

ENVIRONMENTAL MANAGEMENT

<p>Paper 5014/12 Theory</p>

Key messages

Candidates should ensure that numerical data is used accurately and appropriately to support their responses, particularly where this is explicitly required by the question.

Where a question asks for more than one example, it is important that each example is clearly distinct and not simply a variation of the same point. This allows candidates to demonstrate a broader understanding and meet the full requirements of the question.

Candidates are encouraged to show their working when completing mathematical calculations. In questions where multiple marks are available, credit may still be awarded for correct methods and processes, even if a final error occurs. Showing working also helps examiners follow the candidate's reasoning.

When constructing line graphs, candidates should ensure that a logical linear scale is used, with axes correctly orientated and clearly labelled.

General comments

Stronger candidates demonstrated a clear understanding of the scenarios presented by providing detailed and contextually relevant responses, rather than relying on generic statements. These answers reflected thoughtful engagement with the material and an ability to apply knowledge effectively.

The line graph task was attempted by the vast majority of candidates. While many completed it successfully, some overlooked the uneven time intervals in the data table and did not apply a linear scale appropriately. A few candidates also struggled to connect data points in chronological order using lines, as instructed. Nevertheless, there were several well-executed graphs within the cohort, and fewer instances of lines being drawn without the use of a ruler and pencil, indicating improved attention to presentation.

Candidates were required to describe specific locations on a map, in this case the sites of oil spills. Although most attempted this task, a notable number found it challenging to describe locations accurately. There was also some confusion between the Atlantic and Pacific Oceans, which affected the precision of responses.

The final extended response question was handled well by many candidates. There was clear evidence of planning in several scripts, with structured answers that demonstrated substantial knowledge of climate change and its associated challenges. The strongest responses were balanced, well-reasoned, and supported by relevant examples, showcasing both analytical skill and subject understanding.

Comments on specific questions

Section A

Question 1

- (a) Many candidates understood that tsunamis are caused by undersea activity; a few needed to add the fact that they form very large waves.
- (b) Candidates were generally able to name at least one way an early warning system saves lives. Some ideas were more suited to longer term preparations and therefore were not credited. A few

responses described ways in which early warnings could be made which was not the focus of the question.

- (c) Most candidates provided an answer to this question. A common error was to state only the percentage rather than using this to calculate the total number for full credit.
- (d)(i) Less well understood, a wide range of names were provided. Labelling part **C** proved to be the most challenging.
- (ii) There was a noticeable lack of consistency in the incorrect responses, suggesting that many candidates either did not recall the location of the subduction zone or were unable to apply their knowledge effectively to the diagram.

Question 2

A good proportion of candidates were able to use the words provided to score some credit by completing the sentences, although relatively few completed all five statements correctly.

Question 3

- (a)(i) The idea of bycatch was generally understood within this cohort, although some struggled to express their ideas clearly.
 - (ii) Generally well answered, most responses showed an understanding of the benefits of a closed season, the majority linking it to allowing the fish to reproduce.
 - (iii) Slightly more challenging, some responses lacked clarity with regards to the role of international agreements in reserving fish stocks.
 - (iv) A wide range of other methods of conserving stocks were awarded credit. The idea of quotas proved to be the most frequent.
- (b) A wide range of responses were provided; some linked to production systems located in the ocean rather than the ocean itself as a source of energy.

Section B

Question 4

- (a) The majority of candidates attempted this question describing the locations of oil spills on a map. A large number of answers referred to 'above' or 'below' rather than using the correct phrases of North and South, which in many cases limited the credit achieved.
 - (b)(i) This was completed correctly by most candidates. The most common error was not subtracting the other components from the bar.
 - (ii) A very accessible question. Most responses gave the correct answer.
 - (iii) This was found to be more challenging. Credit was awarded for ideas relating to human error, expressed in a variety of ways, although 'tanker collisions' was already recorded separately within the information provided in the question for the candidate to evaluate so was not given credit.
- (c) The role of booms was generally well understood, although a common error was to describe them as collecting oil rather than containing an oil spill and preventing its further spread.
- (d)(i) The more able candidates were successful in constructing the line graph. Weaker candidates often did not construct linear scales and plotted the data evenly. Less common errors included omitting labels for axes (including units) and forgetting to draw a line between plots commencing at day zero.
- (ii) Most candidates correctly identified that the concentration of oil in the mussels decreased. Further credit was available for the accurate use of data from the table.

- (iii) Candidates found this question on bioaccumulation very challenging despite a wide range of potential words being awarded credit.

Question 5

- (a) (i) Many correctly calculated the range from the bar chart and gained full credit. Where candidates showed their working, credit could be achieved for a correct calculation, even if the wrong data had been read off the graph. Where working was not provided, it was not possible to make a relevant observation on the accuracy of the calculation.
- (ii) The majority of responses provided the correct answer: 8.
- (iii) This question was attempted by all candidates and most understood some information about the impact of excess water on crop yields to gain some of the credit available. Fewer were able to provide a sufficient range of impacts to obtain full credit.
- (b) (i) The interpretation of the information on the graph was a skill that was demonstrated well with a high proportion of candidates obtaining the correct answer.
- (ii) Many candidates correctly determined that the student's statement was incorrect; many missed out on the credit by counting the number of instances incorrectly.
- (iii) Most responses identified the roles of global warming and climate change leading to more droughts in the future. A common misconception was that population growth would cause more droughts whereas it would cause more water shortages.
- (iv) Candidates often struggled to link high temperature and lack of rainfall with the availability of combustible materials that would burn in a fire.
- (v) The majority of candidates were able to successfully complete this percentage calculation to achieve the answer of 97%. Some answers needed rounding to an appropriate level of accuracy.
- (vi) A wide range of relevant strategies for managing the impact of drought were seen and worthy of credit. In a few cases the ideas suggested needed to be more precise, for example, trickle drip irrigation rather than simply 'irrigation'.
- (c) Many correctly named the first and second stages in the production of drinking water; the latter two proved to be more challenging for many.
- (d) (i) A wide range of potential water sources were worthy of credit. Candidates found this question very accessible.
- (ii) Many candidates showed great awareness of the needs of the question and focused on relevant reasons why a dam may not be built. The lack of a water source was commonly cited as well as the potential cost. Some mentioned the inability to produce electricity which was not a core feature of this question.
- (e) (i) There was generally a good understanding of the role of turbines in the production of electricity, although some needed to add that the turbine rotated. Some responses described the heating of water or the use of geothermal energy which were not relevant to this specific question.
- (ii) Multiple different examples of additional uses for the dam and reservoir were cited, although some variants of the direct use of fresh water were suggested, such as the use for irrigation.

Question 6

- (a) In this question candidates were expected to apply their knowledge to an unfamiliar situation, in this case the release of carp into a new environment. They were usually able to do this successfully, often identifying the risk of predation of existing species and also the competition for existing resources in the locality.
- (b) Candidates were generally able to interpret the scenario and deduce a valid reason for the increase in the numbers of carp caught.

- (c) (i) This question was well answered. Candidates understood that there are risks in introducing another non-native species into the locality, citing the unknown impact on existing species as well as the potential harm to humans. Some also identified that the reduction in carp numbers might also have a financial impact for those catching fish.
- (ii) Many candidates were unfamiliar with the term biological control and there were numerous incorrect answers.
- (d) Most candidates were able to identify the correct answer from the information presented in the question.
- (e) (i) The concept of ecological corridors was generally not well understood. Many incorrectly stated that they protected animals from hunting or other forms of predation. The stronger responses were able to include ideas such as the fact that linking two areas allowed for greater genetic diversity in offspring and the corridors meant there was less risk of collisions with vehicles.
- (ii) The responses from candidates for this question provided a diverse range of creditworthy answers, often focusing on the provision of reserves or protected areas for the mammals. There was some confusion between captive breeding and the ideas of selective breeding or genetic modification. Many responses included ideas relating to the curtailing or banning of hunting.
- (f) This final question offers candidates the opportunity to explore a topic in greater depth, allowing for extended written responses. The mark scheme outlines descriptors for different levels of performance, along with indicative content that may be included. Candidates are not limited to these suggestions and are encouraged to introduce other relevant ideas, supported by appropriate examples, to strengthen their arguments.

Most candidates gained credit on this question, demonstrating a sound understanding of climate change. However, some responses revealed confusion between climate change and atmospheric pollution, which affected the accuracy and relevance of their explanations.

The strongest responses were well-balanced and analytical. These candidates considered multiple perspectives, reached thoughtful conclusions, and supported their viewpoints with relevant examples and accurate use of subject-specific terminology. In contrast, weaker responses tended to be generic, often focusing narrowly on a single issue without sufficient development.

It was evident in many scripts that candidates had taken time to plan their answers before writing. These planned responses were typically more coherent and structured, enabling candidates to access higher levels of credit by presenting their ideas clearly and logically.

ENVIRONMENTAL MANAGEMENT

<p>Paper 5014/22 Management in Context</p>
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Key messages

Candidates should aim to use examination time efficiently by avoiding unnecessary repetition, such as restating the question in their response. For example, in **Question 2(e)(iii)**, beginning an answer with “*Selective breeding can be used to obtain the lemons the farmer wants by...*” does not contribute meaningfully to the response and can limit time available for more substantive content.

Reading each question carefully before writing is essential. This helps ensure that responses are focused and relevant. Candidates should also follow the rubric precisely, for instance, if a question asks for three reasons, providing a fourth may introduce contradictions and risk losing marks.

Higher-performing candidates often use the mark allocation as a guide to structure their responses, recognising that more marks typically require multiple distinct points. Using bullet points can support clarity and help ensure that enough separate ideas are included.

Candidates should always show their working in calculation questions. Even if the final answer is incorrect, marks may still be awarded for correct methods and processes.

When drawing diagrams, charts, or graphs, candidates should use a sharp pencil and ruler. This improves presentation and allows for easier correction of errors. For line graphs, a logical linear scale and correctly labelled axes are essential.

Extended responses benefit from planning. Candidates who take time to organise their thoughts are more likely to produce well-balanced answers that explore multiple perspectives and use relevant examples to support their arguments. A conclusion should summarise the main findings rather than focus narrowly on one aspect.

Finally, candidates should be encouraged to check their question paper thoroughly before submitting, to ensure that every question has been attempted.

General comments

Candidates should avoid vague statements such as: ‘impacts’ or ‘damages’, ‘causes harm’, ‘causes pollution’, ‘affects the environment’, ‘reduces resources’, ‘causes death’, ‘environmentally-friendly’; these unspecific statements are unlikely to gain credit.

Candidates should avoid using terms that have a specific meaning in science unless they are used in an appropriate context, for example in **Question 1(c)(ii)**, accurate, reliable, valid.

This examination paper assesses environmental management in context and a key aspect of this is understanding how data is collected, how fieldwork is carried out and how the data obtained is presented and analysed. Many candidates would benefit from more experience with fieldwork or lab work. Systematic sampling was not well known. Many could not name a balance. Most candidates could not provide a results table and writing conclusions was found to be challenging. Identifying limitations and anomalous results was also difficult for many candidates.

The terms ‘selective breeding’ and ‘bioremediation’ were not well understood.

There was a general misconception that the term surface run-off related to speed of rock movement down a slope.

Comments on specific questions

Question 1

- (a) Many stronger candidates showed their working for this calculation. Some power of ten errors were seen with 6200 used instead of 62 000. Some candidates needed to follow the instruction to give their answer to the nearest whole number.
- (b) (i) The plotting of the bars was often correct. Many of the bars drawn did not have straight edges and a ruler had not been used. Bars should be equal widths and spaces between bars should be the same. Candidates who used pen rather than pencil were then unable to correct their mistakes.
- (ii) Most responses were correct showing that many candidates could read and process the data from the population pyramid to give the answer of 140.
- (iii) A common error was to divide by 17 348 instead of 16 597. Some candidates rounded incorrectly.
- (c) (i) Some candidates knew the purpose of a pilot survey; others gave vague responses such as 'to compare to the main one'.
- (ii) Candidates were generally able to give two correct limitations of using a questionnaire. A common approach that did not score credit was to state data collected is 'not accurate', 'not valid' or 'not precise'.

Question 2

- (a) (i) Almost all responses interpreted the graph correctly and selected 2020.
- (ii) Almost all responses correctly selected March. The use of 'M' was not credited as this was ambiguous and could have referred to May.
- (b) Good responses referred to competition for a stated resource such as water or nutrients. The reasons for candidates' suggestions were not always given. 'Branches or roots get tangled' was insufficient as this did not provide a reason.
- (c) (i) 'Systematic sampling' was not well known. Many incorrect spellings were seen such as 'systemic'.
- (ii) Most candidates determined the total number of trees correctly. A common incorrect approach was to state '3' – the number of circled sampled trees shown in the diagram.
- (d) (i) It was insufficient to repeat the information in the question, 'to see the impact when fertiliser is not used' without explaining this with 'and compare this to the yield with fertiliser'. A minority of responses correctly identified that this was the control.
- (ii) Some vague answers stated 'because of the ions'. Stronger responses clarified that this was due to mineral ions or nutrients being depleted from the soil.
- (iii) Candidates who performed well referred to yield in their responses. Many gave the same conclusion for each, that the yield fluctuated, whereas the question asked for a different conclusion for each row.
- (e) (i) 'Weighing machine' was a common response but is not the name of the instrument used to record mass. 'Tape' was also seen. Candidates are expected to be familiar with basic equipment used to carry out fieldwork.
- (ii) Most candidates found drawing a table too challenging. Those who did provide a table often did not include units in the headings.
- (iii) Candidates struggled to give a concise answer, and many were not familiar with the term selective breeding. It was common for candidates to repeat the stem of the question in their answer, taking up space in the response area without gaining credit.

- (iv) Most candidates could give two techniques to increase yield.

Question 3

- (a) Through-flow was sometimes confused with run-off.
- (b)(i) Some candidates needed to read the question, which asked for other impacts, more carefully and repeated impacts already given in the stem of the question. The question also required impacts on people, which was missed by some candidates.
- (ii) There was a general misconception that the term surface run-off related to speed of rock movement. The role of vegetation in interception and infiltration was rarely referred to.
- (iii) Many good suggestions as to why illegal construction makes landslides more likely to happen were seen.
- (c)(i) Most candidates could suggest negative impacts of tourism. Weaker responses repeated illegal construction and increased use of vehicles, which had been given in the question. 'Pollution' was too vague and needed to be qualified with the type, e.g., water pollution.
- (ii) Weaker responses did not give a policy that related to transport or could not explain how the policy reduced the impact of tourists on the island.
- (d)(i) Candidates found it challenging to identify a limitation with the investigation based on column 1 of the table.
- (ii) Many recognised that units should not be included in the body of a table and that the use of km was a contradiction to the units in the heading of the column which was given in metres.
- (iii) A number of candidates thought that there were two anomalies in the data despite the question asking for one anomalous result.
- (iv) Many good safety considerations were suggested with reference to wearing gloves or a mask a common answer. Weaker responses stated 'the *E. coli*' without elaborating further.
- (v) Good conclusions recognised the aim of the investigation and gave an appropriate conclusion. Weaker conclusions could not have been understood without reference to the results tables, such as 'column 3 gets lower as column 2 gets further'. This is insufficient as a conclusion should be understandable without reference back to the data.
- (vi) Most responses stated typhoid or cholera. A few gave viral diseases or malaria. Weaker answers gave more than one disease where the second answer was often incorrect.
- (vii) Good answers recognised that the addition of chlorine makes water safe to drink. Filtration and desalination are not sufficient to make water safe to drink as microbes would still be present after these processes.

Question 4

- (a) Many good suggestions for the benefit of the location of the solar panels in the image were given. A common answer was that they provide shade for the cars.
- (b)(i) The majority suggested a pie or bar chart. A few contradicted these correct answers with a line graph.
- (ii) The vague response 'they can be reused' and 'cost' were not sufficient for a benefit of recycling batteries. Many struggled to suggest any valid benefits.
- (iii) The majority could suggest one reason why batteries are not recycled in some locations. Fewer could give two correct reasons.

Question 5

- (a) (i) Some good descriptions for the formation of igneous rocks were seen.
- (ii) Granite and basalt were usually given. Weaker responses gave more than one answer which often contradicted each other, such as 'granite and slate'. 'Graphite', another incorrect answer, was also sometimes seen.
- (b) (i) Many candidates could state three factors that affect the decision to extract rocks. Weaker responses repeated the same point in different ways, such as deep underground, too challenging to extract due to the depth, or a lot of overburden above the ore.
- (ii) Most responses identified the risk of rock collapse.
- (iii) The creation of jobs and an improvement in infrastructure were the most common correct answers.
- (iv) Candidates were confident in identifying negative impacts of rock extraction shown in the photograph.
- (v) The term bioremediation was not well known. Many described the restoration of land following mining, which was not asked for.
- (c) Some responses were not explanations, such as 'nutrients'. Stronger responses referred to an increase in nutrient content in the soil due to previous eruptions.
- (d) (i) Very few candidates referred to the logarithmic scale of the Richter scale. Imprecise terminology was also used, such as measures the strength of a volcano, rather than magnitude or intensity.
- (ii) Most candidates could state at least three valid aspects of a disaster plan. 'Stockpile resources' was too vague – the type of resource should be stated, such as food, water or medical supplies.