterrupted stretch of water across the Indian Ocean.

(a) Although there was a wide variety in the quality of answers, it is probably trite to say that this simply reflected the ability of the candidate to recount learned case studies. The majority of answers were well structured mostly dividing into two sections i.e. volcanic eruptions and earthquakes, with Mt. St. Helens and Pinotubo being popular volcanic selections, and Kobe being by far the most popular earthquake. With the Aceh earthquake being a part (a) topic, it was surprising that this was not a more popular choice.

To varying degrees answers outlined prognoses from gathering: seismic evidence, chemical changes in volcanic emissions, the historic record; precautionary measures such as building structure, rescue agencies, volcanic lava re-routing strategies; and finally post event strategies. Some of the best answers recognised that some of the measures for each did overlap and successfully sought to combine the two.

Conclusion

Whilst it was a little disappointing that candidates still find weather and climate questions difficult, this paper provided an accurate test and good spread of marks (3 to 72 out of 80). Most candidates used their time well and there were very few rubric errors. The quality of written English continues to improve and it is pleasing that the **Section B** questions seem to be popular. In fact, it is **Section A**, with its emphasis upon processes and data response, that is proving to be the more difficult. As stated in previous reports, it is important that Centres build up a bank of past papers, and that their candidates get plenty of practice.

ENVIRONMENTAL MANAGEMENT

Paper 8291/02
Biosphere and Hydrosphere

General comments

The general level of performance for this paper was very similar to paper 1. Although marks spread across a similar range, unlike paper 1, candidates performed fairly evenly across all questions. Most candidates timed themselves well giving each section an equal input. Unlike paper 1 there were some very long and detailed answers to the **Section B** questions.

Comments on specific questions

Section A

Question 1

Performances within this question were frequently patchy with difficulties being encountered within parts **(a)**, **(b)** and **(c)**. The question was concerned with marine pollution and moved from some straightforward definitions to the causes, impact and management of marine pollution.

- (a)(i)** Surprisingly not all candidates were able to provide a definition of marine pollution that mentioned the intrusion of an element that had detrimental effect upon seas and oceans. It was not sufficient to turn the question round and write 'it is pollution of the sea or oceans'.
- (ii)** Although there was some occasional confusion between organic and inorganic, most candidates achieved between 2 and 4 marks for this question. Sewage and phosphates were the most common organic choices and oil or litter the most common inorganic choices.
- (iii)** The majority of candidates successfully linked pollution with land based activities and transference via rivers, sewers or the air, but were unclear as to why it remained in coastal waters. In most instances tides not only take material out to sea but also return it to the coast.
- (b)** This was quite poorly answered as many candidates failed to point out that polystyrene cups and plastic floats, and will be moved by ocean currents and winds. The area between Bermuda and the African coast is influenced by the north equatorial current and trade winds.
- (c)** Having introduced the idea of the oceanic transference of rubbish, part **(c)** was focused on legislation relating to marine pollution.
- (i)** The main problem candidates had with this was in taking the answer beyond the wording of the question. Correct answers referred to treated waste having toxic material removed and being safer in waters close to coastlines; being beyond 3 miles they have time to sink or disperse. In contrast, untreated waste can only be dumped beyond 25 miles so that they either sink or disperse.
- (ii)** For similar reasons oil is discharged beyond 50 miles so that it can disperse and not pollute fragile coastal ecosystems. Once again some candidates found it difficult to move beyond the wording in the question.
- (iii)** There were few difficulties encountered with this question. Most candidates referred to the difficulties of managing oceanic pollution in particular illegal dumping at sea. Good answers supported this statement by describing how marine pollution became dispersed.
- (d)(i)** This was not well answered as many candidates failed to recognise that most oil tanker accidents had a coincidence of dangerous coastal waters and crowded shipping lanes.

- (ii) This received much better answers, with reference to using bacteria, pumping, using booms and nets through to beach removal. Many candidates achieved 3 marks for this part. Most of the weaker answers attempted more than one technique and did not include an assessment.

Question 2

Question 2 was well answered and for many candidates this formed their best answer. The factors that influence the population of a species formed the focus of this question.

- (a)(i) Most candidates possess a good understanding of the term *carrying capacity* and obtained either 1 or 2 marks. A vital feature of carrying capacity is that it is the maximum population that can be supported, not simply the ability of an environment to support its population.
 - (ii) The graph showing fluctuations in Australia's rabbit population is quite commonly used to illustrate how the concept of carrying capacity can be applied. The graph relates the diminishing rate of fluctuations for the rabbit population towards their carrying capacity. Each fall in the curve occurs when the carrying capacity is exceeded and each rise represents the recovery of the rabbit population.
- (b) Continuing with the theme of population, part (b) is concerned with models of projection of changes to the human population. Candidates coped well with describing the changes but were less certain about the explanations.
- (i) This involved an analysis of population growth up to 2007. Most described the exponential growth pattern up point **X** and invariably linked it to economic and social development. The alternative, taken up by a minority, was to use changes to birth rates and death rates.
 - (ii) Descriptions for each of the three projections were generally accurate. Instead of using the interaction of birth and death rates many candidates became embroiled in discussions about economic development, the emancipation of women and carrying capacity; frequently relevant and sometimes without substance.
- (c) This was more of a management question involving some research into controlling the population of spider mites. Fewer problems were encountered in (i) than in (ii) and (iii).
- (i) In a variety of ways most candidates described how chemical control produced a sharply fluctuating trend and biological control a steady and low trend.
 - (ii) Answers were quite varied. Good answers outlined how with chemical control recovery occurred whilst biological controls were more effective as they specifically targeted the mite population. Weaker answers did not provide an explanation to either or both, and repeated information from (i).
 - (iii) This part was well answered as most candidates understood the environmental impact of chemical pesticides which was contrasted with the environmentally friendly or 'more natural' biological control.

Section B

Questions 3 and 4 proved to be more popular than **5**. Although standards varied, most candidates had left sufficient time for **Section B**; in fact there were some very long answers. As with paper 1 good use was made of case studies that were directly relevant to the question.

Question 3

- (a) Depicting the flows and stores as a system has the effect of eliciting some very detailed and occasionally over lengthy answers. Many candidates detailed every flow and store in Fig. 3.1 and frequently achieved marks of between 5 and 8. The best answers, however, focused on how a balance between inputs and outputs of water could be achieved. In these instances it was not necessary to detail every flow and store.

- (b) This question was well answered with some excellent use made of studied examples, of which the Colorado (Hoover), Nile (Aswan) and Yangtze (Three Gorges) featured strongly. However, the question was not simply about dams and reservoirs and the best answers also considered ground water, aquifers and careful management of existing supplies. The only major omission lay in a clear expression of what is meant by achieving a sustainable supply of water; it was frequently implicit rather than stated.

Dams and reservoirs featured strongly in most answers and to varying degrees the positive and negative impacts of the chosen scheme were outlined or analysed. Positive effects were mainly in terms of water supply, hydro-electric power and recreation. Negative effects were social and economic, and included: disruption to settlements, ecological impacts, down-stream loss of water and sediment build-up within the reservoir.

References to using groundwater supplies usually involved stating negative impacts such as loss of groundwater, tapping polluted supplies, and soil salinisation. There were some excellent accounts of how careful water management at a number of scales could achieve a sustainable supply. These included household usage, limited irrigation and industrial controls: in other words avoiding wastage.

Question 4

Although popular, this question was less well answered than **Question 3**.

- (a) Unfortunately Fig. 4.1 did not prove to be as helpful as hoped. Fig. 4.1 located the major biomes in a triangle according to precipitation along the bottom axis and temperature/latitude along the side axes. However most candidates went on to describe each biome without reference to the diagram. Thus many answers tended to focus upon temperature and the ecological characteristics of the biome rather than the question. Some very good answers did make the necessary generalisations about precipitation and temperature and draw out the linkages with the biomes in the diagram.
- (b) The majority of candidates opted for tropical rain forest with almost any other biome to satisfy the question. The fact that many answers were poorly balanced limited the number of marks that could be awarded. Human activity in tropical rain forest invariably and accurately included deforestation, agriculture and mining. Effects were mainly confined to impacts upon biotic composition and structure with incidental mentioning of abiotic factors. It was quite rare to read an answer in which biotic and abiotic components were seen to work together. This interaction is central to ecological stability within the biome.

As previously stated, the second biome received very brief coverage. Candidates who opted for the Savannah frequently covered desertification with its impact upon various animals, particularly big cats and elephants. The tundra also proved to be a popular second biome and there were some creditworthy references to the impact of oil extraction and pipelines. Those candidates who opted for tropical deserts quickly discovered they had very little to write about.

The main difficulty candidates found with this question was in assessing how human activity had affected the ecological stability of the biome. Here it was important to review the interaction of biotic and abiotic factors even to the extent of mentioning nutrient flows.

Question 5

Although in many ways this was the most structured question in **Section B**, it also proved to be the least popular. By highlighting how changes to the biosphere are monitored, the second part of the question asked candidates to analyse an endangered environment. Most of the answers to this question were of a reasonably good standard.

- (a) Candidates were expected to identify and describe three ways in which the biosphere is monitored. To turn the question around once the various factors contributing to the characteristics of the biosphere are identified, mechanisms can be set up to monitor them.

Thus satellite imagery will enable, for instance:

- changes to the terrestrial vegetation cover to be observed
- weather and climatic observations to be made
- marine ecosystems (particularly coral) to be observed

Field investigations enable small or local scale ecological observations to be made, and documented evidence, maps and statistics enable comparisons and prognoses to be made.

Where candidates structured their answer into three sections good quality answers ensued. The weaker answers lacked organisation and frequently failed to identify three methods of monitoring the biosphere.

- (b) Tropical Rain Forest featured strongly in many answers with savannah and coniferous woodland appearing in a small number of answers. Whilst some limited reference to the fragility of the endangered environment was necessary, answers needed to focus on the extent to which economic and political pressures frequently had priority over conservation. This emphasis does however require some evaluation, as in many instances conservation measures are seen as important and sustainability has been the priority.

Although some answers over-emphasised the ecological characteristics of the chosen environment, most candidates expressed an understanding of the relevant detrimental effects of economic development, exploitation and clearance. The political aspect to this question was sometimes mentioned in relation to Brazil.

This question covers some environmental issues of current interest, and good quality answers occurred where the candidate utilised topical case studies. The weakest answers were very general and did not use any specific case studies.

Conclusion

As with paper 1 this biosphere and hydrosphere paper has provided an effective test of the candidates' ability, knowledge and understanding of environmental issues. Particularly in relation to water supply and ecological issues, many candidates were able to empathise with the subject material of the question through their personal experience and studied examples.

The quality of English displayed in this paper was of a high standard and most long and short answers were well structured. There was a fair balance between **Sections A** and **B**, showing that candidates use their time well. There were no rubric errors on this paper.

ENVIRONMENTAL MANAGEMENT

Paper 8291/03

School Based Assessment

General comments

The majority of Centres submitted projects of a very acceptable standard. It is encouraging that candidates are writing well structured reports in the region of 2000 words that in most cases reflect a combination of primary and secondary research. The quality of written English is generally very good and most projects contain a balanced combination of text and illustrative material.

Overall the choice of research topics has been of a good quality. As in previous years, the better projects utilised local small scale topics and the collection of field data. Noticeably this year there was less in the way of laboratory research and greater reliance upon Internet research. There are some issues with Internet research that candidates should be made aware of:

- data can be complex and not always relate to the local information needed for the project
- secondary data should be treated with caution
- there is a tendency for candidates to copy and paste graphs and illustrations
- plagiarism is not permitted.

Although most Centres conducted their assessment accurately and with diligence there have been some administrative inconsistencies. It is important that the final moderated mark is included on the MS1 form and that an assessment form is completed for each candidate; both of these forms plus the summary form should be submitted with the projects. It is also important that candidates are not awarded credit for aspects that are not present in their report. This particularly applies to assessment criteria C1 (a) (hypothesis), C1(c) methodology, C2 (e) statistical tool and C3(c) evaluation. It is important that the assessment criteria on pages 10 to 12 of the syllabus are consulted at all stages.

Comments on assessment criteria

General Comments

The assessment criteria fall into three categories that broadly conform to standard scientific method. Skill C1 targets the initial planning stage of a research project in which the clear establishment of a hypothesis or question is supported by an introductory statement and a clear outline of the methods to be used. Skill C2 involves the presentation of results and their analysis. In drawing together explanations there is a little overlap between skill areas C2 and C3. However the emphasis for C3 should be concluding statements with reference to the data completed finishing with an evaluation of the conduct of the research.

Skill C1

This formed the better of the three skill areas. The majority of candidates provided a clear hypothesis or question either within the title or in an introductory paragraph. The majority of hypotheses were quite specific and established an issue or phenomena that could be tested. The weakest reports invariably lacked this specificity.

A significant number of candidates were less clear about the methodology they used to undertake the research; frequently it was implicit rather than stated. It is helpful for candidates to clearly specify and justify their methodology in order to tighten the latter sections of the report. Frequently the lack of a clearly stated question or hypothesis and a vague or implicitly stated methodology leads to long-winded and over lengthy reports; often giving the impression that the candidate has not planned the work. It follows that high quality reports derive from a clear statement of intent.

Skill C2

Of the five criteria in this skill area (c) and (d) were of a particularly high standard and most sampled reports made for interesting and enjoyable reading. The best reports were succinctly written, directly related to the research and data, and organised into distinct sections by chapter headings.

Criteria (a) and (b) were less well covered. The weakest reports contained no data or some general statistics within the text. The best reports contained tables, graphs and statistical tests derived from the collection of primary data; it follows that the analyses of these data were frequently of a high quality. To reiterate an issue with Internet data, it is difficult to satisfy criteria (a) and (b) when the data and graphs are copied and pasted. It is worthwhile assembling data that can be effectively used within the conclusion where trends and patterns derived from the results is required

Finally it would be nice to see more candidates endeavouring to evaluate their data through some simple statistical tests such as rank correlation, regression and chi squared in addition to histograms and pie charts.

Skill C3

This skill area showed the widest variation in quality and was much weaker than skills C1 and C2. Strangely a significant number of reports:

- failed to draw together information contained in the report
- failed to support the concluding statement with reference to the data.

Criteria (b) had better coverage as knowledge of environmental and management principles was contained within the results analysis as well as the conclusion. Weaker reports tended to be unclear about the environmental trends contained within the data.

Very few candidates constructed an evaluation of their work. For some, an evaluation was confused with a conclusion. Candidates should write a brief assessment of their areas of success and the limitations of the work. Limitations should be supported with some mentioning of possible improvements and areas of success justified.

Conclusion

This section of the examination continues to form an important feature of a candidate's study of environmental management. The fact that most candidates now try to write reports of under 2000 words recognises a correct balance with the two written papers. It is important that candidates select research topics that are practical in terms of scale, data and balance. Thus small scale research projects that utilise locally obtained data are frequently much better than those that 'globalise' the topic, e.g. a local study of the impact of deforestation is much more manageable than 'the effects of deforestation in areas of Tropical Rain Forest'.

We are now getting some large entries from single Centres in which a number of candidates choose the same research area. It can be productive for these candidates to assist each other in their field research. However whilst data may be shared, each candidate must produce a final report that is constructed independently of other candidates. Alternatively, it is of course possible for candidates to develop different aspects of their field or laboratory work.

Once again, I must thank Centres for submitting an interesting, well written and in most cases accurately assessed sample of research reports.