ENVIRONMENTAL MANAGEMENT

Paper 0680/12
Theory

Key messages

- Candidates should avoid using vague or undefined terms, for example, pollution or cost, without further qualification.
- Candidates should take time to read questions carefully so that they address the specific instructions of the tasks. For example, if the requirement is to explain two reasons, the first reason should be written on the line following **1**, the second reason on the line following **2**, with each reason followed by an explanation for that reason.
- Care should be taken when drawing graphs. To ensure they are the correct orientation, use an appropriate linear scale and in the style instructed by the question.

General comments

Candidates were generally well prepared for this paper and displayed knowledge of a range of subjects. Most candidates showed their mathematical working, which is beneficial as there is the opportunity to be awarded credit for interim stages even if an error has been made with the final answer.

The 6-mark level of response **Question 8(d)** was attempted by most candidates. The best responses were well balanced and provided examples or details to back up any statements made.

Candidates should avoid using 'above' and 'below' when describing locations on a map. Candidates should refer to compass points or other specific features when describing locations.

Comments on specific questions

Section A

Question 1

(a) The question required candidates to circle two correct answers. Most followed these instructions and correctly identified geothermal, although a proportion of responses incorrectly identified nuclear, as a renewable energy resource.

(b) (i) There was some confusion over the process of electricity generation. While the majority understood that there was a need for the blades of the turbine to rotate, the link to a generator was frequently omitted. Many correctly understood that the process changed kinetic energy to electrical energy.

(ii) There was some confusion to the role of the sluice gates. Candidates who described how the gates would manage the rate of flow of the water, were awarded credit.

(c) Candidates were required to state one benefit and one limitation of tidal power. The most common benefit was the fact that the resource is renewable. Some gave a vague response about pollution which needed greater detail to gain credit. With regards to limitations, many correctly named the costs of construction. The impact on marine species needed some relevant detail to gain credit. A common misconception was that tides are not predictable.

Question 2

(a) The majority of candidates were able to correctly complete the gaps in the statements from the words provided, showing an understanding of the topic.

(b) (i) The concept of photosynthesis was well understood. There were a few cases where candidates did not read the question accurately and provided the chemical symbols rather than the word equation.

(ii) The majority of candidates correctly identified the pigment as chlorophyll, with few examples of candidates naming structures such as chloroplasts in error.

Question 3

(a) (i) This question required candidates to demonstrate their knowledge of ocean currents. Whilst the map provided the location of some ocean currents, a proportion did not label any of these with an **X** and chose a location elsewhere.

(ii) Whilst many candidates correctly understood that currents in the North Pacific would also have a circular pattern, many incorrectly assumed they would move in the same direction as those in the southern hemisphere. Stronger candidates were generally successful on this question and also their interpretation of the map in part **(a)(i)**.

(b) Whilst many candidates knew about the abundance of nutrients, it was often weakly articulated. There was also an incorrect assumption that fish were carried along by the movement of the water. Many responses omitted the link to food supply.

Section B

Question 4

(a) The majority of candidates were able to correctly name the type of plate boundary where the volcano would be located.

(b) (i) This question required candidates to provide benefits and limitations, requiring them to evaluate an unfamiliar situation and apply their knowledge to this context. Many understood that there was considerable benefit to the local population, as early warning could be provided. A few candidates also identified that they would have a greater commitment to the project, as it protected their own community. With regards to limitations, answers were sometimes less well focussed but common themes included the reliability or accuracy of the data they collect and also that the volunteers might be put at risk. A proportion of responses did not consider that the monitoring was being completed by volunteers or spoke about the general impacts of volcanic eruption rather than this method of monitoring.

(ii) Most candidates were able to provide two good reasons, although some did not provide an explanation which limited their potential mark.

(c) (i) A good proportion correctly stated the troposphere. The stratosphere was the most common incorrect answer.

(ii) It was clear that the majority of candidates understood the formation of acid rain. The strongest were able to identify the chemical reactions taking place, and the fact that the acidic run-off from precipitation is collected by the rivers and lakes.

Question 5

(a) (i) Candidates were required to interpret the information in the photograph to identify evidence of the type of faming taking place. In this case, subsistence farming. Many correctly identified that crops were grown near the home while others identified that the scale of production was small. Credit was not given for information not seen in the photograph.

(ii) Credit was given to methods of increasing yield seen in the photograph. Many identified that irrigation had taken place, and others, the spacing of crops or the use of other plants as wind breaks. Many stated that crop rotation was taking place, which cannot be seen in the photograph.

(b) (i) A wide range of conclusions could be drawn from the data. Commonly seen answers included that the organic fertiliser performed nearly as well as the NPK fertiliser or that the application of only one nutrient gave little increase in yield over the field with no fertiliser added. Some weaker candidates made very simplistic statements such as the field with no fertiliser had the lowest yield, which was still credited as it is a correct statement.

(ii) Many responses demonstrated a knowledge of lack of fertiliser application being used as the control, although some answers were weakly articulated.

(iii) A wide range of potential responses were given credit as examples of organic fertilisers.

(c) This question was answered in great detail by many candidates who were able to achieve all four marks. Common errors included a focus on poisoning or bioaccumulation rather than the impact of oxygen use by the decomposers thereby reducing the concentrations available to other organisms. Almost all candidates correctly referred to the rapid increase in algae as a result of the nutrient enrichment, often referring to it as an algal bloom.

Question 6

(a) Drawing the graph was not completed well. Some did not provide labels on the axes. Candidates were expected to identify that the data was not from uniform dates and this needed to be addressed when plotting the 2015 data. Often this was plotted as if it were for the year 2020. The information in the question also prompted candidates to draw a straight line between each plotted point, but some did not achieve this mark as they extrapolated beyond the plots or attempted to draw a line of best fit.

(b) A common error was to state that CFCs react with ozone, omitting the vital stages that CFCs are broken down by UV light to release chlorine. Many incorrectly linked the breaking down of ozone to the enhanced greenhouse effect.

(c) There was often confusion between ozone depletion and global warming. Some responses were very generic, stating cost without any additional information to support the comment. It is important that any response provides sufficient detail to be awarded credit.

Question 7

(a) (i) Most candidates demonstrated an understanding of the data and were able to complete the missing information.

(ii) The majority of candidates were able to calculate the ratio correctly. Credit was awarded if the correct information was used but resulting in an incorrect final answer, if there was evidence of the calculation provided.

(iii) Stating one other natural form of stored frozen water proved to be demanding for many candidates.

(b) Most candidates gained one mark for the idea of reducing meat consumption and changing to a more plant-based diet. It was not expected that they would know the terms vegetarian or vegan, but these were credited where used. Despite the prompt in the question, many did not quote the data to support their answer and therefore did not achieve the second mark.

(c) This question required candidates to use their knowledge and apply it to an unfamiliar context. Stronger candidates identified the key factors, notably the need for water treatment before drinking and the need for appropriate sanitation. Some weaker responses gave generic examples or confused the treatment of this bacterial disease with the strategies used to control malaria.

Question 8

(a) There was a lack of clarity in some descriptions. It is expected that responses identify locations using north and south rather than ‘above’ and ‘below’. The question required candidates to describe the distribution of countries, so, those that named specific countries had not addressed the requirements of the question. Most commonly recognised areas where forests were increasing, were Asia and Europe.

(b) The focus of the question was a comparison of afforestation and reforestation; therefore, it was expected that statements considered both strategies to either state how they differed or how they were similar. Many weaker candidates were not able to describe afforestation, often mistaking it for forest regrowth.

(c) (i) The trends for both mature forest and young forests were generally well described. There were relatively few examples of answers which focussed on specific years.

(ii) The majority of candidates were able to calculate a percentage, although not all used the correct figures from the information. Where candidates show their working, credit is given for a correct calculation even if there is an error in the final answer. It is expected that candidates are aware of the level of significant figures that would be permissible from the information provided in the data and have an ability to round their answer, up or down, appropriately.

(d) This was a 6-mark question allowing candidates to write more extensively. The published mark scheme provides examples of themes or concepts that could be discussed. If a candidate includes further detail or includes other relevant ideas this too is given credit. There were examples of well-balanced answers, looking at both viewpoints and supporting their ideas with examples. A few stronger candidates also included other strategies, such as specific extraction of trees rather than simply removing or retaining forests.

ENVIRONMENTAL MANAGEMENT

Paper 0680/22
Management in Context

Key messages

Candidates should:

- Read questions carefully to identify the command word e.g., *Compare*, *Describe, Explain, State*.
- Consider the mark allocations and answer lines provided. These indicate the level of detail required. Answers that continue on blank pages and answer sheets should not be necessary.
- Avoid using vague words and terms such as 'resources', 'damages', 'harms', 'impacts', 'pollution', 'resources', 'standard of living'.
- Shade pie charts accurately making sure the shading matches the key. Sectors should be drawn clockwise in rank order (including other) with the largest first, starting at 'noon.'
- Use the north arrow on maps to support descriptions of distributions with points of the compass, not top, bottom, downwards, left, right.
- Show working when completing calculations. If more than one mark is available for the answer, partial credit may be awarded if an error is made.

General comments

This paper invited candidates to consider environmental issues and methods of gathering and interpreting data in the context of one country. Many candidates understood this and made good use of the source material and their written responses were clearly expressed. The mathematical and graphical questions did pose some difficulties for a minority of candidates.

Comments on specific questions

Question 1

(a) (i) Many candidates gained full credit for describing the distribution of land and land use in Somalia. These candidates made good use of the north arrow in their descriptions. A minority of candidates appeared to confuse the symbols for intensive agriculture and forest.

(ii) Few candidates were able to suggest two reasons for the distribution of intensive agriculture in Somalia. The most common suggestions were fertile soil, close to the coast for exporting the crops and close to Mogadishu to supply food to the population. Some responses described the climate of the country, others stated that water from the Indian Ocean could be used for farming.

(iii) Most candidates were able to correctly state that commercial agriculture is growing crops or rearing animals to sell, to make a profit.

(b) (i) Many candidates constructed a food chain with maize, *Spodoptera* or moth and lizard in the correct order. Some candidates linked the organisms with arrows that pointed the wrong way. Others included eagles and wolves when the question asked for three trophic levels. A food chain begins with a producer. A minority of candidates did not include maize in their food chain.

(ii) Most candidates were able to correctly state that a primary consumer is an organism or animal that eats or feeds on producers or plants.

(iii) This question required candidates to suggest benefits and limitations of releasing a fungus into Somalia to control the population of *Spodoptera* moths. The most common benefit suggested was increased crop yield. Limitations were often the more successful part of the response. These included the fungus killing non-target species and disrupting the food chain because organisms depending on the moths for food, like the lizards, would die from starvation.

(iv) Few candidates gained full credit for describing how individual plants in the maize crop, not affected by the moths, can be used to produce a maize crop that is resistant to *Spodoptera* moths. Many answers named either selective breeding or genetic modification. The descriptions of the methods were often vague, and some confused the two methods. Other responses described using fertilisers or crop rotation.

(c) (i) The responses to this question, requiring the description of how a scientist investigates the population of *Spodoptera* moths in a 1000 m^2 field of maize using a random sampling technique, were variable. The stronger responses made good use of the prompts provided:

- uses random sampling
- uses a quadrat
- records the data collected
- obtains an estimate for the population of *Spodoptera* moths in the field.

These responses described putting a grid on a map of the field to divide it into large squares and using a random number generator to choose squares to place quadrats. The number of moths in a 1 m x 1 m quadrat is counted and recorded in a table. Some candidates repeated this, a number of times, to obtain an average. The average is multiplied by the area of the field to estimate the population of moths. Many responses stated that random sampling would be used without describing a method. Others either did not count the moths or used a notebook without the use of a table or a tally to record the data. Some candidates divided the area of the quadrat by the area of the field.

(ii) Few candidates suggested two limitations of sampling *Spodoptera* moths using a quadrat that gained credit. Many candidates suggested that *Spodoptera* moths fly or move as a limitation. Fewer suggested that because the moths move, they could be counted several times. Other candidates seemed to misunderstand the question and suggested limitations of random sampling with quadrats as a method for estimating biodiversity.

(iii) Many candidates suggested pitfall traps or pooters as one other method for estimating the population of *Spodoptera* moths.

Question 2

(a) (i) This question required candidates to compare the overall trends shown in the graph of the mean number of children born per woman in Somalia and the USA from 1980 to 2020. Two trends were required for full credit. The most successful answers made direct, brief comparisons. These included: ‘the birthrate in Somalia is higher than the birthrate in the USA’, ‘both birth rates decrease’, ‘the number of children peaked at 7.7 in Somalia whereas in the USA the peak was lower at 2.19 in 2007’ and ‘in Somalia the birthrate increased, then decreased, whereas the USA had a more stable trend’.

(ii) Most candidates determined 1996, 1997 or 1998 as the year with the maximum mean number of children born per woman in Somalia. Some candidates misread the question and gave the highest number of children born per woman in Somalia.

(iii) Most candidates gained full credit for suggesting three reasons why the mean number of children born per woman is decreasing in many countries. The reasons suggested included: increased availability of family planning and contraception, more girls being educated, more career opportunities for women who marry when they are older and have fewer children, the cost of feeding children and sending them to school, improved healthcare so fewer children die, a decline in the need for children to work to support families, and antinatalist government policies.

(b) Few candidates gained full credit for suggesting benefits and limitations of the strategy of providing school children with meals to prevent malnutrition. Many candidates gained credit for one benefit, stating that providing children with food meant that they did not suffer from malnutrition. The suggested limitations were more successful. These included: the expense of supplying food, the fact that Somalia has a large population of children, and many do not go to school, adults in the country continue to suffer from malnutrition and providing meals is not a sustainable or long-term solution.

(c) (i) This question included a short questionnaire about difference in access to safe drinking water for people in rural areas compared to urban areas. This was used to survey 200 men. The question asked candidates to suggest a suitable question that will allow a conclusion to be made. Many candidates thought they were being asked to suggest another question about access to safe drinking water. Few candidates realised a question about where the men lived was needed to make a conclusion such as 'Where do you live?' or 'Do you live in a rural or urban area?'

(ii) Most candidates were able to suggest at least one way to improve the survey. The most common way was to include women. Other ways suggested were: sample 200 women as well as 200 men, ask more questions, use random sampling, ask the same number of people from rural and urban areas. Asking more people was not credited, as 200 is a large sample.

(d) (i) Most candidates correctly stated groundwater as the source of water that is accessed by wells.

(ii) This question required candidates to suggest two reasons, other than drought, why the river is dry. Many candidates wrote about causes of drought, such as, low or no rainfall and the high temperatures and dry seasons in Somalia. The successful responses included the use of water by farming, industry and people, climate change and the construction of a dam and reservoir upstream from the river in the photograph.

(iii) Most candidates described at least one limitation of collecting fresh water using the method shown in the photograph. There were many references to the small volume that could be collected by the boy using a small tin and a large plastic container, how this was time consuming and when the container was full of water it would be difficult to carry. There were also references to the well drying up quickly and the water containing soil and bacteria that could cause water-related diseases.

(e) Nearly all candidates gained partial credit for stating two strategies of vector control for malaria. Frequent responses were; draining breeding grounds such as standing water and ponds, covering water, spreading oil on water, using larvae-eating fish and insecticides. Some candidates misunderstood the question and wrote about ways to prevent a mosquito from biting people.

(f) (i) Most candidates correctly identified January as the month with the lowest precipitation.

(ii) Most candidates correctly identified April, May and June as the 3-month period with the greatest precipitation.

(iii) Many candidates correctly calculated the range of the mean monthly temperature as 3. Some candidates gave 28–25 as the range. Others calculated the mean rainfall range.

(iv) The expected answer to this question, asking candidates to identify the month when drought conditions are most likely, was January. The explanation is because it is the month with the lowest precipitation, 2 mm. Other months with appropriate explanations were credited. Some candidates identified January but determined the rainfall using the mean temperature axis.

(v) Most candidates were able to suggest at least one strategy for managing the impacts of drought. Some strategies were about management before a drought. Others were strategies that would be used during or after a drought. Responses included: emergency water supplies, storing water, increasing supplies by rainwater harvesting or building dams, international aid and growing drought resistant crops. A number of candidates suggested strategies more appropriate to tectonic disasters such as emergency supplies of food, rescue teams and shelters.

(g) Many candidates gained full credit for stating three strategies for reducing soil erosion. Terracing, contour ploughing, bunds, shelter belts, wind breaks and planting trees were the most common correct answers.

Question 3

(a) (i) Many candidates were able to correctly name the type of mining shown in the photograph. Subsurface mining, deep mining, shaft mining and drift mining were credited. Incorrect answers included strip mining and pit mining.

(ii) Most candidates were able to state at least two factors that the company must consider before deciding to extract the uranium. The most common answers were the amount, size, grade or quality of the deposits, the location or accessibility of the mine, the costs of extraction and transport, and supply and demand. Some candidates wrote 'environmental impact' but the impact needed specifying for credit, e.g. disposal of mining waste or habitat destruction to construct houses for miners. Others wrote geology but this needed detail such as the depth of the deposit or how hard the rock was for digging shafts and tunnels.

(iii) This question required candidates to suggest how a uranium mine will affect people living in a nearby village. The stronger responses suggested positive and negative impacts. The most common positive impacts suggested were jobs and improvements to the local economy and infrastructure. Negative impacts were often the only or stronger part of a response. These included: water pollution caused by toxic chemicals, loss of farmer's land for mine buildings, concern about radioactive dust causing cancer and the village having to be relocated. Some candidates wrote pollution but without specific detail about the type and the cause. Candidates were expected to be able to apply syllabus knowledge about mining to suggest, for example, water pollution or soil pollution from toxic chemicals in mine waste, air pollution caused by dust from the mine, visual pollution caused by large mine buildings and noise from machinery and trucks possibly working day and night.

(iv) A range of strategies to restore the landscape once the extraction of uranium is finished were given credit. These included filling the mine shaft and tunnels with waste rock, bioremediation using bacteria, covering the site with topsoil, adding fertiliser, planting trees and other vegetation and establishing a nature reserve. Few candidates gained full credit, often because they included strategies about lakes and reservoirs which were not appropriate for a subsurface mine.

(b) (i) Most candidates suggested three reasons why Somalia exports all of its uranium and does not use it to generate electricity. The main reasons given were: there were no nuclear power stations to use the uranium, the country was a less economically developed country (LEDC) and was too poor to build a nuclear power station, exporting the uranium produced income that could be used to develop the country and that risks associated with nuclear power and nuclear waste were considered too much of a risk by the government.

(ii) Many candidates were able to correctly calculate the number of people in Somalia in 2022 that did not have access to electricity as 10 745 876 or 10 745 877. Candidates who showed their working were often able to gain partial credit. The most common mistake was calculating the number of people who had access to electricity.

(c) (i) Nearly all candidates correctly calculated 1% as the percentage of total electricity generated by other energy resources in 2019.

(ii) Most candidates gained partial credit for drawing a pie chart of the data in the table. These candidates completed the pie chart by presenting the sectors in the order given in the table. Pie chart sectors should be presented in rank order, largest first, beginning at the top and proceeding clockwise. There were very few plotting errors, and most candidates completed the key to match their sector shading. Some shading could have been better presented. Many of the candidates who achieved full credit listed the energy resources in rank order in the key.

(iii) Few candidates correctly calculated the difference in the percentage of total electricity generated by non-renewable resources in Somalia compared to the global percentage generated by non-renewable resources. The answer was 13%. Somalia generated 92% of the total electricity generated from fossil fuels. Globally 70% was generated from fossil fuels and 9% from nuclear (92 – 79 = 13).

(d) (i) The responses to this question were more successful. It was answered correctly by nearly all candidates. The most common answer was the solar power station cannot generate electricity 24-hours per day because generation needs sunlight which is not available at night.

(ii) Many candidates gained full credit for suggesting benefits of the solar power station in the photograph for the people in Mogadishu. The range of benefits suggested included electricity being supplied to more of the population, lower electricity bills, less air pollution in the city as fossil fuels were not being burnt, more jobs available in the power station or in industries using electricity, and improved infrastructure. Some candidates suggested improved standard of living or quality of life. Both terms are vague and needed qualification. Higher paid jobs in the power station would improve people's standard of living as they would be able to buy more goods and services. Quality of life could be improved by using electricity to light and heat homes and provide power for electrical devices such as ovens, refrigerators, air conditioning units, televisions, and computers.