

# ENVIRONMENTAL MANAGEMENT

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Paper 5014/12

Paper 12

## Key messages

- Candidates should plan their time carefully in the examination. No more than 45 minutes should be spent answering the four short questions in **Section A**; in **Section B**, no more than 45 minutes should be spent on **Question 5**, so that 45 minutes are left to answer **Question 6**.
- It is advisable to read each question more than once and underline key question words, especially the command words which tell candidates what to do. Question instructions most frequently ignored in this examination were 'use the information on the diagram' in **4(b)(i)**, 'what is similar about the tracks followed by cyclones' in **5(d)(ii)**, and 'using both diagrams' in **6(b)(ii)**.
- Candidates should take careful note of the amount of credit available for the question, as this is a good guide as to how much information is expected; it is highly likely that a variety of points or reference to an example are needed, rather than simply repeating one idea or theme. Examples of questions for which candidates did not provide adequate answers as suggested by the credit allowance were **6(f)(ii)** and **6(f)(iii)**. Many candidates gave very brief answers, without any supporting use of percentages from the graphs. Always support descriptions from graphs by referring to relevant values.

## General comments

Most candidates scored at least as well in the short questions in **Section A** as they did in each of **Questions 5** and **6**. This showed that candidates tended to continue the standard set in answering the early questions into the later questions. Only occasionally did a significant difference in candidate topic knowledge result in much higher credit being awarded for either of the questions in **Section B**.

There were fewer instances than previously of candidates failing to complete all the later parts of **Question 6**. Pressure of time appeared to be much less of an issue this year, suggesting that many candidates planned the use of their time more effectively. Fewer answers than previously seen continued into the blank spaces beyond the answer lines in the short questions in **Section A**.

There seemed to be few differences in degree of difficulty between the four questions in **Section A**, with candidates scoring equally well in each of **Questions 1, 2, 3** and **4**. Candidates had most difficulty with **3(c)(i)** and **(ii)** about inversion of temperature.

In **Section B**, most candidates were able to give answers to the majority of the questions, and completely incorrect answers were rarely seen. The only exception to this was **Question 5(b)(i)**, where a few candidates chose to draw a bar graph to show temperature instead of a line graph as instructed by the question. Some candidates misinterpreted **Question 5(a)(i)** or failed to give the depth or breadth in their answers that were required in **Question 5(e)(ii)**.

The main discriminator between candidates was the extent to which they extended their answers in line with the amount of credit available. For those who failed to develop their answers, minimal credit was most frequently awarded in **Questions 6(a)(ii)**, **6(d)(ii)** and **6(f)(ii)**.

## Comments on Specific Questions

### Section A

#### Question 1

- (a) (i) Arrows drawn on the map needed to show plates moving away from each other in general westerly and easterly directions, although it was not important which plate boundary (or boundaries) were marked with arrows. Most attempts were successful.
- (ii) The presence of active volcanoes on the map was typically the trigger for explaining the presence of hot rocks. The best and most convincing answers came from those who understood that magma from the mantle reaches the surface at plate boundaries.
- (iii) Many candidates arrived at an acceptable answer and circled 275 (which is closest to the precise answer) or 300 (which was credited in this case as an answer closer to this could just be obtained from plausible measurements). Some candidates left this blank and others gave one of the incorrect answers.
- (iv) There was a clear reference to given in part (ii) to tropical fruit and vegetables being grown in hothouses. In this question, repetition of the word 'hothouses' triggered appropriate answers about the economic uses in terms of crop growth in a minority of cases. Other answers tended to be vague.
- (v) Geothermal energy and heating inside buildings were the most common answers seen here. Since the question referred to uses of hot water and steam, the basic answer of 'for tourism' was inadequate unless a specific tourist use was stated, such as bathing pools.
- (b) Many answers gave danger and damage from earthquakes and volcanoes. The highest credit was scored by those candidates who introduced breadth to their answers, by referring to the unpredictability of earthquakes and volcanic eruptions and to the economic costs of being prepared for them, for example in more expensive building codes.

#### Question 2

- (a) (i) Credit-worthy answers to this referred to the great depth of the well (about 1500 m below the surface). Other candidates answered by referring to some of the problems associated with the great depth, for example the poor visibility or high water pressure.
- (ii) Frequent references were made to winds, ocean currents and to the lightness of oil compared with water. Many candidates received full credit.
- (iii) Most candidates read the graph accurately to give the correct answer.
- (b) (i) Most candidates correctly added arrows, pointing in an anti-clockwise direction, to show the food chain. A few candidates incorrectly drew a link from large fish to oil; this circular link was invalid.
- (ii) Many candidates focused on damage and death for fauna and plants and gained credit. A few candidates did not read the question and stated the other causes of oil leaks, such as tanker spills, rather than answering the question.
- (c) Most candidates gained credit by giving acceptable suggestions for three methods as asked for by the question.

#### Question 3

- (a) (i) The majority of candidates plotted the bar in the correct position on the graph for the year 2030.
- (ii) A number of candidates simply stated that there was an 'increase in amounts of nitrous oxide'. Other candidates correctly qualified the increase more strongly, emphasising the rapid, or great increase.

- (iii) Most candidates divided the pie graph into 76% and 24%, but some incorrectly did not also add labels to indicate which sector represented which source of nitrous oxide.
- (b) (i) The most common answer here was fertilisers, although some candidates appropriately suggested agricultural machinery exhausts. If exhaust was not linked to agricultural machinery or similar then credit could not be awarded.
  - (ii) Vehicle exhaust was the most frequently seen answer in this part.
- (c) (i) Most candidates made the correct choice, **A**, but some did not give a valid reason which was required in order to be credited.
  - (ii) The minority of candidates who had incorrectly selected **B** in part (c)(i) generally scored credit in this part by making reference to pollutants being 'trapped' in the lower atmosphere. The majority of candidates who correctly chose **A** went on to give a valid explanation.
- (d) The majority of candidates were able to suggest two reasons here, but three were needed in order to score full credit. Weaker candidates often over-relied on the use of the word 'better' to describe inorganic fertilisers without clearly explaining **how** they were superior to organic ones.

#### Question 4

- (a) The majority of candidates attempted to give descriptions which were sufficiently detailed. Most candidates concentrated on the northern hemisphere, particularly on northerly locations mostly within the Arctic Circle. They usually gave support by use of names of continents and countries. This part was consistently well answered.
- (b) (i) While it was clear from answers that the term *plant community* was widely known and understood, many candidates failed to gain credit because they did not follow the instructions in the questions which told them to make use of the information on the diagram in their answers.
  - (ii) Good answers to this began by stating how vegetation on the south facing slope was different. Those who noted the presence of a greater variety of plants were more likely to find a valid physical explanation. Acceptable explanations included references to the south facing slope being warmer and sunnier and also more sheltered from cold (northerly) winds.
  - (iii) Most candidates gained credit for stating that tundra plants can only have short roots.
- (c) There were many excellent answers, gaining full credit in this part. A few candidates concentrated on one opinion only, which restricted the amount of credit that could be awarded. Candidates who strayed from the question by referring to possible advantages and attractions of the tundra for tourists could not be credited.

#### Section B

#### Question 5

Most important in **Question 5** was consistent performance and therefore regular accumulation of credit. The greatest loss of credit was often seen in part (d). Candidates showed good familiarity with the topics being examined.

- (a) (i) Careless reading of the question led to many candidates concentrating on naming the weather instruments instead of the weather elements recorded. While credit could not be awarded for 'wind vane' or 'anemometer', because they did not specifically mention wind direction and wind speed, credit was awarded for 'rain gauge' and 'sunshine recorder', because the weather element was part of the name of the instrument. Plenty of others gave the short accurate answers of 'wind direction', 'wind speed', 'rainfall' and 'sunshine hours'. Of these, 'sunshine hours' was the one most frequently omitted.
  - (ii) The clearest answers almost invariably began with the name of the instrument, either 'maximum and minimum' or 'Six's thermometer'. Whether or not the answers earned full credit depended on the amount of further detail given about the thermometers, and on the accuracy of the description

of how readings from them were taken. Answers obtaining less credit came from candidates who concentrated irrelevantly on describing how the highest and lowest temperatures of the day are used in further calculations of daily mean and range.

- (b) (i) The most accurate line graphs were drawn by those candidates who placed the dot for temperature in the centre of the column for each of the months. Those who placed the values on the lines to the left or the right drew graphs which were not quite as accurate and were only awarded partial credit, provided that all the plots were accurate, which almost all were, and linked by a line. A number of candidates drew a bar graph to show temperature, which was not only more time consuming than drawing a line graph, but also incorrect.
- (ii) Most answers here were correct, although a few candidates stated the extremes (25 °C and 29 °C) instead of working out the range, 4 °C.
- (iii) Answers worth most credit came from candidates who clearly recognised the two season rainfall regime, wet summer and dry winter. Answers in which candidates worked through the year from January to December describing when and whether it was dry or wet were worth less credit. Answers in which candidates did not do much more than pick out the two months with lowest and highest rainfall were not worthy of credit.
- (iv) Most candidates showed themselves to be aware of higher rainfall and more cloud reducing temperatures in June and July compared with April.
- (c) (i) Those candidates who used both temperature and rainfall, and directly related these to opportunities for crop growing, gave the best answers. For example, some related high summer rainfall to the possibilities of storing water for the dry season and/or to the good conditions for rice cultivation. Less convincing were answers based on 'high rainfall all year' being good for crop growing, since rainfall amounts were clearly inadequate for crop growing during the months of January to April, especially with these high tropical temperatures.
- (ii) Most gave correct answers here, although a few reversed their choices.
- (iii) Most candidates showed good understanding of differences between subsistence and commercial farming and gave accurate answers in this part. The amount of credit available meant that more than the basic difference of 'for the family' and 'for sale' was needed; most elaborated further about differences in the size or scale of farming operations between them.
- (iv) 'Monoculture', 'for export', and 'ownership by large companies' were the three characteristics of plantation farming mentioned most in answers. Some supported their answers by naming examples of crops, or some of the many inputs. Less credit-worthy answers were more about commercial farming in general than plantation farming in particular.
- (d) The majority of candidates found part (d) more difficult than part (c).
- (i) Many candidates started by describing the areas as being in the tropics. The best descriptions included references to both oceans and names of adjacent countries; references to cyclone formation in the Indian and Pacific Oceans were usually more precise than to those in the Atlantic.
- (ii) Candidates needed to work harder for credit in this part because they were asked to focus on what was 'similar' about the tracks followed. Most missed the basic point that initial movement was from east to west; more commented on movement away from the Equator or towards the poles. Correctly stating clockwise movement in the northern hemisphere and anticlockwise in the southern hemisphere did not meet the similar theme of the question; those who referred to a circular movement, or to tracks turning or bending with movement away from the Equator, successfully adapted their answers to meet the question theme.
- (iii) The best answers here came from candidates who recognised that the key to answering was high sea water temperatures at the end of the northern summer. Any further elaboration about why this led to air rising enabled full credit to be awarded. Some answers were more about the formation of the Asian monsoon, and differences in pressure between land and sea, than about individual cyclone formation.

- (e) (i) Those candidates who began their answers by stating that cyclones bring strong winds and heavy rainfall gave consistently the most credit-worthy answers. Such candidates tended to follow up with the resulting dangers for humans from the destruction of buildings and trees, and from flooding and landslides. Those candidates who made no mention of the physical problems could still gain credit for stating how loss of life and injuries occurred. Many of the answers which took this approach lacked depth and precision. Even so, the majority of candidates gained some credit on this question by making good use of the information provided.
- (ii) The factors which accounted for the differences in loss of life from cyclones between the Philippines and Japan included poverty and wealth, level of technology, degree of preparedness and organisational efficiency, although most of these were inter-related. Candidates needed to include references to at least two of them to gain full credit. The best style of answer was to make direct comparisons between the two countries throughout. Answers which concentrated on only one of the countries rarely reached more than half the available credit. Answers in which differences were implied without being fully stated gained less credit.
- (iii) A clearly stated view with full and appropriate reasons was the main feature of the most credit-worthy answers here. Either opinion was equally acceptable provided that it was backed up by good justification. This justification was usually stronger for one clear view, because general statement such as 'improvements in technology' could be elaborated upon by reference to key material such as greater coverage by weather satellites, or improved computer models, or more efficient communications with people in areas likely to be affected.

### Question 6

Overall the standard of answers given to **Question 6** tended to be consistent throughout all parts of the question and almost all received about the same amount of credit in both **Questions 5** and **6**. The strongest performances, as usual, were from candidates who gave full and relevant answers throughout.

- (a) (i) Most candidates knew that oil, coal and natural gas were the fossil fuels in the pie graph. Some candidates left natural gas un-shaded or incorrectly shaded nuclear power.
- (ii) Having stated a percentage between 75% and 100% for fossil fuels, most candidates failed to look for further description that could have led to full credit.
- (iii) Answers within the range 25%-27% were accepted in this part.
- (b) (i) The purpose of the shafts in a coal mine were better known than for the towers. Surface towers hold the lifting gear and supply the mine with ventilation and other essential services. Some candidates knew this, but a significant number incorrectly believed that the towers were used for either storing or processing the coal.
- (ii) Answers which gained almost full credit, based on what could be seen in diagram **A**, were predominant. The instruction in the question to make use of **both** diagrams was missed in many cases.
- (iii) Diagram **B** was sometimes used to support the answer in part (iii). Those who thought that the diagram showed an old coal mine found it difficult to explain given the presence of so much large machinery.
- (c) (i) Many candidates gave four reasons in (c)(i); if only three different reasons were found, 'safety standards ignored' was the one most likely to be missed.
- (ii) For an effective explanation candidates needed to demonstrate clear knowledge of opencast mining, so that they could emphasise effectively why the problems referred to in the newspaper report either did not apply or applied less than in deep mining.
- (iii) Those candidates who incorporated breadth into their answers to part (iii), by referring to factors other than safety standards such as age and physical condition of mines, gained more credit. Answers based solely on safety standards and their enforcement tended to gain partial credit. Nevertheless, with sufficient depth it was possible to gain full credit using this line of reasoning, especially if examples of countries were given in support.

- (d) (i) Sulfur dioxide and oxides of nitrogen were the gases needed for answering (d)(i). They were widely known. Carbon dioxide was incorrectly included in quite a number of answers – acid rain as an environmental issue only includes additional acids to the natural carbonic acid produced by carbon dioxide in the air.
- (ii) Carried by the wind to other countries was the most frequent and correct line of answering to (d)(ii).
- (iii) The best answers to part (iii) began with a clear statement about how the trees in Sweden were shown to be different from those in the UK. Following from this was an impressive range of reasons, referring to wind carried pollution from coal fired power stations, causing increased soil acidity, faster leaching of soil nutrients such as calcium and potassium, and their replacement by more harmful manganese and aluminium. Incorrect responses were made by candidates who attempted to explain the greater presence of trees in terms of differences in climate and biomes between the warm UK and cold Sweden.
- (e) (i) Candidates who covered flue gas desulfurisation and/or the use of catalysts to remove nitrogen gained credit in (e)(i). Some candidates tried to go wider than the question set by answering in terms of renewable sources replacing coal which earned little or no credit.
- (ii) Many candidates relied only upon making the basic point about the difficulty of reaching agreements between countries, without further elaboration about differences in national interests or wealth between countries. There were some more perceptive answers, in which a broader look was taken at attempted international agreements; these included references to the limited success of any agreements reached at climate change summits.
- (f) (i) Many candidates gave the correct answer, but some gave 75%, having not recognised geothermal power as one of the renewable sources. Occasionally the answer given was 0% which was surprising.
- (ii) Almost all candidates began by establishing the greater importance of renewables in these three north European countries compared with total world energy consumption. Many filled most or all of the answer lines, but then made no attempt to elaborate more fully, taking into account the credit allocation for this part. Others were more successful when they used percentages from the graph to support the 100% for Iceland already stated in the first part of the question, with 97% for Norway and 53% for Sweden. Also a few successfully approached the answer by discussing the limited fossil fuel use for electricity in Norway and Sweden, with natural gas use at only 3% and 4% respectively. The graphs could have been more fully used to earn more credit.
- (iii) Most candidates followed one line of answering. Sometimes it was related to the higher cost of renewables compared with fossil fuels, and they related this to countries' levels of development. The theme used most frequently was of specific physical needs, supported by outline references to two or three examples of renewables. Answers in which candidates used a variety of reasons, such as the two mentioned above plus references to a country's own fossil fuel resources, stood out as being clearly superior. Even better were those in which candidates regularly included names of countries as examples, which allowed them to make their points even more strongly. The result was that lower scoring answers were much more common than those which gained higher or full credit, even though virtually all candidates understood the type of answer needed, and knew something about three or four different types of renewables.