

ENVIRONMENTAL MANAGEMENT

Paper 0680/11 Theory

Key messages

- Candidates should read questions carefully to ensure their responses provide appropriate detail.
- Candidates are advised to write down enough individual points to match the number of marks available. This is particularly important when the question is worth three marks or more as those who write only one or two points will not be able to access the full credit.
- Command words such as 'describe' or 'explain' provide key information about the style of response required and the level of detail required to access marks.
- The six-mark, level of response question at the end of the paper requires candidates to look at the topic broadly and use appropriate examples to support their views. It is important that candidates address both parts of the question in order to access Level 3.

General comments

The majority of candidates attempted all questions on the paper and there was no evidence of candidates running out of time.

There was evidence of appropriate and accurate use of scientific terminology within some scripts and many candidates used specific examples to clarify their answers.

There was generally a good standard of mathematical work. Candidates are advised to show their working wherever possible. This is especially important when the mathematical question is worth more than one mark as they may gain some credit for appropriate working even if the final answer is incorrect.

Answers to the level of response question were in general well structured. Candidates should consider a range of points in their answer and they should support these with examples where relevant. In order to achieve a Level 3 answer, it is important that candidates reach a conclusion based on the range of points they have considered.

Comments on specific questions

Section A

Question 1

- (a) This question required candidates to show on the map the location of a tropical cyclone. This was attempted by many candidates, the majority gaining credit for knowing that tropical cyclones happened at sea.
- (b) Many candidates knew that the water needed to be warm for tropical cyclones to form. Many responses lacked the details from the syllabus to gain the credit available: an ocean surface temperature of at least 27°C and ocean depth of at least 60 m.

- (c) Most candidates scored some credit, usually for answers referring to loss of life or damage to buildings.

Question 2

- (a) This question proved challenging for many who referred to the mosquito stinging the person rather than biting them. A few candidates knew that the bite was linked to the transfer of the parasite into the bloodstream.
- (b) (i) Many candidates missed out on credit as they wrote that biological control is about not using chemicals and that the method is a natural method, without any reference to the use of a predator.
- (ii) Many candidates were well prepared for this question and knew the ways that the mosquito population could be controlled. Many knew about mosquito nets and antimalarial drugs as well as the need to drain breeding grounds.

Question 3

This question was very well answered by most of the candidates who were able to correctly link the name of the process to a description of the process.

Question 4

- (a) Many candidates knew that the missing gases from the pie chart were nitrogen and oxygen, with nitrogen being the highest percentage. The main error was stating carbon dioxide as one of the two responses.
- (b) This was a very well-answered question as candidates generally knew the other naturally occurring gases in the atmosphere.

Section B

Question 5

- (a) (i) This simple calculation was completed correctly by most candidates to achieve an answer of 4200.
- (ii) This calculation proved to be more challenging. Credit was awarded for the correct use of data even if the final answer was incorrect.
- (b) (i) A minority of candidates believed that pesticides harmed the crop.
- (ii) Many candidates understood that the noise would deter the birds from approaching the crops as it would scare them away.
- (iii) Many candidates suggested that the birds could block the pilot's view or cause damage by being trapped in the engines. Those who missed out on credit often thought that the plane would have to swerve to avoid the birds and would crash as a result.
- (c) The majority of candidates knew that the starling was a primary consumer as it ate tomatoes. Many also understood that the starling was a secondary consumer as it ate earthworms. References to starlings eating insects were not credited.

Question 6

- (a) (i) The majority of candidates gained credit here, achieving an answer of 30.1.
- (ii) Many candidates were able to state an example of a fresh water source, although quite a few suggested that the ocean would be a source of fresh water.
- (iii) Many candidates attempted to write about the impacts of global warming on the availability of fresh water. Many knew that it would result in the melting of glaciers and ice and that this could lead to the mixing of freshwater sources with salt water and could also result in flooding. The most able candidates also knew that freshwater sources could be lost due to the evaporation of fresh water.

- (b) The word equation for respiration was not well known. Those who gained partial credit usually did so for glucose and oxygen. Many candidates did not know that water was a product of respiration.
- (c) The impacts of poor sanitation were not understood by all. Candidates often wrote about the causes of poor sanitation or how it could be improved. Many knew that it caused water-borne diseases including cholera and typhoid as well as causing death and needed to go on to discuss the wider effects in terms of the impact on work and the economy.

Question 7

- (a) (i) Many candidates misunderstood this question and thought it was how long it took a crop to grow, therefore wrote about a 100 day growing season being better than a 140 day growing season as crops obviously grew more quickly. The pattern was complicated and more able candidates were able to see that the growing season was longer in the south or north of Indiana and Ohio.
- (ii) Answers to this question were often vague. Many stated climate as a factor without stating what aspects of climate affect the length of the growing season, such as temperature and water availability. Very few reflected on how the aspect and altitude might affect the length of the growing season.
- (b) (i) Many candidates knew that methane is a greenhouse gas which causes global warming. A common misconception was that methane destroys the ozone layer.
- (ii) Many candidates knew about commercial farming and were able to give at least one characteristic of the process.
- (c) Many candidates suggested that trees at the edge of a field act as windbreaks and therefore help to prevent wind erosion.
- (d) Candidates recognised that rainwater was free and clean and therefore most gained some credit on this question. Some thought the question was referring simply to rain falling on the land, rather than the collection of rainwater.

Question 8

- (a) Many candidates were able to explain what the narrow top and the wide base showed on the graph. Many responses stated reasons as to why males died at an earlier age compared to females instead of that females were living longer and that there were more females in the 75+ age group.
- (b) Completing the population pyramid proved challenging for candidates.
- (c) (i) Quite a number of candidates did not understand what 'pregnancy is wanted' meant and wrote about providing hospitals, money for parents and pro-natalist policies.
- (ii) Many candidates realised that the UNPF would have less money to achieve its aims and were able to suggest an aim that would not be achieved with less funding available.
- (d) (i) Many candidates misunderstood the net migration per 1000 people and therefore were unable to access the credit for this question. Some candidates realised that the trend was fluctuating and that overall migration had increased; others tried to describe the graph point-by-point rather than describing the trend.
- (ii) Many candidates knew at least two reasons for migration with conflict/war and lack of employment being cited.

Question 9

- (a) (i) Many candidates could correctly identify the direction of both the warm and the cold currents.

- (ii) Many candidates were able to state the direction of the movement of the ocean currents south of the equator as either a circular or anticlockwise motion.
- (b)(i) Many candidates were able to work out the length of the bar, although a considerable number made the bar wider than the three squares to match those already drawn, and therefore lost out on credit.
- (ii) Many candidates scored credit on this question for showing their working even when their final answer was incorrect.
- (c) Many candidates were able to state two ways that oceans could be used as a resource. Some candidates knew that they could be used as a source of fresh water after the water was desalinated.
- (d) There were some excellent answers that dealt thoroughly with both pollution and other reasons, notably overfishing, for sustainability issues in the oceans. Many did not mention overfishing, which is one of the main reasons why fish stocks are in decline in various parts of the ocean. Others suggested cleaning the fish to remove pollution once they are caught and had not realised that washing the fish would not get rid of plastics and heavy metals. Many spent time outlining how oil spills could be reduced and also cleaned up. Many also wrote about how governments should pass laws to stop pollution and require oceans to be cleaned.

ENVIRONMENTAL MANAGEMENT

Paper 0680/12 Theory

Key messages

- Candidates should read questions with care and respond to the command verb to maximise the credit they achieve.
- The six-mark, level of response question requires candidates to look at the given topic broadly. The use of appropriate examples, either local or national, are beneficial to support their views. Question planning is important for this question and this was evident in some of the scripts seen.
- Candidates showed greater confidence in completing the mathematical activities within this paper and were generally able to form valid conclusions. Graph drawing was generally neater and there was a greater use of rulers, although care should be taken to ensure axes are labelled and appropriate scales are used.

General comments

There were relatively few examples of candidates not attempting questions. Candidates should attempt all questions even if they are less familiar with the topic as credit may still be available for weaker or incomplete responses. This is particularly important in questions where the command word is 'suggest', where responses are required that apply existing knowledge to an unfamiliar situation and a wide range of potential answers are credited.

There was also greater evidence of candidates providing answers that more closely addressed the command words such as 'explain', 'describe', or 'state'.

Candidates generally demonstrated a broad range of knowledge, although there were some significant misconceptions about the ways in which malaria is spread and how it may be controlled. Similarly, applying their knowledge to the unfamiliar scenario of gravel extraction from the oceans proved challenging for some.

The six-mark, level of response question at the end of the paper was attempted by most candidates, with a general improvement in the way in which it was approached. Some more able candidates showed good technique and supported their opinions with specific examples. Stronger candidates were able to provide a clear conclusion to the question posed, and also provide details on both points of view within their response.

Comments on specific questions

Section A

Question 1

- (a) There was varied success in identifying the layers of the atmosphere. Some candidates showed great confidence and there were some who left the answer lines blank.
- (b) Using the same diagram, candidates were required to mark the location of the ozone layer. Again, the success was variable. In a few cases, candidates did not answer this question.

- (c) Many responses showed that candidates generally understood the role of the ozone layer in absorbing UV radiation. Answers were required to give the specific reference to ultraviolet for credit to be awarded. Many also knew of the link to skin cancer and cataracts. There were relatively few responses that identified the role of the ozone layer in the natural greenhouse effect.

Question 2

- (a) (i) This question required candidates to measure a distance and apply a scale. A high proportion were successful.
- (ii) Most responses identified the impact on the tourism industry due to the ocean currents as the first local industry to be affected with a justification from the information within the map. Other valid industries were given credit if clearly named and justified. The most common error was omitting to name an industry, which was essential to confirm that the reasoning was valid.
- (b) Attempted by most candidates, the majority appeared to be prepared for such a question on oil spills. This was generally well answered with a small amount of confusion regarding the role of booms to retain the oil spill and some difficulty in explaining the role of the skimmers.

Question 3

- (a) The requirement to label the diagram was completed effectively by the majority of candidates with many scoring most or all of the credit. The most common error was to assume that subsidence farmers do not use any machinery. Whilst it may not be as sophisticated as that seen on many commercial farms, it is still often a feature.
- (b) Most candidates attempted this question and showed some understanding of the environmental issues relating to the use of insecticides, others needed to give further detail to gain the credit available. The most common error was to link the issue of insecticides to eutrophication, which is primarily an issue with the mismanagement of fertilisers so was not given credit in this context.
- (c) The majority of candidates were able to provide a suitable alternative to the use of insecticides; biological control and crop rotation were the most common answers, although more specialist examples such as the use of pheromone traps or breeding pest resistant varieties were also given credit as these might be common approaches locally to the candidate.

Section B

Question 4

- (a) (i) This question was designed to test the candidate's skills in evaluating the sufficiency and relevance of evidence, which is an important skill to develop to be able to interpret news reports and articles to measure their accuracy and reliability. Many candidates correctly identified the lack of comparative data to make a judgement, the idea that not all disasters are linked to climate change and that predictions are not valid as proof. Stronger candidates were able to identify three different issues with the article for full credit, while this question proved challenging for many weaker candidates.
- (ii) Responses showed a level of confidence in understanding the causes of drought, and many candidates were able to gain credit by stating the lack of rain; many struggled to provide a second reason to achieve full credit on this question.
- (iii) This question proved to be more challenging; whilst many responses described lack of rain causing soils to dry out, they needed to go on to make the connection that these lighter soils were more prone to erosion. There were some good examples of candidates identifying that drought would cause plant death which meant there were less roots to hold the soil.
- (b) There was generally a clear understanding of some of the reasons loss of homes in a natural disaster causes an increase in deaths. Many successfully linked issues such as unsafe water and lack of food to this scenario.

Question 5

- (a) (i) The majority of candidates correctly plotted the data for trout and followed the style already presented for the other organisms. The most common errors were to plot the pH bar to a value greater than 6.5 and in some cases not aligning the bar with the same relative spacings to the other bars as shown in the graph.
- (ii) Candidates showed confidence in interpreting the data in the graph with the significant majority identifying bacteria as living in the widest range of water pH.
- (iii) A more challenging question for some candidates, many had an understanding that some organisms would not survive in the more acidic conditions. Stronger responses included an interpretation of how this loss of species within the ecosystem might impact the other organisms through disruption to the food chain.
- (b) (i) The majority of responses correctly identified the role of sulfur dioxide and oxides of nitrogen, although the sources of these gases were less accurately understood. Some candidates did well in stating the acids formed when they reacted with atmospheric water vapour.
- (ii) Most candidates were successful in naming strategies that could be used to reduce acid rain. In addition to those focused on reducing emissions from vehicles, references were made to methods to reduce factory emissions such as flue-gas desulfurisation.

Question 6

- (a) (i) Using the world map, candidates were required to describe the distribution of countries where people are at risk of malaria. Credit was given to a wide range of descriptions, although any mention of a location made with reference to the tropics or the Equator needed to use the terms North and South rather than above and below.
- (ii) Many candidates had difficulty in providing a suggestion as to why some countries are not affected by malaria. The most common correct responses made a link with the climate being unsuitable for mosquitoes to thrive. Others identified access to suitable control methods.
- (b) (i) Some candidates were able to provide significant detail which achieved full credit. Within many other responses there was significant confusion over the mechanism for spreading malaria. Common misunderstandings included the risk of sharing food with an infected person and drinking contaminated water.
- (ii) Most candidates successfully identified two distinct methods of controlling malaria. Common correct responses included the use of mosquito nets, removing areas for the mosquitoes to breed and the use of medication. Common errors were often linked to a misunderstanding of the way malaria is transmitted.

Question 7

- (a) (i) Candidates were generally able to plot the data correctly and there were relatively few plotting errors. Similarly, most correctly drew lines to join the plots to the other data shown in the graph.
- (ii) In most cases, candidates correctly read the requirements of the question and referred to the trend rather than highlighting a specific year. Credit was awarded for identifying the overall trend within the graph, and for providing relevant information relating to this trend. Candidates showed confidence to attempt this question with relatively few not providing an answer.
- (iii) Testing mathematical skills, this question required the accurate reading of data from the graph and then calculating a percentage. A good proportion completed this correctly, although some were challenged with an appropriate rounding of the final answer.

- (b)(i) This question required candidates to use their knowledge of environmental management topics in an unfamiliar context. Some demonstrated the skills required and suggested three distinct effects on the marine ecosystem. A wide range of effects were awarded credit, and many focused on the impact to the organisms in the seabed and the resultant impact on the food chain and biodiversity. Weaker candidates found this question more challenging. Some incorrectly suggested that this type of activity would cause eutrophication. Generic statements such as 'causes pollution' were too vague to be awarded credit.
- (ii) Successful candidates understood the challenges of monitoring, such as the cost and the large areas involved; others also identified that commercial pressures due to high demand for the gravel made it difficult for governments to control. Weaker candidates were unable to apply their existing knowledge to this context.

Question 8

- (a)(i) Candidates were generally able to complete the table as requested, understanding the directions of the question. There were relatively few errors seen.
- (ii) There were relatively few examples of candidates attempting to draw the bars without the use of a ruler and the majority chose an appropriate linear scale that occupied over half of the space available. Common errors were a lack of labelling of the axes and drawing bars that were not all the same width.
- (iii) The command word for this question was 'suggest', meaning that candidates should use their knowledge and apply it to an unfamiliar situation. In this case, to use the data and formulate reasons why the rhinoceros population had not increased. A wide range of plausible answers were given credit. Common themes seen in responses were the lack of suitability of conditions for breeding, the pressures on the animals in the wild, such as loss of habitat or poaching, and the fact that those held in captivity were all of one gender. Candidates frequently identified one valid point with the stronger candidates able to provide two.
- (b) The six-mark, level of response question requires a longer answer from the candidate and allows them to combine their knowledge of environmental management to answer a specific question. Candidates are required to provide a range of details, or to focus on a lesser number in more depth, and elaborate on their points with relevant examples to support their opinion. Stronger candidates provided their own conclusion whilst demonstrating knowledge of both sides of the debate.

There were some very good examples where candidates took the time to plan their answer, and were able to provide a detailed, balanced response within the time constraints imposed by the examination. In some cases, these gave local examples, in others, international examples.

Only a small number of scripts were identified where this question was not attempted. Providing a balanced, evidence-based response was challenging for many who did not fully address the question posed. Many weaker candidates wrote about items that had not been included within the main themes of the previous questions, which did not always have great relevance to the challenge of balancing the needs for resources against the desire to prevent animal extinctions. Some weaker candidates provided a strong opinion but were not able to support this with any level of supporting evidence.

ENVIRONMENTAL MANAGEMENT

Paper 0680/13 Theory

Key messages

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There was generally a good standard of mathematical work. Candidates are advised to show their working wherever possible. This is especially important when the mathematical question is worth more than one mark as they may gain some credit for appropriate working even if the final answer is incorrect.

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This question was very well answered by most of the candidates who were able to correctly link the name of the process to a description of the process.

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- (a) Many candidates knew that the missing gases from the pie chart were nitrogen and oxygen, with nitrogen being the highest percentage. The main error was stating carbon dioxide as one of the two responses.
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Question 5

- (a) (i) This simple calculation was completed correctly by most candidates to achieve an answer of 4200.
- (ii) This calculation proved to be more challenging. Credit was awarded for the correct use of data even if the final answer was incorrect.
- (b) (i) A minority of candidates believed that pesticides harmed the crop.
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- (b) The word equation for respiration was not well known. Those who gained partial credit usually did so for glucose and oxygen. Many candidates did not know that water was a product of respiration.
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ENVIRONMENTAL MANAGEMENT

Paper 0680/21 Management in Context
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Key messages

- Candidates should read questions carefully, taking note of each command word used and paying particular attention when there is supporting information provided.
- Working should be shown when completing calculations, especially when more than one mark is available for the answer, as partial credit may be given even if the final answer is incorrect.
- Candidates should use the number of answer lines and the marks available as a guide to the number of ideas needed in the answer.
- A ruler and sharp pencil should be used to draw bar charts.
- Candidates should write answers in full sentences and not just one or two words, and attempt all questions as answers may gain some credit even where there is partial understanding of the topic.

General comments

It is important that candidates read each question carefully and check that they are answering the question asked. For example, in **Question 2(a)(ii)**, three other components of a fertile soil were required, so those who gave three mineral ions did not gain credit.

The use of a line transect and quadrat is an area for improvement for candidates, as demonstrated in responses to **Question 3(b)(i)**.

Comments on specific questions

Question 1

- (a) (i)** Most candidates were able to correctly calculate the number of people living in rural areas in Denmark in 2021. Some gave the answer in thousands, 696 000; others gave it in millions, 0.696 million or 0.7 million. Some candidates correctly multiplied 5.8 million by 0.12 to arrive at 0.696 but then omitted to state that the units were millions. Candidates who showed their working were often able to gain partial credit. A minority calculated the urban population.
- (ii)** Most candidates were able to suggest at least one reason why only a small number of people live in rural areas in Denmark. These responses usually stated that there were few jobs in rural areas. Other reasons suggested were few services such as schools, hospitals and shops and that people migrated to the urban areas. Some candidates wrote about urban areas but did not indicate this in their responses; those who did were sometimes able to gain credit.
- (b) (i)** Most candidates gave the correct answer of commercial or arable as the type of farming shown in the photograph. Some candidates gave wheat farming which was not credited, neither was pastoral farming.

- (ii) This question required candidates to state the number of months wheat grows in the field. The question stated that the wheat is planted in April and harvested in August, and that it needs a minimum average temperature of 12 °C to grow. Some candidates counted 5 months in the period April to August and gave this as the answer, not taking into account the 9 °C average temperature in April. Other candidates counted every month with temperatures of 12 °C or above and gave 6 as the answer.
 - (iii) This question required candidates to give two reasons why most farmers near Copenhagen do not use irrigation methods to grow crops, using information from the table in their answers. Many gained credit for stating that there were a high number of wet days so irrigation was not needed. Using the rainfall data was more challenging with many describing the average rainfall as high or adequate, descriptions that needed qualifying. Stronger responses stated that there was rain in every month or throughout the year. Some candidates did not support their responses with data from the table.
 - (iv) Many candidates gained full credit for describing the environmental impacts of mismanagement of irrigation. The strongest responses described a range of impacts, the most common being waterlogging, loss of nutrients, reduced crop yield and eutrophication. Weaker responses focused on flooding or crops being drowned.
- (c) (i) Most candidates correctly named the two other main ions present in fertilisers as potassium and phosphate. A common mistake was naming phosphorous instead of phosphate.
- (ii) Most candidates plotted the data correctly as a bar chart with bars of equal width that fitted onto the grid. Many missed full credit by not labelling both axes or drawing bars of different widths. Some candidates plotted line graphs although the instruction in the question was to plot a bar chart. Some candidates used a pen to draw the bars, which made correcting errors difficult.
 - (iii) Most candidates gained full credit for describing the trend shown by the data as a steady decrease from Year 1 to Year 17 and constant between Year 17 and Year 18.
 - (iv) The responses to this question, asking candidates to suggest two reasons why nitrous oxide emissions from farming in Denmark will not reach zero tonnes in the future, were variable. Many candidates suggested that bacteria break down nitrogen compounds in the soil to produce nitrogen oxide. Fewer suggested that farming and fertilisers will always be needed or that agricultural machinery and vehicles used on farms release nitrous oxide. Weaker responses confused nitrous oxides with nitrates or nitrogen compounds. A minority of responses wrote about the graph in the previous question.
- (d) Many candidates suggested several reasons why the population of Denmark may be impacted by climate change and gained full credit. These candidates understood the question and wrote about Denmark being a low-lying country with a long coastline. They went on to explain how sea level rise would cause flooding, farmland would be submerged, crops would fail, weather would become more extreme and people would migrate. Some responses misunderstood the question and described causes of climate change. Others described ways the people of Denmark contribute to global warming by adding greenhouse gases to the atmosphere.

Question 2

- (a) (i) Many candidates did not know that clay has a smaller particle size than sand or silt.
 - (ii) Candidates who understood what was meant by the term 'components' usually gained full credit. Air, water, organic matter and microorganisms were the most common correct answers. Some responses named nitrate, phosphate and potassium, although the question asked for three other components of a fertile soil. Some weaker candidates stated three features of soil as a medium for growth, such as the ease of cultivation, nutrients, drainage and pH.
 - (iii) Most candidates could state what is meant by a cash crop. The most common answer was 'a crop grown to sell for profit'.
- (b) (i) Few candidates suggested that the student decides to use **Plan B** because it was a larger sample or more representative of the whole field. 'Accurate' and 'reliable' were common incorrect answers.

- (ii) Few candidates gained full credit for suggesting a method the candidate can use to select the nine trees at random. Many described a method of random selection, such as random number generators or picking pieces of paper out of a hat, bag or box. Most of these responses needed to describe a way of identifying each tree in the field, such as numbering them, in order to randomly select nine. A minority of candidates described systematic sampling.
- (iii) This question required candidates to draw a table to record the data from **Plan B**. Most candidates scored partial credit for drawing a table with two columns. Some tables had nine or ten cells for the data. Most tables had headings and a few included the two headings required to record the number of the tree and the number of apples. Some candidates drew a graph, others copied out the steps in **Plan B** in a box.
- (iv) Most candidates gained some credit for describing one method scientists can use to produce new varieties of apple trees. These answers named either selective breeding or genetic modification. The details of the methods were often vague. Some responses did not answer the question and described how yields of the trees could be increased by adding fertilisers or using crop rotation.

Question 3

- (a) (i) Few candidates were able to state clearly that an ecosystem is all the living or biotic and non-living or abiotic components in an area. Some used the phrase 'living and non-living organisms'; all organisms are living.
 - (ii) Most candidates gained partial credit for describing how timber extraction can be done to maintain biodiversity. These responses described selective logging as a method of timber extraction. They needed to go on to describe how the remaining trees maintain biodiversity by providing a habitat for the species in the forest ecosystem. Some candidates suggested the trailer carrying wood in the photograph maintained biodiversity.
 - (iii) This question required the calculation of the total mass of wood on the trailer. The stronger candidates were able to determine the volume of the wood by multiplying the dimensions. A minority of candidates incorrectly rounded their answer. A common error was adding the dimensions of the wood instead of multiplying to find the volume.
 - (iv) Most candidates gained partial credit for explaining two differences between wood chips and coal as an energy resource. The most common correct answers were that coal is more energy dense than wood and emits more carbon dioxide. Many candidates stated that wood is a renewable energy resource and coal is non-renewable. Common errors were not comparing the two resources or describing the way they were formed or extracted.
- (b) (i) This question required a description of how the student can use a quadrat to record the number of different plant species, other than trees, along three transects in the forest. The stronger responses included a suggested size for the quadrat and its spacing along a transect. They described counting the number of plant species in each quadrat and recording the number in a table, then repeating the method along the other two transects. Very few candidates included repeating this investigation on another day or at a different time of the year. Quadrats ranged in size from 25 cm × 25 cm to 100 m × 100 m, longer than the length of the transects. Some candidates wrote about estimating, checking or recording instead of counting. Others wrote about plants instead of plant species. Results were sometimes written on recording sheets or in notebooks with no mention of a table. Many candidates did not show understanding of what a quadrat was, and some named it as the equipment in **Question 3(b)(ii)**. Some candidates described the student as throwing the quadrats in any direction instead of placing them along the transects, others left the quadrat in place for weeks. Some candidates counted animals.
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- (iv) Most candidates suggested a suitable conclusion for the results in the table, such as the average number of different types of insect and the average total number of insects were greater at the end of the transect than at the beginning. Some candidates did not refer to the ends of the transect or the road. Few answers mentioned biodiversity.
- (c) (i) Some candidates gained partial credit for explaining that plants are called producers because they make their own food using photosynthesis. These answers often stated that the plants use sunlight but did not mention chlorophyll. Sometimes only one of the reactants or products was included in a description of the process. A number of candidates included the word and/or chemical equation in their responses. The weakest responses stated that plants were called producers because they produce their own food.
- (ii) This question required a response that explained the flow of energy through the food web. Many candidates gained partial credit for stating that energy transfers when organisms are eaten and gave an example from the food web. The strongest responses explained that energy was used in the food web by the animals during growth, movement and to maintain body temperature. Some of these responses stated that only about 10% of energy was transferred and mentioned the '10% rule'. Many weaker responses described the food chains in the food web in detail, which was not what the question required.
- (d) This question required explanations of how seed banks and zoos can help to maintain biodiversity. There were some excellent responses showing a good understanding of how zoos protect endangered animals by preventing predation, helping them to breed and releasing animals back into the wild to re-establish a population, or increase an existing population. Some candidates stated that zoos can educate people about biodiversity and conservation. Seed banks were less well understood and some candidates suggested they stored and grew plants. The responses gaining credit usually stated that seed banks prevent extinction because if plants become extinct in the wild, the seed bank can provide seeds so plants can be grown to replace them. Few responses mentioned seed banks as a source of genes or their importance in preventing genetic depletion.

Question 4

- (a) (i) There was evidence of candidates measuring the fish in the diagram to estimate the length of the haddock. Many answers were given to two decimal places. Some candidates measured the length of the haddock and gave this as the answer without applying the scale in the diagram.
- (ii) Many candidates gained full credit for explaining what may happen to the haddock population if the mesh size of the gill net is not regulated. These candidates correctly assumed that the question referred to the impact of small mesh size catching many juvenile haddock, who were not able to breed, leading to a decline in the population of haddock. Some candidates incorrectly interpreted 'not regulated' as mesh having large holes that would allow all the haddock to escape and breed, leading to an increase in the population.
- (iii) Most candidates were able to state three strategies, other than regulating mesh size, that can be used to control fishing in Denmark. The most common strategies were quotas to limit the number of fish caught, protected areas and restricted areas to reduce fishing, and closed seasons so fish can breed.
- (b) This question required were candidates were required to give two reasons why some people think feeding animals on farms fish meal to help them grow quickly is not a sustainable activity, was not well understood. The most common reason given was that it causes overfishing and a decline in numbers of fish. Some candidates stated that it would affect food chains. Many responses did not answer the question, suggesting it was unethical to feed fish to farm animals and that the animals might not like the taste if given fish to eat.
- (c) This question required candidates to describe the benefits and limitations of fish farms. Most gained partial credit. The most common benefit was protection from predators. The most common limitation was the spread of disease. Some candidates wrote about tourists being a benefit and the cost of setting up and running fish farms a limitation. Some candidates wrote answers suggesting that fish would be kept on a farm with livestock.

ENVIRONMENTAL MANAGEMENT

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Key messages

- Higher-achieving candidates were guided by the mark allocation for each question which indicates the number of separate marking points required in a response. The use of bullet points helps to ensure concise answers that address a sufficient number of points. The rubric of a question should be followed. For example, if three reasons are asked for, candidates should not give a fourth as an incorrect answer can contradict a previous correct one.
- A conclusion should summarise the main findings of an investigation rather than focusing on one aspect, as in **Question 3(d)(iii)**.
- Candidates should be encouraged to check their question paper to ensure they have attempted every question.
- Candidates should avoid repeating the question in their answer. For example, stating 'One benefit of geothermal energy is...' can be omitted to make best use of examination time.
- Diagrams, charts and graphs should be drawn with a sharp pencil and ruler. Errors are more difficult to correct if a pen is used.
- Stronger candidates read each question carefully to ensure they fully understood what was required in their answers. This was particularly relevant in **Questions 1(a)(i), 1(c)(ii), 1(d)(ii) and 3(e)**.
- Candidates should always show their workings for calculation questions, as credit may be available for correct workings even if the final answer is incorrect.

General comments

Candidates could improve responses by avoiding vague statements such as 'causes harm', 'causes pollution', 'affects the environment', 'causes death', and instead give details of how these effects might come about.

Fieldwork skills such as sampling techniques, how to interpret data and how to give a sensible conclusion from data provided were not well known and were an area where improvements could be made. Strategies or sampling descriptions should be clear enough that another candidate could follow the written method.

Systematic and random sampling was not well understood.

Comments on specific questions

Question 1

- (a) (i) Some candidates analysed individual bars in the population pyramid instead of giving a description of the shape, as required by the question. Weaker responses stated 'a pyramid' – this was insufficient as the question stem informed candidates that the diagram is a population pyramid.
- (ii) The strongest responses to this calculation question showed full working out. Some answers were incorrect due to incorrect rounding.

- (iii) Many suggested that good employment and a lack of availability of contraception were reasons for the increase in population. Some answers were confused and suggested that poor healthcare would increase the population.
- (b) (i) Weaker responses stated that generating electricity by coal causes 'air pollution', without specifying what type of air pollution was involved.
- (ii) Most candidates recognised that Laos has large quantities of natural water sources. Some also identified the suitable terrain and rainy season. It was insufficient to state 'good climate' or 'good weather' as this did not identify what aspect of the weather is good.
- (iii) Good answers stated the creation of jobs and tourism. Weaker responses needed to focus on the economic benefits required by the question. Many needed to suggest a third economic benefit to gain full credit.
- (c) (i) The majority could suggest two reasons why people were affected when the dam burst. The third suggestion was often a repeat of an earlier answer. For example, 'infrastructure washed away' and 'roads washed away'.
- (ii) Some responses needed to focus on the long-term effects as asked for in the question.
- (iii) The majority calculated the quantity of electricity correctly to achieve the correct answer.
- (d) (i) Most candidates could state two distinct correct factors. Suggestions were often repeated in different words and so no further credit could be attained. For example, 'accessibility to the site', 'the location' and 'how easy it is to drive to the mine'.
- (ii) Stronger responses answered the question posed and often gave full descriptions. Some detailed answers about creating a lake or a landfill site were seen – these did not answer the question that was asked.

Question 2

- (a) (i) Many very good bar charts were seen. The most common errors included omitting the label on the y-axis or the units. A few used non-linear scales or scales that did not cover half the grid.
- (ii) Most candidates could suggest two reasons why annual fish consumption per person varies; fewer were able to give three reasons. Some suggested it was due to a larger population in different countries but as the question referred to 'per person', this was not relevant.
- (b) (i) Most calculated the range correctly to achieve the answer of 52. Errors included finding a mean rather than a range or not calculating the value and stating '60 – 6'.
- (ii) Almost all candidates gave the names of the fish in rank order.
- (iii) Candidates found this a challenging question and many focused on the health of the African catfish. The same idea was often repeated in different words, where a different limitation was required for further credit.
- (iv) Common correct answers included 'to avoid bycatch' and 'prevent overfishing'.
- (c) (i) Candidates found this challenging and some answered in terms of how to select a representative sample of catfish rather than people to answer the questionnaire. There was confusion between random and systematic sampling. Some responses referred to stratified sampling, which is not a syllabus requirement.
- (ii) The strongest answers added an explanation, as required by the question rubric, rather than simply copying down the data directly from the table. For example, 'more people do not eat more fish now than 5 years ago, this shows a reduction in demand'.
- (iii) There was considerable confusion between abiotic and biotic factors.

- (iv) Candidates performed poorly on this question about why the farming of plant-eating fish is more energy efficient than the farming of insect-eating fish. Some knew that plant-eating fish are at a lower trophic level and that energy is lost between trophic levels. However, there was a lack of appreciation that energy is lost as heat or through metabolic processes.

Question 3

- (a) (i) Some candidates were able to identify terracing.
- (ii) A few repeated the strategy they had given in **Question 3(a)(i)** when the question asked for 'other' strategies.
- (b) Candidates had difficulty describing the effect of the activities shown on surface run-off and evaporation and performed poorly on this question.
- (c) Evaporation was a common incorrect answer for **A**. Precipitation was usually given for **B**; rain was also seen. Candidates were required to give the name of the process rather than the product.
- (d) (i) Weaker responses stated 1.76, which was not creditworthy as it was not rounded to the same number of decimal places as the rest of the figures in the table.
- (ii) Most knew that group A was a control.
- (iii) The strongest responses considered all the groups in their answer.
- (iv) Candidates performed well when providing suggestions for confirming the results. Most stated repeating the investigation and the higher-achieving responses went on to give details such as repeating 'with a different tree species' or 'at different locations'.
- (e) Many responses did not refer to afforestation and it was clear that many candidates believed this question was about deforestation. Most could state that trees remove carbon dioxide by photosynthesis. Many contradicted the impact of this by going on to suggest that ozone depletion, as well as global warming, would be reduced by a reduction in carbon dioxide in the atmosphere. The majority then went on to give a detailed explanation of how trees increase biodiversity or improve soil. These suggestions were not creditworthy as the question asked about the management of atmospheric pollution.

ENVIRONMENTAL MANAGEMENT

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Key messages

- Candidates should read questions carefully, taking note of each command word used and paying particular attention when there is supporting information provided.
- Working should be shown when completing calculations, especially when more than one mark is available for the answer, as partial credit may be given even if the final answer is incorrect.
- Candidates should use the number of answer lines and the marks available as a guide to the number of ideas needed in the answer.
- A ruler and sharp pencil should be used to draw bar charts.
- Candidates should write answers in full sentences and not just one or two words, and attempt all questions as answers may gain some credit even where there is partial understanding of the topic.

General comments

It is important that candidates read each question carefully and check that they are answering the question asked. For example, in **Question 2(a)(ii)**, three other components of a fertile soil were required, so those who gave three mineral ions did not gain credit.

The use of a line transect and quadrat is an area for improvement for candidates, as demonstrated in responses to **Question 3(b)(i)**.

Comments on specific questions

Question 1

- (a) (i)** Most candidates were able to correctly calculate the number of people living in rural areas in Denmark in 2021. Some gave the answer in thousands, 696 000; others gave it in millions, 0.696 million or 0.7 million. Some candidates correctly multiplied 5.8 million by 0.12 to arrive at 0.696 but then omitted to state that the units were millions. Candidates who showed their working were often able to gain partial credit. A minority calculated the urban population.
- (ii)** Most candidates were able to suggest at least one reason why only a small number of people live in rural areas in Denmark. These responses usually stated that there were few jobs in rural areas. Other reasons suggested were few services such as schools, hospitals and shops and that people migrated to the urban areas. Some candidates wrote about urban areas but did not indicate this in their responses; those who did were sometimes able to gain credit.
- (b) (i)** Most candidates gave the correct answer of commercial or arable as the type of farming shown in the photograph. Some candidates gave wheat farming which was not credited, neither was pastoral farming.

- (ii) This question required candidates to state the number of months wheat grows in the field. The question stated that the wheat is planted in April and harvested in August, and that it needs a minimum average temperature of 12 °C to grow. Some candidates counted 5 months in the period April to August and gave this as the answer, not taking into account the 9 °C average temperature in April. Other candidates counted every month with temperatures of 12 °C or above and gave 6 as the answer.
 - (iii) This question required candidates to give two reasons why most farmers near Copenhagen do not use irrigation methods to grow crops, using information from the table in their answers. Many gained credit for stating that there were a high number of wet days so irrigation was not needed. Using the rainfall data was more challenging with many describing the average rainfall as high or adequate, descriptions that needed qualifying. Stronger responses stated that there was rain in every month or throughout the year. Some candidates did not support their responses with data from the table.
 - (iv) Many candidates gained full credit for describing the environmental impacts of mismanagement of irrigation. The strongest responses described a range of impacts, the most common being waterlogging, loss of nutrients, reduced crop yield and eutrophication. Weaker responses focused on flooding or crops being drowned.
- (c) (i) Most candidates correctly named the two other main ions present in fertilisers as potassium and phosphate. A common mistake was naming phosphorous instead of phosphate.
- (ii) Most candidates plotted the data correctly as a bar chart with bars of equal width that fitted onto the grid. Many missed full credit by not labelling both axes or drawing bars of different widths. Some candidates plotted line graphs although the instruction in the question was to plot a bar chart. Some candidates used a pen to draw the bars, which made correcting errors difficult.
 - (iii) Most candidates gained full credit for describing the trend shown by the data as a steady decrease from Year 1 to Year 17 and constant between Year 17 and Year 18.
 - (iv) The responses to this question, asking candidates to suggest two reasons why nitrous oxide emissions from farming in Denmark will not reach zero tonnes in the future, were variable. Many candidates suggested that bacteria break down nitrogen compounds in the soil to produce nitrogen oxide. Fewer suggested that farming and fertilisers will always be needed or that agricultural machinery and vehicles used on farms release nitrous oxide. Weaker responses confused nitrous oxides with nitrates or nitrogen compounds. A minority of responses wrote about the graph in the previous question.
- (d) Many candidates suggested several reasons why the population of Denmark may be impacted by climate change and gained full credit. These candidates understood the question and wrote about Denmark being a low-lying country with a long coastline. They went on to explain how sea level rise would cause flooding, farmland would be submerged, crops would fail, weather would become more extreme and people would migrate. Some responses misunderstood the question and described causes of climate change. Others described ways the people of Denmark contribute to global warming by adding greenhouse gases to the atmosphere.

Question 2

- (a) (i) Many candidates did not know that clay has a smaller particle size than sand or silt.
 - (ii) Candidates who understood what was meant by the term 'components' usually gained full credit. Air, water, organic matter and microorganisms were the most common correct answers. Some responses named nitrate, phosphate and potassium, although the question asked for three other components of a fertile soil. Some weaker candidates stated three features of soil as a medium for growth, such as the ease of cultivation, nutrients, drainage and pH.
 - (iii) Most candidates could state what is meant by a cash crop. The most common answer was 'a crop grown to sell for profit'.
- (b) (i) Few candidates suggested that the student decides to use **Plan B** because it was a larger sample or more representative of the whole field. 'Accurate' and 'reliable' were common incorrect answers.

- (ii) Few candidates gained full credit for suggesting a method the candidate can use to select the nine trees at random. Many described a method of random selection, such as random number generators or picking pieces of paper out of a hat, bag or box. Most of these responses needed to describe a way of identifying each tree in the field, such as numbering them, in order to randomly select nine. A minority of candidates described systematic sampling.
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