

ENVIRONMENTAL MANAGEMENT

Paper 0680/11
Paper 1 Theory

Key messages

- Many candidates showed knowledge of a wide range of topics and were able to use and interpret data. There were opportunities for some to gain additional credit by presenting data in a table appropriately.
- Candidates must take care to read the questions thoroughly which will shape the type of information required in their answer.
- Some responses were too general and not specific enough to gain credit at this level. Candidates should take the opportunity to provide sufficient context to any comments made.
- Candidates should show their working out in all calculations even if this is not specifically asked for in the question.
- There was confusion for many candidates about the impact of acid rain on the pH of water.
- The definition of biodiversity and how this varies in different locations was poorly understood.

General comments

Candidates are advised to use the maximum number of marks that can be awarded for a question as a guide to the number of points they should make in their responses.

Some responses were too general to gain full credit; examples included references such as 'causes pollution'. Candidates should clarify their meaning such as 'causes air pollution' linked to a reason. Similarly, phrases such as 'damages the environment' or 'better' require further development within the response.

When plotting bar charts the bars should be the same width and follow the style of any bars already present on the graph. Candidates should always use a sharp pencil and ruler for all types of graph work.

Comments on specific questions

Section A

Question 1

- (a) The majority of candidates correctly used the diagram to answer the question; some did not expand sufficiently on the key words which limited the credit they could achieve. Others attempted to describe the whole of the rock cycle shown rather than focusing on the formation of sedimentary rocks.
- (b) This question proved accessible to most candidates who identified three items, often with expansion or justification of their answers. The most common were air, noise and visual pollution. Responses that mentioned 'pollution' without any clarification were not credited.

Question 2

- (a) The majority of candidates were successful in identifying the use of solar power as the energy resource that is used in the photograph.
- (b) Many candidates were able to identify an advantage and a disadvantage of solar power. A few responses contained a long list of advantages and disadvantages where only one was required for each. In these cases only the first response in each list was considered.

- (c) Strategies to reduce the amount of electricity used in a house was a topic which was well understood by the majority of candidates. It was expected that responses mentioned two distinct strategies rather than examples of two pieces of electrical equipment that could be switched off.

Question 3

- (a) Candidates were aware of many reasons for migration, but many had difficulty in selecting economic reasons for migration. Some weaker responses needed to provide further development or context to their comments rather than simply using words such as 'better'.
- (b) As with **Question 3(a)**, some weaker answers could have benefitted from providing additional detail rather than simply stating 'natural disaster' for example. This small amount of extra information could have resulted in additional credit for many candidates.

Question 4

- (a) This was generally well answered. The most common error was to quote wind erosion which was specifically excluded within the question.
- (b) Most candidates clearly understood and were able to cite desertification or lack of fertility as being an outcome of erosion.
- (c) A wide range of potential solutions were given credit, with the majority including the addition of vegetation and windbreaks. Some more detailed answers were able to describe the role of organic matter in holding the soil together.

Section B

Question 5

- (a) (i) This question proved to be challenging, although was a topic known by many stronger candidates. Relatively few who were able to name both layers put them in the incorrect order.
- (ii) Some responses showed a lack of knowledge about the impact of acid rain. There was a common error in stating that acid rain causes an increase in the pH of water rather than a decrease, although many were able to identify the impact on aquatic organisms and/or plants.
- (b) (i) The majority of candidates were able to interpret the graph and correctly identify the three countries.
- (ii) A high number of candidates showed good mathematical competence and answered the question correctly. Some responses did not include their workings which was not penalised. However, showing the working could potentially gain a candidate credit for the first stage of the calculation even if the final answer were incorrect.
- (iii) This question proved challenging for many candidates with relatively few gaining full credit. Many identified the difficulty in prediction and potential changes which may occur but far fewer focused on the sufficiency of the data and the limited range of countries which would affect any conclusion that could be drawn.
- (c) While this question was well attempted by many candidates, many answers lacked a logical order and often missed the opportunity to gain further credit with greater clarification. For example, some identified the impact on global warming but could have provided more detail such as the melting of ice caps and rise in sea levels. Some others identified that air pollution is not confined by national borders and will spread to other areas.

Question 6

- (a) This question proved challenging to many candidates. Whilst many used the information in the diagram, some merely stated the phrases listed and did not provide any additional information

needed to show their understanding of the conditions and processes which would cause a flood in Australia.

- (b) (i)** Whilst many candidates were well prepared for this question about the causes of cyclones, providing precise detail, many others wrote about the impacts of the cyclone which was not creditworthy within this question.
- (ii)** Good attempts were made by most candidates to this question. Some weaker responses lacked detail and gave generic terms which could apply to any disaster rather than being linked to the cyclone. Some responses such as 'provide help' required greater clarification before being suitable for credit.

Question 7

- (a) (i)** Most candidates completed the bar on the graph correctly and neatly. A few did not draw a bar of equivalent width to the other examples in place which was required to gain the allocated credit.
- (ii)** Many responses showed a good understanding of the status of Japan as a MEDC and the relationship to water availability. Some incorrectly identified the availability of seawater without any explanation or clarification.
- (b)** Candidates were generally able to complete the table with the missing data. Few completed the calculations incorrectly.
- (c)** The majority of candidates were prepared for this question and able to describe ways in which dams affect local people. In a few cases, candidates wrote about the provision of drinking water (which was included in the question) but these were in the minority. The strongest responses were able to give a wide-ranging set of examples.
- (d)** Stronger candidates were able to identify the impact of bioaccumulation or biomagnification on the aquatic ecosystem. Weaker responses incorrectly described the process of eutrophication, which is linked to nutrient leaching rather than pesticide use.
- (e)** Most candidates were able to use the stimulus material as the basis for their answer and the strongest provided development or explanations of the statements with a reasoned and often balanced approach within their response. These candidates often included specific examples to support the points made.

Question 8

- (a) (i)** The majority of candidates were able to successfully complete the calculation in the table.
- (ii)** The most common errors in completing the bar graph were omitting accurate labels for the axes (including units), the use of inappropriate scales which did not make good use of the graph paper provided or misreading the question and plotting only one set of data.
- (iii)** The majority of responses showed a competence in describing the trends in the data presented. Relatively few candidates incorrectly focused only on specific countries rather than the overview that was required.
- (b)** Answers to this question were variable; a common misconception seen was a poor understanding of techniques for farming fish which was often confused with the fishing of wild fish. The majority of responses correctly identified that change in demand would be a major factor.

Question 9

- (a)** Most candidates were able to draw a table, although candidates should remember that the units in the table should be placed in the column headings and not within the body of the table. It is also expected that the units are expressed in a standardised way. A few weaker answers attempted to draw a graph or pie chart rather than presenting the data in a table.



- (b)(i)** A wide range of ways of describing biodiversity were given credit. The most common error was to describe the number of organisms rather than the range or variety within the location.
- (ii)** A number of candidates were unable to name a piece of apparatus that could be used to investigate biodiversity or supply a method. A wide range of valid examples were given credit.
- (iii)** There was generally a poor understanding of the reasons why different forest ecosystems may have different biodiversities. Relatively few responses achieved full credit. Some successfully answered the question citing examples to explain their comments.
- (c)** This six-mark level of response question allowed for candidates to write a more extensive answer and develop their arguments for or against the statement given. The majority of responses did well and evaluated both the arguments in support of and against the statement. While not essential to do so, this style of question allows the candidate greater opportunity to develop a more complete answer. There was a good range of responses, identifying the importance of preserving trees as well as the practical needs of the population. It was possible for the candidate to form a conclusion which either agreed or disagreed with the statement.

The best responses showed evidence of good planning and were able to use technical words correctly, and in the very strongest answers, assertions were supported by relevant examples. Despite being the last question on the paper, there was little evidence of candidates running out of time to develop a full answer, many writing at length. Weaker responses lacked some of this supporting evidence or omitted to form a conclusion.



ENVIRONMENTAL MANAGEMENT

Paper 0680/12
Paper 1 Theory

Key messages

- Many candidates showed knowledge of a wide range of topics and were able to attempt all questions.
- Candidates must take care to read the questions thoroughly to ensure they provide the information required in their answer.
- Some responses were too general and not specific enough to gain credit at this level. Candidates should take the opportunity to provide sufficient context to any comments made.
- Some candidates needed additional time spent developing skills in data presentation, particularly ensuring that tables include units in an appropriate format.
- The ways in which genetic modification improves agricultural yield was not well understood.

General comments

Candidates are advised to use the maximum number of marks a question can award as a guide to the number of points they should make in their responses.

Some responses were too general to be given maximum credit and should provide context to phrases such as 'causes damage'. Candidates should continue to practise their technique in readiness for the six-mark level of response question which is a feature of each paper.

When plotting line graphs, candidates should ensure they are using an appropriate scale and clearly label axes and include units where applicable.

It is important that appropriate terminology is used within answers and that it is used accurately.

Comments on specific questions

Section A

Question 1

- (a) The majority of candidates used the diagram as a stimulus to answer the question. The generation of electricity from HEP was generally well known although the most common misconception was that water needed to be turned to steam to turn the turbine, which is not the case in this production system. Some referred to energy transfer which was given due credit.
- (b) This question was attempted by most candidates with a large number of creditworthy answers. Some were too generic in their approach and would have benefitted from more detail as justification.
- (c) The majority of responses were sufficiently detailed to gain credit; most usually linked to the lack of a suitable water supply or the cost of development.

Question 2

- (a) There was a common misconception on the use of the mesh tanks. Many responses implied that fish farming involved fishing in open seas which affected all responses in this question. As a result, many stated that the mesh tanks were used to catch fish rather than retain them.

- (b) Candidates were able to identify additional reasons for reducing overfishing of wild fish stocks. A common error was to describe the use of a large net rather than an increase in mesh size.
- (c) The strongest responses correctly identified the issues of fish waste, the risk of spreading disease to the wild fish community and the impact on the ecosystem if fish escaped from the tanks. Weaker answers showed a basic lack of understanding about the process of fish farming, many referring to the impact of trawling (a question on a previous paper).

Question 3

- (a) Candidates understood that point **X** on the graph showed growth but often did not use the correct terminology for this phase. There was some confusion between 'log' and 'lag'.
- (b) There was generally a good knowledge of strategies to control human population. Some stronger responses contained specific examples which earned credit whereas other answers were too generic to be creditworthy. There were relatively few examples of pronatalist policies such as those used in countries such as France or Russia.

Question 4

- (a) Most candidates were able to interpret the diagram of the carbon cycle to identify respiration and combustion. Some weaker responses referred to the source rather than the process.
- (b) A concept that was generally well understood; the majority correctly named the source of energy for photosynthesis as the sun.
- (c) While the majority of candidates were able to name two gases, some gave examples which do not add to the greenhouse effect and therefore were not given credit.

Section B

Question 5

- (a) (i) A large number of candidates were able to state that many countries within Africa are LEDCs but then struggled to clearly articulate why this results in fewer people having access to safe drinking water. Responses often referred to Africa and North America as countries rather than continents. There was sometimes a lack of clarity in relation to which continent candidates were referring to in their answer with a subsequent lack of comparison.
- (ii) The majority of answers demonstrated knowledge of a range of sources of fresh water.
- (b) (i) Candidates showed good skills in interpreting the data in the graph to name the correct year when the incidence of cholera was at its peak.
- (ii) A good interpretation of the graphical data meant most candidates correctly identified Africa as having the highest number of infections during the period indicated.
- (iii) While slightly more challenging, candidates were able to identify that the incidence of cholera was variable during this period. Candidates should have avoided giving a year by year commentary on the data.
- (c) There was evidence that many candidates were well prepared for this question, although some confused the spread of malaria with that of cholera. Some responses were very general in their comments and would have performed better with a greater level of detail.

Question 6

- (a) (i) It was clear that the majority of candidates were familiar with a food chain, although a common error was the suggestion that the arrows represented which organism preyed on another rather than showing energy flow.

- (ii) The trophic levels were generally well understood, the majority correctly identifying the hawk.
 - (iii) The impact of predation on a population was a well-understood concept, most citing that caterpillar numbers would increase. Responses which identified that the caterpillars might become prey of other organisms were also given credit.
- (b) (i) Many candidates made good use of the stimulus material although some needed to read the question more carefully as they provided responses linked to the impact on humans rather than biodiversity.
- (ii) Some responses lacked appropriate focus, and often missed the key link between the generation of finance to support the upkeep of the wetlands or in increasing the level of education about their importance.
 - (iii) This question provided a range of stimulus material to support the answer. The strongest responses used the material and developed concepts or ideas to enhance the basic statements. The highest achieving answers were able to refer to both the advantages and disadvantages, while still developing a conclusion, often with supporting evidence from specific examples.

Question 7

- (a) The formation of metamorphic rocks was generally well understood as a topic. The majority of responses identified the role of temperature and pressure on existing rocks.
- (b) (i) Candidates were generally able to complete the bar chart, plotting the information correctly. In a few cases, the bar did not match the width of the other bars on the chart. The provision of a sharp pencil and ruler was helpful in candidate accuracy.
- (ii) This question required the candidate to perform a mathematical calculation and was completed successfully by the majority of candidates.
 - (iii) There were opportunities for a wide range of different creditworthy answers within the scenario of this question. Many identified the role that mechanisation might have on employment numbers, others considered the possibility that reserves might be depleted or that mining was no longer profitable. Many statements were well supported by suitable examples.
- (c) (i) Candidates were generally able to provide benefits of living near the coal mine, although some responses mentioned employment at the mine (which was included in the stem of the question).
- (ii) Some responses were generic in their approach and required more detail. Many potential uses omitted key early stages such as reclamation or restoration of the land.
- (d) Most answers included a reference to cost, although many of these comments needed to be qualified and used as part of a comparison. More developed responses also identified the lack of suitable alternative energy resources or indeed to significant reserves of coal that may be present in a country. More sophisticated answers also included the ease of using an existing technology compared to the transition to a new one.

Question 8

- (a) (i) The table was successfully completed by most respondents. Some candidates missed answering this question.
- (ii) Common errors in plotting the line graph included omitting accurate labels for the axes (including units), the use of inappropriate scales which did not make good use of the graph paper and not drawing a line between the plotted points. Some candidates plotted the total yield rather than the increase as instructed.
 - (iii) The majority of responses were able to conclude that there would be no further increase in yield.

- (iv) A wide range of environmental factors were suitable for credit, although some responses focussed on management techniques such as soil cultivation, changing soil pH or addition of fertiliser which did not answer the question.
- (b) Answers demonstrated a broad understanding of the reasons fertilisers enter rivers. Some attempted to describe eutrophication which was not required in this question. Some candidates were confused between fertilisers and insecticides/ pesticides. Responses occasionally did not use key terminology accurately.
- (c) The ways in which genetic modification can increase yield was less well understood. Candidates often listed modifications that could be made rather than their role in increasing yield.

Question 9

- (a) (i) Candidates were generally able to use the information in the text to provide a suitable definition of a flood plain.
- (ii) Most candidates were able to use the stimulus material to form the basis of their answers, although stronger candidates developed their responses further.
- (b) This question required candidates to provide a table of the key information in the stimulus material. This was achieved successfully in most responses although some needed to provide suitable column headings (and express units in an appropriate manner). Some did not read the information in the text box fully and presented a table with one set of data missing.
- (c) This six-mark level of response question allowed for candidates to write a more extensive answer and develop their arguments for or against the statement given. Whilst most responses featured evidence in support of and also against flooding, there were many examples of a conclusion not being reached. Similarly, many responses were at a low level in their evaluation and could have been improved with specific examples to support assertions made. Some candidates did not focus on the issue of small-scale flooding and whilst the size was not explicitly defined, their answers related more closely to the impact of large-scale flooding.

The strongest answers showed a balanced response to the statement and often an indication of planning of the answer prior to its commencement. Candidates would continue to benefit from practising answering this style of question which is common to all these papers.

ENVIRONMENTAL MANAGEMENT

Paper 0680/13
Paper 1 Theory

Key messages

- Many candidates showed knowledge of a wide range of topics and were able to attempt all questions, although some topics caused confusion for weaker candidates.
- Some responses were too general and not specific enough to gain credit at this level. Candidates should take the opportunity to provide sufficient context to any comments made.
- Additional time should be spent developing skills in data presentation, particularly ensuring that tables include units in an appropriate format.
- The formation and impact of acid rain was poorly understood as a topic.
- Some responses showed confusion in the identification and mode of spread of bacterial water-borne diseases.

General comments

Candidates are advised to use the maximum number of marks a question can award as a guide to the number of points they should make in their responses.

Some responses were too general to be given maximum credit and should provide sufficient context to enable credit rather than generic statements. Candidates should continue to practise their technique in readiness for the six-mark level of response question which is a feature of each paper. There was evidence of some candidates having focused on these skills.

When plotting bar charts, candidates should ensure they are using an appropriate scale and clearly label axes and include units where applicable. Bars should be of a consistent width.

It is important that appropriate terminology is used within answers and that it is used accurately.

Comments on specific questions

Section A

Question 1

- (a) (i) The majority of candidates used the diagram as a stimulus to answer the question. A common error was to describe the shapes of the population pyramids rather than the reasons for the differences. Stronger responses identified a range of economic or environmental-based reasons.
- (ii) This question required candidates to observe the differences in the above 64 age group for an MEDC. While generally answered well, some did not read the question carefully and included all age groups.
- (b) Candidates were well prepared for this question and were able to cite examples such as the increased burden on healthcare services and the requirement for pensions. Some also identified potential skills shortages and similar impacts on the economy.

Question 2

- (a) A few responses included prolonged rainfall which was given in the question, but the majority were able to name a cause such as melting of snow or tsunamis. A few identified the rise in sea levels as a longer-term issue.
- (b) This question required one positive and one negative effect of flooding. This was ably answered by the majority, although some found a positive impact more challenging to name.
- (c) A good number of candidates were able to write in detail about the strategies that could be put in place. Some weaker candidates put one-word answers or very short statements which provided insufficient context to be creditworthy.

Question 3

- (a) Candidates were expected to use the photograph to identify the type of mining shown. This was generally completed well with few incorrect answers.
- (b) Describing how to restore land after mining has ended proved to be challenging. There was a general lack of understanding of the order of the processes involved, such as soil improvement and bioremediation prior to tree planting. Whilst the question was aimed at a description of how the damage would be addressed, some credit was given for reference to how the land may be used in the future.

Question 4

- (a) Candidates were often confused about the classification of different water-related diseases and were not able to consistently name two bacterial diseases, often incorrectly including malaria or bilharzia.
- (b) Many were able to identify sources of infection such as animal waste or sewage. Some responses were too vague to be given credit, such as 'animals' without any further clarification.
- (c) The majority of candidates gained credit on this question, many citing chlorination and other common water treatment methods. Few identified the role legislation could play in the provision of safe water.

Section B

Question 5

- (a) (i) There was a wide range of potential answers to this question; stronger candidates provided three distinct reasons to gain full credit. Many identified that fossil fuels were readily available and an established (and accessible) technology. Responses referring to fossil fuels being 'cheap' or 'costing less' were not given credit unless there was good justification with comparison to other fuel sources.
- (ii) The majority of answers demonstrated a good knowledge of renewable energy sources, although some needed further clarification as they were insufficient to gain credit on their own. An example being 'water'.
- (b) (i) Candidates were required to interpret the table to identify the correct answers. The majority correctly identified 'Italy', although some did not review all the data and gave an incorrect response as a result.
- (ii) On the whole, candidates were able to compare the trends of the MEDCs and the LEDCs and avoided writing about the year on year changes. The overall reduction in MEDCs was usually stated, but a few candidates were less able to describe the data for LEDCs.

Question 6

- (a)(i) Candidates were generally less well-prepared for this question concerning the way in which a greenhouse would increase plant growth and production. The strongest candidates were able to

identify factors that would impact on photosynthesis, often within their explanation of the benefit of changing the condition. Weaker responses were less focused, and while often able to name one or two conditions, were not able to articulate how they would improve production.

- (ii) Many candidates misunderstood the use of a greenhouse and wrongly linked these structures to the greenhouse effect in the atmosphere. Correct answers were often linked to the cost of construction and upkeep or the visual impact of the structures on the countryside.
- (b) Many candidates made good use of the stimulus material although only stronger candidates were able to develop their responses with linked information and/or specific examples to support their conclusions.

Question 7

- (a) (i) This question requiring an explanation of how air pollution causes acid rain was often answered with a lack of clarity. Some candidates were unsure about the gases involved, often confusing with ozone depletion. Many did not identify the source of these gases, or the fact that they were released into the atmosphere.
- (ii) Candidates were required to provide three effects of acid rain. These were sometimes stated in a vague way, e.g. 'affects plants', or were very extreme, e.g. 'kills organisms', and would have benefitted from further detail. Relatively few identified the damage to buildings and rocks. There was often confusion as to whether acidification caused an increase or decrease in pH.
- (b) (i) Most candidates plotted the information on the bar chart correctly. It was expected that the bar should be of equivalent width to the other bars already provided on the graph.
- (ii) The majority of candidates correctly identified the 10-year period.
- (iii) A good proportion of responses identified a correct reason for the increase in the carbon dioxide concentration in the atmosphere. It was essential for candidates to provide sufficient context to their answer rather than relying upon a single word.
- (c) Three different strategies for reducing the carbon dioxide in the atmosphere were required. Some answers were too similar to each other or were not specific enough to gain credit. Some good responses included less commonly seen solutions such as taxation and the need for international agreements.
- (d) A more broad question in terms of scope, a good number of candidates listed the issue in a logical order such as the increasing temperature causing melting of ice caps, which in turn causes a rise in sea level and the flooding of land. This is a good strategy for this type of question.

Question 8

- (a) (i) The table was completed successfully by most respondents. Some candidates missed this question.
- (ii) A percentage calculation which was ably completed by the majority of candidates. Most understood how to complete the task and used the correct data.
- (iii) Another calculation based on the table which was handled well by most respondents. Many limited the number of significant figures of their answer to match that shown in the data. The majority rounded their answer correctly.
- (iv) Many candidates provided plausible reasons why biosphere reserves might be removed. The pressure to use the land for other purposes was a common response.
- (v) For this question, candidates were required to plot a bar chart. Some missed this instruction and produced a line graph. It was expected that the plotted bar chart should use at least half of the graph paper and be linked to a linear scale. Axes are required to be labelled with units if relevant, and, in addition to having accuracy in plotting, bars should be of equivalent width to each other. It is strongly recommended that candidates have a sharp pencil and a ruler to complete this activity.

- (b) Stronger candidates were able to provide two distinct strategies for conserving biodiversity of a natural ecosystem. Some responses did not fully understand the question and quoted examples such as 'zoos' or 'seed banks' which, while conserving species, take place outside of the natural ecosystem.

Question 9

- (a) (i) The topic of El Niño proved challenging for many candidates. Relatively few were able to link the phenomenon to changes in fish population (and fish catch). The strongest responses provided a narrative which started with the change in weather conditions/current and explained the impact on nutrients and the consequent change in fish numbers and location. Many answers incorrectly suggested that fish would die due to drought which would not be the case in the Pacific Ocean.
- (ii) This question required candidates to provide a table of the key information from the stimulus material. This was completed successfully in most responses. The most common error was in providing suitable column headings (and expressing units in an appropriate manner).
- (b) This six-mark level of response question allowed for candidates to write a more extensive answer and develop their arguments for or against the statement given. Whilst most responses featured evidence in support of and also against monitoring the ENSO phenomenon, there were many examples of a conclusion not being reached. Similarly, many responses were at a low level in their evaluation and could have been improved with specific examples to support assertions made. Credit was given for the level of detail used to develop a specific point as well as the range of the arguments made within the response.

The strongest answers showed a balanced response to the statement and often an indication of planning of the answer prior to its commencement. Candidates would continue to benefit from practising answering this style of question which is common to all these papers.

ENVIRONMENTAL MANAGEMENT

Paper 0680/21
Paper 2 Management in Context

Key messages

Candidates should:

- 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, especially when more than one mark is available for the answer.
- Look at 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 needs 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 state of the USA, Florida. Many candidates understood and made good use of the source material and their written responses were clearly expressed. The mathematical and graphical questions posed some difficulties for a minority of candidates.

Most candidates completed the paper in the time available.

Comments on specific questions

Question 1

- (a) (i) Most candidates correctly calculated the percentage of the total USA population that lived in Florida in 2018.
- (ii) Most candidates were able to suggest at least one reason why people migrate to Florida. There were many answers about the jobs available in farming and tourism. Some answers suggested better standard of living or better quality of life; these needed to be supported with reference to a pull factor such as education or medical care to be awarded credit.
- (b) (i) Most candidates correctly calculated 8°C as the range of the monthly average temperature for the weather station. Some candidates wrote down the correct range (29°C in August and 21°C in January and February) and needed to go on to do the calculation.
- (ii) Many candidates plotted the data correctly as a bar chart and fully labelled both axes. Some candidates did not include the unit 'month' on the x-axis, although most fully labelled the x-axis. A minority of candidates made one of the following errors: plotted a line graph, used less than half the space provided (which meant their small scale was difficult to read), plotted bars with different widths or used unequally spaced divisions as a scale on the y-axis.
- (iii) Most candidates suggested appropriate months for Florida's rainy season.
- (iv) Most candidates correctly determined the category of Hurricane Irma when it hit Florida.

- (v) Most candidates stated a suitable ocean surface temperature and ocean depth needed for a hurricane to form.
 - (vi) There were many excellent answers suggesting ways heavy rainfall, storm surges and flooding caused by Hurricane Irma affected the growing and exporting of Florida's citrus fruit. The most common responses were about damage to the fruit trees, soil being washed away, problems with transporting fruit and either less or no citrus fruit to export.
 - (vii) Most candidates suggested at least two good reasons why some people did not evacuate but decided to stay in their homes or in storm shelters. Many responses developed ideas about having nowhere to go, having no money to fund their evacuation and concern about their homes and possessions. A minority of candidates wrote answers more suited to a permanent migration rather than evacuation, for example about not wanting to leave jobs and families.
 - (viii) Many candidates wrote detailed answers about why bottled water was supplied to people in Florida for several weeks after Hurricane Irma. There were many answers explaining that the drinking water had been contaminated by sewage and that the people in Florida were at potential risk of getting waterborne diseases such as cholera and typhoid. There were also descriptions of ways water supplies to houses may have been damaged or disrupted.
- (c) (i) Many candidates correctly calculated the percentage increase in tourists visiting Florida from 2016 to 2017. Those who showed their working were sometimes able to gain partial credit when the final answer was incorrect.
- (ii) This question required candidates to suggest reasons why, after Hurricane Irma, there was a decrease in the number of tourists visiting Florida for several months. Most candidates made at least one sensible suggestion related to tourist accommodation or tourist attractions. Concern about the area experiencing another hurricane was also suggested. Few candidates wrote about damage to beaches.
- (d) (i) Candidates found stating two factors that affect the decision to extract minerals such as sand challenging. The most common correct response was about the cost of extraction of the deposit.
- (ii) Responses to this question asking candidates to suggest three environmental impacts of extracting sand were more successful. Most candidates wrote about loss of habitat. Loss of biodiversity and damage to food chains were other suggested impacts. The most common error was listing types of pollution. Credit was awarded for the impact of one type of pollution.
- (iii) Few candidates were able to explain what 'sand is extracted unsustainably' means. The more successful answers wrote about future generations not being able to meet their need for sand.
- (iv) This question required candidates to suggest reasons for the increasing demand for sand in the building industry. The successful responses described how the population of the world is increasing and that this means more sand is needed for houses for people to live in. Some answers described uses of sand with reference to beach replenishment and tourism.
- (e) (i) Suitable questions matching those in the questionnaire and related to building the new houses gained credit.
- (ii) There were many vague descriptions of how the company could select people at random for the questionnaire. Many candidates wrote that they would use random number tables or a computer program to produce random numbers, but they did not go on to describe how the numbers could then be used to select people to answer the questionnaire.
- (iii) Many candidates stated, correctly, that one benefit of random sampling is that it is unbiased.
- (iv) This question required candidates to use the scale on the map correctly to determine whether the building company can build at the suggested location and give a reason for their answer. Although many candidates stated that the houses could not be built at the location shown on the map, few gave the reason required: that the location is 3 cm from the rattail orchid plants on the map, which means that it is 60 m away and the local government says that the new houses must be a minimum distance of 80 m from the orchid plants.

- (f) (i) Most candidates correctly determined the number of mainland regions in Florida that had a burn ban in April 2018.
- (ii) Many candidates found this question, asking them to suggest reasons why a burn ban is introduced when there is a drought, challenging. The strongest responses gave suggestions about preventing wildfires that would spread easily and quickly, with some mentioning how drought meant the vegetation in the area is dry. Some candidates wrote about shortages of water to put the fires out or that the fires would cause global warming.
- (iii) Answers to this question were generally successful with many candidates gaining full credit. The stronger responses showed an understanding of several different strategies for managing the impacts of drought. Nearly all candidates described ways of increasing water supplies with reference to building reservoirs, wells, desalination, and rainwater harvesting. There were good descriptions of conserving water by rationing, banning the use of hosepipes and farmers growing drought-tolerant crops. A minority of candidates described how international aid is a strategy that could provide food to parts of the world suffering from drought.
- (iv) Most candidates were able to state one way human activities can increase the risk of drought.

Question 2

- (a) (i) Many responses were too vague to receive credit for this question requiring candidates to state the meaning of ecosystem.
- (ii) There were many excellent responses describing three impacts of habitat loss on wetlands such as the Everglades. The most common answers were about loss of biodiversity, including endangered species which could eventually mean extinction for some species, genetic depletion causing loss of genetic diversity within a species, and disruption of food chains causing starvation. A common error was writing about habitat loss which was in the stem of the question.
- (b) This question gave candidates information about the Everglades. While most candidates gave an opinion about whether they thought the strategies for protecting the Everglades were effective, few gained full credit. The stronger responses developed their opinion with reference to a strategy. For example, 'tourist numbers are limited because tourists can only travel around the Everglades in a boat if they take a guided tour or get a special permit. This also prevents tourists from damaging the ecosystem' and 'burning plant species that are not native to Florida means they cannot compete with the native plants for water and nutrients or poison the wildlife.' Weaker responses needed to follow the instruction to use information from the fact sheet to support their answer. Few candidates copied out the text.
- (c) Most candidates suggested one way that the people of Florida can prevent invasive animal species from reaching the Everglades.

Question 3

- (a) Candidates found suggesting one reason why controlling the concentration of mercury in the atmosphere is a global concern challenging. Many seemed to think mercury caused global warming.
- (b) (i) There were many detailed answers about why sampling plan **B** is better than sampling plans **A** and **C**. Some of these made no reference to plans **A** and **C**. This limited the credit achieved.
- (ii) Most candidates suggested that the scientist collected more mosquitofish than largemouth bass because they are smaller.
- (iii) Most candidates achieved some credit for comparing the trends in the results shown in the graphs. To gain credit, candidates needed to describe the main trends supported by data rather than describe how the data changed over the ten years. A few candidates needed to inspect the graphs more carefully as they incorrectly described the mosquitofish as having a higher average concentration of mercury than the largemouth bass.

- (iv) Most candidates correctly completed the table for year 1.
- (v) Many candidates explained that mosquitofish flesh is safe to eat because it has a mercury concentration of 0.024 which is lower than 1 ppm, but the largemouth bass flesh has a mercury concentration 0.2 ppm above the recommended limit and is not safe to eat. Some candidates used data from year 1 instead of year 10. Others did not interpret the question correctly and wrote that neither fish is safe to eat or that eating them will increase the problem of overfishing.
- (vi) Almost all candidates were able to suggest an advantage of measuring the mercury concentration in the water. Most suggestions were about there being no need to collect fish and that it is a quicker method. Suggesting a disadvantage proved more challenging with many candidates stating that the method is inaccurate without giving an explanation.
- (c) (i) While many candidates correctly stated that there are five trophic levels in the food chain a large number counted the arrows instead of the organisms and gave four as the answer. Some candidates' answers indicated that they were unsure whether to count the arrows or the organisms. Some answers suggested that a minority of candidates might have confused the term trophic level with producer or consumer.
- (ii) This question proved challenging for many candidates. The stronger responses included reference to the fish as a source of food for people. The weaker responses often compared the size of the fish to the size of a human. There were some references to food chains but few to bioaccumulation.
- (iii) Almost all candidates explained that mosquitofish eat mosquito larvae or mosquitoes. The stronger answers went on to explain how female mosquitoes are the vectors of malaria. There were references to plasmodium parasites being spread to people through the bites of female *Anopheles* mosquitoes. A minority of candidates suggested the mosquitofish spreads malaria and needed to be killed.
- (d) This question required a description of eutrophication. The responses were variable. The strongest answers showed a sound understanding of the process and gained full credit. Many candidates described an algal bloom causing a reduction in photosynthesis and the death of plants. The role of decomposers in the reduction of oxygen was the weakest part of the process in many responses. Weaker responses often suggested that the nutrients used up the oxygen and/or caused pollution.

ENVIRONMENTAL MANAGEMENT

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Key messages

- Candidates who have practical experience of sampling techniques such as quadrats and transects are more likely to be able to accurately describe these methods.
- Some candidates would benefit from practising using and interpreting keys.
- A range should be given as the calculated difference between the largest and smallest value in a data set.
- Graph axes must always be fully labelled and include any relevant units. Appropriate linear scales should be chosen that cover over half of the graph paper provided.
- The units for tables should be included in the column headings and not in each cell. The expected format is e.g. distance / km or distance (km).

General comments

Candidates should avoid simply copying out the text already given in a question, without adding their own interpretation of the information.

Many candidates would benefit from practising table completion. This should include the use of units in the column row or heading rather than the individual table cells.

Using scale drawings was an area of weakness for some candidates.

Comments on specific questions

Question 1

- (a)(i) The majority of responses gave a correctly calculated value for the number of people over 65. A common error was to give 3621000. As the response line included 'million', these answers were incorrect.
- (ii) Two impacts of an increasing number of older people were well known. An increased requirement for healthcare and an effect on the economy such as paying more pensions were common correct responses.
- (b)(i) Some responses presented the range as 170 to 38 or 38 to 170 without performing the calculation. A range should be given as the calculated difference between the largest and smallest value in a data set.
- (ii) A common error was to omit the axis labels on both the axes. The x-axis label 'month(s)' was frequently missing and the unit for average temperature was rarely seen. Plotting was generally good, with many graphs plotted using a sharp pencil and using clear crosses. A linear scale for the y-axis was usually given in an appropriate format.
- (iii) Responses usually linked an increase in energy demand with increased use of air conditioning as temperatures increased. Some answers suggested that energy demand would decrease as heating would not be needed; these were also credited.
- (iv) It was common to see comments regarding plentiful light; linking this to photosynthesis was seen less often.

- (c) (i) Good descriptions were seen. Occasionally, the direction of the hurricane was reversed, or it was suggested that each circle represented a different hurricane. Some candidates would have benefited from practising using and interpreting keys.
- (ii) Many responses recognised that transportation would stop and flooding was likely to occur. Some weaker responses stated that export and extraction would be affected, without stating what this effect would be.
- (iii) Successful responses used the information given to support their view on whether the strategies were effective. Weaker answers simply copied out text from the question paper which was not creditworthy.

Question 2

- (a) (i) Most responses could give a reason why **A** and **D** were not used. Candidates found **C** more challenging. A minority answered in terms of sampling method **B** and did not address the question as they did not refer to **A**, **C** or **D** in their answers.
 - (ii) The majority of candidates used the graph in their response, as required by the question.
 - (iii) This was well answered. Candidates who have had experience in using questionnaires in field work and writing their own questionnaires are likely to perform well on this type of question.
 - (iv) The original questionnaire required yes/no/do not know answers and a minority of responses did not follow this format.
 - (v) Stronger candidates used the scale, clearly showed this on the diagram and explained their working out in their response. Weaker responses did not give evidence of using the map and did not include a reason for their answer. A few incorrect scale conversions were seen.
 - (vi) The environmental impacts of clearing vegetation were well known. Weaker responses stated habitats or biodiversity 'are affected'; this is too vague and the effect should be stated.
 - (vii) One reason was often stated, usually efficiency of extraction. A second correct reason was more rarely provided.
 - (viii) Most responses could suggest why land reclamation is preferred by some companies. Expense was the most commonly seen answer. Many beneficial uses that would provide an economic benefit to the company were also given.
- (b) (i) Nitrogen and potassium were widely known.
 - (ii) Two reasons for using fertilisers were often correctly given.
 - (iii) Concern for the impact of overuse of fertilisers leading to eutrophication was a common answer. The high cost of fertilisers to farmers was also frequently suggested.
- (c) (i) Many clear tables were presented. Some did not include units in the column headings or incorrectly included units in each cell of the table. A few candidates sketched a bar chart rather than a suitable table.
 - (ii) Candidates found this question challenging. Many incorrectly suggested that the concentration would be greater to the north of the mine.
 - (iii) The time frame for the formation of oil was often stated as 'thousands of years' or 'many years'; this should be 'millions of years'. Many candidates needed to include the information that oil formed from dead marine organisms.
 - (iv) Most candidates answered correctly. Occasionally, weaker responses suggested that carbon dioxide caused ozone depletion or acid rain.

- (v) Many good suggestions for reducing carbon dioxide concentrations in the atmosphere were stated.
- (vi) Few candidates were able to express the idea that the atmosphere has no boundaries or that atmospheric circulation or wind carries pollution from country to country.

Question 3

- (a) (i) Many candidates correctly calculated the area of the Everglades in 2018.
- (ii) This question was generally answered well.
- (iii) Candidates gave good suggestions for other ways to protect the Everglades.
- (b) Candidates occasionally struggled to express themselves clearly. An awareness that the two species were likely to be confused and crocodiles killed by mistake if alligators are not protected was rarely seen. It was common to see the statement from the question paper directly copied 'Alligators and crocodiles look very similar'; this approach did not gain credit.
- (c) (i) Orchid was mostly correctly stated as the producer.
- (ii) Candidates were familiar with strategies to make an area malaria free. Some incorrect references to using antibiotics or discussions about sewage were seen.
- (d) (i) Candidates found this a challenging question. It was common to see responses that answered about the benefits of the pepper plant, which was not the subject of the question.
- (ii) A few responses reversed the limitations and advantages. Some weaker responses stated 'cost' and needed to explain whether they were referring to high or low costs.
- (iii) Candidates who have carried out practical field work are likely to perform well in this type of question. Some responses indicated that candidates were not familiar with quadrats or transects. It was common to see confusion between random and systematic sampling methods. Methods of data collection is an area in which candidates would benefit from more practice.
- (iv) Two good suggestions were often seen, including the risk of the fires getting out of control and burning native species of plants and animals.

ENVIRONMENTAL MANAGEMENT

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Key messages

Candidates should:

- 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 must be written in a table or on a diagram.
- Show working when completing calculations, especially when more than one mark is available for the answer.
- Look at 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 needs 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 state of the USA, Florida. Many candidates understood and made good use of the source material and their written responses were clearly expressed. The mathematical and graphical questions did pose some difficulties for a minority of candidates.

Most candidates completed the paper in the time available.

Comments on specific questions

Question 1

- (a) (i) Many candidates correctly calculated the increase in percentage of the population of Florida.
- (ii) Many candidates were able to suggest at least one impact of the increasing population of Florida. Some answers suggested a change in the standard of living and other similar suggestions. These did not gain credit as a specific reference to a clearly stated factor was required.
- (iii) Many candidates suggested two methods of managing population size.
- (b) (i) Nearly all candidates correctly calculated 9°C as the range of the average low temperature for the weather station.

- (ii) Many candidates plotted the data correctly as a bar chart and fully labelled both axes. Most fully labelled the x-axis, although some did not include the unit 'month'. A minority of candidates made one of the following errors: plotted a line graph, used less than half the space provided (which meant their small scale was difficult to read), plotted bars with different widths or used unequally spaced divisions as a scale on the y-axis.
- (iii) Most candidates suggested one appropriate reason as to why Florida was a good location for growing crops.
- (c) (i) Most candidates made some good use of the information given to suggest reasons why people living in Florida should be concerned about climate change.
- (ii) Many candidates made vague statements that did not clearly identify a strategy to reduce climate change. Explanation of a suitable strategy often required greater clarification to achieve full credit.
- (d) (i) Nearly all candidates suggested an appropriate wind speed for Hurricane Irma.
- (ii) Most candidates used information from the map to suggest the types of damage caused by the hurricane to achieve some of the credit available.
- (iii) Many candidates described some ways in which the hurricane could affect farming in Florida. A small number of candidates gained all of the credit available. The number of marks available is a good indication of the amount of supporting points needed for full credit.
- (iv) Many candidates described how the strategies used managed the impacts of the hurricane. Fewer were able to evaluate the effectiveness of some of the strategies. Candidates should be prepared to give opinions as well as select relevant information in answers to this type of question.

Question 2

- (a) (i) Nearly all candidates completed the tally chart correctly. Some needed to follow the example format given in the table.
- (ii) Many candidates provided sensible reasons as to why the student's conclusions were not valid.
- (iii) Most candidates correctly identified the producer in the food chain.
- (iv) Many candidates gave two appropriate reasons why captive breeding programmes are expected to allow more offspring to survive. A small number of candidates gave answers that were too vague to be given credit.
- (b) (i) Most candidates demonstrated understanding that field 3 was a control treatment for the experiment by either using the word 'control' or giving a description that showed they understood the concept of a control.
- (ii) The majority of candidates identified two clear differences between the treatments in their conclusion.
- (iii) Most candidates made good use of the information provided to explain why the farmer's results were not valid. Some did not note that the fields had different dimensions.
- (iv) Most responses made at least one suggestion as to why farmers do not use artificial fertilisers. However, only a small number of candidates scored full credit.
- (v) Most candidates identified at least two ways of increasing agricultural yields.
- (vi) A minority of candidates could describe the characteristics of a clay soil.
- (vii) Most candidates decided the farmer could not build in the suggested location. However, to gain full credit there needed to be evidence that the scale of the map had been used.

- (c) (i) Nearly all candidates drew five sensible locations for the water samples. Most gave explanations that gained full credit.
- (ii) Nearly all candidates drew a table to record data from the water samples. However, the table headings were sometimes too vague to be given credit.
- (d) (i) Candidates were asked to describe the benefits and limitations of two different sampling methods using a questionnaire. Most candidates made one comment for each method that was worthy of credit. A small number of respondents commented on a benefit and a limitation for each method.
- (ii) Most candidates demonstrated very limited knowledge about the requirements of an environmental impact assessment.

Question 3

- (a) (i) Candidates usually gave two or three convincing reasons why the Everglades National Park was established.
- (ii) Most candidates could describe at least one way that ecotourism could benefit the Everglades National Park. A significant number demonstrated a good understanding of the principles of ecotourism.
- (b) (i) Very few candidates successfully identified a sedimentary rock.
- (ii) A minority of candidates correctly identified the process that leads to recharging an aquifer.
- (iii) Most candidates demonstrated understanding of the problem of reverse flow in an aquifer. However, in some cases the answers were very poorly expressed.
- (iv) Many candidates were able to give one reason why the aquifer might be threatened by an unusually high water table. A small number of candidates developed their answer to gain full credit.

