

ENVIRONMENTAL MANAGEMENT

Paper 8291/11
Paper 11

Key messages

- Candidates should apply scientific theory in their answers and use subject related vocabulary where appropriate.
- In **Section A**, candidates should consider the command word for the question, using it to instruct them on how to write their response.
- In **Section B**, candidates should include greater consideration of the relationships present in the data provided.
- In **Section B**, candidates could develop their responses further by providing a more balanced response.

General comments

There was a good response to all questions on the paper with candidates scoring slightly higher in **Section A** compared to **Section B**. Candidates generally scored higher marks in **Question 1** (mass movement) rather than in **Question 2** (atmosphere). Topics that were found most challenging were describing weathering, explaining volcanic warning signs, explaining air pressure and describing how the ozone layer can be protected.

In **Section B**, **Question 3** was a slightly more popular choice than the other optional questions. Candidates used the data provided very well in **Question 3** and **Question 4**, but the data could have been interpreted further in **Question 5**. The responses where candidates were selective on the content covered and chose information that supported the question were more successful than those who wrote a broad and general response on the subject which was not directed to the question asked.

Comments on specific questions

Section A

Question 1

- (a) (i) Many correct responses were given with candidates able to correctly describe weathering as the breakdown of rocks and some developed their answer further to say this occurred in situ. Unsuccessful answers often did not mention rocks and wrote generally about a surface.
- (ii) Some good responses to this question included a clear contrast between chemical weathering involving a chemical reaction and physical weathering as there being no reaction and that the rock was being broken down into smaller pieces.
- (iii) Many candidates were able to use the information provided to identify rock fall. Some candidates needed to look carefully at the descriptions such as a curved surface linking to rotational slumping. The slow movement of soil during wet and dry conditions was often classified as solifluction rather than soil creep.
- (b) (i) This question was usually answered well. The majority of candidates were confident in extracting information from the given text and writing it as stages in a sequence of events; almost all candidates discussed the ice melting at the top of the volcano due to increasing temperatures and many candidates then went on to discuss the high energy flow of water which was able to transport sediment and debris.

- (ii) Many responses to this question included the identification of two early warning signs which could indicate an eruption happening soon. Some candidates went on to effectively explain what these signs meant by discussing the tremors relating to magma moving within the volcano and that the steam and gas was associated with higher heat flow or gases being released from solution when the pressure is reduced.
- (iii) Most candidates were able to suggest two or more reasons why the people were reluctant to leave their homes. Many discussed the fact that they had nowhere to go, no transport options or potential loss of livelihood. Some responses discussed the farming quality on volcanic slopes, which would answer why people would move there but not why they might not have left.
- (iv) Stronger answers were characterised by candidates using what they had found out from Fig. 1.3 and linking it to their knowledge of volcanic hazards. Candidates described the layout of the hazard on the map and linked it to how the hazard may have moved, for example the lava flow was close to the peak as it cooled and crystallised rapidly before travelling far, the ash was carried in the air further from the peak. Very few candidates used the scale on the map to quantitatively describe the expanse of each hazard; this information could have been used to support more descriptive answers.

Question 2

- (a) (i) Many candidates were able to correctly name the Troposphere, common incorrect answers included the lithosphere and asthenosphere.
 - (ii) Many candidates made effective use of the data provided in the graph to describe the temperature condition in each atmospheric zone. Some candidates could have improved their response by checking the scale and noting where positive and negative temperatures were.
 - (iii) Few candidates were able to answer this clearly with the majority describing air pressure as increasing with altitude and trying to explain this by relating to temperature. Candidates who answered well discussed the trend that air pressure would decrease as altitude increased and that air was compressible, including the point that as you increase in altitude there is less air.
 - (iv) Few candidates were able to name ultraviolet or UV as the type of radiation absorbed by the ozone layer. Many candidates wrote sunlight and many left this question blank.
 - (v) There were many examples where candidates were not able to name UV in **Question 2(a)(iv)** but were able to give two examples of risk from this type of radiation. Many stated that skin cancer would be a risk with some responses mentioning sunburn, cataracts or loss of sight.
 - (vi) Many candidates found this question challenging with few able to link CFCs to damage to the ozone layer. Those who mentioned CFCs often stopped at that point without developing further and many others went on to discuss the greenhouse effect. Many options could be considered by candidates including the recycling of products containing CFCs, international collaboration, monitoring with satellites and researching alternatives.
- (b) Candidates answered this question very well and virtually all were able to select information from the diagram and then develop the strategy with an explanation on how this would work by either absorbing noise or reflecting sound away. Some candidates were able to add other examples of methods to manage noise beyond what was suggested in **Fig. 2.2**.

Section B

Question 3

- (a) **Fig. 3.1** provided data on the speed of seismic waves with relation to depth below the Earth's surface that candidates were able to use together with a section through the Earth to explain the evidence of the internal structure of the Earth. Many candidates used a range of trends from the graph to link to structure, often identifying the boundary between the core and mantle as corresponding with a significant drop in both P and S wave velocity. These candidates linked the change in physical properties from the solid mantle to the liquid outer core. Many candidates also noted the change in velocity associated with the boundary between the crust and mantle and the inner and outer core boundary. Some candidates could have developed their answer further by

considering the complex pattern near the Earth's surface which links to the property change between the lithosphere and asthenosphere and also by explaining why the property changes cause the velocity changes in seismic waves.

- (b) Candidates wrote some excellent extended responses to this question with a reflection on a range of earthquake case studies from contrasting parts of the world. Well-structured answers considered preparations which could happen before an earthquake, then measures to put in place as a response to an earthquake such as rescue strategies. Finally, they considered how a location could be rebuilt following a major earthquake. Candidates contrasted how these measures may look in MEDCs and LEDCs supported by case studies. The weakest responses often only briefly considered hazards in a very general way without focussing on earthquakes in particular and without using any examples.

Question 4

- (a) Candidates described the patterns seen in the two maps very well, noting areas with higher or lower population density and areas where the risk from hazards were significant. Some responses attempted to explain these patterns by discussing that the hurricane hazard would be high in the South East corner of Africa and that the risk would decrease by moving inland. Candidates did not note the shape of the sinuous hazard area in North East Africa and link it to where the River Nile would flow and possibly flood. Few candidates mentioned that risks such as landslides would likely be found in mountainous areas or in river valleys. Some candidates discussed the large areas of unknown risk and linked this to countries being LEDCs that may not have the funds to carry out the risk assessments.
- (b) Some responses met many of the requirements of this question by providing a balanced and carefully considered discussion on the rights of countries to produce pollution and its links to development and progress. Some candidates developed their answers by including that as countries developed further, they may become more environmentally aware and therefore the pollution levels may fall. To improve answers candidates could consider the nature of each pollutant from **Key Question 3 of The Lithosphere** section of the specification. Candidates may include how CFCs are stable and transported globally in the atmosphere with consequences that impact on everyone, whereas ground level ozone impacts the people and environment close to where the pollutant is formed. Carbon dioxide emissions could be discussed, being produced in large quantities by many countries and the resulting enhanced greenhouse effect that impacts all countries regardless of whether they contributed to the emissions. Discussing pollutants specifically and supporting these ideas with examples would give candidates the opportunity to use a range of subject specific vocabulary.

Question 5

- (a) Many candidates were able to describe methods in which scientists could gather data, discussing examples such as using satellite data, investigating temperature variation or composition of the atmosphere. Candidates could improve their answers by understanding what a scientist's level of confidence meant; this was often misunderstood by candidates thinking it was the level of damage to an environment rather than whether scientists had data to show that damage was due to climate change.
- (b) Candidates were confident in knowing what a National Park is and its role in a sustainable future and many discussed the importance of the parks and the research that is carried out. Most candidates supported their discussion by using one or two examples of National Parks, the strongest answers using a range of examples to demonstrate different points. The discussion on the conflicts that exist within National Parks was less well developed in many cases. This was often limited to animals' habitats and humans entering these habitats. Candidates had the opportunity here to gain further credit by, for example, discussing conflicts between farming occurring within or on the margins of a National Park with the traditional hunting grounds being near parks. The conflicts between tourists bringing funds with the demand for hotels, transportation and food could also be discussed. As locations become more overcrowded National Parks may be threatened for building housing developments.

ENVIRONMENTAL MANAGEMENT

Paper 8291/12
Paper 12

Key messages

- In **Section A**, candidates should consider the number of marks available for each answer and then plan to include an appropriate number of points.
- Candidates should use appropriate subject specific vocabulary in their responses.
- The data provided in **Section A** and **Section B** for each question should be carefully considered and manipulated for use in answers.
- When planning **Section B** answers, candidates should be selective and choose relevant case studies which address the whole question.

General comments

There was a good response to all questions on the paper with candidates scoring slightly higher in **Section B** compared to **Section A**. Candidates generally found **Question 1** (mass movement and soil) and **Question 2** (climate) similarly challenging. Topics that were found most challenging were soils and soil profiles, and interpreting weather maps.

In **Section B**, **Question 3** was the most popular choice of optional questions, with fairly equal numbers choosing **Question 4** and **Question 5**. Candidates showed good understanding of the topics covered in these longer answer questions, a range of case studies were included along with subject specific vocabulary. In order to achieve further credit, candidates should consider the exact wording of the questions and then be more selective in terms of the case studies used and the comments made.

Comments on specific questions

Section A

Question 1

- (a) (i) Many detailed responses were given by candidates in their descriptions of the role of water in mass movement. Candidates often considered the input of the water to the system by rainfall, they discussed how this may travel across the surface as surface runoff and how this may erode the surface as it travels. Candidates also discussed the infiltration of the water to become groundwater. Many discussed the water collecting in weaker horizons and acting as a lubricant between layers resulting in movement of overlying material downslope. Answers which needed improving often did not contain a sufficient number of different points or repeated information from the diagram without adding extra information.
- (ii) This question was usually answered well. Many candidates were able to explain one method very effectively; this was often afforestation where candidates discussed the roots binding the soil together and went on to explain how this would reduce surface runoff and therefore erosion of the slope. For a second method candidates often described reducing the angle of the slope, in some cases this needed a little more explanation in terms of reducing the speed of the runoff and allowing more infiltration to occur on the slope.
- (b) (i) Candidates often found this question challenging, stating that biotic factors were climatic factors and rather than including fauna and flora would discuss temperature and rainfall.

- (ii) Candidates found this question quite challenging; the explanation requirement was often missed. These responses gave a climatic factor but often did not link it to how it would affect the soil formation process. Some successful candidates discussed that high rainfall could be acidic in nature and that this would break down the parent rock causing the rock particles in soil to be smaller.
- (c) (i) This question was answered successfully by the majority of candidates; most used the data from **Table 1.1** and clearly understood what the data in the table showed. Candidates used information such as the iron pan present in soil **Z** to identify it as a tropical region and the well-mixed nature of soil **Y** to identify it as a moist temperate region.
 - (ii) Candidates provided a range of suitable reasons for the decisions they made in **Question 1(c)(i)**; some linked the warmth and high moisture levels to the thick O and A horizons in soil **Z** and this eliminated it as a soil formed in a moist and temperate region. Candidates discussed the relatively high organism activity and high decay rates in a moist and temperate location; some candidates discussed the fact that the conditions would be dry, which does not support a moist region. Responses were given credit if they incorrectly selected soil **X** or soil **Z** in **Question 1(c)(i)** but could use data to justify their choice here.

Question 2

- (a) (i) Many candidates correctly calculated the range in temperature for Location **B** by subtracting the lowest temperature from the highest temperature. Some candidates gained partial credit by writing the calculation out but not completing it.
 - (ii) Most candidates answered this question correctly and were able to take information from the two graphs and identify differences in terms of patterns, ranges and frequency and also similarities between these two locations. Many candidates made effective use of data in their answers.
 - (iii) Candidates made good attempts to suggest reasons for the differences seen, with some correctly suggesting that the latitude may have been different for each location but then went on to say that Location **A** was on the equator, which was unlikely due to the temperatures experienced. Many candidates correctly suggested that both locations were in the northern hemisphere and linked this to both locations experiencing summer in July and winter in December. A number of candidates discussed Location **A** being close to a water body due to the high levels of rainfall recorded.
- (b) (i) Many candidates were able to use the pattern in the isobars to predict that the pressure at point **Z** would be around 1010 mbar.
 - (ii) Few candidates were able to name the weather system as a depression, identifiable by the warm and cold front meeting to form the occluded front.
 - (iii) Many candidates gained some of the available credit by suggesting relevant weather conditions. Fewer gained full credit by adding more detail or including more factors. Few candidates directly related their suggestions to the figure, for example, including that the front was approaching from the west. Many of the successful responses described the wind speed increasing, the temperature decreasing, cloud level increasing and rainfall increasing.
 - (iv) Stronger responses were characterised by candidates considering the specific benefits a forecast can give in terms of the time a cyclone will arrive at a location, the severity of the cyclone that is arriving and the path that the cyclone will take as time progresses. Further credit could be achieved by candidates linking these ideas to strategies such as securing buildings, evacuating areas at high risk and stopping flights.

Section B

Question 3

- (a) Candidates used the data in **Table 3.1** very effectively in their responses, selecting appropriate examples to illustrate reasons. For example, when discussing the effect of the economic development level, candidates often contrasted Haiti and USA, while when they discussed the use of earthquake proof design, they would contrast Japan 1923 with Japan 1995. Candidates

considered the magnitude, the education, preparedness and underlying geology amongst other relevant factors.

- (b) Candidates wrote some excellent extended responses to this question where a range of volcanic case studies from contrasting parts of the world and contrasting eruption styles were included, sometimes in great detail. The strongest responses described the characteristics and hazards caused by the volcanic hazards and contrasted this with how more economically developed countries could mitigate these hazards. Responses which needed further development may not have specifically described volcanoes and instead discussed earthquakes or hazards in general. Some candidates discussed how the plate tectonic setting and the chemistry of the magma determined the eruption style and could support this with relevant examples.

Question 4

- (a) There were many good responses to this question where candidates effectively used the information provided and described in detail the potential impacts both positive and negative of fracking on the local area. Candidates selected ideas based on the information provided and described them very well, incorporating some of their own ideas of the issues with this type of development. Many responses then went on to explain some of the further reaching consequences, for example the effect of increased access leading to more people fishing reducing fish stocks for local people and that this may reduce food supply or income for those who are dependent on fishing.
- (b) Candidates made a good attempt in most cases to discuss how alternative energy requirements could be used to reduce dependence on fossil fuels. Few candidates discussed the challenges in reducing carbon emissions from transport and that the development of electric cars is helping in this area. Alternative ways of using renewables to fuel power stations were discussed by many. The impact of building renewable energy plants was not mentioned by many candidates, only that when in use the carbon dioxide levels would reduce. The opportunity for countries to improve efficiencies to reduce their energy requirements was rarely discussed by candidates; the suggestion of improving public transit and improving insulation to reduce the need for generating electricity could have been included. Strategies being developed to carbon capture to store carbon emissions could have been discussed. Weaker responses wrote more generally about all types of air pollution rather than focussing on carbon dioxide emissions.

Question 5

- (a) **Fig. 5.1** presented data on the air quality for ten cities with the largest population in 2000. Candidates were effective at describing some of the patterns associated with increasing population and air quality; some candidates identified anomalies in this pattern and suggested reasons for it. Some candidates could have made use of their knowledge of pollutants and considered the patterns associated with one pollutant, for example suspended particulate matter would be linked to the use of diesel-powered transport methods, or the lead levels being low as generally this has been banned for use in fuels.
- (b) Candidates must carefully consider the question requirements when planning their answer. In this question, candidates wrote in detail about the pollution associated with development but as it was a 'to what extent' question further credit was available for balancing this with development being linked to a reduction in pollution. Candidates discussed in detail how, as countries began to increase production levels and export more material goods, their energy requirements would increase which may lead to higher pollution levels. Candidates often described the increase in car ownership linked to development and how this would impact on air quality. Candidates could balance this with some of the improved technology to reduce atmospheric pollution including using scrubbers to reduce acidic emissions from chimneys, removing lead from petrol and technology to improve the efficiency of appliances and homes. Candidates could discuss how development has allowed the installation of renewable energy and carbon capture technology. Candidates supported their answers with a range of case studies from countries practicing many strategies.

ENVIRONMENTAL MANAGEMENT

Paper 8291/13
Paper 13

Key messages

- Candidates should apply scientific theory in their answers and use subject related vocabulary where appropriate.
- In **Section A**, candidates should consider the command word for the question, using it to instruct them on how to write their response.
- In **Section B**, candidates should include greater consideration of the relationships present in the data provided.
- In **Section B**, candidates could develop their responses further by providing a more balanced response.

General comments

There was a good response to all questions on the paper with candidates scoring slightly higher in **Section A** compared to **Section B**. Candidates generally scored higher marks in **Question 1** (mass movement) rather than in **Question 2** (atmosphere). Topics that were found most challenging were describing weathering, explaining volcanic warning signs, explaining air pressure and describing how the ozone layer can be protected.

In **Section B**, **Question 3** was a slightly more popular choice than the other optional questions. Candidates used the data provided very well in **Question 3** and **Question 4**, but the data could have been interpreted further in **Question 5**. The responses where candidates were selective on the content covered and chose information that supported the question were more successful than those who wrote a broad and general response on the subject which was not directed to the question asked.

Comments on specific questions

Section A

Question 1

- (a) (i) Many correct responses were given with candidates able to correctly describe weathering as the breakdown of rocks and some developed their answer further to say this occurred in situ. Unsuccessful answers often did not mention rocks and wrote generally about a surface.
- (ii) Some good responses to this question included a clear contrast between chemical weathering involving a chemical reaction and physical weathering as there being no reaction and that the rock was being broken down into smaller pieces.
- (iii) Many candidates were able to use the information provided to identify rock fall. Some candidates needed to look carefully at the descriptions such as a curved surface linking to rotational slumping. The slow movement of soil during wet and dry conditions was often classified as solifluction rather than soil creep.
- (b) (i) This question was usually answered well. The majority of candidates were confident in extracting information from the given text and writing it as stages in a sequence of events; almost all candidates discussed the ice melting at the top of the volcano due to increasing temperatures and many candidates then went on to discuss the high energy flow of water which was able to transport sediment and debris.

- (ii) Many responses to this question included the identification of two early warning signs which could indicate an eruption happening soon. Some candidates went on to effectively explain what these signs meant by discussing the tremors relating to magma moving within the volcano and that the steam and gas was associated with higher heat flow or gases being released from solution when the pressure is reduced.
- (iii) Most candidates were able to suggest two or more reasons why the people were reluctant to leave their homes. Many discussed the fact that they had nowhere to go, no transport options or potential loss of livelihood. Some responses discussed the farming quality on volcanic slopes, which would answer why people would move there but not why they might not have left.
- (iv) Stronger answers were characterised by candidates using what they had found out from Fig. 1.3 and linking it to their knowledge of volcanic hazards. Candidates described the layout of the hazard on the map and linked it to how the hazard may have moved, for example the lava flow was close to the peak as it cooled and crystallised rapidly before travelling far, the ash was carried in the air further from the peak. Very few candidates used the scale on the map to quantitatively describe the expanse of each hazard; this information could have been used to support more descriptive answers.

Question 2

- (a) (i) Many candidates were able to correctly name the Troposphere, common incorrect answers included the lithosphere and asthenosphere.
 - (ii) Many candidates made effective use of the data provided in the graph to describe the temperature condition in each atmospheric zone. Some candidates could have improved their response by checking the scale and noting where positive and negative temperatures were.
 - (iii) Few candidates were able to answer this clearly with the majority describing air pressure as increasing with altitude and trying to explain this by relating to temperature. Candidates who answered well discussed the trend that air pressure would decrease as altitude increased and that air was compressible, including the point that as you increase in altitude there is less air.
 - (iv) Few candidates were able to name ultraviolet or UV as the type of radiation absorbed by the ozone layer. Many candidates wrote sunlight and many left this question blank.
 - (v) There were many examples where candidates were not able to name UV in **Question 2(a)(iv)** but were able to give two examples of risk from this type of radiation. Many stated that skin cancer would be a risk with some responses mentioning sunburn, cataracts or loss of sight.
 - (vi) Many candidates found this question challenging with few able to link CFCs to damage to the ozone layer. Those who mentioned CFCs often stopped at that point without developing further and many others went on to discuss the greenhouse effect. Many options could be considered by candidates including the recycling of products containing CFCs, international collaboration, monitoring with satellites and researching alternatives.
- (b) Candidates answered this question very well and virtually all were able to select information from the diagram and then develop the strategy with an explanation on how this would work by either absorbing noise or reflecting sound away. Some candidates were able to add other examples of methods to manage noise beyond what was suggested in **Fig. 2.2**.

Section B

Question 3

- (a) **Fig. 3.1** provided data on the speed of seismic waves with relation to depth below the Earth's surface that candidates were able to use together with a section through the Earth to explain the evidence of the internal structure of the Earth. Many candidates used a range of trends from the graph to link to structure, often identifying the boundary between the core and mantle as corresponding with a significant drop in both P and S wave velocity. These candidates linked the change in physical properties from the solid mantle to the liquid outer core. Many candidates also noted the change in velocity associated with the boundary between the crust and mantle and the inner and outer core boundary. Some candidates could have developed their answer further by

considering the complex pattern near the Earth's surface which links to the property change between the lithosphere and asthenosphere and also by explaining why the property changes cause the velocity changes in seismic waves.

- (b) Candidates wrote some excellent extended responses to this question with a reflection on a range of earthquake case studies from contrasting parts of the world. Well-structured answers considered preparations which could happen before an earthquake, then measures to put in place as a response to an earthquake such as rescue strategies. Finally, they considered how a location could be rebuilt following a major earthquake. Candidates contrasted how these measures may look in MEDCs and LEDCs supported by case studies. The weakest responses often only briefly considered hazards in a very general way without focussing on earthquakes in particular and without using any examples.

Question 4

- (a) Candidates described the patterns seen in the two maps very well, noting areas with higher or lower population density and areas where the risk from hazards were significant. Some responses attempted to explain these patterns by discussing that the hurricane hazard would be high in the South East corner of Africa and that the risk would decrease by moving inland. Candidates did not note the shape of the sinuous hazard area in North East Africa and link it to where the River Nile would flow and possibly flood. Few candidates mentioned that risks such as landslides would likely be found in mountainous areas or in river valleys. Some candidates discussed the large areas of unknown risk and linked this to countries being LEDCs that may not have the funds to carry out the risk assessments.
- (b) Some responses met many of the requirements of this question by providing a balanced and carefully considered discussion on the rights of countries to produce pollution and its links to development and progress. Some candidates developed their answers by including that as countries developed further, they may become more environmentally aware and therefore the pollution levels may fall. To improve answers candidates could consider the nature of each pollutant from **Key Question 3 of The Lithosphere** section of the specification. Candidates may include how CFCs are stable and transported globally in the atmosphere with consequences that impact on everyone, whereas ground level ozone impacts the people and environment close to where the pollutant is formed. Carbon dioxide emissions could be discussed, being produced in large quantities by many countries and the resulting enhanced greenhouse effect that impacts all countries regardless of whether they contributed to the emissions. Discussing pollutants specifically and supporting these ideas with examples would give candidates the opportunity to use a range of subject specific vocabulary.

Question 5

- (a) Many candidates were able to describe methods in which scientists could gather data, discussing examples such as using satellite data, investigating temperature variation or composition of the atmosphere. Candidates could improve their answers by understanding what a scientist's level of confidence meant; this was often misunderstood by candidates thinking it was the level of damage to an environment rather than whether scientists had data to show that damage was due to climate change.
- (b) Candidates were confident in knowing what a National Park is and its role in a sustainable future and many discussed the importance of the parks and the research that is carried out. Most candidates supported their discussion by using one or two examples of National Parks, the strongest answers using a range of examples to demonstrate different points. The discussion on the conflicts that exist within National Parks was less well developed in many cases. This was often limited to animals' habitats and humans entering these habitats. Candidates had the opportunity here to gain further credit by, for example, discussing conflicts between farming occurring within or on the margins of a National Park with the traditional hunting grounds being near parks. The conflicts between tourists bringing funds with the demand for hotels, transportation and food could also be discussed. As locations become more overcrowded National Parks may be threatened for building housing developments.

ENVIRONMENTAL MANAGEMENT

Paper 8291/21
Paper 21

Key messages

- Candidates need to be aware of the equal balance between **Section A** and **Section B** of the paper and plan their time and answers accordingly.
- In **Section A**, candidates should note the number of marks available for each part question and write their answers accordingly. This would give them an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates need to clearly understand the differences in meaning of command words such as state, suggest, explain, describe, identify and assess.
- It is important that candidates are able to apply an understanding of a principle to a novel situation such as the principles of food chains and webs to any given example.
- Candidates should avoid repeating the question in their answer to make best use of the time available in the examination.

General comments

There was a reasonably good response to all questions on this paper and performance was relatively even across the two sections of the paper. Topics which were found to be most challenging were the explanation of desertification and the advantages of storing water in reservoirs. A significant number of candidates had difficulty describing changes to a food web.

Many answers showed a good understanding of terms and attention to detail, with effective use of exemplar material.

The more successful responses included effective use of appropriate examples to illustrate key points along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

- (a) (i) This was generally well-answered. Some candidates referred to aspects of the weather or climate rather than specific abiotic factors such as water and temperature.
- (ii) Answers tended to be quite generalised rather than selecting a single abiotic factor as required and developing an explanation.
- (iii) Most were able to identify the thick, dry horizon over parent rock.
- (b) (i) Plants were often referred to as primary consumers. Weaker answers did not use the terms primary and secondary.
- (ii) Successful candidates were able to describe the likely changes in the food web, such as a decrease in scorpions due to loss of food source. The most common misunderstanding was to describe what might have caused the loss of the insects rather than the effect of this loss.

- (iii) The answer required was top predator/hawk/desert foxes or a correct count of the levels (5). The most common error was to state tertiary consumer.
- (iv) Most candidates correctly identified decomposers.
- (v) A generally well-answered question, with most candidates having an understanding of the activities. Credit was lost through not developing the description and simply stating global warming without describing the causes, or deforestation without the effects. Stronger responses developed the detail for each suggested activity.
- (vi) The most popular answer was increasing population with reference to increased urbanisation.

Question 2

- (a) (i) In general, interpretation of the pie charts was good and the use of water generally well understood.
- (ii) This was generally well answered.
- (b) (i) The concept of the Colorado river drainage basin was poorly understood. Some weaker responses suggested that it was actually a man-made structure, and that the basin drained the rivers rather than drained into the rivers. Popular answers referred to the dams and the effects of the proximity of Las Vegas. Weaker answers often lacked development.
- (ii) There were few good responses and candidates did not refer to pipelines, education, water-saving strategies or water transfer schemes. Those who gave a strategy often did not go on to develop the explanation. The most common suggestion was reservoirs.
- (iii) Candidates gave stronger responses for disadvantages than advantages. Weaker answers focused on the potential for water to become poisoned or infected with bacteria and the risk of the dam bursting. More successful candidates understood the cost of building and maintenance and the effect on the environment.

Section B

Question 3

- (a) Candidates focused on the possible causes of the loss of sea ice in the Arctic and gave detailed descriptions of global warming. Fewer responses followed this with the effects such as reduced ice, changes in traditional shipping routes, potential for loss of habitat or the spread of diseases.
- (b) Answers often reflected a poor understanding of the purpose behind the international protocols, referred to Kyoto in passing without any details and did not refer to any other examples. More successful answers showed some understanding of the challenges faced in reaching agreement, the purpose and intent behind the discussions and the difficulty of monitoring them. The use of named examples was infrequently seen.

Question 4

- (a) Candidates found it difficult to suggest more than one advantage and disadvantage and often these were not developed or explained. Weaker answers referred to the transfer as being between countries rather than areas of China.
- (b) Although the supply of safe drinking water was understood there was only a small range of strategies described, suggestions being limited to reservoirs and desalination treatment. More successful responses provided examples of countries at different levels of income and contrasted the issues facing them with examples of water treatment.

Question 5

- (a) Candidates found it difficult to correctly explain the stages of succession. Some choices of habitat were made without any real knowledge of the possible succession stages e.g. coral reef. Weaker responses described the diagram rather than the succession. Some described the germination and growth of a seed into a tree.
- (b) Many responses described political and economic factors as separate unconnected entities with separation into discrete paragraphs. More successful answers were able to demonstrate the links between the two factors. Candidates supplied few examples of conservation strategies to support their answers. Successful candidates used named examples of conservation strategies and explained how political and economic factors affected the success of the strategy.

ENVIRONMENTAL MANAGEMENT

Paper 8291/22
Paper 22

Key messages

- Candidates need to be aware of the equal balance between **Section A** and **Section B** of the paper and plan their time and answers accordingly.
- In **Section A**, candidates should note the number of marks available for each part question and write their answers accordingly. This will give them an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates need to clearly understand the differences in meaning of command words such as state, suggest, explain, describe, name and assess.
- It is important that candidates are able to apply an understanding of a principle to a novel situation, such as the principles of food chains and webs to any given example.
- Candidates should avoid repeating the question in their answer to make best use of the time available. When asked to show working for calculations, it is advisable to do so as marks may still be obtained even if the final answer is incorrect.

General comments

There was a reasonably good response to all questions on this paper and performance was relatively even across the two sections. Topics which were found to be most challenging were the explanation of the shape of a pyramid of biomass and the reasons why a local hydrological cycle is not a closed system. In **Question 1(a)(v)**, a significant number of candidates had difficulty stating which biome had the highest net primary productivity.

Many answers showed a good understanding of terms and attention to detail, with effective use of exemplar material.

The more successful responses included effective use of appropriate examples to illustrate key points along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

- (a) (i) This question was generally well answered.
- (ii) A good understanding of gross and net primary production was shown.
- (iii) There was good understanding of abiotic factors.
- (iv) Most candidates were able to name photosynthesis.
- (v) Candidates supplied a range of biomes and a minority were able to give the correct answer, the tropical rainforest. None suggested swamps, estuaries or marshes.
- (b)(i) This was generally well answered.

- (ii) Candidates were able to describe what a pyramid of biomass shows. Weaker answers referred to the species and described the feeding relationship; more successful ones referred to energy flow.
 - (iii) Weaker answers described the shape rather than explained the shape through energy loss.
 - (iv) Generally, candidates showed a good understanding of the effects of a change in the food chain.
- (c) (i) Generally, candidates were able to describe or name the process of absorption.
- (ii) This question elicited good, well-expressed answers. Weaker responses missed the link to stores and flows.

Question 2

- (a) (i) This was generally well answered with the ocean the correct answer.
- (ii) Some candidates missed the 12.7 box labelled atmosphere, whilst others did not select enough numbers. Candidates should show their working because credit can still be gained from the process.
 - (iii) Some candidates found this concept difficult. Some mentioned evaporation or cloud formation but needed to go on to refer to movement away from the area. Flows of rivers into and out of the area were better described. Some candidates did not show understanding of the concept of a drainage basin.
 - (iv) Generally, a good range of examples of human influence were given.
- (b) (i) This was generally well answered with candidates showing a good understanding of the causes of rising sea levels. Weaker responses referred to melting ice and global warming without providing the causes of these phenomena.
- (ii) A good range of responses were seen. Some impractical suggestions were given such as digging channels to take the water back to the sea.

Section B

Question 3

- (a) Candidates who chose this question were often unable to clearly describe the different farming methods shown or describe many effects on local habitats. Most popular descriptions were of land clearance and some loss of habitat. Methods such as loss of fertility of soils, reduction of available water as land becomes more arid, soil compacted by machinery and soil fertility maintained artificially leading to problems such as eutrophication of water resources, were not described.
- (b) Answers were generally weak with candidates providing an example of each economy but only describing generalised differences such as not being able to afford machinery. The more successful answers touched on some differences such as quality of seed and fertilisers but lacked depth in the explanations.

Question 4

- (a) Few candidates referred to the data in the chart. Those who did were able to describe the relationship between low income economies, population and the problems posed by aridity leading to more successful responses. Answers used examples such as the Aral Sea.
- (b) There were a few reasonable answers which used a range of examples and referred to a variety of strategies. Weaker responses were limited to reference to reservoirs and desalination plants. More successful answers developed each example and contrasted the issues in both economies.

Question 5

- (a) This was generally well answered. Weaker responses were limited to temperature and precipitation and simply described the graph. More successful responses used explanations of the effects of these factors and other abiotic factors in creating the individual biomes.
- (b) Responses were most often good and candidates demonstrated an understanding of the various methods of conservation and were able to assess relative successes. Less successful answers did not use a very wide range of examples or provide much depth of description. There was a good use of named examples.

ENVIRONMENTAL MANAGEMENT

Paper 8291/23
Paper 23

Key messages

- Candidates need to be aware of the equal balance between **Section A** and **Section B** of the paper and plan their time and answers accordingly.
- In **Section A**, candidates should note the number of marks available for each part question and write their answers accordingly. This would give them an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates need to clearly understand the differences in meaning of command words such as state, suggest, explain, describe, identify and assess.
- It is important that candidates are able to apply an understanding of a principle to a novel situation such as the principles of food chains and webs to any given example.
- Candidates should avoid repeating the question in their answer to make best use of the time available in the examination.

General comments

There was a reasonably good response to all questions on this paper and performance was relatively even across the two sections of the paper. Topics which were found to be most challenging were the explanation of desertification and the advantages of storing water in reservoirs. A significant number of candidates had difficulty describing changes to a food web.

Many answers showed a good understanding of terms and attention to detail, with effective use of exemplar material.

The more successful responses included effective use of appropriate examples to illustrate key points along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

- (a) (i) This was generally well-answered. Some candidates referred to aspects of the weather or climate rather than specific abiotic factors such as water and temperature.
- (ii) Answers tended to be quite generalised rather than selecting a single abiotic factor as required and developing an explanation.
- (iii) Most were able to identify the thick, dry horizon over parent rock.
- (b) (i) Plants were often referred to as primary consumers. Weaker answers did not use the terms primary and secondary.
- (ii) Successful candidates were able to describe the likely changes in the food web, such as a decrease in scorpions due to loss of food source. The most common misunderstanding was to describe what might have caused the loss of the insects rather than the effect of this loss.

- (iii) The answer required was top predator/hawk/desert foxes or a correct count of the levels (5). The most common error was to state tertiary consumer.
- (iv) Most candidates correctly identified decomposers.
- (v) A generally well-answered question, with most candidates having an understanding of the activities. Credit was lost through not developing the description and simply stating global warming without describing the causes, or deforestation without the effects. Stronger responses developed the detail for each suggested activity.
- (vi) The most popular answer was increasing population with reference to increased urbanisation.

Question 2

- (a) (i) In general, interpretation of the pie charts was good and the use of water generally well understood.
- (ii) This was generally well answered.
- (b) (i) The concept of the Colorado river drainage basin was poorly understood. Some weaker responses suggested that it was actually a man-made structure, and that the basin drained the rivers rather than drained into the rivers. Popular answers referred to the dams and the effects of the proximity of Las Vegas. Weaker answers often lacked development.
- (ii) There were few good responses and candidates did not refer to pipelines, education, water-saving strategies or water transfer schemes. Those who gave a strategy often did not go on to develop the explanation. The most common suggestion was reservoirs.
- (iii) Candidates gave stronger responses for disadvantages than advantages. Weaker answers focused on the potential for water to become poisoned or infected with bacteria and the risk of the dam bursting. More successful candidates understood the cost of building and maintenance and the effect on the environment.

Section B

Question 3

- (a) Candidates focused on the possible causes of the loss of sea ice in the Arctic and gave detailed descriptions of global warming. Fewer responses followed this with the effects such as reduced ice, changes in traditional shipping routes, potential for loss of habitat or the spread of diseases.
- (b) Answers often reflected a poor understanding of the purpose behind the international protocols, referred to Kyoto in passing without any details and did not refer to any other examples. More successful answers showed some understanding of the challenges faced in reaching agreement, the purpose and intent behind the discussions and the difficulty of monitoring them. The use of named examples was infrequently seen.

Question 4

- (a) Candidates found it difficult to suggest more than one advantage and disadvantage and often these were not developed or explained. Weaker answers referred to the transfer as being between countries rather than areas of China.
- (b) Although the supply of safe drinking water was understood there was only a small range of strategies described, suggestions being limited to reservoirs and desalination treatment. More successful responses provided examples of countries at different levels of income and contrasted the issues facing them with examples of water treatment.

Question 5

- (a) Candidates found it difficult to correctly explain the stages of succession. Some choices of habitat were made without any real knowledge of the possible succession stages e.g. coral reef. Weaker responses described the diagram rather than the succession. Some described the germination and growth of a seed into a tree.
- (b) Many responses described political and economic factors as separate unconnected entities with separation into discrete paragraphs. More successful answers were able to demonstrate the links between the two factors. Candidates supplied few examples of conservation strategies to support their answers. Successful candidates used named examples of conservation strategies and explained how political and economic factors affected the success of the strategy.

ENVIRONMENTAL MANAGEMENT

Paper 8291/03
Centre-based Assessment

This year's report falls into two sections:

- general comments and candidate performance report
- three appendices covering Cambridge Assessment administrative procedures.

General comments

The level of credit achieved varied across almost the full range available; most scripts were in the upper part of the range. Candidates selecting the same or a similar topic evidenced independent data processing and reporting skills and there appeared no issue of plagiarism, demonstrating that candidates had been given good individual guidance in this respect.

There were a number of candidate reports that achieved very high levels of credit; these demonstrated an excellent approach to the organisation and structuring of projects, whilst at the same time providing strong evidence of collected and collated primary data, often combining this with secondary data sources. Generally, where full credit was not achieved, this was due to not showing use of an appropriate data analysis statistical tool, or not providing a clear and reflective evaluation of the investigation, i.e. strengths or weaknesses of the study in terms of their executed methodology.

A significant number of the higher achieving candidates clearly demonstrated the ability to balance and combine secondary data in support of their primary data when discussing and forming conclusions to their study. This led to very rigorous reports overall.

High achieving candidates most often submitted detailed sources of references in support of their environmental proposals and also submitted a detailed and considered methodology in their outline proposal form prior to undertaking the investigation.

Other issues were as follows:

- There was commonly some leniency, particularly in assessment criteria C2(a), (b) and (e) and C3(a) and (b); additional credit was awarded where the work did not show the required level of skill.
- Credit was, in some cases, given for criteria not actually present in project reports, e.g. no credit can be awarded for use of a statistical tool when one has not been used, nor can full credit be given for conclusions that do not relate to the candidate's specific data.
- Where projects tended to rely on secondary data only, reports could be overly long at times and extend beyond the syllabus word count. Candidates need to take care to provide a clear and concise report that aligns with criteria C2(c) and C2(d).

There were many project reports demonstrating an excellent approach towards organisation and structuring of the coursework in a logical order: introduction, methods (justified), results and analysis, conclusions and evaluations, and many used these stages as section or chapter headings. However, candidates and centres must be able to clearly recognise the difference between a research report and an extended essay, given the range of assessment criteria, and importantly criterion C2(c).

Candidates should carefully consider each of the following:

- Will my hypothesis or question 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?

For administration purposes, it is important that the correct mark from the Coursework Assessment Summary Form has been entered correctly on the MS1 form for each candidate; this should be a mark out of 40.

Comments on assessment criteria

Skill C1

Most candidates performed well in this skill area, and there was often an excellent level of detail demonstrated surrounding the background knowledge in relation to the hypothesis or research question.

Either as the project title or as part of an introduction, hypotheses or questions were stated by most candidates, frequently being clearly written and not implicit to the introduction. This is important as a significant number of candidates concluded that their hypothesis was correct, yet there was no evidence anywhere in the script of a research question or hypothesis. High achieving candidates often included the location of the hypothesis within a contents page.

Candidates, in the main, adequately stated and justified a methodology. Good quality research requires the formulation of a plan detailing research sites, equipment, expected data and how it will be collated and presented. Candidates need to recognise that a detailed methodology is crucial when testing their hypothesis or answering their research question; without this element, there is the risk that the report will become an extended essay, thereby interfering with the achievement of C2 criteria.

Where candidates produced reports that had a limited methodology, which was often a brief list without any explanation or justification, it can be difficult to judge whether or not their methodology would be effective in testing their hypothesis or answering their question. Candidates should not rely on the assumptions of an assessor in this aspect, C1(c).

Skill C2

To achieve full credit for C2(a), candidates need to make sure all graphs and tables are clearly presented. This includes labelling all axes as well as providing a title. Graphs were sometimes inappropriate for the type of data to be represented; line graphs are suited to continuous data and bar graphs for discrete data. Graphs should have axes containing labelled units and both lines and bars should be easily interpreted.

There were a limited number of candidate reports that would be better described as extended essays and contained very little data presented in the form of graphs and/or tables. As a result, it was difficult for candidates to achieve credit in any criteria that required reference to data; this also negated the use of a statistical tool. Often, these reports were heavily reliant upon photographic evidence with a limited amount or no quantitative data provided. This factor reduced the credit available for the associated criteria. It is better that photographic evidence supplements other forms of information.

The use of a statistical tool was a weakness for some. There is a difference between statistical methods that are used to describe data and statistical tools that are used to analyse data. Candidates need to consider the nature of the data and select an appropriate statistical test. A simple mean is unlikely to yield appropriate analysis unless it is backed up with graphical representation and/or further processing. Some centres awarded credit for C2(e) when there was no evidence at all of a statistical tool.

The majority of candidates deserved full credit for the general organisation of their work and the quality of written communication.

Skill C3

This skill frequently formed the weakest part of a candidate's work. The main weakness in C3(a), the conclusion, was a lack of reference to the data presented in the report. C3(b) was also often very limited, as only a small number of candidates referred to related environmental management principles, without which full credit cannot be awarded. This element also needs reference to the actual data within the report.

The evaluation needs to be a brief summary of those things that went well and not so well, i.e. success and limitations. There was still confusion between an evaluation and a conclusion. Some candidates evaluated their secondary data, instead of appraising their methodology (success and limitations of the methodology). A relatively small number did not include an evaluation for criterion C3(c).

Concluding comments

The evidence with regard to candidate report submissions demonstrated a clear and enthusiastic engagement with this element of the Environmental Management syllabus, in which candidates are given the opportunity to research a topic of their choice. The selection of topics was excellent and continued to focus on some very key and current environmental issues at a local level, such as the issue of plastic waste, or issues of water pollution in relation to excessive fertiliser application, to name a few.

The project title must be chosen very carefully, as a significant number tried to review global data (often in relation to climate change), which is extremely challenging given the assessment criteria and word count. Often the title can be too broad in scope, thereby limiting the testing of the hypothesis effectively. Occasionally, more than one hypothesis was evidenced, and candidates need to be aware that this may also have an impact in respect of their methodology being able to securely test all hypotheses. Close guidance is needed at the project proposal stage.

In addition to the topic chosen, there is the opportunity to learn some research techniques and put them into practice during completion of the assessment. The stronger topics and final reports were often derived from locally based research and the utilisation of primary data.

Appendix 1 is concerned with how centres select their sample for external moderation. Most importantly, it is not necessary for centres with over ten candidates to send all candidates, although extra can be requested by the external Moderator.

Option	Details
<p>Option A: The centre selected sample.</p> <p>It is essential that the marks of candidates from different teaching groups within each centre are moderated internally and the moderated mark out of 40 is entered onto the MS1, Candidate Record Card and Coursework Assessment Summary Form.</p>	<p>You select the sample, according to the criteria below:</p> <ul style="list-style-type: none"> • 1–10 entries: all candidates • 11–50 entries: 10 candidates • 51–100 entries: 15 candidates • 101–200 entries: 20 candidates • Over 200 entries: 10% of candidates <p>The sample should include a candidate with the highest mark and a candidate with the lowest mark in the cohort, with the remaining candidates spread evenly across the mark range. All work which contributed to the candidate's final mark must be included.</p> <p>If more than one teacher has assessed the work, the sample should include an even number of examples of the marking of each teacher.</p> <p>The sample must be sent using a method that provides a tracking facility (i.e. a reputable courier), to arrive by the deadline specified. We reserve the right to request additional samples.</p>

Appendix 2

All centres must submit the following completed forms with their sample:

- An Individual Candidate Record Card for each candidate with a mark out of 20 doubled to out of 40. Comments should be made so that the external Moderator can clearly determine where and why credit has been given.
- A Coursework Assessment Summary Form with candidates inserted in candidate number order as in the MS1.
- A MS1 form covering all candidates entered for the examination. Marks out of 40 should be clearly entered and absent candidates given abs or A.

The syllabus contains a detailed amplification of these points.

Appendix 3

For the May/June session centre marks should be submitted by 30th April and the sample should be dispatched at the same time. Therefore, all sample reports should be with Cambridge Assessment no later than 14th May.

For the November session all marks should be submitted by 31st October and the report at the same time so that they are with Cambridge Assessment no later than 14th November.