

ENVIRONMENTAL MANAGEMENT

Paper 0680/11
Paper 1 Theory

Key messages

- Candidates should be precise in their answers and avoid generalities (such as 'pollution').
- Candidates should make use of key scientific terms where appropriate.
- Answers should link to the command verbs within the question (describe, explain etc.).
- Numerical responses should be calculated to a similar level of accuracy to the source data.

General comments

The majority of candidates attempted all questions on the paper. This strategy may enable weaker candidates to gain some credit for their responses even if their answers are incomplete. Candidates should use the maximum number of marks a question can award as a guide to the number of points they need to make in their responses. Similarly, they should ensure they understand the importance of the command words such as 'describe' or 'explain' as these provide key information about the style of response required. Some questions also required the answer to be tailored to a specific context. This could have been acknowledged further within some answers to maximise the credit awarded.

There was generally a high standard of punctuation and spelling and candidates were well prepared for the style of questions presented to them, although there was some uncertainty about some topics such as the order of the processes of eutrophication as seen in **Question 1**.

The responses to the six mark, level of response question generally showed some familiarity amongst candidates with the requirements. Responses should consider a range of points and support them with examples where relevant. Candidates should also ensure that their response includes a clear conclusion.

Comments on specific questions

Section A

Question 1

- (a) Eutrophication was clearly a familiar topic to most candidates and the majority of responses achieved some of the credit available.
- (b) Stronger candidates were able to provide a description of the term bioaccumulation, often linking it to the food chain. In some cases, weaker candidates needed to avoid using the word 'accumulate' in their answers and give an alternative term to describe its meaning.

Question 2

- (a) Most candidates were prepared and were able to state an example of a sedimentary rock.
- (b) This question was attempted by most candidates and the majority of responses provided the detail required and were given credit as a result. A few responses were too generic, such as simply stating the term 'pollution'.

- (c) The majority of responses identified at least one way in which the quarry benefits the local community. A few incorrectly described potential uses for damaged land after extraction had finished which was not required in this particular question.

Question 3

- (a) This topic was less well understood by some candidates. The pattern of major currents already present within the map needed to be followed. A significant number of candidates omitted to complete this question and did not draw on the map.
- (b) Many candidates showed some knowledge and were given some credit for this question. It was clear that this was a challenging topic for many and the impact of El Niño was not fully understood.

Question 4

- (a) A significant number of candidates were able to name two distinct causes of deforestation, many naming farming or logging as being major causes.
- (b) The majority of candidates were able to interpret the food chain and name the producer.
- (c) Candidates often had difficulty in explaining why forests should not be cut down. Many understood there was a link to photosynthesis and needed to go on to explain that trees act as a carbon store. Some others mentioned the impact on habitats or food chains which was included within the question.

Section B

Question 5

- (a) (i) The causes of soil erosion were widely known and many described valid reasons for the loss of trees. Some responses missed gaining the credit available by giving reasons that were not natural causes, such as overgrazing by farm animals.
- (ii) Many candidates were able to suggest three distinct strategies to reduce soil erosion, often linked to the planting of trees to increase soil retention by roots or to act as a windbreak.
- (b) (i) Most candidates were able to use the data in the graph to complete the table, although a few weaker responses applied the converse of the expected answer.
- (ii) The analysis of the data to write a conclusion proved far more challenging. Stronger candidates were able to communicate that the optimum was at pH 6.0 and describe the effects either side of this value. A common error was to confuse acid and alkaline soils.
- (iii) The impact of soil pH on nutrient availability was poorly understood and many responses simply identified that a soil might be too acid or alkaline.
- (iv) A wide range of answers were given credit including references to the level of organic matter, mineral ions and air or water content. Some stronger candidates also referenced the presence of soil organisms which are essential to a healthy soil.

Question 6

- (a) (i) Candidates were required to provide an explanation of the pattern of the earthquakes that had been plotted on the map. Many did not follow the instruction signified by the command verb 'explain' and merely described the distribution and not the reasons for it.
- (ii) This question proved to be less challenging and most candidates drew arrows in the correct directions. There were a small number of who did not complete this question.
- (b) (i) This question provided candidates with a large amount of data to use to help shape their responses. Successful candidates developed this information using their knowledge rather than simply rewrote the facts given. The best responses compared the longer-term effects with the damage caused in the short term and gave specific examples.

- (ii) Stimulus material was provided to assist the candidate. Those responses that limited their answers to the quotes without interpretation achieved less credit. Higher achieving candidates were able to use their existing knowledge and these comments to form a valid and reasoned opinion.

Question 7

- (a) Candidates were required to describe the distribution of the human population. Most responses showed a good understanding with a high number of candidates achieving full credit. Common errors included not naming both North and South America. Some candidates referred to population density which is not shown on the map.
- (b)(i) Candidates were generally confident in accessing the graph to find the relevant value of 210.
- (ii) Most candidates were able to successfully complete the percentage calculation and provide an answer to a suitable number of significant figures. Appropriate rounding of the answer was also credited. Answer: 9.63.
- (c) While there are many reasons why a population might decrease, not all are relevant to an MEDC. Candidates were required to apply their knowledge to this specific situation.
- (d) Candidates were again required to apply their knowledge to a specific situation. The majority were able to interpret the population pyramids and conclude that there was predicted to be a smaller working population. Fewer were able to identify what this might mean in terms of the economy and implications for the care of a larger population of older people.
- (e) Most candidates showed confidence in describing a strategy to increase the birth rate and were able to give specific answers that gained credit.
- (f) Candidates found providing a suitable definition of 'carrying capacity' reasonably complex. Whilst many understood the limitation of population size, many did not link this to the ability of the environment to sustain the population.

Question 8

- (a) Most candidates were confident in attempting to plot the data provided. Whilst this was largely successful, there were a few examples of inaccurate plotting or the use of the incorrect information, showing the need to read the question carefully. Candidates should remember to label the axes and use an appropriate scale. Plotted bars should occupy at least half of the printed graph paper.
- (b)(i) Most candidates attempted the calculation. The most common error was in providing a suitable number of significant figures. Answer: 3170.
- (ii) A good proportion of responses correctly identified that the number of large marine oil spills was decreasing over time. Fewer used the other information in the table to also identify a reduction in the total mass of oil spilt.
- (c) This question required candidates to describe strategies to prevent oil spills. Many identified the role of double hulled ships and the role of improved navigation systems. A few also described methods to clean up a spill, which did not answer this specific question.
- (d)(i) Few candidates had difficulty in naming two oil tankers causing the largest spills. There was good understanding of the information provided.
- (ii) The majority of candidates were confident in providing impacts of oil on the marine ecosystem, although there was some confusion in the role of oil in preventing gas exchange.

Question 9

- (a) The majority of candidates were successful in calculating the sea level rise to be 29.7 mm. If the candidate incorrectly calculated the timescale, credit was still available for the additional correct calculation if the candidate showed their working.

- (b) This question was accessible to most candidates who had an understanding of the impacts of climate change.
- (c) Whilst some candidates wrote extensively on this question, more concise responses also gained full credit for identification of the process of combustion of a fossil fuel.
- (d) A six mark, level of response question, allowing a range of potential answers and providing the opportunity for candidates to demonstrate their broader knowledge about the topic. The strongest responses provided a balanced view, identifying the role of trees in combating climate change and also the need for the development of timber products, extraction of raw materials and other land uses. Some responses gave a good focus to other methods of reducing climate change such as the use of renewable energy.

Weaker candidates often provided only a limited response or used generic phrasing without contextualisation.

There was evidence in some stronger scripts of good planning of responses prior to candidates starting to write their final answer. This helped provide a logical structure to these responses that maximised the credit awardable.

ENVIRONMENTAL MANAGEMENT

Paper 0680/12

Paper 1 Theory

Key messages

- Candidates should be precise in their answers and avoid generalities (such as 'pollution').
- Many responses could have been improved with greater accurate use of key scientific terms.
- Answers should link to the command verbs within the question (describe, explain etc.).
- Numerical responses should be calculated to a similar level of accuracy to the source data.
- If the question asks for a trend, the general trend from the information should be given. This can be exemplified by using the data.
- When drawing graphs, candidates should ensure that each axis is labelled and units are provided. A suitable linear scale should be drawn which uses at least half the area of the graph paper.

General comments

The majority of candidates attempted all questions on the paper. This strategy is effective as it may enable weaker responses to gain some credit even if answers are incomplete. Candidates should be aware of the importance of the command words such as 'describe' or 'explain' as these will provide key information about the style of response required. Some questions also required the answer to be tailored to a specific context. This was sometimes not acknowledged within the answer provided by the candidates.

Whilst many candidates were able to answer each question, there were still opportunities to be more precise with detail and, where needed, specific examples. This was particularly important for the six mark, level of response question. Evidence of preparation was clear in many scripts, although candidates should be aware they need to consider a range of points and ensure that their response includes a clear conclusion.

Questions involving calculations showed good engagement. It is important to show relevant working as some credit may be awarded even if there is an arithmetic error within the final answer. Candidates should be aware of the level of accuracy provided within any data they use and reflect this within their final answer. This may mean rounding up or down if appropriate.

Comments on specific questions

Section A

Question 1

- (a) An accessible first question to the paper; most candidates achieved full credit, a few incorrectly matched oxygen and carbon dioxide.
- (b) Most candidates were able to correctly identify chlorophyll.
- (c) The majority of responses correctly identified respiration. A small number incorrectly named photosynthesis.
- (d) Candidates found this question more challenging; there were a number of examples where the response omitted to explain why the conditions they had identified would increase crop yield. A common mistake was to say that greenhouses gave plants more sunlight.



Question 2

- (a) A significant number of candidates were able to interpret the photograph correctly and state that this showed an example of a commercial arable farm.
- (b) Many correct responses were seen with candidates naming a wide range of suitable methods for improving yield.
- (c) Slightly more challenging, the cohort generally showed good knowledge of the topic and understood the risk of salinisation. Soil erosion was also commonly mentioned.

Question 3

- (a) This question provided some stimulus information to help shape the candidate's response. Whilst generally completed well, a few candidates misinterpreted the question and explained how effective the poster was in delivering its message.
- (b) Candidates were able to provide relevant suggestions for the reasons why cholera outbreaks are more common in LEDCs. The most frequently seen error was a lack of sufficient detail within an example.

Question 4

- (a) Candidates provided a good range of reasons for high population density in cities, although some misinterpreted the question and gave reasons for a high birth rate. A few responses identified that the reason for high population density was the limited amount of land available with a large population.
- (b) The majority of candidates across the cohort were confidently able to provide two distinct methods for managing population size.

Section B

Question 5

- (a) (i) The photograph was correctly interpreted by the majority of the cohort and a correct answer was given. Very few candidates did not attempt an answer.
- (ii) Although most candidates were aware of the environmental impacts of the mine, often naming air, water or noise pollution, many did not go on to explain the impact. As a result, they did not fully address the question set.
- (iii) Candidates showed awareness of how sedimentary rocks are formed. Very few related their answer specifically to limestone.
- (iv) Candidates showed a good understanding of the variety of factors that affect the decision to open a mine, citing economic and environment factors. Weather or climatic conditions were common misconceptions.
- (b) (i) Most candidates were able to correctly interpret the graph and identify the year as being 2016.
- (ii) Whilst it was clear that most candidates were confident in using the data in the graph, there was often a misreading of the question, causing some to focus upon the trend in cement production or the difference between production and consumption, which limited access to full credit for many.
- (iii) The majority of candidates attempted this calculation and most of these gained full credit for the correct answer of 311.4/311. Where the candidate showed their working, it was possible to award credit if a correct stage in the calculation was given, even if the final answer was incorrect.

Question 6

- (a) (i) Most candidates completed the graph with the additional information given. There were few examples of inaccurate plotting, although candidates were expected to draw a bar of the same width as the others already shown.
- (ii) Candidates showed confidence in using the data to complete this calculation to achieve an answer of 30.
- (b) (i) This question, requiring candidates to interpret information from a map, was completed with varying levels of success. Candidates must refer to compass points rather than right, left, above or below. Similarly, positions should be precise, i.e. West coast of Africa rather than 'around Africa'. A significant number of candidates described areas that do not have major marine fish populations.
- (ii) Candidates were able to name strategies for managing marine fish populations. The command verb 'describe' indicated that the named strategies needed some further development rather than simply naming to gain full credit. This was done with varying degrees of success.

Question 7

- (a) (i) This question was generally handled well and a wide range of plausible reasons for water scarcity were given credit.
- (ii) Candidates made some well-reasoned suggestions for a lack of data within the selected area. Suggestions of an issue with accessibility or a lack of resident population were the most popular responses.
- (b) Impacts of drought were clearly stated by most candidates.
- (c) This slightly longer question required candidates to provide advantages and disadvantages of different methods of supplying water. The majority of candidates who attempted it gave a range of good suggestions, although there were some factual inaccuracies within some of the weaker scripts. Relatively few identified the limitations of bottled water to deal with the range of ways water is used rather than direct consumption.

Question 8

- (a) (i) The calculation was completed correctly by most candidates.
- (ii) Using the data in the table, most correctly identified that diesel engines are causing most harm.
- (iii) In questions such as this, where candidates are required to produce a bar chart from the data provided, the axes must be labelled and units given. Some responses showed difficulty in applying a suitable linear scale. Candidates should commence their scale at zero and use at least half of the graph paper provided.
- (b) Candidates provided some good suggestions as to how governments could encourage the use of electric vehicles. Weaker responses such as 'make laws' were not given credit without a suitable explanation. Most responses contained a balance of taxation, subsidies and increasing awareness.
- (c) Candidates were able to state that carbon dioxide causes global warming. They were often able to identify the problems associated with global warming. However, they had difficulty outlining why reducing carbon dioxide emissions was of global importance. There was also a level of confusion within some scripts, incorrectly attributing carbon dioxide increases to ozone depletion.

Question 9

- (a) Candidates were required to compare nuclear power with fossil fuels. Whilst there were a range of comparisons that could be made, many responses focused on either one or the other, thus were not given credit.
- (b) An appropriate table was successfully completed by most candidates, although there was a range of common errors within the presentation of the data. Candidates should ensure that each column

in the table has a full heading and that units are given in the column heading and not next to each entry in the table, where applicable.

- (c) A question which assessed the implications of the data used by the candidates. This proved to be challenging for many, although stronger candidates provided valid reasons linked to limited supply and the risk to supplies due to political instability. Many had concerns about the danger of exposure to radioactivity.
- (d) A six mark, level of response question, allowing a range of potential answers and allowing the candidate to demonstrate their broader knowledge about the topic. Virtually all candidates attempted this question and there were some comprehensive answers.

Candidates realised that the demand for energy is ever increasing. They also acknowledged that the amount of uranium needed to generate energy is far smaller than if fossil fuels were used. It was widely known that nuclear power stations do not produce carbon dioxide or sulfur dioxide. Candidates were also able to identify problems associated with nuclear power generation. Higher level responses additionally discussed the benefits (and disadvantages) of using renewable energy sources.

ENVIRONMENTAL MANAGEMENT

Paper 0680/13
Paper 1 Theory

Key messages

- Candidates are reminded of the need to be precise in their answers and avoid generalities.
- Answers should link to the command verbs within the question (describe, explain etc.).
- Numerical responses should be calculated to a similar level of accuracy to the source data.
- When drawing graphs, candidates should ensure that each axis is labelled and units are provided. A suitable linear scale should be used which uses at least half the area of the graph paper. In the case of bar charts, drawn bars should be of similar width.
- The six mark, level of response question requires candidates to bring together a range of views and opinions, supported with relevant examples where necessary.

General comments

The majority of candidates attempted all questions on the paper. This strategy may enable weaker responses to gain some credit even if answers are incomplete. Candidates should understand the importance of the command words such as 'describe' or 'explain' as these will provide key information about the style of response required.

Whilst many candidates were able to answer each question, there were still opportunities to be more precise with detail and, where appropriate, include specific examples. This was particularly important to the six mark, level of response question where candidates should also ensure that their answer includes a clear conclusion.

Calculation questions showed good engagement. Candidates should be aware of the level of accuracy provided within any data they use and reflect this within the final answer. This may mean rounding up or down if appropriate.

Where questions provide additional information for the candidate, it is expected that any answer will contain an application of this information rather than simply a restating of it. This approach allows the candidate to demonstrate their knowledge in a less familiar situation.

Comments on specific questions

Section A

Question 1

- (a) The majority of candidates provided a response to this opening question and were able to interpret the diagram. Most described the movement of the plates. Some needed to provide a more complete answer to achieve all of the credit available.
- (b) Candidates understood the impacts of an earthquake on people living near a plate boundary. A few weaker responses needed to give more of a description as the command verb suggested.

Question 2

- (a) (i) Most responses correctly stated the type of policy described as being pronatalist.

- (ii) Most candidates were knowledgeable about alternative strategies to increase the birth rate of a country. A few statements were too vague for credit to be awarded.
- (b) A wide range of potential answers were given credit, although the majority of responses focused on the availability of medicines and health care. Those that mentioned pollution were given credit if there was a suitable context to their statement.

Question 3

- (a) There was significant confusion regarding the chemicals that cause ozone depletion. Many responses confused ozone depletion with global warming and incorrectly named carbon dioxide as an example.
- (b) Most candidates were able to name an impact of ozone depletion. There were very few vague generic phrases (such as 'cancer') and credit was commonly awarded for more accurate descriptions of the likely cancer.
- (c) Many candidates were confident in naming a strategy for reducing ozone depletion. Fewer were able to provide a suitable description, as requested by the command verb in the question. There was some confusion between ozone depletion, climate change and global warming.

Question 4

- (a) Candidates provided good examples of the strategies that could be used to manage fish stocks at sea. There was some confusion regarding net size and mesh size and the impact these would have on the catch. Candidates must make it clear which they are referring to when they use words such as 'larger' or 'smaller'.
- (b)(i) Candidates' knowledge regarding the use of fish farms was well demonstrated, with a good range of potential benefits seen in responses. Many identified the consistency of supply and the opportunity to manage the growth of the fish.
- (ii) While candidates understood the benefits of fish farming, many had greater difficulty in naming a potential problem. Many correctly identified the risk of water pollution from wastes, although some incorrectly suggested that there would be competition with wild fish stocks.

Section B

Question 5

- (a)(i) Candidates needed to compare the composition of two soils. This was managed well and the majority correctly identified that the sandy soil had a larger content of mineral particles.
- (ii) The majority of candidates were able to use the pie charts and identified that the sandy soil had better drainage, and provided reasons either using their knowledge of sandy soils or the information in the chart.
- (iii) Responses showed that candidates understood the fact that organic matter could increase the nutrient content of the soil. Credit was also awarded for answers that correctly linked the organic content to the water holding capacity or increase in air spaces, although these were stated less often.
- (b)(i) The majority of candidates were able to correctly identify the mineral ion as potassium.
- (ii) Whilst more challenging, the majority of candidates were able to calculate the mass from the percentage given and the size of bag provided to obtain an answer of 10 kg.
- (iii) This question proved to be more challenging for many candidates. Whilst it was clear that many were familiar with different formulations, there was some difficulty in clearly stating why. Many understood that crops had different nutritional needs but were unable to provide a second reason.

Question 6

- (a) The question required candidates to complete the sentences with the words provided. This was attempted by most candidates with varying levels of success. The most common error was a lack of understanding of the word 'vector', although most knew that spread is by the female *Anopheles* mosquito.
- (b) It was important that the candidate applied the command verb 'describe' to achieve full credit within this question. Whilst the strategies were familiar, the weakest responses only stated the strategy without any further detail.
- (c) This question proved challenging for many candidates. The material provided in the question was often simply restated without further development, even though the question required the candidate to 'add to the comments'. As a result, these answers were limited in the credit they could achieve. Stronger responses referred to these comments and added additional information or provided a context for the statements, such as the need for food production as well as vector control.

Question 7

- (a) (i) Most responses contained an accurate plotting of the missing data. The bar drawn should be of similar width to those already present in the chart.
- (ii) Candidates were generally confident in completing this calculation and achieved an answer of 26 500. Some needed to pay attention to the accuracy of the data given and apply an appropriate number of significant figures to their response.
- (iii) There was a good general understanding that the numbers of extinctions would increase due to climate change. Weaker candidates were unable to provide further details to gain full credit.
- (iv) Whilst familiar with the role of zoos, some candidates needed to use appropriate scientific language, a lack of which limited the credit achieved.
- (b) (i) Responses were expected to be precise with regards to location in this question requiring candidates to describe a distribution on a map. Answers using terms such as 'North' or 'South' rather than 'above' or 'below' gained most credit.
- (ii) There was limited understanding of the ways in which trees help prevent soil erosion. The most able candidates were successful in describing two distinct mechanisms.
- (iii) Candidates were confident in describing the causes of deforestation.

Question 8

- (a) This question required the plotting of data on to the graph. Candidates should use a logical linear scale and at least half the graph paper provided to plot the points. Common errors were omitting the labelling of the axes and plotting the wrong data set. Most candidates accurately plotted the bars on the grid. Candidates should ensure that the bars drawn are of similar width.
- (b) (i) A small number of candidates omitted this question and did not complete the table. Most who attempted it completed the calculation accurately and added 388.8 to the table.
- (ii) Candidates found it challenging to suggest reasons for the change in energy use. Some incorrectly suggested that other sources had been used. More able candidates gave two distinct reasons such as improved energy efficiency.
- (iii) Relatively few responses achieved full credit on this question. Many missed the amount of time it would take to design and build a new nuclear power station, although many cited the impact of public opinion.
- (c) It was widely understood that energy consumption within MEDCs is greater due to reasons such as improved accessibility, the use of more electrical devices and a higher standard of living.

Question 9

- (a) (i) Most candidates were able to complete the calculation correctly to achieve an answer of 7.75.
- (ii) There was considerable variance in the quality of answers for this question; some were able to provide detailed reasoning as to why it is important that mining is sustainable. Weaker responses often only identified that resources are finite.
- (iii) This question proved more accessible with many candidates able to describe strategies for using minerals sustainably. Greater success was achieved by candidates who responded fully to the command verb 'describe' to write their answer.
- (iv) Candidates were well prepared to answer a question relating to strategies for land restoration.
- (b) A six mark, level of response question, allowing a range of potential answers and providing the opportunity for candidates to demonstrate their broader knowledge about the topic. Virtually all candidates attempted this question and there were some comprehensive answers.

There was considerable variance with regards to conclusions and all were given credit if supported by logical reasoning. The best responses included a range of economic and environmental factors within the answer.

ENVIRONMENTAL MANAGEMENT

Paper 0680/21
Paper 2 Management in Context

Key messages

Candidates should:

- Read each question carefully to make sure they answer the question asked.
- Know how to present line graphs, bar graphs and histograms.
- Use the mark allocations, shown in brackets, and the number of answer lines provided as a guide to the amount of detail needed to answer each question.
- Remember that answers written as bullet points should be whole sentences, not one or two words.
- Read the whole of each question carefully. For instance, when plotting graphs, check whether the type of graph, line or bar, is specified.
- Remember that not all the answers are on lines, check if answers have to be written in a table or on a diagram.
- Show working when completing calculations as credit may be available for the method even if the final answer is incorrect.
- Take into account the command word, mark allocation and the number of answer lines provided for a question before starting to write a response. For instance, a question asking for reasons with an allocation of three marks needs three reasons. A question with the command word 'describe' and three marks requires at least three pieces of information.

General comments

This paper invited candidates to consider environmental issues and methods of gathering and interpreting data in the context of one country, Costa Rica. Many candidates understood and made good use of the source material and their written responses were expressed clearly and effectively. The mathematical and graphical questions posed some difficulties for a minority of candidates.

Candidates had no problems completing the paper in the time available.

Comments on specific questions

Question 1

- (a) (i) Most candidates gained full credit for describing the trend shown in the graph.
- (ii) Most candidates suggested two reasons for the changes in population shown in the graph. Many made effective use of the information about Costa Rica provided at the start of the questions. Pronatalist population policies and migration were also suggested.
- (iii) Most candidates correctly calculated the number of people in Costa Rica living in urban areas in 2019. Some gave the answer as 3 892 200, others as 3.89 million. A minority of candidates gave an answer without the word 'million.'
- (b) (i) Many candidates suggested overcrowding, lack of clean water and poor sanitation as reasons why infectious bacterial diseases can spread quickly in informal urban settlements.

- (ii) Most candidates named either cholera or typhoid as an infectious bacterial disease. Some responses incorrectly named malaria, which is caused by a protozoan parasite. Diseases caused by viruses were not given credit.
 - (iii) Most candidates stated at least one correct reason why people migrate to urban areas from rural areas. The most common correct answers were about employment and access to services, such as education and healthcare. Some candidates wrote 'better standard of living'; this answer needed to be supported with an example to gain credit. A few responses gave reasons why people move from urban to rural areas.
- (c) (i) Many candidates correctly suggested that the months from January to April are in the dry season in Costa Rica.
- (ii) This calculation question was attempted by almost all candidates. While some gave the correct answer of 2.3 °C, others misread the graph. Some of the candidates who showed their working gained partial credit.
 - (iii) Many candidates made good use of the climate data to explain how the road shown in the photograph that crosses over a river is affected at different times of year. The most successful responses referred to the wet and dry seasons or to different months. These responses linked rainfall in the wet season and temperature in the dry season to the condition of the road and whether vehicles could use it. There were some vague responses that did not mention any time of the year or referred to the road being 'affected' without supporting detail.
 - (iv) Most candidates gained some credit for using the climate data to explain why crops can be grown all year in Costa Rica. Many candidates referred to the availability of rainfall in every month. Using the temperature data proved more challenging, with several references to 'suitable' temperatures that would have gained credit if an example had been given. Few responses referred to warm temperatures or water from rainfall supporting photosynthesis.
- (d) (i) Responses to this question were stronger, with many candidates gaining full credit for detailed descriptions of the environmental impacts of deforestation.
- (ii) Most responses correctly calculated the decrease in forested land as 46%.
 - (iii) The responses to this question, requiring an explanation of the causes of deforestation in Costa Rica, were variable. The stronger responses showed a sound understanding of how land was cleared for several types of agriculture, timber supplies and tourist developments, although few gained full credit. The strongest responses mentioned the increase in the population in Costa Rica or that coffee and bananas were grown as cash crops for export. Weaker answers simply copied the information provided.
 - (iv) Most candidates plotted the data correctly as a bar chart that fitted onto the grid. Many missed out on credit by not fully labelling both axes. Very few candidates plotted line graphs.
 - (v) There were some good suggestions of a limitation of the data set for the percentage rate of deforestation in Costa Rica between 1900 and 2000. Some of these focused on the unequal time periods, others on the absence of data before 1900 and/or after 2000. Some weak responses suggested that the deforestation rate of 2.7% was a limitation.
 - (vi) For strategy 1, the payment was often suggested as an incentive that would encourage landowners to manage their forests sustainably. Some candidates suggested that the money could be used to finance selective logging or planting trees, compensating the landowners for the money they would have made from logging. Suggestions for strategy 2 were weaker than those for strategy 1. More successful responses were about laws stopping deforestation and there were a few references to trees being carbon stores. Some candidates described the two strategies instead of suggesting how each can stop deforestation.
 - (vii) Most candidates stated at least one other correct strategy to conserve forests. The most common strategies mentioned were biospheres, national parks, protected reserves, laws against deforestation and fining offenders.

- (e) Most candidates stated three correct agricultural techniques for increasing crop yields. The most frequently seen techniques were the use of crop rotation, fertilisers, pesticides and trickle drip irrigation.

Question 2

- (a) (i) Many of the stronger responses suggested that an increase in the number of long-tailed weasels, hawks or owls and a decrease in the number of wild avocado trees or lizards were possible causes of the population decrease of the Resplendent Quetzal birds. Weaker responses did not state that there was a decrease in food supply or an increase in predation. Disease and tourist activity were also suggested as possible causes.
- (ii) The stronger responses explained that climate change would cause temperatures to increase and gave details of the effects this could have on the Resplendent Quetzal birds' food and habitat. The weaker responses stated that climate change would have an impact without providing supporting evidence.
- (iii) Most candidates wrote a food chain and incorporated the position of the avocado tree, the producer, correctly. Some candidates did not link the organisms with arrows or drew arrows that pointed the wrong way.
- (b) (i) Most candidates showed some understanding of the transect method. Many answers were vague as to how the method could be used to record the number of Resplendent Quetzal birds. There were inappropriate references to using quadrats to capture birds and to estimating the number. Few candidates mentioned counting them, although there were references to repeating the transects, calculating averages and recording the results in tables.
- (ii) Many candidates did not use the information in the first line of the question that 'The conservationist estimates there are four Resplendent Quetzal birds per km²'. This meant their suggestions could not gain credit.
- (iii) Many candidates successfully described at least one advantage of using sound recordings from microphones placed in the forest to estimate the population of the Resplendent Quetzal birds. Good responses included ideas about fewer people being required, birds not being disturbed, more birds being recorded singing than would be seen by people, and the possibility of the microphones recording 24 hours a day.
- (iv) Many responses contained good suggestions of advantages and disadvantages of both methods. Some candidates would have benefitted from giving greater detail to some of their suggestions; use of words such as 'cheap', 'easy' and 'accurate' needed supporting information to gain credit.

Question 3

- (a) (i) Many responses displayed a good understanding of the strategy described in the question. These responses explained how profits would be affected so the factories and companies would reduce their carbon emissions. The stronger answers went on to explain that factories and companies would change from using fossil fuels to a renewable source of energy such as wind or solar.
- (ii) The stronger responses gained partial credit for outlining how carbon capture and storage reduces carbon dioxide emissions by capturing and storing carbon dioxide before it is released into the atmosphere. There were some references to carbon dioxide being captured and stored in trees and to underground storage.
- (b) (i) Most candidates correctly stated two renewable energy resources, other than hydroelectric power, used for generating electricity. A minority of candidates incorrectly included nuclear power as one of their answers.
- (ii) Nearly all candidates gained partial credit for using the diagram to describe how a hydroelectric power station generates electricity. The strongest responses described how water from the reservoir flows through the dam down to the turbine, converting the gravitational potential energy into kinetic energy as it flows downhill. The water then turns the turbine which turns the generator converting kinetic energy to electricity.

- (iii) Most candidates gained full credit for presenting the data in a suitable table. A common error was not to include either 'day' or 'electricity generated' in the column headings. Some candidates attempted to graph the data.
 - (iv) Most candidates gained full credit for suggesting other ways the Reventazón dam benefits the people of Costa Rica. The most common ways suggested were potable water, irrigation, flood prevention and fishing. The most common error was to include jobs, an answer which needed an appropriate example to gain credit.
 - (v) Many responses explained that people are concerned about the release of methane into the atmosphere because it is a greenhouse gas that contributes to climate change. Some candidates confused global warming with ozone depletion.
- (c) (i) Many candidates correctly calculated the distance between **X** and **Y** on the map.
- (ii) Most candidates gained partial credit for explaining why some people were concerned about the Reventazón dam having a negative impact on jaguar populations. The stronger responses explained how the jaguars could no longer use the corridor to travel between populations and this would reduce their opportunities to find a mate and breed. They also explained that the dam disrupted the jaguar habitat, and this meant there was less prey or food available. Some responses concluded with the idea that jaguars could become extinct in Costa Rica.

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Key messages

- Candidates should clearly understand that climate change is not caused by ozone depletion or acid rain.
- Greater practice with graph drawing would be of benefit to many candidates.
- Candidates should be able to describe and evaluate all the methods of estimating biodiversity listed on the syllabus, such as pitfall traps, pooters, quadrats, transects and random and systematic sampling.
- Candidates should read the question carefully to avoid giving answers that have already been provided in the question. This is often the case in questions that ask for one 'other reason'.

General comments

Candidates found the longer answer questions, worth four marks, to be challenging. Responses to these questions tended to be vague or repetitious. Candidates may find that using bullet points to help structure longer answers helps them to give focused responses.

Candidates found suggesting limitations for experimental methods challenging.

Comments on specific questions

Question 1

- (a) (i) The trend in the graph of a gradual increase was well observed.
- (ii) The percentage of 6.8% was usually correct.
- (iii) Most responses gave two relevant advantages of living in urban areas. 'Better standard of living' was considered too vague.
- (iv) Stronger responses focused on the question asked and gave reasons why people living in rural areas were concerned about urbanisation rather than general statements about urbanisation.
- (v) Some responses included two reasons that were the same. For example, 'better healthcare' and 'better health'.
- (b) (i) Most candidates stated months that were correct, with a minority confusing the wet and dry season.
- (ii) A number of calculated ranges used the temperature data rather than the rainfall data. In many cases, those candidates who showed their working were able to gain credit if their method was correct, even if they made an error in their final answer.
- (iii) The higher-achieving candidates suggested ways the climate affected crop growth and supported their answer with the data. For example, 'it is hot all year and higher temperatures lead to more photosynthesis'. Weaker responses did not answer the question as they simply listed information from the data without suggesting how this affected crop growth.
- (c) (i) The impacts of soil erosion were well known and many responses also included impacts that could be seen on the photograph.

- (ii) Intercropping appeared more familiar to candidates than bunds. A number of weaker responses repeated the intercropping explanation for bunds.
- (iii) The description of total area of forest cover was well done, with good use of the data. Good responses included an overall trend and then gave specific details, such as, 'decreased then increased, 1940 to 1980 decreased, fluctuated and then increased from 2000 to 2019'.
- (iv) Weak responses listed the statements made by each landowner. More able candidates added further detail to the discussion. For example, 'Yes, because farmers are given a financial incentive to reduce deforestation, which encourages ecotourism and generates foreign income'. 'No, because the forms would discourage illiterate farmers, there will be a reduction in export, the government is spending more and as it is not compulsory farmers can leave whenever they like'.
- (v) Many good responses explained why climate change is an impact of deforestation. There were a number of responses that linked climate change to ozone depletion or acid rain.
- (vi) 'Loss of habitat' was a common correct answer, and many other correct reasons were stated. The response, 'death' was not sufficiently detailed.

Question 2

- (a) (i) Reversed food chains and chains with more than four trophic levels were commonly seen and did not gain credit.
- (ii) Many correct responses were credited, with 'for camouflage' being the most common.
- (iii) Some good responses that used the information in the factsheet and added their own reason to this were seen, such as, 'ozone depletion has led to an increase in UV radiation'.
- (b) (i) The majority of candidates gained credit for this question. The incorrect answer **B** was occasionally seen.
- (ii) Many candidates needed to apply the correct methods to the drawing of graphs: fully labelled axes with linear scales and bars drawn of equal width with a ruler.
- (iii) Candidates found suggesting a limitation challenging.
- (c) (i) Most responses stated that random sampling reduces bias.
- (ii) Most responses suggested either that averaging could be used or that anomalous results could be identified.
- (iii) Candidates found suggesting two limitations challenging. Vague answers such as, 'it is at night', did not answer the question in sufficient detail. Stronger responses were more thoughtful and included details of why this might be a problem.
- (iv) The size of the quadrat chosen was often unsuitable, such as 1 cm² or 10 m². It was rare to see reference to taking an average of repeated results, and very few responses referenced scaling up the counted number of frogs to the whole area.

Question 3

- (a) (i) Good responses were seen. Weaker responses gave impacts that were not economic.
- (ii) Candidates were familiar with disaster preparation planning.
- (b) (i) It was insufficient to say a generator generates electricity. Stronger responses linked the rotation of the turbine to the rotation of the generator. Some answers did not make it clear that hot water becomes steam and that the steam is then condensed back into water. Occasionally, references to wind power were seen.
- (ii) Many good responses were seen.

- (iii) The opportunities for people living near volcanoes were well known with stronger candidates giving details such as increased soil fertility and the extraction of minerals. Weaker answers were limited to 'more minerals'.
- (c) (i) A few tables did not include column headings and did not separate out the data for weeks 6 and 7.
- (ii) Some responses showed confusion about what decreasing pH indicated about acidity.
- (iii) Abiotic components were well known. Occasionally, pH was stated when 'other' abiotic components were asked for.
- (d) (i) Some vague responses stated 'factories'. The strongest answers were able to clearly state 'combustion of fossil fuels.'
- (ii) An impact of acid rain was well known. Some responses stated acidification of lakes which had already been given in the question.

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Key messages

- Candidates should be clear about the causes of climate change. Climate change is not caused by ozone depletion or acid rain and deforestation is not a cause of either of these environmental issues.
- Candidates should be aware of the requirements for success when drawing graphs, such as in **Question 1(f)(i)**.
- Candidates should be able to describe and evaluate all the methods of estimating biodiversity listed on the syllabus, such as pitfall traps, pooters, quadrats, transects and random and systematic sampling.
- Candidates should read the question carefully to avoid giving answers that have already been given in the question. This was often the case in questions that asked for one 'other reason'.

General comments

Candidates found **Questions 3(c) (i) and (ii)**, worth four marks, particularly challenging. Responses to these questions tended to be vague or repetitious. Candidates may find that using bullet points to help structure longer answers helps them to give focused responses.

Candidates found comparing experimental methods challenging.

Candidates were not confident rounding data.

There was a lack of familiarity with how the death of algae in the eutrophication process leads to the death of other aquatic life.

The purpose of pollination was not well known.

Comments on specific questions

Question 1

- (a) (i) The percentage of the population was usually calculated correctly. Occasionally, incorrect rounding was seen. For example, 4.88 should not be given as 4.8; correct rounding is 4.9.
- (ii) Many good suggestions for a difficulty for people living without access to electricity were seen.
- (iii) Most responses gave a reduction in water-related infectious diseases or named a reduction in cholera as a correct suggestion.
- (b) The reduction in agricultural labour and growth in tourism were common correct answers. Stronger responses also stated an investment in services as a valid reason.
- (c) (i) Candidates confidently described the trends in area of forested land. Stronger responses gave the overall trend and then supported their answer with specific data. For example, decrease then increase, 1940–1987 decrease then increased to 2010.
- (ii) The impacts of deforestation were well known.
- (iii) Some responses incorrectly linked deforestation to ozone layer depletion and acid rain.

- (d) (i) The average rainfall was generally correctly calculated to achieve an answer of 330 mm.
- (ii) The range of 290– 40 was often correct. Those candidates who showed their working and applied a correct method, were able to gain partial credit even if they made an incorrect choice of numbers.
- (e) (i) Weaker responses stated that chlorophyll was a green pigment and did not address the reason for its importance in photosynthesis.
- (ii) The meaning of a cash crop was widely known.
- (f) (i) Many candidates drew graphs that needed to include labels for the axes and use a linear scale. Bars were often of different widths and drawn without a ruler.
- (ii) The total percentage of 98% was usually correct.
- (iii) Few responses referred to the combustion of fossil fuels.
- (g) (i) Many responses did not include the term ‘turbines’.
- (ii) Many good suggestions for objections to wind turbines in rural areas were given.
- (iii) Reasons why wind power cannot be used to generate large amounts of electricity in some countries were well known.

Question 2

- (a) (i) Many responses stated that the artificial nests prevented predators climbing into the nest. Some suggested that it was easier to monitor the birds and kept them away from tourists.
- (ii) Weaker responses suggested that reserves protected species from predation. These candidates confused zoos with reserves.
- (b) (i) The producer was almost always stated correctly.
- (ii) Occasionally, lizard was incorrectly suggested.
- (c) (i) Responses clearly described separating the stone and skin from the flesh.
- (ii) The average was usually correct. Occasional rounding errors were seen, with 151.6 rounded to 151 instead of the correct answer of 152.
- (iii) Most responses stated the mass was too low or anomalous.
- (iv) C was almost always stated correctly with the correct reason that its mass was the greatest.
- (v) Candidates rarely stated the sampling should be random or systematic and correct descriptions were seldom seen.
- (vi) There was a lack of familiarity with how the death of algae in the eutrophication process leads to the death of other aquatic life.
- (d) The purpose of pollination was not well known.
- (e) (i) Many candidates found it challenging to suggest reasons why method 2 was better than method 1.
- (ii) Almost all candidates could use a tally chart.
- (iii) Good suggestions were seen for why bee populations are decreasing. Climate change and predation were common correct answers.
- (iv) Techniques to increase agricultural yields were well known.

Question 3

- (a) (i) The type of plate boundary shown in the diagram was not well known.
- (ii) Weaker responses referred to movement of plates to the left or right rather than below and above. These responses often did not make it clear that magma rises.
- (b) The benefits of living near to a volcano were well known. Weaker answers referred to 'more minerals' for example, whereas stronger responses gave more detail, such as 'more fertile soil' and 'extraction of minerals'.
- (c) (i) The impacts to the region of another eruption of Arenal were well known. Occasionally, 'loss of life' was stated even though other impacts were asked for in the question.
- (ii) Weaker responses gave the same strategies for before and during the eruption.
- (d) (i) Most responses did not agree with the strategy to invest in managing the impacts of volcanic eruptions and suggested that as flooding occurred more frequently money would be better spent on this hazard. Responses that agreed with the statement were also accepted.
- (ii) Some responses did not link increased global temperatures with climate change.
- (iii) The formation of a tropical cyclone between 5° and 20° north and south of the Equator, at an ocean surface temperature of at least 27 °C and ocean depth of at least 60 m was not well known.