

ENVIRONMENTAL MANAGEMENT

Paper 0680/11

Theory

Key messages

Candidates should read questions carefully and their answers should address the question with sufficient detail to gain all of the marks available. This is particularly important when the question is worth three marks or more.

When answering graph questions, it is important that candidates use appropriate scales and plot points with precision.

The six-mark, level of response question requires candidates to look at a statement and then to address the topic covered in the statement broadly. Appropriate examples should be given to support their views. It is important that candidates address the statement from both sides of the argument and decide whether they agree or disagree with the statement.

General comments

Candidates answered almost all of the questions on the paper and most attempted the level of response question in detail. Many gave a considered opinion.

It is important that candidates use appropriate and accurate scientific terminology. In the six-mark, level of response question, candidates needed to use specific examples to illustrate their points.

When answering mathematical questions, candidates should show their working wherever possible as some credit is often available for correct working out, regardless of their final answer.

Comments on specific questions

Section A

Question 1

(a) This question required candidates to know an example of an igneous rock and an example of a sedimentary rock. Many were able to give correct examples of both rock types. Where a question asks for one example, it is best if candidates write just one answer as an incorrect answer added to a list can result in no credit being awarded.

(b) Many candidates were able to describe the formation of sedimentary rock. Detailed answers included the process of erosion, the formation of sediments and how compaction occurred. Many of the candidates scored some credit, usually for weathering as a process.

Question 2

(a) (i) Just over half of the candidates were able to identify the process as trickle drip irrigation. A range of incorrect answers was given, including contour ploughing and bunds, and some candidates just wrote that there was a lack of water or that the area was suffering a drought.

(ii) Many candidates were able to give one example of why the process is sustainable, usually that the water is given directly to the roots only or that the process results in less water wastage. Incorrect

answers included more than one crop could be grown and that it was automated and well controlled.

(b) Just over two thirds of the candidates knew that the process of water loss from plant leaves was transpiration.

Question 3

(a) The diagram showed a ship and an oil spill, and candidates were asked to state the method that was being used to deal with the oil spill. Many of the candidates were able to identify this correctly as detergent spraying.

(b) Candidates were asked to state two other methods of dealing with oil spills. Many gained the credit for writing skimmers and booms. Incorrect responses included double-hulled tankers and MARPOL, both of which are strategies aimed at the reduction of spills rather than minimising the impacts.

(c) Many candidates knew that the oil would kill marine animals. Credit was lost on this question for answers which were too generalised such as 'it affects food chains' rather than stating it will disrupt food chains. Candidates who gained more credit on this question also understood that the oil would stop light from reaching producers.

Question 4

(a) Many candidates knew that the gas going to the human was oxygen and that the gas moving from the human into the plant was carbon dioxide. Those who missed out on full credit usually did so for writing transpiration instead of glucose on the top label.

(b) This was a very well-answered question. The majority of candidates knew that the pigment was chlorophyll. Most of the incorrect responses were for writing chloroplasts rather than chlorophyll.

(c) This was another well-answered question. The majority of candidates stated that respiration was the process that uses oxygen. Many who did not gain credit wrote anaerobic respiration.

(d) Many responses correctly stated why trees were carbon sinks. Candidates who missed out on the credit often stated that the trees stored carbon dioxide or that the trees released oxygen by photosynthesis, rather than discussing the use of carbon dioxide or the storing of carbon.

Section B

Question 5

(a) Many candidates scored full credit for completing the bar chart. Some lost out as they presented the two bars touching each other and did not follow the pattern shown in the rest of the graph.

(b) For longer answer questions such as this, candidates should try to give sufficient points of information for all four marks to be awarded. Stronger responses included details of both constructive and destructive boundaries, and many knew that the movements of the plates were caused by convection currents. Some responses consisted of one or two lines with little detail and therefore were not able to access the credit available.

(c) (i) Candidates were asked to use the data given to suggest whether the conclusion was correct. Many successful candidates compared the data and stated that the plume height and the volume was higher. For credit to be awarded, responses needed to use the data provided to show a difference and not simply quote from the table.

(ii) This question was well answered with the majority able to select the correct VEI from the table.

(iii) From the information given, many candidates were able to gain credit, usually for earthquake B having a higher magnitude compared to earthquake A. Those who missed out on this point often simply quoted the numbers given, such as 'A has a value of 2 and B has a value of 4'. Many candidates were able to link the magnitude of the earthquake to B causing more damage. Very

few responses understood the effect of an increase of 1 on the Richter scale or that the scale was logarithmic.

- (iv) This 'suggest' question had a variety of answers. Candidates who appreciated that the volcano was not that far from Pasto and therefore an eruption would cause damage to houses, roads or infrastructure and could lead to loss of life gained full credit.
- (v) Some candidates were able to state the gases involved and that these reacted with water to form sulfuric acid and nitric acid respectively. Those who gained partial credit usually knew the gases and stated that they dissolved in rain to form acid rain and needed to go on to give further detail to complete their answer. Some responses stated that the gas released was sulfur or sulfur oxide rather than sulfur dioxide. Candidates should remember that they need to write down four specific pieces of information for questions such as this, worth four marks.
- (d) Many candidates knew that crops growing near to volcanoes would benefit from the soil being more fertile due to its high mineral content. Very few gained further credit.
- (e) Candidates had to explain the strategies used to manage the impact of earthquakes before they happen. Many of the strategies given could have been explained in more detail in order to gain credit. Successful responses stated that the buildings needed to be earthquake resistant, that there needed to be areas to evacuate to, and that warning and monitoring was required. The more detailed responses described land zoning and exemplified one or more of the strategies to explain the impact of the strategy.

Question 6

- (a) The majority of candidates scored some credit for this question which required the knowledge from the specification that cyclones occur between 5° and 20° north and south of the Equator and require an ocean surface temperature of at least 27 °C and ocean depth of at least 60 m.
- (b) (i) Every candidate attempted this question, and the majority were able to state the correct month of August.
- (ii) Most candidates attempted this question, and many were able to state the correct months that typhoons reached land. The most common incorrect answers were between July and October or September.
- (iii) The majority of candidates attempted this question and many were able to estimate the number of typhoons reaching land in September and gave an answer of 17%.
- (iv) This question proved very difficult for the majority of candidates. Most used the information in **Question 6(a)(i)** and suggested that the reason why these typhoons did not reach Japan was because of the conditions not being met rather than why once formed, they failed to reach Japan. It is important that candidates look for key words, which will help them to understand what type of response the question is looking for.
- (c) (i) This question had a variety of responses. Nearly half of the candidates knew that there would be a decrease in the number of typhoons; many were unable to link this to a reduction in the temperature of the water.
- (ii) Successful responses recognised that the change would lead to less fish in the area. Many wrote about the temperature getting warmer or there being more typhoons and did not gain credit.

Question 7

- (a) Many of the candidates who had not calculated the correct number of squares in the corridor, but who had multiplied their value by 4 were able to gain some credit for this question.
- (b) Many realised that an international agreement was needed as there was more than one country involved in the area of the corridor. Some candidates suggested that without the international agreement there could be a war between the countries which was not credited.

(c) (i) Many candidates explained that connecting the two ecological reserves by a corridor would mean that the tigers would be able to breed together and that there would be more food.

(ii) The question asked why the type of ecotourism described is a sustainable activity. Some candidates just wrote a definition of what is meant by sustainability rather than suggesting why staying in houses in villages in the corridor would be an example of sustainability. Candidates who were successful suggested that this project would make money for the local community and that there would be less damage to the environment as there would be no need to build hotels.

Question 8

(a) (i) This was a well-answered question and most gave the answer. Unsuccessful responses gave the names of the countries rather than the number of countries that was asked for in the question.

(ii) Many candidates missed out here and wrote an incorrect example such as biofuel or coal.

(iii) Many of the stronger responses for this question knew that a non-renewable energy source was finite and would run out. Many of the incorrect responses stated that the uranium would take a long time to reform and had not appreciated the difference between uranium and fossil fuels.

(iv) Most candidates were able to name at least one other non-renewable energy resource, and many who did not gain full credit did so because they had written fossil fuels as one of their responses.

(v) Candidates knew that many governments could not afford to set up nuclear power stations. Those who gained full credit often cited a lack of uranium in the country or that the country had other alternative energy sources.

(b) Candidates were required to describe how the nuclear power station generated electricity. Candidates who wrote detailed answers included uranium decay, heating up water to produce steam, and then the steam being used to turn the turbines.

(c) The six-mark, level of response question required knowledge drawn from sections on the paper and a wider knowledge of whether nuclear power stations would be the best way of reducing the world's carbon dioxide emissions.

Candidates knew that uranium was a non-renewable source and that there was an issue with the risks associated with waste disposal and radiation leaks. Many knew that using uranium would not result in the production of carbon dioxide, although a number suggested that it would produce carbon dioxide and would be no better than using a fossil fuel. More detailed responses discussed using a renewable energy source such as solar or wind which would not produce carbon dioxide and would be safer to use than a nuclear power station using uranium. Some candidates were successful in quoting examples of other ways to reduce carbon dioxide emissions.

ENVIRONMENTAL MANAGEMENT

Paper 0680/12

Theory

Key messages

Candidates are reminded to read questions carefully and ensure that responses always answer the question posed.

Candidates should avoid using generic terminology. Ideas such as 'pollution' should be qualified as to the type that would have the impact.

When drawing a graph, as in **Question 8(a)(ii)**, scales should be linear and enable the data to occupy at least half the area provided.

General comments

The paper followed the pattern of previous series, combining a broad knowledge of the syllabus to specific scenarios, sometimes including images or data as stimulus material. Candidates were generally able to attempt most questions which increased their opportunities to gain marks even if their knowledge was weaker in certain areas.

Mathematical questions were generally well answered and linked questions relating to aspects such as trends were completed well. As with previous series, the final question on the paper was a longer response question and provided the opportunity for candidates to combine a range of concepts from across the syllabus. There were relatively few examples of simple lists within answers; most responses were contained within a structure, an area where candidates have shown improvement.

While candidates were generally well prepared for most questions on the paper, there was a lack of knowledge relating to the operation of extractive reserves and to a lesser extent, seed banks. There were some misunderstandings regarding the formation of tsunamis and a small number of candidates confused the conditions required for the spread of malaria with that for cholera.

There was generally a good understanding of the availability of energy supplies and their impacts on the environment, although the mislabelling of nuclear energy as a renewable resource was often seen.

Many candidates wrote in a clear, concise manner and with sufficient detail to demonstrate knowledge of the diverse range of topics covered within this qualification.

Comments on specific questions

Section A

Question 1

- (a)** Most candidates were able to make an interpretation of the carbon cycle represented in the diagram. Combustion and respiration were frequently correctly named. **C** (photosynthesis) proved to be more challenging.
- (b)** This was generally well answered, the majority of scripts contained a reference to the role of aquatic plants and algae as a food source. The importance of photosynthesis in the survival of animals was frequently identified.

Question 2

(a) (i) Most candidates were able to extract the correct data from the table and complete the linked subtraction. A few needed to read the question more carefully and only stated the year the resource was predicted to be used up rather than the correct answer, 66 years.

(ii) The majority of responses gained full credit, often citing the increase in population leading to an increase in the demand for these resources.

(b) Some good descriptions of the formation of coal were seen. Some weaker responses needed to give the role of heat and pressure or identify that plant material is the primary source.

(c) Most candidates were able to successfully name two renewable energy sources.

Question 3

(a) Carbon monoxide and oxides of nitrogen were common correct responses. A proportion of candidates needed to read the question more carefully, and stated the converted gases from the catalytic converter.

(b) Some candidates used the information from the diagram as a stimulus for their answer. Many correctly identified that there were other sources of pollution which will not be affected by the fitting of catalytic converters in vehicles.

(c) This topic was well known across the cohort and a good range of strategies were cited. The most common error was missing the instruction that responses needed to relate to vehicles.

Section B

Question 4

(a) This question required candidates to provide an explanation. Many responses needed more detail or were simply a rephrasing of the wording of the stage in the stimulus image.

(b) (i) The majority of candidates were able to correctly describe the type of mining shown in the photograph. Some chose to provide many different answers which was not required within the question instructions.

(ii) While many candidates understood the issues covered by the question, they were not always successful in clearly articulating these ideas. Some assumed that recycling of metals would have no impact. Some respondents identified that there would be pollution caused by mining but lacked detail as to the type of pollution that was needed for credit to be awarded.

(c) (i) Most candidates were able to complete the graph using the data provided accurately and managed to follow the pattern of the existing bars, both in shading and width.

(ii) While some candidates did not read the question correctly and described the production of new steel, most gave a good interpretation, referring to the trend as requested rather than data relating to a series of years.

(iii) This calculation was completed correctly by the majority of candidates, providing an answer to one decimal place as requested.

(d) Identifying practical ways in which recycling could be promoted was another topic that was well known by a good proportion of candidates. Ideas relating to taxation, increasing the ease of recycling or providing rewards for recycling were common.

Question 5

(a) Candidates were generally able to describe the distribution of population from the information given on the map. There were two common errors: references to 'above' and 'below' rather than north and south and generalities such as high or low population without reference to actual population growth. A few candidates tried to link population distribution to climate or economic development, which was not required.

It is expected that candidates should have knowledge of the locations of continents but there is no requirement to be able to identify specific countries within the scope of this syllabus.

(b) While many candidates understood that an increase in population would reduce the availability of resources, without responding to the question requiring them to link this to the impact on natural resources, they were unable to achieve full credit.

(c) (i) A wide range of responses were credited as examples of a pronatalist strategy. Those who identified that a specific country had one, but did not identify what it was, missed out on the credit available.

(ii) A question attempted by most candidates, some needed to link their answer to the economy of the country as requested to gain the credit available.

Question 6

(a) Candidates showed confidence in understanding the data in the graph and were successful in providing the correct answer, 74%.

(b) Candidates showed a good level of knowledge and a wide range of different ideas were credited.

(c) (i) A large proportion of candidates gained full credit for this question, naming both chlorination and boiling as methods of treating drinking water which is contaminated with cholera.

(ii) Many candidates showed an awareness of cholera and how it is spread, and needed to go on to clearly state how this disease enters the drinking water to gain credit. There were a few examples of candidates referencing the spread of malaria in error.

(d) This question proved to be more challenging, many responses included an example of water contamination despite the question specifically requesting other reasons.

Question 7

(a) While the majority of candidates were able to demonstrate a good understanding of how a tsunami forms, there was sometimes confusion with descriptions of tropical cyclones. Some candidates omitted to state what a tsunami was after a detailed description of how they are formed.

(b) A challenging question for many candidates, some counted the number of arrows and assumed this related to the levels of radiation at different points in the ocean. Many creditable answers lacked the use of relevant vocabulary. The strongest responses were able to name bioaccumulation and also explained that radiation had entered the waters of the ocean and the way in which the levels built up at higher trophic levels.

(c) There were a few misconceptions apparent within the responses seen for this question. Many incorrectly stated that nuclear power was renewable, and that it does not produce pollution.

There was also an incorrect assumption that nuclear power stations are cheap to construct. Despite this, some candidates achieved high levels of credit, identifying the lack of carbon dioxide emissions, the ability to produce a large quantity of energy from a small amount of fuel, and also the issues some countries may have in providing the space or location suitable for the generation of renewable energy systems. The idea that nuclear power stations were needed to meet future energy needs was also worthy of credit.

Question 8

(a) (i) Most candidates were able to calculate the correct answer, rounded to the nearest whole number.

(ii) The drawing of the graph was completed to a high standard by many candidates, most remembering to use a ruler. The main errors seen were the choice of too small a scale to sufficiently use the grid provided, missing labels for axes and variable widths of bars. There were relatively few plotting errors.

(iii) Many candidates found suggesting additional reasons challenging and provided a rephrasing of the categories included within the stimulus article or an example of these categories.

(b) The quality of responses suggested that candidates were less familiar with these methods of helping to conserve species. Knowledge of extractive reserves was limited; many descriptions were based on knowledge of world biosphere reserves. Similarly, many descriptions of seed banks were limited in scope and did not achieve all of the potential credit available.

(c) The final question of the paper is a longer, six-mark question marked according to the quality of the response provided. Assessment is based upon how well the answer meets the level descriptors within the mark scheme. The mark scheme also includes some indicative content that may be seen in an answer; however credit may also be given for other ideas or concepts within the response, including relevant examples.

Most candidates attempted the question, the majority agreeing with the statement, often identifying the lack of a range of habitats and its effect on biodiversity as reasons. Stronger responses expanded on this and included the lack of genetic diversity and the related danger of pests and diseases.

It was clear that many candidates based their ideas on an understanding of monoculture in agriculture. This sometimes resulted in the inclusion of information that was not directly applicable to forests, such as soil degradation and the use of fertiliser. The arguments against banning commercial forests were generally brief and centered around finance and employment. Consequently, responses were often heavily weighted towards the disadvantages of only growing one type of tree. There were very few examples of candidates concluding that a potential solution would be to use a combination of both allowing for commercial production but retaining suitable habitats and genetic diversity in non-commercial forests.

ENVIRONMENTAL MANAGEMENT

Paper 0680/13

Theory

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It is important that candidates use appropriate and accurate scientific terminology. In the six-mark, level of response question, candidates needed to use specific examples to illustrate their points.

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few responses understood the effect of an increase of 1 on the Richter scale or that the scale was logarithmic.

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- (ii) Successful responses recognised that the change would lead to less fish in the area. Many wrote about the temperature getting warmer or there being more typhoons and did not gain credit.

Question 7

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(v) Candidates knew that many governments could not afford to set up nuclear power stations. Those who gained full credit often cited a lack of uranium in the country or that the country had other alternative energy sources.

(b) Candidates were required to describe how the nuclear power station generated electricity. Candidates who wrote detailed answers included uranium decay, heating up water to produce steam, and then the steam being used to turn the turbines.

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Candidates knew that uranium was a non-renewable source and that there was an issue with the risks associated with waste disposal and radiation leaks. Many knew that using uranium would not result in the production of carbon dioxide, although a number suggested that it would produce carbon dioxide and would be no better than using a fossil fuel. More detailed responses discussed using a renewable energy source such as solar or wind which would not produce carbon dioxide and would be safer to use than a nuclear power station using uranium. Some candidates were successful in quoting examples of other ways to reduce carbon dioxide emissions.

ENVIRONMENTAL MANAGEMENT

Paper 0680/21
Management in Context

Key messages

Candidate should understand the difference in meaning of the command words describe, explain, state and suggest.

Candidates should show their working when completing calculations. When two marks are available for the answer, partial credit may be given even if the final answer is incorrect.

For plotting bar charts, candidates should use a sharp pencil and ruler. Rulers are needed to draw bars of equal width accurately and errors are more difficult to correct if a pen is used.

The mark allocation and the number of answer lines should be used as a guide to the number of ideas needed in the answer.

General comments

It is important that candidates read the whole of each question with care as there may be supporting information in an earlier part question or a resource. For example, the photograph at the start of **Question 2** on this paper and **Question 2(e)(iii)**.

Candidates should make sure they do not write more than the question requires. An incorrect response may contradict a correct one. For example, **Question 1(e)(ii)** asked for candidates to state two mineral ions in fertilisers. Many candidates gave three answers, these were not always correct.

In **Question 2(e)(ii)**, candidates were required to calculate a percentage increase. Some were unable to do this. Candidates should be familiar with the mathematical requirements listed in the syllabus.

Candidates should be clear about the difference between global warming and ozone depletion. Global warming is the increase in mean global temperatures. Ozone depletion is the thinning of the ozone layer which protects the Earth from ultraviolet radiation from the Sun.

Question 1

(a) (i) This question required candidates to state one fact from the source information that indicates New Zealand is a more economically developed country (MEDC). Many candidates stated 'life expectancy of 82.5 years'. This needed a comment that it was high as would be expected in a MEDC. Many stated facts taken from the list of main economic activities of New Zealand, however all of these are also found in less economically developed countries (LEDCs).

(ii) Few candidates gained full credit for describing the typical population pyramid of a MEDC. Those who understood that the question was asking them to describe the shape of the pyramid usually gained partial credit for describing a narrow base and wide middle section. Very few candidates stated that the bars for males and females had a similar width or that a MEDC pyramid is taller because the life expectancy is higher. Many responses were descriptions of the age distribution of the population in MEDCs without any reference to a population pyramid.

(iii) Most candidates were able to correctly calculate the number of people living on the South Island in 2022. A minority of candidates needed to add 'million' after 1.275 in their answer. Others missed a zero out and gave answers of 1275 00 instead of 1275 000.

(iv) Many candidates correctly circled **75** as the best estimate for the percentage of the total area of land of South Island occupied by the regions of Canterbury, Otago and Southland.

(b) Candidates who began their answers by stating changing the crops grown in fields is called crop rotation usually gained full credit. Explanations included: the soil staying fertile, different crops needing different nutrients, some crops adding nutrients to the soil, fewer pests and diseases, less need for fertilisers and insecticides and less chance of soil erosion. The less successful responses were about growing a range of crops so that some profit would be made as yields were unlikely to be low for every crop grown.

(c) Most candidates correctly calculated the total annual rainfall. Some calculated the mean monthly rainfall instead of the total annual rainfall.

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(e) (i) Many candidates had learnt definitions of pollination. They wrote accurately that pollination is the movement of pollen grains from the male anther of a flower to the female stigma of the same or another flower. They described how pollination can be carried out by insects or the wind. Some went on to write about fertilisation, which was not required. Others confused anther and stigma, or described bees moving seeds or nectar.

(ii) Most candidates were able to state two mineral ions in fertilisers. Some candidates named three ions. The correct answer was two from nitrate, potassium and phosphate. Incorrect answers included nitrogen, phosphorus and magnesium.

(f) Many candidates successfully completed the diagram of the water table with precipitation, infiltration and ground water flow. Some of the errors resulted from candidates misinterpreting the diagram as a cross section.

(g) This question required candidates to suggest how farmers prevent fertilisers entering streams and rivers. Many gave a range of ideas about the quantity and timing of fertiliser application and methods of preventing, or reducing, leaching and runoff. Suggestions included controlling fertiliser use, not applying fertilisers during the wet season, and not growing crops requiring fertiliser near streams and rivers. There were some detailed answers about using terracing, contour ploughing and bunds. These methods of controlling the runoff of water containing fertilisers needed further explanation to gain full credit.

Question 2

(a) Some candidates were able to use the scale to estimate the actual length of the fish shown in the diagram as 75 mm. 7.5 cm was also credited. There was evidence that most candidates did a calculation, those who were unsuccessful either used incorrect measurements, or were unable to convert the units correctly.

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(iii) Suggesting one reason why the scientist recommends option three to manage this fishing area proved to be more challenging for many candidates. Many did not suggest a reason related to sustainable fishing, instead they compared the new TACC with catches during the 11 years shown in the graph. Those who interpreted the question correctly often began their responses by stating that reducing the TACC to 10 tonnes per year was the lowest option. Reasons suggested included that this would conserve or maintain the population of yellow eye mullet, preventing overfishing and saving the fish from becoming endangered or extinct.

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(e) (i) Many candidates gained full credit for plotting the bar chart of exports of salmon from New Zealand between 2016 and 2020. These candidates worked with care and began with a regularly numbered, evenly spaced scale on the y-axis. The most common errors were not labelling the y-axis or not including year on the x-axis. Other errors were not using a linear scale for the y-axis, not using half the grid space and not drawing bars of the same width. A minority of candidates plotted line graphs. Some bar charts could have gained more credit if the bars had been plotted more precisely using a ruler and a sharp pencil.

(ii) Many candidates correctly calculated the percentage increase in the mass of exported salmon from 2016 to 2020. Some candidates who showed their working were able to gain partial credit. A common error was using the highest value in the table instead of the value for 2020.

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(f) Few candidates were able to explain how the enhanced greenhouse effect can cause increased ocean temperatures around New Zealand to be more frequent in the future. Many candidates gained partial credit for mentioning greenhouse gases or a named greenhouse gas. Most candidates gave answers that did not address the question. They described the impacts of climate change: how global warming increases temperatures, causing ice sheets to melt and sea levels to rise. Some candidates wrote answers that confused global warming with ozone depletion, suggesting that greenhouse gases cause ozone depletion. A minority of candidates wrote answers about plants in greenhouses and carbon dioxide.

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Question 3

(a) (i) Many candidates correctly stated the type of mining shown in the photograph as surface mining, opencast, open-pit or open-cut. The most common wrong answers were subsurface and deep mining. Some candidates wrote open-pit and subsurface mining; these contradictory answers were not credited.

(ii) This question required candidates to suggest one risk to miners working in the mine in the photograph. Many responses were vague suggestions about death, injuries, falling, visual and noise pollution. Stronger answers suggested injuries from falling rocks, landslides, machinery, explosions, and dust causing respiratory diseases and lung cancer.

(iii) Most candidates were able to name sedimentary and metamorphic as two other rock types. Some variation in spelling was credited but not 'sediment' for sedimentary. A minority of candidates named basalt and granite, two igneous rocks.

(iv) Many candidates were able to complete the table to show the components of soil. Air, water and organic matter were the most common correct answers. Some responses included mineral ions, sand, silt and clay although mineral particles were included in the table.

(b) (i) Many candidates explained that the scientist includes pots with soil in the investigation either to act as a control or so the results of the investigation can be compared with the waste rock.

(ii) Most candidates gained partial credit for suggesting three factors the scientist should keep the same in the investigation. Successful answers included temperature, light, size of pot and humidity. Many references to water, soil and waste rock stated amount instead of volume or mass. A minority of candidates stated items from the description of the method, such as filling the pots, watering every five days, measuring the leaves and counting the flowers.

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(iv) Few candidates gained full credit for describing how the scientist uses genetic modification (GM) to produce a grass that is resistant to insect pests. Partial credit was often given for responses describing extracting a gene for resistance from a plant and inserting it into a grass plant. Many candidates described either selective or cross breeding. A minority wrote about adding fertilisers or using crop rotation.

(c) (i) Some candidates described the process of bioremediation in detail instead of suggesting how bioremediation can be used to restore the mine. Others focused on the early stages, such as using microorganisms to remove toxins and then planting vegetation. There were few references to the addition of topsoil and organic matter or the reintroduction of animals. Several responses did not refer to bioremediation, instead they focused on other strategies for restoring landscapes damaged by mining.

(ii) Many candidates gained full credit for describing two benefits of nature reserves. These candidates understood the question and wrote about providing safe habitats and increasing biodiversity.

(d) Most candidates gained partial credit for describing the trends shown in the bar chart. The strongest responses described an overall decrease and went on to say that there were fluctuations at first followed by a decrease. Some candidates did not realise that a trend is a pattern over several years and attempted to describe every increase and decrease shown in the bar chart.

(e) This question required candidates to suggest reasons why some people object to a new gold mine. The strongest responses suggested several types of pollution, loss of habitat or vegetation and the need to relocate people living on or near the site of the mine. A minority of candidates considered the impact of transport such as heavy lorries on local roads.

Responses that only described different types of pollution gained partial credit. A significant number of candidates misunderstood the question and wrote at length about the jobs and wealth the mine might bring. The word 'object' may have been a source of difficulty for these candidates.

ENVIRONMENTAL MANAGEMENT

Paper 0680/22
Management in Context

Key messages

There is a common misconception that carbon dioxide in the atmosphere destroys the ozone layer or contributes to acid rain or smog.

Candidates should avoid repeating the question in their answers. For instance, stating "The scientist can randomly sample the Aral Sea by..." is not an efficient use of examination time.

High-performing candidates are guided by the mark allocation for each question, which indicates the number of distinct marking points needed in a response.

A conclusion should summarise the main findings of an investigation, rather than focusing on a single aspect.

Candidates should read each question carefully to ensure they address what is being asked.

Candidates are encouraged to check their question papers to confirm that all questions have been answered.

Diagrams, charts, and graphs should be drawn using a sharp pencil and ruler, as corrections are more difficult with pen.

Candidates should always show their workings out for calculation questions, as partial credit may be awarded for correct procedures even if the final answer is incorrect.

Candidates should adhere to the rubric of a question. For example, if three reasons are requested, providing a fourth reason may result in an incorrect answer that contradicts a previously correct one.

General comments

Candidates should avoid vague statements such as "causes harm", "causes pollution", "affects the environment", "reduces resources", or "causes death", as these are too unspecific and unlikely to receive credit.

Some candidates could benefit from additional fieldwork experience, as skills in sampling techniques, data interpretation, and drawing sensible conclusions from data were not well demonstrated. Sampling strategies or descriptions should be clear enough for another candidate to replicate the method.

The graph drawing presented some opportunities for improvement, particularly with the use of non-linear scales.

Comments on specific questions

Question 1

(a) (i) Many candidates were able to calculate the population density. Some gave an incorrectly rounded answer, e.g. 69.2 rather than 69.3 or 69.

(ii) Employment was the most commonly seen correct answer. Vague answers referred to 'availability of resources' and needed to state a specific resource such as food for credit to be awarded.

(b) (i) Many candidates read the question carefully and gave the correct answer. A common error was to give the total for either 25–29 or 30–34 instead of the total of these two bars.

(ii) Most identified that between 0–54 the population was similar for males and females. Many candidates were also able to identify that there were more females than males in the 55–100+ age range.

(iii) Most candidates could suggest one reason why there were fewer people aged 10–14 than 25–29. It was less common to see two correct suggestions. Education of women and availability of contraception were the most common correct answers.

(iv) The most common correct response was that there would be a decrease in the future workforce. Vague answers stated government policies without giving a specific example, e.g. antinatalist policies.

(c) Many candidates found this question challenging, with many thinking the answer was ‘services’.

(d) Ways to increase agricultural yields were well known. A few gave answers relating to irrigation despite this being ruled out in the question.

(e) (i) Candidates found using the scale challenging and many incorrect answers were seen.

(ii) Some candidates could determine the percentage decrease and gave the answer of 91%; others were not familiar with this mathematical requirement of the syllabus.

(iii) The most common correct answer was a reduction in fishing industry or reduced fish exports. Candidates who performed less well had not read the question carefully and gave answers that did not relate to economic activities.

(iv) Trickle-drip irrigation and use of bunds were well known. Rainwater harvesting was given by many. Some responses were too vague, such as ‘collect or store water’ without reference to where this water had been obtained, e.g. from rainwater. Other vague answers which did not gain credit included the use of sprinklers.

(v) Random sampling was not well known and many incorrect responses were seen. Some candidates crossed out ‘random sampling’ and gave an answer that related to systematic sampling, which was not asked for in the question. One of the most common misconceptions was suggesting that a quadrat could be used in an aquatic environment; higher-performing candidates realised that picking coordinates using a quadrat overlaid on a map would be more sensible.

(vi) A common answer which did not receive credit was ‘accuracy’; others repeated the information in the question without adding any further detail, e.g. ‘to sample at different times of year.’

(vii) Weaker answers only focused on fish species or shellfish and plants, but not both. A conclusion should encompass all of the data provided. Many answers did not describe that total or overall species had decreased and were, therefore, too vague for any credit.

(f) (i) Some good pie charts were seen. The strongest answers used a sharp pencil with shadings sufficiently different from one another for clarity. However, many poorly plotted examples were also given. Some struggled to plot each sector correctly and included a fifth unknown sector. A ruler and protractor were not used by many candidates. Weaker examples included numbers as the key rather than shadings. Many did not follow the syllabus requirements of starting at ‘noon’ with the largest sector and plotting clockwise in rank order from noon.

(ii) Many good answers were seen that considered all of the data in the table. Weaker responses only quoted the data rather than using this data to support their answer, e.g. ‘cotton uses more water than synthetics’.

Question 2

(a) (i) Some good explanations included how biosphere reserves conserve biodiversity. Many suggested that human activities were restricted in some way. The strongest answers gave examples such as ‘no hunting’ or ‘no mining’. Many were also able to describe the zones and type of activity allowed

or restricted in each. A common mistake by candidates who performed less well was to explain why rather than how biosphere reserves conserve biodiversity.

(ii) Candidates did not perform well on this line graph. Bar charts were seen and most x-axis scales and some y-axis scales were non-linear. Many wavy lines were drawn between points, rather than using a ruler. It was common to see lines extended before 1980 or after 2020. Many did not label either axes.

(b) (i) Some candidates could recall the meaning of carrying capacity; others appeared unaware of the term.

(ii) Many candidates suggested overcrowding and a shortage of food would impact the deer. Weaker answers referred to 'a shortage of resources' without saying what these resources were.

(c) (i) This was well answered with some good descriptions of what must be done to the mine before deer are introduced.

(ii) Many candidates were able to suggest at least one benefit and one limitation of introducing deer to a new location. The most popular benefit given was that it would increase the deer population. A common answer for negative impacts was that the deer would find it difficult to adapt.

Question 3

(a) (i) Occasional incorrectly rounded answers were seen, e.g. 254.2 rather than 254.3.

(ii) The majority of candidates could give one reason why Uzbekistan has been slower to invest in renewable energy than some other countries. Weaker answers did not make it clear whether they were referring to renewable or non-renewable resources. A common vague answer was that the country has a lack of money, without qualification that investing in renewable energy is expensive. The stronger answers were able to explain that non-renewable resources are plentiful in Uzbekistan and would last many years, or that their extraction generates money for the country.

(iii) A large number of candidates did not recognise carbon dioxide as a greenhouse gas. There was a common misconception that it is responsible for ozone depletion and a major contributor to acid rain.

(b) (i) Most could determine the percentage electricity consumption correctly.

(ii) Stronger responses were guided by the mark allocation and used bullet points to give three different strategies. Weaker responses repeated points but with different wording or only described one strategy.

(iii) This question was very poorly answered, and few candidates could suggest a sensible reason why a MEDC might consume more electricity in its transport sector than a LEDC. Most answers suggested reasons for differences in transport sectors between LEDCs and MEDCs rather than the electricity consumption differences. Candidates needed to read the question more carefully before responding.

Question 4

(a) (i) There were some candidates who were unable to determine the range to give the answer of 29 °C.

(ii) Many candidates struggled to interpret the graph correctly, providing either too few, too many or the wrong months.

(iii) Soil erosion was well known by most candidates with the most popular answer being that low rainfall causes soil to dry out.

(b) (i) Many candidates thought mineral particles referred to ions such as potassium rather than sand, silt and clay as stated in the syllabus. These candidates often repeated these ions for the mineral ions section of the table. Most could identify an example of organic matter.

- (ii) It was common for candidates to gain credit for stating one way organic matter improves the fertility of soil. Few gained full credit. Many repeated the content in the question and went no further.
- (iii) The majority of candidates could state two correct processes in the carbon cycle that release carbon dioxide.
- (iv) Two other gases in clean air were well known. Occasional wrong answers included pollutants such as NOx when the question stated 'clean air'.
- (v) The majority could state two ways atmospheric carbon dioxide could be reduced. Weaker answers repeated suggestions with different wording. The strongest responses used bullet points to ensure they gave two ways.

(c) The importance of sustainably managing ecosystems was well known by many candidates and some good explanations were seen in many responses.

ENVIRONMENTAL MANAGEMENT

Paper 0680/23
Management in Context

Key messages

Candidate should understand the difference in meaning of the command words describe, explain, state and suggest.

Candidates should show their working when completing calculations. When two marks are available for the answer, partial credit may be given even if the final answer is incorrect.

For plotting bar charts, candidates should use a sharp pencil and ruler. Rulers are needed to draw bars of equal width accurately and errors are more difficult to correct if a pen is used.

The mark allocation and the number of answer lines should be used as a guide to the number of ideas needed in the answer.

General comments

It is important that candidates read the whole of each question with care as there may be supporting information in an earlier part question or a resource. For example, the photograph at the start of **Question 2** on this paper and **Question 2(e)(iii)**.

Candidates should make sure they do not write more than the question requires. An incorrect response may contradict a correct one. For example, **Question 1(e)(ii)** asked for candidates to state two mineral ions in fertilisers. Many candidates gave three answers, these were not always correct.

In **Question 2(e)(ii)**, candidates were required to calculate a percentage increase. Some were unable to do this. Candidates should be familiar with the mathematical requirements listed in the syllabus.

Candidates should be clear about the difference between global warming and ozone depletion. Global warming is the increase in mean global temperatures. Ozone depletion is the thinning of the ozone layer which protects the Earth from ultraviolet radiation from the Sun.

Question 1

(a) (i) This question required candidates to state one fact from the source information that indicates New Zealand is a more economically developed country (MEDC). Many candidates stated 'life expectancy of 82.5 years'. This needed a comment that it was high as would be expected in a MEDC. Many stated facts taken from the list of main economic activities of New Zealand, however all of these are also found in less economically developed countries (LEDCs).

(ii) Few candidates gained full credit for describing the typical population pyramid of a MEDC. Those who understood that the question was asking them to describe the shape of the pyramid usually gained partial credit for describing a narrow base and wide middle section. Very few candidates stated that the bars for males and females had a similar width or that a MEDC pyramid is taller because the life expectancy is higher. Many responses were descriptions of the age distribution of the population in MEDCs without any reference to a population pyramid.

(iii) Most candidates were able to correctly calculate the number of people living on the South Island in 2022. A minority of candidates needed to add 'million' after 1.275 in their answer. Others missed a zero out and gave answers of 127500 instead of 1275000.

(iv) Many candidates correctly circled **75** as the best estimate for the percentage of the total area of land of South Island occupied by the regions of Canterbury, Otago and Southland.

(b) Candidates who began their answers by stating changing the crops grown in fields is called crop rotation usually gained full credit. Explanations included: the soil staying fertile, different crops needing different nutrients, some crops adding nutrients to the soil, fewer pests and diseases, less need for fertilisers and insecticides and less chance of soil erosion. The less successful responses were about growing a range of crops so that some profit would be made as yields were unlikely to be low for every crop grown.

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