ENVIRONMENTAL MANAGEMENT

Paper 8291/11
Principles of Environmental Management

Key messages

In *Section A*, candidates should note the number of marks available for each part question and write answers accordingly. This will give them an indication of the amount of content and detail expected.

In *Section B*, candidates should indicate clearly which question they are answering, i.e. **Question 7** or **Question 8**.

It is important that instructions are followed carefully. Candidates should make sure that they understand the difference in meaning of the command words such as state, suggest, predict, justify, describe, explain, compare and evaluate.

Candidates should avoid repeating the question in their answers to make best use of examination time.

General comments

There was generally a good response to all questions across the paper. Most candidates found **Question 4** (photochemical smog and Ultra-Low Emission Zones) and **Question 6** (ozone layer) more demanding than the other questions in *Section A*.

Topics which proved more challenging were the equation for photosynthesis, photochemical smog, Ultra-Low emission zones, and the definition of the term 'ozone hole'.

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

The most successful answers included effective use of appropriate examples to illustrate key points, along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

This question covered the topics of plastic pollution (impacts and strategies to manage its reduction) and food webs.

(a) (i) This question was accessed by the majority of candidates with most answers referring to littering on beaches and plastic from boats or from fishing. Common errors were to describe different types of plastics, discuss animals carrying the plastics into the gyres and some just gave the name of adjacent land areas. 'Ocean dumping' was an often-used phrase which needed more specific description.

(ii) Most candidates were able to access all of the credit available with full descriptions of the various ways that plastic pollution could affect migrating aquatic animal species. Weak answers simply suggested that migration would be affected without specifying how, or just stated that the animals would be harmed/killed without describing how this would happen.

(iii) Most candidates accessed some credit for stating two strategies to manage reduction of plastic waste with re-use/recycling and beach clean-ups as the most common responses. Weaker candidates needed to give sufficient detail to access further credit. Some candidates misunderstood the question, and instead of describing strategies to prevent plastic waste from entering the ocean, gave accounts of how plastics in the ocean gyre could be cleaned up.

(b)(i) Most candidates were able to correctly identify an organism feeding at more than one trophic level.

(ii) Although the majority of candidates correctly stated the shark/apex predator/tertiary consumer, a significant number of candidates stated algae/phytoplankton/zooplankton as their response. A few candidates did not access the credit by stating 'tertiary' as it was not clear whether they meant third trophic level or tertiary consumer.

(iii) This question was accessed by the majority of candidates with responses equally split between arguments for the squid population decreasing on the basis of disruption to themselves or their food sources, and arguments for the squid population increasing due to their predators decreasing. Some candidates could have improved by explicitly stating whether the squid population would increase, decrease or stay the same.

Question 2

This question covered the topics of photosynthesis and the impacts of wildfires.

(a)(i) The word equation for photosynthesis was not well known with non-chemical substances often given in responses. The most common incorrect response was sunlight instead of water. Other incorrect responses, in various places in the equation, were chlorophyll, ATP and energy. In some cases, water was stated as a product and oxygen or glucose as a reactant.

(ii) Most candidates showed some understanding that a limiting factor is a factor that affects the outcome of a process, with many giving a correct discussion of the role of carbon dioxide in photosynthesis. Some candidates gave an incorrect response by suggesting that too much carbon dioxide would be detrimental to the process of photosynthesis and would limit it.

(iii) This question was generally well answered with most candidates accessing full credit. Successful answers described the role of carbon dioxide as a greenhouse gas, leading to global warming, drought, melting of glaciers/sea level rise and acidification of oceans. A common misconception was that carbon dioxide, a greenhouse gas, destroys the ozone in the atmosphere leading to global warming.

(b) Candidates found this question more challenging and it was generally less well answered. Very few accessed full credit. Successful answers were characterised by a good understanding of the effects of wild fires – increased carbon dioxide, smoke and ash on photosynthesis and soil fertility. Very few responses discussed the issue of smoke reducing light intensity or dust/ash covering leaves. There was an equal split amongst candidates as to whether wild fires would have a positive or negative effect on the soil, but many were unable to provide a satisfactory reason to support their answer.

Question 3

This question covered the topic of energy security/insecurity with reference to both fossil fuels and renewable energy sources.

(a) Most candidates were able to correctly state that hydroelectric is the largest source of renewable energy used by the three countries in **Fig. 3.1**.

(b) Very few candidates were able to correctly give tidal or wave energy as one other source of renewable energy other than those shown in **Fig. 3.1**. Nuclear energy was the most common incorrect answer.

(c) Most candidates were able to access full credit for understanding that Brazil is reliant on hydroelectric power which requires flowing water, and that the amount of electrical power generated from this source is likely to reduce during a drought.

Cambridge Assessment
International Education

(d)   Most candidates gained credit for comparing Costa Rica's four sources of energy to Iceland's two sources. Successful responses went on to explain that, as a result, Costa Rica has more flexibility/back up options if one source fails.

Question 4

This question covered the topic of photochemical smog, combustion of fossil fuels and Ultra-Low Emission Zones.

(a) (i)   This question was less well accessed, with many candidates giving a description of an example of pollution produced by burning fossil fuels, rather than an example of the combustion of a fossil fuel. The most common correct answer was burning coal.

(ii)   The majority of candidates found this question challenging and answers were often limited to descriptions of photochemical smog as a dense cloud of pollution caused by burning fossil fuels. Very few candidates accessed any credit and there were a significant number who did not write a response. Successful candidates gave a precise, correct definition of photochemical smog including reference to NO_x, VOCs and ground-level ozone.

(iii)   Most candidates gained the credit for reference to respiratory issues such as asthma or difficulties in breathing. Weaker candidates referred to adverse effects on human health which were too vague to gain credit.

(b)   Candidates found this question more challenging and very few accessed all of the credit available; most candidates gained some credit. The most common response referred to vehicles being restricted from entering the zone, so emissions are reduced which leads to improved air quality. Weaker candidates generally repeated the question and stated air pollution would decrease. Some responses did not make it clear that the strategy only reduces emissions from vehicles, rather than from other sources such as factories and industry. Some candidates showed lack of understanding of an Ultra-Low Emission Zone, stating that in **Fig. 4.1** there are less roads in the central zone, while others included irrelevant discussion about rivers and lakes shown in **Fig. 4.1**. Stronger candidates also referred to the use of alternative modes of transport such as electric vehicles or bicycles.

Question 5

This question covered the topic of water security.

(a)   This question was generally well answered and candidates accessed full credit by suggesting that reasons for the reduction of water in the Puzhal reservoir in **Fig. 5.1** were climate change, lack of rain, drought and increased rate of evaporation. Less successful responses only suggested over-use by the large human population surrounding the reservoir, limiting the credit they could achieve. A small number of candidates misunderstood the question and suggested the reservoir had been deliberately infilled to provide land for building.

(b)   Most candidates were able to give an acceptable definition of water security to access some credit, but few candidates gave a complete answer.

(c)   This question was generally well answered with most candidates accessing some of the available credit. Less successful responses suggested reduced opportunities for hydroelectric power, less fish available in the reservoir and referred to people having less water, but without specifying how this would impact them. Some candidates did not provide responses that addressed the key word 'impact' and wrote answers about water management which would have been better reserved for **Question 5(d)**. Some candidates gave answers that were not relevant to the question, discussing reduction in habitat and biodiversity in the area surrounding the reservoir.

(d)   Most candidates were able to access some of the credit, and could have achieved more by developing the points they made further. A very few gained full credit. The most common strategies referred to were rationing, reduction in water use and education. Although some candidates suggested gaining water from elsewhere, very few were able to give creditworthy suggestions such as obtaining groundwater from aquifers.

Cambridge Assessment
International Education

Question 6

This question covered the topic of the structure of the atmosphere and the ozone layer.

(a)   Candidates were required to use **Fig. 6.1** to state the range of altitudes that contain the ozone layer. Many candidates did not know that the ozone layer is within the stratosphere, and some did not give a range with an acceptable lower and higher number (between 10 and 50 km).

(b)   The role of the ozone layer in shielding the Earth from UV radiation was well known. However, very few candidates used the correct terminology 'absorb' or the accepted alternative 'block' in their answers. Many candidates described the harmful effects of UV radiation, comments that would have been better reserved for **Question 6(d)**. A common misunderstanding was that the ozone layer plays a part in global warming by preventing the Earth from getting too hot.

(c)   Most candidates were able to access credit by stating 'an area where the ozone layer is depleted'. A few candidates were able to define the ozone hole as an area where the concentration of ozone is below 100 Dobson Units. Some candidates referred to the use of CFCs as the cause, which did not answer the question.

(d)   The majority of candidates stated either skin cancer or cataracts. Weaker candidates often suggested adverse health effects, skin or eye problems or cancer, none of which were specific enough to gain credit. There was also some confusion with global warming with some candidates describing rising temperatures, rising sea levels, drought and crop failure.

Section B

Most candidates chose to answer **Question 7** rather than **Question 8**.

The questions in *Section B* assess two skill areas: AO2 (Information Handling and Analysis) for which there is a total of 8 marks and AO3 (Investigation Skills and Making Judgements) for which there is a total of 12 marks. The two marks are combined to give a total mark out of the 20 marks available.

In general, the majority of candidates were awarded Level 2 for both AO2 and AO3 with a total mark between 8/20 and 12/20. A small number of candidates were unable to achieve more than Level 1 for AO2 as they did not provide any examples to support their answer, and Level 1 for AO3 as their response was largely descriptive and they did not make any judgements. There were a few candidates who did not answer either question in *Section B*.

Question 7

Most candidates made a good start to their answer by referring to local strategies with examples such as: beach clean ups, litter picking, reduction in single use plastics, recycling, tree planting, growing own vegetables, conserving water or using environmentally friendly modes of transport to help reduce air pollution.

Very few candidates discussed examples of global strategies, therefore limiting their response to Level 2 for AO2. When International Protocols were cited, there was some confusion between the Kyoto Protocol, the Paris Agreement and the Montreal Protocol.

Most candidates only discussed one side of the argument by concluding that 'think globally and act locally' is or is not an effective strategy, limiting their response to Level 2 for AO3.

Stronger candidates gave a good range of directly relevant examples (both local and global) of their chosen environmental issues and made comparisons between the luxury of choice for people living in HICs compared to the difficulties facing people living in LICs. Some candidates understood that many environmental strategies are more expensive and out of reach of LIC countries and people on lower incomes.

Only a small minority of candidates gave high-level responses with balanced comparisons and evaluations of both local and global strategies to achieve Level 3 for AO2 and Level 4 for AO3.

A few candidates discussed strategies to manage human population size which was not relevant to the question.

Question 8

This question was chosen by relatively few candidates and was generally poorly answered. Candidates who opted for this question often did not show understanding of the definition of a tundra, and that tundra is most commonly found in the Arctic.

In consequence, the most common 'tundra' chosen was Antarctica which caused a problem as only the peripheral islands of Antarctica are tundra. Most of Antarctica is too cold and dry to support vegetation and is covered by ice fields. Other incorrect examples quoted included the tropical rainforest in Brazil and the Sahara Desert in North Africa.

Despite this, some examples of human impacts such as climate change, tourism, oil extraction and oil spills, mining and scientific research could still gain credit for AO2 as these also impact true tundra regions. Most candidates achieved Level 2 for AO2.

The most common management strategy given in responses was the Antarctic Treaty, which was not strictly relevant to tundra regions. However, candidates could still gain credit for AO3 if they evaluated the success of strategies within the Antarctic Treaty such as protected areas, tourism control, banning or limiting mineral extraction and waste management which are also relevant to tundra regions.

Discussion of the Montreal Protocol and banning of CFCs in relation to the 'hole in the ozone' did not attain credit as it was not relevant to the question.

Very few candidates were able to achieve more than Level 2 for AO3 as evaluations tended to be one-sided, stating simply that the strategy was either successful or unsuccessful.

ENVIRONMENTAL MANAGEMENT

Paper 8291/12

Principles of Environmental Management

Key messages

In **Section A**, candidates should note the number of marks available for each part question and write answers accordingly. This will give them an indication of the amount of content and detail expected.

In **Section B**, candidates should indicate clearly which question they are answering, i.e. **Question 7** or **Question 8**.

It is important that instructions are followed carefully. Candidates should make sure that they understand the difference in meaning of the command words such as state, suggest, predict, justify, describe, explain, compare and evaluate.

Candidates should avoid repeating the question in their answers to make best use of examination time.

General comments

There was generally a good response to all questions across the paper. Most candidates found **Question 2** (air pollution, combustion of fossil fuels and the carbon cycle) and **Question 3** (tundra and desert biomes) more demanding than the other questions in **Section A**.

Topics which proved more challenging were the enhanced greenhouse effect, processes in the carbon cycle, abiotic components in the tundra biome, stores of biomass and litter in the desert biome, and definitions of the terms gross primary productivity and net primary productivity.

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

The most successful answers included effective use of appropriate examples to illustrate key points, along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

This question covered the topics of population density and population pyramids.

(a) (i) Almost all candidates were able to correctly calculate the population density for Bangladesh as 1265.

(ii) Most candidates were able to correctly state that the land area of France was larger than that of the UK even though the populations were very similar.

(iii) This question was generally well answered with most candidates accessing the majority of the credit. Successful responses described the environmental aspects of the land, economic factors such as job opportunities and standard of living, political factors such as conflict, and historical factors such as prolonged drought influencing population density of different regions within a

country. Less successful candidates tried to make comparisons of population density between the three countries in **Table 1.1** rather than answer the question set.

(b)(i) Candidates needed to consider the shapes and make comparisons between the data shown in the population pyramids for the UK and Mozambique. Very few candidates were able to compare the shapes in a meaningful way. A very small number accessed full credit with most gaining some of the credit available. The more successful answers made clear comparisons between the data for the two countries with the most common responses referring to an ageing population in the UK, and the higher birth rate and higher mortality in Mozambique. Some candidates gave answers not relevant to the question, discussing reasons for the differences in the population pyramids, which would have been better reserved for **Question 1(b)(ii)**.

(ii) Most candidates accessed credit with the commonest responses referring to better healthcare as a reason for a higher elderly population in the HIC, and lack of education and availability of contraception for the higher birth rate in the LIC.

Question 2

This question covered the topics of gases (carbon dioxide, methane, oxides of nitrogen and CFCs) that cause air pollution, combustion of fossil fuels and the enhanced greenhouse effect, and the carbon cycle.

(a)(i) The sources of methane and oxides of nitrogen were not well known. Incorrect responses were varied or the table was left blank for methane. The most common incorrect responses for oxides of nitrogen were factories or fossil fuels. Most candidates gained some credit for this question.

(ii) This question was generally well answered with most candidates accessing the majority of the credit. Successful answers referred to strategies such as switching to renewable resources or reducing fossil fuel use, reducing landfill, having catalytic converters in cars and reducing the use of products that contain CFCs.

(iii) Candidates found this question more challenging and it was generally less well answered. Very few candidates gained full credit. The strongest responses were characterised by a good understanding that the increased carbon dioxide absorbs radiation from the Sun, converts it to longer wave energy, which is then reflected back to the ground, increasing temperatures and leading to climate change. Weaker responses simply referred to heat being trapped causing global warming. A common misconception was that the carbon dioxide resulted in a hole in the ozone layer which was the cause of global warming.

(b) The processes of the carbon cycle were generally not well known with most candidates only able to name one process correctly. The most common correct response was photosynthesis for **X**.

Question 3

This question covered the topics of tundra and desert biomes.

(a)(i) The majority of candidates were able to correctly state one abiotic component other than water, with temperature or sunlight being the most popular responses.

(ii) Candidates generally found this question more challenging. Most candidates who had some understanding of conditions in a tundra biome were able to access some credit. The most common response was reference to low temperatures with lack of available water as it is frozen. The strongest responses included the idea of water being scarce, the presence of a permafrost layer with thin soil lacking in nutrients, low temperatures and a lot of wind. Some candidates incorrectly described the conditions of a desert biome. There were a significant number of candidates who did not write a response.

(iii) Very few candidates were able to correctly state permafrost as the store of methane and carbon dioxide found in tundra.

(b)(i) This question was more challenging and generally less well answered. Successful responses were characterised by a good understanding of conditions in a desert biome – hot and dry with little vegetation and few animals, followed by an explanation of why this leads to stores for litter being low. Weaker responses showed little understanding of how litter is formed and a common

Cambridge Assessment
International Education

misconception was that few humans living in the desert meant there was very little 'trash' or litter thrown away. Very few candidates accessed full credit for this question.

(ii)   Very few candidates were able to define either gross primary productivity or net primary productivity. A common misconception was that productivity was the amount of biomass produced rather than energy. A significant number of candidates did not write a response.

Question 4

This question covered the topics of hydroelectric power, energy security and insecurity.

(a) (i)   The majority of candidates were able to access some credit with very few accessing the full credit available for the question. The most common correct responses were that hydroelectric power is renewable and a reliable or more affordable source of energy. Stronger responses considered the reduction in reliance on fossil fuels and that it provides an extra energy source. Some candidates misunderstood the question and described the topography in **Fig. 4.1** rather than how hydroelectric power contributes to energy security. Almost no candidates mentioned that Austria is landlocked so cannot access energy sources such as tidal or wave energy from the sea.

(ii)   Some candidates described what is meant by energy insecurity rather than explain the causes. Most candidates stated two causes of energy insecurity, with population growth and increased demand as the most common responses. Weaker candidates needed to give sufficient detail to access further credit. Stronger candidates included references to supply disruption or inability to access energy due to wars or conflicts, and economic or political instability.

(b)   Candidates who answered this question well gave detailed responses for both advantages and disadvantages. Stronger answers considered advantages such as dams being used for recreation or tourism and hydroelectric being a cleaner power source, and included disadvantages such as the cost of construction of the dams, the alteration or destruction of habitats and effects on the river downstream from the dam. Many weaker answers needed developing as they were too vague to be awarded credit.

Question 5

This question covered the topics of plastic waste and its management.

(a)   This question was accessed by most candidates, with most answers referring to plastics being brought by ocean currents from other beaches, the wind carrying plastic from landfill or other beaches and visitors to conservation areas still littering. Some candidates only provided one or two responses so were unable to access all of the credit. 'Dumping waste' by people on boats or factories was a common phrase used by weaker candidates, which needed more specific description.

(b)   Most candidates were able to correctly suggest one impact of plastic waste on beach environments.

(c)   Candidates found this question more challenging as they suggested a number of strategies to manage the disposal of plastic waste, rather than evaluating the success of one strategy. Credit was generally gained for naming a strategy and describing it. The more successful responses named, described and evaluated a valid strategy, e.g. use of landfills results in land pollution in urban areas where plastic is collected reducing, but chemicals leach into the soil causing water pollution, and it takes hundreds of years for the plastic to degrade.

Section B

There was a fairly even split between candidates choosing to answer **Question 6** and **Question 7**.

The questions in *Section B* assess two skill areas: AO2 (Information Handling and Analysis) for which there is a total of 8 marks and AO3 (Investigation Skills and Making Judgements) for which there is a total of 12 marks. The two marks are combined to give a total mark out of the 20 marks available.

In general, the majority of candidates were awarded Level 2 for both AO2 and AO3 with a total mark between 8/20 and 12/20. A small number of candidates were unable to achieve more than Level 1 for AO2

as they did not provide any examples to support their answer, and Level 1 for AO3 as their response was largely descriptive and they did not make any judgements. There were a very small number of candidates who did not answer either question in *Section B*.

Question 6

This question was generally less well answered than **Question 7**. Most candidates linked wild fires to global climate change but tended to focus on a description of global warming for the bulk of their response rather than providing examples of evidence of global climate change and then analysing the evidence, thus limiting their response to Level 2 for AO2. Very few candidates considered the arguments against wild fires being evidence for global climate change, with little reference to a normal part of the cycle in Australia, i.e. a wild fire season and some plants or trees relying on this cycle to re-grow and re-populate the bush area. This limited their response to Level 2 for AO3. To improve and achieve high-level responses, candidates need to give balanced comparisons and evaluations, of arguments for and against the statement to achieve Level 3 for AO2 and Level 4 for AO3. A few candidates discussed damage to the ozone layer which was not relevant to the question.

Question 7

This question was answered slightly better than **Question 7** with most candidates able to demonstrate an understanding of a range of strategies to manage conservation of habitats such as national parks, conservation areas, zoos and wildlife parks, ecotourism and legislation to ban poaching and logging. Stronger candidates provided directly relevant examples of specific locations and provided a balanced evaluation of the strategies to achieve Level 3 for AO2 and Level 4 for AO3. Weaker candidates often listed a range of strategies with little development, use of specific examples or evaluation, limiting their response to Level 2 for AO2 and AO3.

ENVIRONMENTAL MANAGEMENT

> **Paper 8291/13**
> **Principles of Environmental Management**

Key messages

In **Section A**, candidates should note the number of marks available for each part question and write answers accordingly. This will give them an indication of the amount of content and detail expected.

In **Section B**, candidates should indicate clearly which question they are answering, i.e. **Question 7** or **Question 8**.

It is important that instructions are followed carefully. Candidates should make sure that they understand the difference in meaning of the command words such as state, suggest, predict, justify, describe, explain, compare and evaluate.

Candidates should avoid repeating the question in their answers to make best use of examination time.

General comments

There was generally a good response to all questions across the paper. Most candidates found **Question 2** (air pollution, combustion of fossil fuels and the carbon cycle) and **Question 3** (tundra and desert biomes) more demanding than the other questions in **Section A**.

Topics which proved more challenging were the enhanced greenhouse effect, processes in the carbon cycle, abiotic components in the tundra biome, stores of biomass and litter in the desert biome, and definitions of the terms gross primary productivity and net primary productivity.

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

The most successful answers included effective use of appropriate examples to illustrate key points, along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

This question covered the topics of population density and population pyramids.

(a) (i) Almost all candidates were able to correctly calculate the population density for Bangladesh as 1265.

(ii) Most candidates were able to correctly state that the land area of France was larger than that of the UK even though the populations were very similar.

(iii) This question was generally well answered with most candidates accessing the majority of the credit. Successful responses described the environmental aspects of the land, economic factors such as job opportunities and standard of living, political factors such as conflict, and historical factors such as prolonged drought influencing population density of different regions within a

country. Less successful candidates tried to make comparisons of population density between the three countries in **Table 1.1** rather than answer the question set.

(b)(i) Candidates needed to consider the shapes and make comparisons between the data shown in the population pyramids for the UK and Mozambique. Very few candidates were able to compare the shapes in a meaningful way. A very small number accessed full credit with most gaining some of the credit available. The more successful answers made clear comparisons between the data for the two countries with the most common responses referring to an ageing population in the UK, and the higher birth rate and higher mortality in Mozambique. Some candidates gave answers not relevant to the question, discussing reasons for the differences in the population pyramids, which would have been better reserved for **Question 1(b)(ii)**.

(ii) Most candidates accessed credit with the commonest responses referring to better healthcare as a reason for a higher elderly population in the HIC, and lack of education and availability of contraception for the higher birth rate in the LIC.

Question 2

This question covered the topics of gases (carbon dioxide, methane, oxides of nitrogen and CFCs) that cause air pollution, combustion of fossil fuels and the enhanced greenhouse effect, and the carbon cycle.

(a)(i) The sources of methane and oxides of nitrogen were not well known. Incorrect responses were varied or the table was left blank for methane. The most common incorrect responses for oxides of nitrogen were factories or fossil fuels. Most candidates gained some credit for this question.

(ii) This question was generally well answered with most candidates accessing the majority of the credit. Successful answers referred to strategies such as switching to renewable resources or reducing fossil fuel use, reducing landfill, having catalytic converters in cars and reducing the use of products that contain CFCs.

(iii) Candidates found this question more challenging and it was generally less well answered. Very few candidates gained full credit. The strongest responses were characterised by a good understanding that the increased carbon dioxide absorbs radiation from the Sun, converts it to longer wave energy, which is then reflected back to the ground, increasing temperatures and leading to climate change. Weaker responses simply referred to heat being trapped causing global warming. A common misconception was that the carbon dioxide resulted in a hole in the ozone layer which was the cause of global warming.

(b) The processes of the carbon cycle were generally not well known with most candidates only able to name one process correctly. The most common correct response was photosynthesis for **X**.

Question 3

This question covered the topics of tundra and desert biomes.

(a)(i) The majority of candidates were able to correctly state one abiotic component other than water, with temperature or sunlight being the most popular responses.

(ii) Candidates generally found this question more challenging. Most candidates who had some understanding of conditions in a tundra biome were able to access some credit. The most common response was reference to low temperatures with lack of available water as it is frozen. The strongest responses included the idea of water being scarce, the presence of a permafrost layer with thin soil lacking in nutrients, low temperatures and a lot of wind. Some candidates incorrectly described the conditions of a desert biome. There were a significant number of candidates who did not write a response.

(iii) Very few candidates were able to correctly state permafrost as the store of methane and carbon dioxide found in tundra.

(b)(i) This question was more challenging and generally less well answered. Successful responses were characterised by a good understanding of conditions in a desert biome – hot and dry with little vegetation and few animals, followed by an explanation of why this leads to stores for litter being low. Weaker responses showed little understanding of how litter is formed and a common

misconception was that few humans living in the desert meant there was very little 'trash' or litter thrown away. Very few candidates accessed full credit for this question.

(ii)   Very few candidates were able to define either gross primary productivity or net primary productivity. A common misconception was that productivity was the amount of biomass produced rather than energy. A significant number of candidates did not write a response.

Question 4

This question covered the topics of hydroelectric power, energy security and insecurity.

(a) (i)   The majority of candidates were able to access some credit with very few accessing the full credit available for the question. The most common correct responses were that hydroelectric power is renewable and a reliable or more affordable source of energy. Stronger responses considered the reduction in reliance on fossil fuels and that it provides an extra energy source. Some candidates misunderstood the question and described the topography in **Fig. 4.1** rather than how hydroelectric power contributes to energy security. Almost no candidates mentioned that Austria is landlocked so cannot access energy sources such as tidal or wave energy from the sea.

(ii)   Some candidates described what is meant by energy insecurity rather than explain the causes. Most candidates stated two causes of energy insecurity, with population growth and increased demand as the most common responses. Weaker candidates needed to give sufficient detail to access further credit. Stronger candidates included references to supply disruption or inability to access energy due to wars or conflicts, and economic or political instability.

(b)   Candidates who answered this question well gave detailed responses for both advantages and disadvantages. Stronger answers considered advantages such as dams being used for recreation or tourism and hydroelectric being a cleaner power source, and included disadvantages such as the cost of construction of the dams, the alteration or destruction of habitats and effects on the river downstream from the dam. Many weaker answers needed developing as they were too vague to be awarded credit.

Question 5

This question covered the topics of plastic waste and its management.

(a)   This question was accessed by most candidates, with most answers referring to plastics being brought by ocean currents from other beaches, the wind carrying plastic from landfill or other beaches and visitors to conservation areas still littering. Some candidates only provided one or two responses so were unable to access all of the credit. 'Dumping waste' by people on boats or factories was a common phrase used by weaker candidates, which needed more specific description.

(b)   Most candidates were able to correctly suggest one impact of plastic waste on beach environments.

(c)   Candidates found this question more challenging as they suggested a number of strategies to manage the disposal of plastic waste, rather than evaluating the success of one strategy. Credit was generally gained for naming a strategy and describing it. The more successful responses named, described and evaluated a valid strategy, e.g. use of landfills results in land pollution in urban areas where plastic is collected reducing, but chemicals leach into the soil causing water pollution, and it takes hundreds of years for the plastic to degrade.

Section B

There was a fairly even split between candidates choosing to answer **Question 6** and **Question 7**.

The questions in *Section B* assess two skill areas: AO2 (Information Handling and Analysis) for which there is a total of 8 marks and AO3 (Investigation Skills and Making Judgements) for which there is a total of 12 marks. The two marks are combined to give a total mark out of the 20 marks available.

In general, the majority of candidates were awarded Level 2 for both AO2 and AO3 with a total mark between 8/20 and 12/20. A small number of candidates were unable to achieve more than Level 1 for AO2

as they did not provide any examples to support their answer, and Level 1 for AO3 as their response was largely descriptive and they did not make any judgements. There were a very small number of candidates who did not answer either question in *Section B*.

Question 6

This question was generally less well answered than **Question 7**. Most candidates linked wild fires to global climate change but tended to focus on a description of global warming for the bulk of their response rather than providing examples of evidence of global climate change and then analysing the evidence, thus limiting their response to Level 2 for AO2. Very few candidates considered the arguments against wild fires being evidence for global climate change, with little reference to a normal part of the cycle in Australia, i.e. a wild fire season and some plants or trees relying on this cycle to re-grow and re-populate the bush area. This limited their response to Level 2 for AO3. To improve and achieve high-level responses, candidates need to give balanced comparisons and evaluations, of arguments for and against the statement to achieve Level 3 for AO2 and Level 4 for AO3. A few candidates discussed damage to the ozone layer which was not relevant to the question.

Question 7

This question was answered slightly better than **Question 7** with most candidates able to demonstrate an understanding of a range of strategies to manage conservation of habitats such as national parks, conservation areas, zoos and wildlife parks, ecotourism and legislation to ban poaching and logging. Stronger candidates provided directly relevant examples of specific locations and provided a balanced evaluation of the strategies to achieve Level 3 for AO2 and Level 4 for AO3. Weaker candidates often listed a range of strategies with little development, use of specific examples or evaluation, limiting their response to Level 2 for AO2 and AO3.

ENVIRONMENTAL MANAGEMENT

> **Paper 8291/21**
> **Management in Context**

Key messages

- Candidates are not required to repeat the question in their answer. For example, in **Question 1**, stating 'Alternative fuels to methane are needed because…', did not make best use of examination time for some candidates.
- Candidates should use the mark allocation for each question as a guide to the number of separate marking points required for the response.
- The use of bullet points in a response helps to ensure concise answers that address a sufficient number of points.

General comments

Candidates should avoid vague statements such as 'causes harm', 'causes pollution', 'affects the environment', 'causes death'; these unspecific statements are unlikely to gain credit.

Field work skills, such as sampling techniques, how to interpret data and how to give a sensible conclusion from data provided, were not well known. Strategies or sampling descriptions should be clear enough that another student could follow the written method.

Evaluations should include both positive and negative arguments.

Candidates should check their question paper to ensure they have attempted every question.

It is not advisable to use pen for any diagram, graph or chart. Errors are more difficult to correct if pen is used. A ruler and sharp pencil should always be used for a graph.

Comments on specific questions

Question 1

(a) (i) There was a common misconception that carbon dioxide emissions contribute to ozone depletion.

   (ii) Most candidates recognised the economic issue with the trial. Fewer were able to suggest a second valid reason.

   (iii) Relatively few responses gave the correct answers: carbon capture and carbon storage. Some recalled that planting trees would remove carbon dioxide.

(b) (i) The trends in the graph were compared well by many candidates. Some stated data rather than trends. Others did not compare the two graph lines. A minority gave reasons for the trends which was not what the question asked for.

   (ii) Most responses gave a good explanation. Weaker answers focused solely on being reliant on another country without developing this idea further.

Question 2

(a) (i)   The majority correctly stated two countries.

(ii)   Candidates were not confident determining a percentage. Many misread the second part of the question and gave the mass of waste that was recycled in Finland.
Answers: 3120; 13 440.

(iii)   Strategies for increasing recycling were well known.

(iv)   Suggestions for the negative impacts of waste incineration were less successful. Vague responses such as 'causes harm or pollution', were insufficient for credit.

(v)   The majority of responses attempted an evaluation that included positive and negative impacts.

(b) (i)   Candidates found this question challenging. Very few realised that sewage is hazardous.

(ii)   This proved to be a challenging question for candidates. Some vague answers such as, 'harms wildlife' did not clarify the response with what the harm could be. Stronger answers stated 'animals choke on plastic' or 'waste ends up in oceans'.

(c)   Some good descriptions were seen on how tourism can be controlled.

Question 3

(a) (i)   Many candidates realised that the increasing world population has resulted in an increased use of artificial lighting.

(ii)   A minority of candidates realised that insects are pollinators and the effect of their absence on food chains and food availability.

(b) (i)   The average of 250 was generally calculated correctly. A minority left this question blank. Candidates should check their question paper to ensure they have attempted every question.

(ii)   Most candidates were able to interpret the data correctly to suggest every 4 days for field **A** and no spray for field **B**.

(iii)   Candidates were familiar with agricultural techniques to control pests. A few stated insecticides, despite this being ruled out in the question.

(iv)   A minority of candidates were able to clearly describe a sampling strategy. Often systematic and random strategies were described in one method. Strategies or sampling descriptions should be clear enough that another student could follow the written method.

(v)   Most were able to give one benefit and one limitation of a sweep net. Weaker descriptions were contradictory; for example, 'quick to use' and 'time consuming'.

Question 4

(a) (i)   A minority suggested a sensible way of measuring forest cover, such as using satellites or aerial photographs.

(ii)   Most responses stated habitat loss and increased competition.

(b) (i)   Many gave a suitable conclusion. Weaker responses referred to 'a change' rather than a specific decrease in forest cover.

(ii)   Good pie charts were drawn using a sharp pencil and ruler. The sectors were in rank order, with the largest first, beginning at noon and proceeding clockwise, and the key matched the sectors.

(iii)   Many made the correct suggestion that the sample size needed to be known. Weaker responses stated that a title was needed. This would not ensure the data in the table was reliable.

(c) (i)   Many suggested a good reason why not all of the trees will grow.

(ii)   The most common correct responses were lack of funds and lack of space.

(iii)   The question of how reforestation can improve water security was poorly answered. Statements such as 'changes evaporation' were not sufficient as the direction of change was needed and where the evaporation is occurring from, e.g. decreased evaporation from soil or increased evaporation from leaves. Few responses referred to increasing groundwater stores or the capacity of the soil to absorb more water.

(iv)   A number of responses referred to invasive species. Weaker answers focused on why non-native trees could die rather than the impact of the non-native trees.

(v)   Most answers referred to photosynthesis. However, hardly any responses gave a correct equation for this.

Question 5

(a)   Some very good advantages and disadvantages of a solar stove compared with a wood stove were given. Good responses were clearly structured and identified whether a suggestion was an advantage or a disadvantage and clarified which stove they referred to. For example, a weak response – 'it is time consuming' and a stronger response – 'advantage: solar stoves use less time as no wood is collected'.

(b)(i)   Very few candidates suggested that this method allowed for countries with different populations to be directly compared.

(ii)   Many suggested 'lack of funds', which was not sufficient. Stronger answers gave reasons why, such as lack of funds to buy an electric stove instead of a wood stove.

(c) (i)   A majority of candidates gave a sensible suggestion as to why the polluter pays principle is not always implemented.

(ii)   Some responses were a repeat of **Question 5(c)(i)**. Good answers recognised that some people are unable to pay and that many people do not have access to a viable alternative such as buying an electric vehicle.

ENVIRONMENTAL MANAGEMENT

Paper 8291/22
Management in Context

Key messages

- Candidates should note the number of marks available for each part question and write answers accordingly. This will give them an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates must make sure that they understand the difference in meaning of the command words such as state, suggest, predict, justify, describe, explain, compare and evaluate.
- Candidates should avoid repeating the question in their answers to make best use of examination time.
- All working out should be shown in calculation questions, as credit may be available for the correct calculation method.

General comments

There was generally a good response to all questions across the paper. Most candidates found some parts of **Question 1** (energy sources and electricity generation) and parts of **Question 4** (forest cover, questionnaires and sampling strategies) more demanding than the other questions on the paper.

Topics which proved more challenging were imported energy, carbon neutrality, trophic levels, and sampling techniques.

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

The most successful answers included effective use of appropriate examples to illustrate key points, along with supporting details using appropriate terminology.

Comments on specific questions

Question 1

This question covered the topics of energy sources (including the disadvantages of imported energy sources) and electricity generation.

(a) (i) Most candidates attempted this question. Credit was most commonly given for responses that included the term 'fossil fuel' and the fact that it is non-renewable. Where candidates gained limited credit, they often did not make three separate points, generally stating that coal is non-renewable, finite and supply limited. There was some mention of the greenhouse effect but these references were vague and did not develop the idea to describe or state that the greenhouse effect would be enhanced.

(ii) Candidates performed well in this question with many mentions of wind energy not being enough, weather conditions being variable or the idea that insufficient wind turbines had been built.

(iii) Candidates found this question more challenging, with many giving responses on renewable energy rather than imported energy. The idea of energy security was rarely included. Some candidates considered the interruption of electricity supply due to conflict, and this was often a well-developed point.

(iv) Very few candidates could explain carbon neutrality. A common misconception was the idea that no carbon dioxide is released in burning biomass. For further credit, candidates needed to be able to describe the role of photosynthesis and the idea of a cycle with plants being able to capture the carbon dioxide from the atmosphere.

(b) This question was very well answered with the majority of candidates able to give three clear, distinctive impacts of burning wet wood on human health to access full credit.

(c) (i) Candidates needed to consider the relationship between the width of the oil contribution in 1985 compared to the most recent data in **Fig. 1.1** to access the credit. The oil section had decreased by around 50%, a far greater percentage compared to other sources. Some common errors included selecting nuclear or coal.

(ii) Candidates used data from **Fig. 1.1** well by incorporating information from the chart into their responses, including facts such as 'the greatest contribution was from coal and nuclear'. To develop answers further, candidates needed to focus more on the idea of comparison and include direct comparisons between the coal and nuclear trends.

(iii) Some candidates answered the question well and considered improved extraction methods and the detection of new reserves. Common misconceptions included thinking that natural gas was biogas and that the increase in use was due to increasing sustainability.

Question 2

This question covered the topic of waste management including landfill and recycling.

(a) (i) Almost all candidates were able to correctly identify the number of countries in 2016 that disposed of more of their waste using landfill than recycling as 4 (Finland, Malta, Serbia and Sweden).

(ii) The majority of candidates were able to calculate the percentage of waste disposed of using landfill to achieve the answer of 18%. The most common error was not rounding the answer to the nearest whole number, and therefore not accessing full credit.

(iii) This question was answered very well with the most common answer being the idea that there were other methods of waste disposal. Many candidates included examples of methods not included in support of their answer.

(iv) Many candidates answered this question effectively, referring to many clear and independent impacts of landfill as a method of waste disposal. The more successful candidates who accessed most or all of the credit, commonly included discussion of leaching, soil contamination, water pollution, the production of methane and the potential for explosion. Weaker candidates needed to develop their answers further by including a greater range of impacts.

(v) Candidates generally answered this question well with many suggesting increasing the number of recycling bins as a strategy to increase the amount of waste recycling.

(b) (i) Candidates were commonly able to construct an appropriate key which linked to their pie chart. The main challenge in this question was the order of the sectors; the convention of sectors in rank order, large to small, starting at noon and proceeding clockwise, was followed by few candidates. Another area of development for candidates was the accurate plotting of sectors by converting percentages to degrees and using a protractor. Few responses accessed all of the credit available for this question.

(ii) The majority of candidates were able to suggest that reducing domestic waste would be unlikely to reduce Europe's overall waste production, due to the small contribution it made (9%) to the overall percentage.

(c) Candidates could have developed their answers further, to access the credit available, by including the idea that large amounts of waste could be dealt with using incineration, or by linking to some of the landfill issues. Successful responses included the idea that incinerating waste could fuel a power station.

Question 3

This question covered the topics of estimation of population size, Simpson's index of biodiversity, food webs and conservation of sandhill cranes.

(a) (i)   Almost all candidates were able to count the birds and record the number as 4 for grid square **A4** and 5 for grid square **D3**.

(ii)   Candidates who answered this question well gave detailed responses linked to the method and to the specific setting. Strong responses, gaining most of the credit available, considered the issues of moving birds, the effect of vegetation blocking view and the need for a drone or aeroplane to take the images, which is costly. Many answers were vague and needed developing. Ideas which were rarely mentioned included the benefits of automated counting and the idea of being able to repeat the counting process.

(b) (i)   The majority of candidates who attempted this question answered correctly and could successfully substitute the values into the given formula and arrive at the correct answer of 0.56. Many candidates did not attempt this question.

(ii)   Many candidates could interpret the Simpson's index of diversity values and explain clearly what these meant in terms of diversity. These candidates were able to state that location **Z** is more diverse than location **Y**.

(c) (i)   Many candidates showed a very good understanding of this population estimation method and described the steps in detail. There were many examples of candidates not being aware of the process who gave vague responses, e.g. 'mark' the cranes, or repeated the question information in their answer.

(ii)   Candidates who understood the question were able to answer accurately, referring to no change in population, no deaths and/or no migration. Few candidates referred to the random mixing of the population. Some were unsure of the meaning of the term 'assumption'. Some candidates who did not gain credit, mentioned the risks associated with marking the sandhill cranes.

(d) (i)   Very few candidates were able to identify the maximum number of trophic levels as 5 in the food web given in **Fig. 3.3**.

(ii)   The majority of candidates were able to construct a three-stage food chain with direction from the question. Several candidates constructed the correct stages and needed to include arrows showing direction to gain credit.

(e)   Many candidates used a lot of their response to describe the impact of the strategies on the hunters rather than the impact the measures would have on the sandhill crane population. Strong responses considered the positive effects that protecting nesting sites, restricting hunting seasons and restricting numbers being hunted would have on the cranes, meaning fewer would die and there would be more successful breeding of the cranes.

(f)   Many good responses included the impact on the crane's habitat, diet and migration patterns. Few candidates mentioned the risk of invasive species.

Question 4

This question covered the topics of decrease in forest cover in Ethiopia, questionnaires and sampling strategies.

(a) (i)   Candidates approached this question in a wide variety of ways to arrive at the correct answer of 18.6%. Some were unsure how to calculate percentage change. Some candidates worked out the difference between the 2 years and needed to take the calculation further to gain full credit.

(ii)   This question was answered well with candidates suggesting a wide range of reasons for the loss of forest cover. Some limited their answer by suggesting that the forest area was reduced due to deforestation rather than why the deforestation had occurred.

(b)(i) The majority of candidates were able to correctly calculate the mean value as 87 from the table of results.

(ii) Almost all candidates were able to construct an appropriate conclusion based on the data, that the farmers were in favour of planting more trees on their land.

(iii) Candidates found this question more challenging, with many not describing a sampling strategy and instead looking at the benefits of the strategy. The most successful candidates considered the practical steps needed to carry out a random sampling method.

(iv) Many candidates identified the limitation of different numbers of farms in each area. Few candidates noted that it would be useful to find out the age or gender of the farmers.

Question 5

This question covered the topics of the impacts of traffic congestion on people in four cities in India, and the benefits and limitations of a pedal-operated, motor-assisted form of transport.

(a) This question was generally answered well. Many candidates considered a wide range of impacts of the traffic congestion including the economic impact of the time lost in traffic as well as the health and environmental implications.

(b) Candidates found this question more challenging and often did not include the basics such as reduction in fossil fuel use, and that the solar panels are a renewable source of energy. Many candidates mentioned the expense involved and that the battery would not charge at night. Some, more successful candidates, discussed the advantage of swapping batteries rather than waiting for charging to happen or switching to pedal power so the battery charges as the driver moves along.

ENVIRONMENTAL MANAGEMENT

Paper 8291/23
Management in Context

Key messages

- Candidates should note the number of marks available for each part question and write answers accordingly. This will give them an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates must make sure that they understand the difference in meaning of the command words such as state, suggest, predict, justify, describe, explain, compare and evaluate.
- Candidates should avoid repeating the question in their answers to make best use of examination time.
- All working out should be shown in calculation questions, as credit may be available for the correct calculation method.

General comments

There was generally a good response to all questions across the paper. Most candidates found some parts of **Question 1** (energy sources and electricity generation) and parts of **Question 4** (forest cover, questionnaires and sampling strategies) more demanding than the other questions on the paper.

Topics which proved more challenging were imported energy, carbon neutrality, trophic levels, and sampling techniques.

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

The most successful answers included effective use of appropriate examples to illustrate key points, along with supporting details using appropriate terminology.

Comments on specific questions

Question 1

This question covered the topics of energy sources (including the disadvantages of imported energy sources) and electricity generation.

(a) (i) Most candidates attempted this question. Credit was most commonly given for responses that included the term 'fossil fuel' and the fact that it is non-renewable. Where candidates gained limited credit, they often did not make three separate points, generally stating that coal is non-renewable, finite and supply limited. There was some mention of the greenhouse effect but these references were vague and did not develop the idea to describe or state that the greenhouse effect would be enhanced.

(ii) Candidates performed well in this question with many mentions of wind energy not being enough, weather conditions being variable or the idea that insufficient wind turbines had been built.

(iii) Candidates found this question more challenging, with many giving responses on renewable energy rather than imported energy. The idea of energy security was rarely included. Some candidates considered the interruption of electricity supply due to conflict, and this was often a well-developed point.

(iv) Very few candidates could explain carbon neutrality. A common misconception was the idea that no carbon dioxide is released in burning biomass. For further credit, candidates needed to be able to describe the role of photosynthesis and the idea of a cycle with plants being able to capture the carbon dioxide from the atmosphere.

(b) This question was very well answered with the majority of candidates able to give three clear, distinctive impacts of burning wet wood on human health to access full credit.

(c) (i) Candidates needed to consider the relationship between the width of the oil contribution in 1985 compared to the most recent data in **Fig. 1.1** to access the credit. The oil section had decreased by around 50%, a far greater percentage compared to other sources. Some common errors included selecting nuclear or coal.

(ii) Candidates used data from **Fig. 1.1** well by incorporating information from the chart into their responses, including facts such as 'the greatest contribution was from coal and nuclear'. To develop answers further, candidates needed to focus more on the idea of comparison and include direct comparisons between the coal and nuclear trends.

(iii) Some candidates answered the question well and considered improved extraction methods and the detection of new reserves. Common misconceptions included thinking that natural gas was biogas and that the increase in use was due to increasing sustainability.

Question 2

This question covered the topic of waste management including landfill and recycling.

(a) (i) Almost all candidates were able to correctly identify the number of countries in 2016 that disposed of more of their waste using landfill than recycling as 4 (Finland, Malta, Serbia and Sweden).

(ii) The majority of candidates were able to calculate the percentage of waste disposed of using landfill to achieve the answer of 18%. The most common error was not rounding the answer to the nearest whole number, and therefore not accessing full credit.

(iii) This question was answered very well with the most common answer being the idea that there were other methods of waste disposal. Many candidates included examples of methods not included in support of their answer.

(iv) Many candidates answered this question effectively, referring to many clear and independent impacts of landfill as a method of waste disposal. The more successful candidates who accessed most or all of the credit, commonly included discussion of leaching, soil contamination, water pollution, the production of methane and the potential for explosion. Weaker candidates needed to develop their answers further by including a greater range of impacts.

(v) Candidates generally answered this question well with many suggesting increasing the number of recycling bins as a strategy to increase the amount of waste recycling.

(b) (i) Candidates were commonly able to construct an appropriate key which linked to their pie chart. The main challenge in this question was the order of the sectors; the convention of sectors in rank order, large to small, starting at noon and proceeding clockwise, was followed by few candidates. Another area of development for candidates was the accurate plotting of sectors by converting percentages to degrees and using a protractor. Few responses accessed all of the credit available for this question.

(ii) The majority of candidates were able to suggest that reducing domestic waste would be unlikely to reduce Europe's overall waste production, due to the small contribution it made (9%) to the overall percentage.

(c) Candidates could have developed their answers further, to access the credit available, by including the idea that large amounts of waste could be dealt with using incineration, or by linking to some of the landfill issues. Successful responses included the idea that incinerating waste could fuel a power station.

Question 3

This question covered the topics of estimation of population size, Simpson's index of biodiversity, food webs and conservation of sandhill cranes.

(a) (i)   Almost all candidates were able to count the birds and record the number as 4 for grid square **A4** and 5 for grid square **D3**.

(ii)   Candidates who answered this question well gave detailed responses linked to the method and to the specific setting. Strong responses, gaining most of the credit available, considered the issues of moving birds, the effect of vegetation blocking view and the need for a drone or aeroplane to take the images, which is costly. Many answers were vague and needed developing. Ideas which were rarely mentioned included the benefits of automated counting and the idea of being able to repeat the counting process.

(b) (i)   The majority of candidates who attempted this question answered correctly and could successfully substitute the values into the given formula and arrive at the correct answer of 0.56. Many candidates did not attempt this question.

(ii)   Many candidates could interpret the Simpson's index of diversity values and explain clearly what these meant in terms of diversity. These candidates were able to state that location **Z** is more diverse than location **Y**.

(c) (i)   Many candidates showed a very good understanding of this population estimation method and described the steps in detail. There were many examples of candidates not being aware of the process who gave vague responses, e.g. 'mark' the cranes, or repeated the question information in their answer.

(ii)   Candidates who understood the question were able to answer accurately, referring to no change in population, no deaths and/or no migration. Few candidates referred to the random mixing of the population. Some were unsure of the meaning of the term 'assumption'. Some candidates who did not gain credit, mentioned the risks associated with marking the sandhill cranes.

(d) (i)   Very few candidates were able to identify the maximum number of trophic levels as 5 in the food web given in **Fig. 3.3**.

(ii)   The majority of candidates were able to construct a three-stage food chain with direction from the question. Several candidates constructed the correct stages and needed to include arrows showing direction to gain credit.

(e)   Many candidates used a lot of their response to describe the impact of the strategies on the hunters rather than the impact the measures would have on the sandhill crane population. Strong responses considered the positive effects that protecting nesting sites, restricting hunting seasons and restricting numbers being hunted would have on the cranes, meaning fewer would die and there would be more successful breeding of the cranes.

(f)   Many good responses included the impact on the crane's habitat, diet and migration patterns. Few candidates mentioned the risk of invasive species.

Question 4

This question covered the topics of decrease in forest cover in Ethiopia, questionnaires and sampling strategies.

(a) (i)   Candidates approached this question in a wide variety of ways to arrive at the correct answer of 18.6%. Some were unsure how to calculate percentage change. Some candidates worked out the difference between the 2 years and needed to take the calculation further to gain full credit.

(ii)   This question was answered well with candidates suggesting a wide range of reasons for the loss of forest cover. Some limited their answer by suggesting that the forest area was reduced due to deforestation rather than why the deforestation had occurred.

(b)(i) The majority of candidates were able to correctly calculate the mean value as 87 from the table of results.

(ii) Almost all candidates were able to construct an appropriate conclusion based on the data, that the farmers were in favour of planting more trees on their land.

(iii) Candidates found this question more challenging, with many not describing a sampling strategy and instead looking at the benefits of the strategy. The most successful candidates considered the practical steps needed to carry out a random sampling method.

(iv) Many candidates identified the limitation of different numbers of farms in each area. Few candidates noted that it would be useful to find out the age or gender of the farmers.

Question 5

This question covered the topics of the impacts of traffic congestion on people in four cities in India, and the benefits and limitations of a pedal-operated, motor-assisted form of transport.

(a) This question was generally answered well. Many candidates considered a wide range of impacts of the traffic congestion including the economic impact of the time lost in traffic as well as the health and environmental implications.

(b) Candidates found this question more challenging and often did not include the basics such as reduction in fossil fuel use, and that the solar panels are a renewable source of energy. Many candidates mentioned the expense involved and that the battery would not charge at night. Some, more successful candidates, discussed the advantage of swapping batteries rather than waiting for charging to happen or switching to pedal power so the battery charges as the driver moves along.