ENVIRONMENTAL MANAGEMENT

Paper 5014/11

Paper 1

Key messages

- Only short answers are expected to the four 10 mark questions in **Section A**. Beware of extending answers beyond the lines left for answering. This increased the chances of candidates rushing the last question and not answering in the same detail as they had in previous questions.
- Likewise control the length of answers given to **Question 5 Section B**. Candidates can always go back and add more once they have finished all of **Question 6**.
- Read the questions carefully, read each question more than once and underline key question words such as the command words, words which tell candidates what to do.
- Question instructions most frequently ignored were 'Looking at the graph' in **5(b)(ii)** and 'Describe how the evidence' in **5(d)(ii)**.
- Take careful note of the number of marks for the question. For 3, 4 and 5 mark questions it is not just a matter of filling all the lines; it is highly likely that a variety of points needs to be made, or details about an example given, instead of just repeating one idea.
- Questions which suffered from limited candidate coverage in relation to number of marks available included **5(b)(ii)**, **5(d)(iv)** and **6(b)(iii)**, three or four mark questions to which many one mark answers were given.

General comments

There were only minor variations in the quality of responses between the four short questions which formed **Section A**. If anything, marks for **Question 3** were slightly lower. Some candidates extended their answers below the lines available for answering. While this was perfectly acceptable practice, candidates did not always add greatly to their overall performance, often repeating points already made, without further worthwhile elaboration or any use of examples. Also in a few cases spending too much time answering **Section A** resulted in a noticeable decline in amount written in **6(e) Section B**.

Despite the inevitable individual variations in performance between Centres and between candidates, total marks for **Question 5** and **Question 6** in **Section B** were usually similar. In some cases a significantly lower mark for **Question 6** was a sign of mis-allocation of time. There is always some pressure to complete this paper on time, which is why candidates must control their initial enthusiasm and not spend too much time on the short questions in **Section A**. Questions left unattempted were few and far between, suggesting that most candidates were comfortable with the topics covered.

Questions which were generally well answered by candidates included most parts of **(a)** in **Questions 1 – 4, 5(b)(i)**(drawing the bar graph), **5(d)(i)** and **(ii)** (about the effects of hurricanes), **6(a)(i)** and **(ii)** (about the importance of water and the water cycle) and **6(a)(ii)** and **(iii)** (the flow diagram for salinisation, and drawing a labelled diagram showing either trickle drip or clay pot methods of irrigation). Conversely, the questions which proved to be more difficult than average for the majority of candidates included **3(b)** (sources of methane in the atmosphere), **5(c)(ii)** (about the formation of cyclones), **6(d)(ii)** and **(iii)** (explaining the underground store of water and the presence of oases in relation to the diagram) and **6(e)(v)** (non-irrigation farming methods for crop growth such as drought resistant seeds).

Candidates who followed carefully the themes of the questions were the ones most likely to give successful answers. Often the following questions within the lettered sub-sections **(a – e)** continued the same theme, for example, question **5(b)** with a graph showing relative costs of different power sources in **(i)**. Relative costs was the basis of the questions set and for the answers needed in **(ii)** and **(iii)**. Some candidates lost sight of costs and referred more to other advantages and disadvantages of these power sources. Answers to **5(b)(i)** and **(ii)** fed into the answer needed to **(iii)**. Showing the position of the aquifer on the diagram in **6(d)(i)** was intended to make it much easier for candidates to answer **(ii)** and **(iii)**; however, a good number

of candidates never used the aquifer again in their answers, having not realised its importance in answering why surface water was available allowing farming in some places and not others.

Many questions required the use of resource information supplied. The better the candidate used the sources, the more likely the success of the answer. Using relative costs from the bar graph in **5(b)(i)** provided the basis for answering **(b)(ii)**; only a minority quoted or used any values from the graph. Likewise in the best answers to **5(d)(ii)**, candidates made use of named examples from the hurricanes listed to reinforce the general points made by them, obeying the question reference to 'evidence' from the sources. Answers to **6(c)** should have only been taken from the resource supplied, the world map. Two groups are shown on the map, areas already at risk from drought and countries expected to be at risk. Answers gaining full credit were only possible with named references to both.

Comments on individual questions

Section A

Question 1

Parts **(a)(i)** and **(ii)** fulfilled their role as the easy starter questions, even though a few candidates gave one of the two 10 year periods without any very strong earthquakes instead of the 20 year period requested by the question. Likewise **(a)(iii)** caused few problems because the table contained plenty of supporting evidence for both a relationship and for no relationship, although the amount available to the candidate was greater for the latter. In **(b)**, candidates did not develop their answers to explain how earthquakes occur, after having made the basic point about colliding plate boundaries. The quality of the answers given to **(c)** depended upon how well focused they were on question need. Instead of concentrating on 'difficulties', and 'in the first few days after a destructive earthquake', many candidates described strategies for reducing loss of life, both before and after the earthquake. This meant that fewer difficulties such as disrupted communications, broken infrastructure and power shortages (however expressed) were referred to than should have been.

Question 2

Candidates found questions **(a)(i)** – **(a)(iii)** easier than **(a)(iv)**, probably because most of the answers could be taken from the source graph. The best answers to **(iv)** were from those candidates who realised that shanty towns are commonly located on the edges of urban areas in developing world cities. Even then, many of the answers fell short of making all the three points needed for a full answer. In particular, there were relatively few references to the speed of growth and the sheer scale of numbers, which make it difficult for city authorities to keep pace, even when willing to try. Part **(b)** was quite well answered, with a majority of candidates trying to satisfy the needs of the question by looking to give at least one advantage and one disadvantage. References to cheapness and ease, and to problems in dry climates or during dry seasons, were the relevant points most frequently seen. One often repeated disadvantage was that the rainwater was acid and too contaminated to drink, which was somewhat surprising, especially when comparing rainwater quality with that from surface and ground supplies.

Question 3

In **(a)** some candidates only referred to the post 1850 part of the graph, as if the graph showed the same trend throughout the period since 1600. Part **(b)** was much less well answered, especially among candidates who spread the blame for methane in the atmosphere no further than fossil fuels. Indeed many of the answers were more appropriate for a carbon dioxide question on the same theme. Thus there was a shortage of references to such as rotting vegetation, animal waste and landfill sites. After correctly stating greenhouse gas in **(c)(i)**, candidates struggled more with **(c)(ii)** because many seemed unaware that methane was present in the atmosphere in relatively small concentrations.

Question 4

Stating the density of trees was the easy starter in **(a)**. There needed to be a range of points made about tree characteristics; in some answers there was not much progress beyond tall trees. Given the number of characteristics that could have been identified, and candidates' general familiarity with tropical rainforests, this was something of a surprise. The most obvious piece of evidence for subsistence cultivation in **(b)(i)** is the smoke. A few candidates gained further credit by stating its significance for shifting cultivation. Alternatively, others used the photographic evidence of small clearings. Most candidates observed the photograph well enough to be awarded full credit in **(b)(ii)**. Some candidates appreciated the needs of **(c)**

better than others, by explaining how and why subsistence cultivation can be sustainable and has been in some areas for thousands of years. Other answers were more descriptive of subsistence cultivation without really addressing the question.

Section B

Question 5

Most candidates were awarded at least partial credit for **(a)(i)** and **(ii)**, about the weather instruments used to record wind. They seemed to find it easier to describe similarities in site in **(a)(ii)** such as in an open space, on the top of a building and away from obstructions like trees than to state what was similar about how they work. Expected answers for this included both 'with arms rotated by the wind', or 'both fixed high up at the top of a long pole'.

Full credit was commonly awarded in **(b)(i)**. Many graphs were not only accurately completed, but neatly executed as well, to give a good overall appearance. Using one large square of five small squares for 10 US cents on the vertical axis led to the most accurate and best looking graphs. Some candidates used an irregular scale for costs, typically with the scale for low costs larger than that for high costs; their graphs consequently did not display the great size difference in costs of production between fossil fuels and solar. Part **(ii)** was poorly answered by candidates who ignored the clear question instruction to look at the graph; usually these candidates referred to the general advantages and disadvantages of wind power without any reference to costs. Some candidates stopped too quickly after making only the basic point that wind power is cheaper than the other two renewables shown in the graph. Fuller use of the graph, including relative differences in cost such as solar power being nine times more expensive than wind, was the characteristic which distinguished answers receiving full credit. Variations in climate and / or national supplies of raw materials between countries were the key to the successful answers to **(iii)**. If these were not used, answers tended to skirt around the question, often referring instead to differences in level of economic development, which were less relevant for this particular question.

The correct choice of **B**, supported by an explanation based on understanding, was restricted to more able candidates in **(c)(i)**. They knew that **C** in the eye of the storm was an area of calm and used this as part of their choice justification. Part **(ii)** was perhaps the least well answered question on this year's paper. Precise knowledge and understanding of cyclones was restricted to a real minority of candidates. In **(c)(iii)** candidates did not necessarily focus on strong winds. References to flooding were relevant only if placed in the context of strong winds whipping up high waves in coastal areas increasing the flood risk on adjacent coasts. Many of the wind based answers seemed to be more appropriate to what happens in a brief but very fierce tornado, where warnings are more immediate and less reliable than for cyclones. Answering **(iv)** was meant to be straightforward and it was. It was intended as a lead into **(v)** to make it easier for candidates to recognise that 2005 was truly a record season. Somewhat surprisingly, some candidates did not come to this conclusion, because they compared the difference they had worked out in the table with previous record numbers stated in the final conclusion. They arrived at the erroneous conclusion that 2005 was not as bad.

Part **(d)** was generally well answered throughout. The weakest answers to **(d)(ii)** came from those candidates who ignored the question instruction to 'Describe how the evidence...'. These candidates gave general answers about the importance of poverty in determining loss of life in climatic hazards, some of which they then needed to repeat in the next two parts. Otherwise there were some really strong answers from those who compared the effects of Hurricanes Katrina and Rita on rich and poor within the USA, or compared the effects of Katrina and Wilma on the economies of the USA and Mexico, or recognised how poverty played a part in the large losses of life from Hurricane Stan in developing countries like El Salvador and Guatemala. The most successful answers to **(d)(iii)** were given by candidates who focused on the question theme of 'climatic hazards'. This made them more likely to refer to strategies that were relevant to severe weather events, such as improved forecasting and provision of shelters with emergency food and water supplies. Others who turned this into a question about tectonic hazards gained some credit for referring to strategies useful when planning for all hazards, such as using trained emergency teams. It left their answers short of references to sufficient relevant strategies for climatic hazards. As always with the style of question used in **(d)(iv)**, the explanation mattered more than the view expressed. Answers with limited range or development, often with one point repeated and re-stated, were awarded little credit. Whereas candidates who covered a wider range of points, such as suggestions that climatic hazards are becoming stronger and more frequent due to climatic change, were able to access further credit.

Question 6

The better answers to **(a)(i)** referred to more than just humans. Those candidates who began with water as essential for plant growth, and extended this in terms of plants as producers for other species to consume, gained credit easily. Of the three water cycle processes indicated in the diagram in **(ii) A** (transpiration, although evaporation was also accepted) was the best known; **B** (interception) was the least well known. Candidates who recognised that **P** showed a permeable rock, while **Q** was impermeable gave the most convincing and shortest answers to **(iii)**. There was considerable variation in the quality of candidate answers to **(a)**, although overall it was quite well answered.

In **(b)(i)** and **(ii)** some candidates simply stated the answers, which was all that was needed. Others showed the totals on which they were based. These were often more correct than the final result. For example, the increase from 3 to 6 billion in world population led many to an answer of three instead of two. Some candidates gave the number of times for one of the questions, and somewhat mysteriously stated the actual difference for the other. More care in answering might have led to a higher percentage of accurate answers here. These two questions were intended to set candidates up for answering **(b)(iii)**. Often they did, but only for incomplete answers about population increase causing more water use. The difference in ratio of 2:3 between population increase and water use was used by only a few. More detailed answers typically included references to economic development with increased demands for water for irrigation and industrial purposes.

The most common candidate approach to answering **(c)** was to describe first the distribution of areas already at risk in 2005 and then to move on to the countries expected to be at risk by 2025. This was also the approach which led to the fullest and most accurate answers, especially when specific references were made to a range of countries and to different continents. The weakest answers came from candidates unable or unwilling to refer to places, who attempted to describe locations only by reference to the Equator and the two Tropics using the latitude lines drawn on the map. Their appreciation of the distribution was shown to be very limited. As a result this question was another one which led to wide variations in the quality of candidate performance and discriminated well in terms of candidates' abilities.

Most candidates correctly identified the sandstone layer as the aquifer and shaded in the whole layer in **(d)(i)**; a few only shaded in that part of the layer below the oasis. Some also shaded in the surface sand layer, which was not correct. Others shaded in one or both of the limestone layers; while this was understandable on the basis that limestone is a permeable rock, their locations made them less suitable as aquifers in this example. From many of the answers given to **(d)(ii)** it was clear that candidates understood what an aquifer was and how it needed to be trapped in a layer of porous or permeable rock between two layers of impermeable rocks, with access to rain for the permeable layer to be filled up. What many candidates were unable to do was to apply their knowledge to this diagram. Few referred to the source of rain shown; more did refer to the clay as the impermeable rock trapping the water, although by no means all. When answering **(iii)**, not all candidates referred back to the aquifer layer which they had shaded on the diagram. A considerable number tried to explain the presence of an oasis in terms of nearness to surface water flows down the mountain, instead of the closeness of the sandstone layer to the surface. The next diagram was better used in the answers given to **(iv)**. **B** was far and away the most common choice. In good answers the advantages of **B** for the reliability of its water supply were contrasted with the limits of **A** and **C**. Some candidates made a good case for **A** on the basis of ease and cost compared with **B**. However, the small number of candidates who chose **C** were always going to struggle, and their answers tended to confirm their limited understanding.

In **(e)(i)** candidates mentioned either evaporation or seepage into the soil, but more rarely both of them. Reference to only one of them was sufficient for full credit to be awarded, provided that there was some development or elaboration. From the amount of crossings out, very few candidates seemed to have made just one attempt at fixing the statements into the flow diagram in **(e)(ii)**. Judging by the number of reverse arrows used, there were plenty of examples of candidates wishing to change their order. Both suggested that candidates would have benefited from more study time before committing pen to paper. Many of the solutions were eventually correct. The most common reversal was for 'high concentrations of salt accumulate around crop roots' to be placed on the second line above 'salts are drawn up to the top of the soil', which was incorrectly relegated to the third space. Many successful labelled diagrams were drawn in **(e)(iii)** for either trickle drip or clay pot methods of irrigation. A good diagram made justification easier and there were many instances of the award of full credit. However, diagrams and answers based on some form of channel irrigation were not worthy of credit because they were not allowed by the question. Between the two extremes were answers based on use of sprinklers; usually some of the content could be rewarded, although not as fully as for trickle drip irrigation. A good choice of irrigation method made it easier to answer **(e)(iv)** well. In answers to **(e)(v)** the most common way suggested was some form of small scale irrigation,

sometimes down to garden level. However, the question was directed at new crop strains (19.1 in the syllabus) and / or dry land farming (30.1). Candidates who used one or both of these gave the most successful answers.

Overall the standard of answers given to **Question 6** was comparable with that for **Question 5**, since the topics examined seemed to be equally familiar to most candidates. Most candidates managed a group of good answers to three or four consecutive questions once or twice during **Question 6**, which raised the standard of their performance. As usual the strongest answers came from candidates able to maintain high standards of answering throughout, with relevant answers related in length and depth to the number of marks available.

ENVIRONMENTAL MANAGEMENT

Paper 5014/12

Paper 1

Key messages

- Only short answers are expected to the four 10 mark questions in **Section A**. Beware of extending answers beyond the lines left for answering. This increased the chances of candidates rushing the last question and not answering in the same detail as they had in previous questions.
- Likewise control the length of answers given to **Question 5** in **Section B**. Candidates can go back and add more once they have finished all of **Question 6** if they have time spare.
- Read the questions carefully, read each question more than once, and underline key question words, such as the command words, words which tell candidates what to do.
- Question instructions most frequently ignored were 'How does the graph ....' in **5(c)(iii)** and 'Describe how the population structure ...' in **5(d)(iii)**.
- Take careful note of the number of marks for the question. For 3, 4 and 5 mark questions it is not just a matter of filling all the lines; it is highly likely that a variety of points need to be made, or details about an example given, instead of just repeating one idea.
- Questions which suffered from limited candidate coverage in relation to number of marks available included **5(b)(iv)**, **5(d)(iv)** and **6(c)(v)**, four mark questions to which many one and two mark answers were given.

General comments

Questions 1 and **2** were much better answered than **Questions 3** and **4** in **Section A**. Despite this, only occasionally, and for relatively few candidates, was there a noticeable difference between the total mark out of 40 for **Section A** and the individual total marks out of 40 for each of **Questions 5** and **6** in **Section B**. Additionally, total marks for **Question 5** and **6** were themselves usually similar; if anything, a slightly higher mark for **Question 6** was more common, the reverse of what has happened in most previous years' papers.

Pressure of time to complete this paper was an issue only for a few candidates; however it was significant for those who spent too long giving exceedingly full answers to the short questions in **Section A**. One or two also did the same for **Question 5**. The unfortunate result was a marked decline in the amount written or number of questions left unanswered in **(c)** to **(e)** of **Question 6**. Any extra credit gained from writing those very full answers, often filling spaces below the lines left for answering, was unlikely to have offset the credit unavailable in **Question 6**. Questions left unattempted were few and far between, which suggested that most candidates were comfortable with the topics covered, apart from the ones mentioned in the second half of **Question 6** caused by candidates' time mis-allocations.

Although there was a definite pattern of performance in **Section A**, in **Section B** there was less of a pattern than previously. This made it more difficult than usual to identify questions which were either persistently well answered by candidates, or consistently answered badly. The nearest to the former was drawing the line graph in **5(c)(ii)**, for which the vast majority of candidates were awarded full credit. The nearest to the latter was **5(b)(iv)**, for which candidates did not seem to know what to say; most resorted to using what was given in the stem at the start of **(b)**; e.g. 'High average amount of use of air, land, fresh water and resources in developed countries and low use in developing countries' was stated without any attempt to give any reasons why. Otherwise, varying standards of performance on each question seemed to reflect the understanding of individual candidates more than inherent question difficulty.

A variety of question resources was used. The better the use made of these, the better the answer. The labels on the sketch in **3(a)** provided useful starting points for answers to **(a)(ii)** and **(b)**. Using the shape and gradient of the line graph in **5(c)(ii)** led to more effective answers in **(c)(iii)** than quoting population totals from the table. The graph had the advantage of showing in a clear way the change in speed of population growth from 1950, by the marked change in steepness of the line, a key point referred to by only a few in answers to **(c)(iii)**. In **5(d)(iii)**, birth and death rates could show continued population growth into the future,

but this question asked for population structure to be used; the information needed for answering was in the next box in the table. Answers to **6(b)(v)** and **(vi)** could only be taken from the diagram of rock formations. Candidates who looked for more than one piece of evidence gave the best answers. Although most commented on the depth of layer C, many fewer referred to its folds in **(v)**, and even fewer referred to the size and thickness of this mineral bearing layer compared with all the others shown, in answers to **(vi)**.

Comments on specific questions

Section A

Question 1

Parts **(i)** – **(iii)** of **(a)** fulfilled their role of gentle starter questions. 'Electricity' alone was insufficient in **(i)** and more than just 'solar cells' was needed for description in **(ii)**. The disadvantages of wind power needed in **(iv)** were well known, and most candidates made points that were sufficiently different for them to be awarded full credit. One objection quite frequently mentioned in answers, needing more space than solar, was not considered valid in the context of this question. Mentioning it, however, did not prevent a candidate from gaining full credit, provided that three other acceptable objections were stated. 'High cost' on its own was not enough in **(b)(i)** until something to qualify it, such as 'installation', was added. A long list of advantages was considered acceptable in **(b)(ii)**. Sometimes explanation was inadequate, but many candidates answered by using a range of points to secure full credit. Most candidates were very comfortable answering the questions and on average performed very well.

Question 2

How malaria spreads was well known to the majority of candidates in **(a)**. Some good answers fell short of a complete explanation. In a few cases, candidates lost their way by believing that malaria was a water-spread disease, passed on to other people through contaminated water. There were so many different points that candidates could validly describe from the graph in **(b)** that reaching a total of three, with the support of relevant values and dates from the graph, proved to be a relatively easy task. Part **(c)** proved to be more testing. Some did not focus upon variations from year to year; instead these candidates looked at variations between places and countries with different climates. Others gave entirely climatic or entirely human prevention answers, which limited the breadth of their responses. Some tried to structure their answers around preventative measures, but without either mentioning specific measures or by referring to some that are not at present possible for malaria, such as vaccination. Those who gave answers of the type expected by the question typically referred to differences between wetter and drier years, and to variations in how seriously precautions are pursued, such as spraying, draining stagnant water bodies and provision of insecticide treated nets. Again, candidates appeared to be comfortable throughout with this question.

Question 3

Mention of fossil fuels in general or coal in particular was necessary for the award of credit in **(a)(i)**. Candidates who began their answers to **(a)(ii)** by stating that carbon dioxide was a greenhouse gas usually went on to give the most complete and accurate answers about why the world is heating up. Similarly, those who began their answers to **(a)(iii)** with references to how higher temperatures increase rates of evaporation and dry out the soil, then found it easier to explain the decline in pastoral farming in areas that were already semi-arid. Once again, those who began their answers to **(b)** by stating what the diagram showed, such as factors for reducing the run-off into rivers flowing to Central China, were the ones most likely to receive full credit. In **(c)**, some candidates showed awareness of the great importance of coal burning in China. However, that was not essential knowledge, since there were many other points that could be made: in relation to the importance of industry to economic growth and development in China, to the high costs of replacing fossil fuels by alternatives that apply everywhere, and to the belief in developing countries that they should not be made to pay for the damage already done by developed countries.

Question 4

Any value between the maximum and minimum distances of 1300 and 850 km was credited in **(a)(i)**. Most answers to **(i)** were correct; in contrast, few answers to **(ii)** were credited. Instead of trying to suggest why much of the wildlife in the Galapagos was unique on the basis of an island location separated by too great a distance from the nearest landmass, most gave answers about their preservation in the National Park. There were many answers of 10,500 in **(b)(i)** rather than the correct answer of 25,500, after having used total population for 2000 instead of 2010 as the starting point for their calculation. Part **(b)(ii)** was the best answered part of this question; most answers included both push and pull factors. Additionally some made use of the introductory information in the question about the growing tourist industry in the Galapagos. It was rare for candidates not to be awarded at least partial credit for answering **(b)(iii)**, typically either for references to different types of pollution, or for the use of more and more land at the expense of vegetation and wildlife. Answers receiving full credit gave a wider range of precise references, which sometimes included other valid points such as poaching or the introduction of exotic plants and animals. These answers had greater breadth.

Section B

Question 5

The three natural resources named most frequently in **(a)** were sunlight, plants and fish (but with some variations in wording). The most commonly named resource that was not credited was water for oceans, unless its use was specified say for transport or for desalination into fresh water. Fish, salt and minerals such as oil and gas were considered to be the best answers for oceans; any others were assessed on their merits.

There were immense variations in the quality of candidates' answers given to **(b)(i) and (ii)**. Answers awarded little credit gave location and distribution examined only in terms of nearness or otherwise to the Equator and tropics, and/or in terms of the North-South dividing line between the developed and developing worlds. For further credit answers included names of continents and countries. In order to gain full credit there needed to be more detailed references to locations within continents, or by a good use of the scale separating out locations for the very high footprints above 6 from those between 2 and 6. In **(b)(iii)** candidates most frequently marked and named their home country plus either the USA or Australia, although the choices made were almost limitless. A few candidates (from quite different ranges of ability) merely labelled 'above average' and 'below average' on the map without adding any country names. Most candidates only received partial credit for **(b)(iv)**, usually for stating some of the differences between a developed and a developing country, but without starting to give any reasons for these differences. Bearing in mind that the values quoted were per person, some candidates did make perceptive points about how countries with very large populations such as India and China inevitably had low footprints per head because of numbers; this was despite recent progress towards higher levels of economic development. Good reasons to explain the differences, which were given by only a small minority of candidates, included higher levels of economic development leading to greater resource consumption per head for industry, transport and domestic purposes, the great size of the home resource base as in the oil rich countries of the Middle East, and the subsistence rural based economies still dominant in many developing countries. Part **(b)(v)** was much better answered, especially when candidates referred to the fossil fuels and their short life expectancies compared with the millions of years needed for their formation. The concept of sustainability was well understood; however, without useful references to such as fossil fuels, minerals or overfishing further credit was often not awarded.

Perhaps as many as one in three of the candidates stated the difference in millions (8820) instead of the number of times greater (10) when answering **(c)(i)**. The line graph in **(ii)** was usually accurately drawn and full credit awarded. Some candidates displayed even higher levels of understanding by showing the expected line between 2000 and 2050 in a different way from the line showing known population up to 2000. This was not essential, but it did allow candidates some leeway should one or more of their values not have been plotted slightly accurately on the graph. A very small number of candidates incorrectly drew bar graphs. In **(c)(iii)** there was often a lack of evidence of graph use; a question requirement. What the candidates' own line graphs clearly showed was the fast and persistent population growth from 1950, in marked contrast to earlier speed of growth. Most candidates relied instead on stating values from the table.

Part **(d**) was generally well answered throughout. 123 million in **(i)** and 21 per 1000 in **(ii)** were easy enough to work out from table data, although a few candidates made mistakes. In order to gain full credit in **(d)(iii)** candidates needed to state that Nigeria was shown to have a dominantly young population under 15, who were coming up to reproductive age and could soon be expected to start their own families. Some

candidates instead referred to birth and death rates; these do suggest that the population will continue to grow for many more years, but the question focus was population structure. Many full answers were given to **(d)(iv)**. In the best answers, candidates looked for a range of factors to explain high birth rates; some increased answer quality further by giving named examples of countries to illustrate the factors referred to. Less able candidates tended to repeat just one or two factors, often expressed in an imprecise way, such as 'lack of education' and 'lack of family planning'. A few candidates tried to approach the answer by using an example of a country with a population policy (usually China) or by stating what was different in developed countries. These answers tended to skirt around the question set and were mostly unsuccessful. The fact that the question mentioned Africa, Asia and Central America meant that answers needed to be focused on developing world countries, preferably without successful population policies.

A lot of the advantages suggested by candidates for the spider diagram in **(e)(i)** were really already covered by labels already given. One common label was 'preserving habitats' (or similar), already covered by 'conservation of the biodiversity of plant and animal species'. The three that were acceptable and most commonly used by candidates were carbon store, oxygen supply and growth of eco-tourism (however expressed, and they did come in many different forms). There were another four suggestions in the mark scheme, which meant that candidates had plenty of potential choices. The most successful answers to **(e)(ii)** came from candidates who homed in on the question theme of biodiversity. Less successful were those who gave broader answers referring to the advantages of conservation of the forests, which merely led to repetition of answers already given in **(e)(i)**. Some answers to **(e)(iii)** were not much more than a list of uses of land after forest clearance. Much better were answers from candidates who created a more structured framework around reasons such as financial gain for big companies, national needs for economic development and great population growth.

Varied was a suitable general summary for the performance of most candidates when answering **Question 5**. However, the distribution of these strong and weak answers varied greatly between individual candidates, often even those from within the same Centre. The two exceptions were consistently better responses to **1(c)(ii)** and worse in **1(b)(iv)**.

Question 6

The two uses which virtually all candidates knew in **(a)(i)** were limestone for cement and concrete and uranium for nuclear power. The least well known was oil (petroleum) for plastics and synthetic fibres. Bauxite was the mineral option wrongly substituted most often for oil. In **(ii)** candidates who chose coal, and those who used oil because they had not already used it in **(a)(i)**, needed to write more than simply 'a source of energy' to be awarded credit. Bauxite was widely used in this part by those who did know that it was the raw material for aluminium.

The term opencast mining was the almost universal answer to **(b)(i)**. A few candidates continued with opencast mining into the next part, **(b)(ii)**. However, deep shaft mining, and the methods employed, were widely known. A good number of the answers given to **(b)(iii)** were more descriptive of methods of mining, than explanatory for why it was easier and cheaper to use four mines on the surface as opposed to only one underground. The choice of **A** in **(iv)** made this question much easier to answer. The specification of environmental problems in the question largely cut out the choice of **B**. Human problems are greater than in **A**, but apart from dangers of land subsidence and pollution of ground water supplies, environmental problems are usually less noticeable in underground mining. Part **(b)(v)** was effectively answered by most, especially those who recognised that the mineral bearing seams were more folded. In **(b)(vi)**, the choice of **C** could be justified by the thickness of the seam, which was likely to be sufficient to offset the higher costs of mining deep; the choice of **D** could be explained by ease of access into the mineral bearing seam from the surface, despite the steep slopes. Both lines of reasoning were regularly used. A significant number of candidates, however, gained no credit because of unrealistic explanations, like only having to dig down lower to layer **C** from layer **B** once mining finished in **B**.

Some said what needed to be done using the key and the map to answer the question in **(c)(i)** without actually doing it. Others gave direct answers in the order of 2 km long and 1.5 km wide for maximum sizes, although some tolerance was allowed for measurements, recognising that much depended on which part of the mine was being measured. Credit was also given to those who tried to relate mine size to city size with estimates of between a quarter and a half gaining further credit. Parts **(c)(ii)** to **(c)(iv)** were straightforward, although reference to the location of the houses alone, without some reference to mining techniques, was not enough for credit in **(c)(iii)**. There was plenty of repetition of what was given in the question in answers to **(c)(v)**. Candidates needed to extend their answers by referring to dust from mining causing air pollution, to the dangers of toxic substances entering water courses, and to the proximity of everyone in Cerro de Pasco to the mine. Credit was also given for syllabus knowledge about health problems caused by lead,

such as brain damage in young people, and by dust, such as bronchitis and asthma. In other words, the more candidates moved away from the information in the question and supplemented it with their own knowledge, the better their answers, and the more credit they gained.

Candidates who showed selective use of the information given with a small amount of extra comment added to it usually were awarded partial credit. The award of full credit was reserved for wider ranging answers, in which candidates recognised that Plan 1 was a more sustainable longer-term solution, although this made the chances of it being implemented lower. This was because sustainable solutions cost money; people and companies tend to be more interested in short-term profits.

Candidates needed to state the actual difference of US$5000 in **(e)(i)**, and nearly all of them did. The main issue which held back many of the answers to **(e)(ii)** was scale. The clear focus of the question was 'local people living in Zambia's copper belt'. The focus for more than half the answers appeared to be loss of income in Zambia as a whole, or how the national economy was being affected. This approach was sometimes made more relevant when candidates related it to the lack of money for implementation of government services badly affecting local people. However, those answers which began with loss of jobs in the copper mines, followed by mention of the economic and social effects on their families, and the worsening of the poverty trap, were awarded more credit more quickly. Only a tiny few took note of the comment from the market stall holder in Chingola by referring to the knock-on effects of lower mine worker earnings on local service providers who depended on their spending. Candidates who showed an appreciation of the general pattern of world trade, between developing countries as exporters of primary products and developed countries as importers for processing and manufacturing, were the ones most likely to gain full credit in **(e)(iii)**. Globalisation is not in the syllabus, but over the last few years the term is being used more and more in the world's media. Candidates who understood were in essence referring to the effects of globalisation without, of course, stating explicitly that they were, as they did not need to do.

Overall the standard of answers given to **Question 6** were at least as good as those given to **Question 5**. Candidates kept working well to the end of the question, with any signs of tailing off restricted to a tiny minority. Candidates showed good familiarity with the topic areas examined, and there were few questions that they felt they could not try to answer.

ENVIRONMENTAL MANAGEMENT

Paper 5014/21

Paper 21

Key messages

1. Adequate preparation for the examination is essential. This includes learning the facts, possessing the necessary skills of analysis and interpretation, and practising on questions from past papers.
2. Ensure you understand the various question instructions, and answer only what is asked. Irrelevant answers, even though correct in themselves, will not gain credit and will waste your valuable time.
3. Use the published mark schemes to identify the type of answer, both in content and length, required by different questions. Use the allocated number of marks to assist you in constructing your answer.
4. Apportion your time sensibly between questions.
5. Most data gathered in the field does not show a perfect pattern so some thought needs to be given before writing answers about the findings of an investigation.

General comments

This paper invited candidates to consider environmental issues and methods of gathering and interpreting data in the context of one country, Morocco. Many candidates understood and made good use of the source material and their written responses were sufficiently clearly expressed that the Examiners could be confident that credit awarded was deserved. The mathematical and graphical questions did pose some difficulties for a minority of candidates.

Candidates had no problems completing the paper in the time available.

Comments on specific questions

Question 1

(a)

(i) Most candidates gave good detailed descriptions of how overgrazing can lead to desertification, often gaining full credit.

(ii) Many candidates realised that by having farms next to each other they would provide similar conditions for the trial. Only a minority went on to give a specific example of a condition expected to be similar and subsequently gained further credit.

(iii) The majority of candidates suggested that using the same number of sheep allowed a fair comparison of the output.

(iv) A range of other factors that needed to be kept the same were suggested. A common suggestion that was not given credit involved all the animals being given the same amount of food. This was unrealistic in the context of this trial.

(v) This question was very well answered by nearly all candidates; the advantages of each breed of sheep were clearly identified.

(b)

(i) The calculation was correctly completed by the majority of candidates.

(ii) The majority of candidates found this question quite demanding. All the ideas on the mark scheme were seen on scripts but a surprisingly large number of candidates did not seem to appreciate the advantage of having an additional food supply.

(iii) Just over half the candidates identified that being self-seeding meant that little work was required to establish a new pasture. Very few candidates suggested that ploughing would not be necessary.

(c)

(i) Nearly all the candidates completed the table correctly.

(ii) Most candidates correctly selected the driest and wettest months from the data presented.

(iii) This question was answered in a wide variety of ways most of which equated to the idea that Medicago did not grow well in drought years or it grew about the same as the weedy pasture in drought years.

(iv) There were some elaborate suggestions as to how to improve the trial. All that was required was to repeat the trial or words to that effect.

(d) This question proved to be rather difficult for many candidates as they seemed not to have given enough thought to the information given. As a consequence they often resorted to copying out some of the source information without any of their own ideas. Repeating given information could not gain credit here. Part **(i)** only required a suggestion about overgrazing or lack of food for the animals, but many candidates did not seem to appreciate the risk of overstocking in this context. In **(ii)** only a minority of candidates appreciated that the sheep would do better in drought years and indeed this would also be true in non-drought years. In **(iii)** all the ideas stated in the mark scheme were seen, and a small majority gained full credit here.

(e)

(i) Most candidates gave an account of how they would organise their crops but there was less detailed knowledge within many answers than was expected. All the points on the mark scheme were seen but very few candidates gained maximum credit. Questions of this type have been asked in previous years which elicited very good responses.

(ii) This question was more demanding than expected. There were very few references to organic matter improving soil fertility though references to minerals not being washed out of the soil were seen regularly. The prevention of soil erosion was better understood.

Question 2

(a) Phosphate was correctly given by nearly all candidates. In **(ii)** most candidates correctly calculated the answer as 99 million.

(b)

(i) Candidates were asked to inspect a source of data and then assess the harm that could be done by different minerals. There were many thoughtful answers that made good use of the information so most gained credit.

(ii) Surprisingly, many answers had the arrow not pointing in the direction that food flows along a food chain. However this did not seem to have any direct influence on the answers given in the next section.

(iii) Candidates generally seemed to appreciate the concept of bioaccumulation yet they often stated that algae had the highest concentration and large fish the lowest. Only a small number of candidates described the processes clearly to gain maximum credit.

(c)

(i) Nearly all answers were correct, stating five times more.

(ii) Many candidates correctly calculated 500 cubic metres.

(iii) Candidates were asked to look at source information and then suggest an advantage to the country of processing phosphate rock. The most obvious answer from the information was an increase in agricultural output. This answer was often given along with all the other ideas stated in the mark scheme. However a significant minority gave vague answers which the Examiners could not equate to a clear advantage.

(iv) The graphs were well plotted and fully labelled by nearly all the candidates.

(v) The trends shown by the graph were very well described by nearly all the candidates.

(vi) The optimum fertiliser application was clearly identified and justified by nearly all candidates.

Question 3

(a) Whilst most candidates managed to state one advantage of positioning a cement factory near a coal fired power station only a small number of candidates managed to make a second point. There were hardly any references to the fact that this arrangement could last a long time (30 years) as stated in the source.

(b) Most candidates readily appreciated that coal burning released carbon dioxide and sulfur dioxide leading to the greenhouse effect and acid rain. Unfortunately some candidates suggested that the gases lead to ozone depletion which is incorrect.

(c) The advantages of solar power were readily stated by most candidates.

(d) This final question asked candidates to suggest an energy plan for the future. Whilst a small number of candidates made good suggestions that related to all the information given about Morocco there were a significant number of candidates who gave answers completely unrelated to the context given. Some candidates suggested that hydroelectric power could be developed along the coast and many just wanted to import more coal and oil which was not the point of the plan for the future. Some of the marking points were rarely seen. This type of question could be expected to appear in this paper as sustainable development is at the heart of the syllabus

ENVIRONMENTAL MANAGEMENT

Paper 5014/22

Paper 22

Key messages

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3. Use the published mark schemes to identify the type of answer, both in content and length, required by different questions. Use the allocated number of marks to assist you in constructing your answer.
4. Apportion your time sensibly between questions.
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General comments

This paper invited candidates to consider environmental issues and methods of gathering and interpreting data in the context of one country, Cuba. Many candidates understood and made good use of the source material and their written responses were sufficiently clearly expressed that the Examiners could be confident that credit awarded was deserved. The mathematical and graphical questions posed some difficulties for a minority of candidates.

Candidates had no problems completing the paper in the time available.

Comments on specific questions

Question 1

(a)

(i) Most candidates correctly identified lack of demand or the world recession as the likely cause of lower nickel prices.

(ii) Many candidates made a suitable suggestion such as reducing costs of production or reducing supply to encourage the price to rise again.

(b)

(i) The calculation was correctly completed by most candidates. However there were a significant minority who gave the answer as 15 % which was not correct. An answer in kg was also not given credit.

(ii) The majority of candidates gained credit here for selecting an appropriate problem associated with opencast mining. Only a very small number of candidates just suggested the process left a scar on the landscape; this statement needed further detail to make sure the candidate really was answering correctly.

(c) Nearly all candidates suggested one method of protection used by miners and most also gave a second method.

(d)

(i) Nearly all candidates stated that there would be very few female miners. Some of the reasons given were not related to carrying out a scientific study.

(ii) This question required some thought as to why the study was carried out over ten years. A significant minority correctly suggested that many diseases take time to develop, and therefore could be recorded by the study.

(iii) This question proved to be the most demanding on the paper. Some candidates correctly suggested that long term exposure to nickel might cause other diseases. Very few suggested that this might show other differences between miners and non-miners. As the examination is an alternative to coursework this question did not require candidates to have any knowledge of the health risks, but rather an appreciation of what long term surveys might find out.

(iv) Most candidates gave two sensible ways in which the study could have been improved; all the alternatives given on the mark scheme were seen on scripts.

(e)

(i) Most candidates correctly identified the most polluted stream and gave a valid reason for their choice.

(ii) This question required some knowledge of the mechanisms of heavy metal poisoning along food chains. Although a minority of candidates have a clear understanding of the process there are still a significant number trying to answer the question by repeating the source information without adding any further information. A small number of candidates thought this question required knowledge of eutrophication so they could not gain credit.

(iii) Nearly all the candidates correctly chose to plot a bar graph but the vertical axis was often labelled 'number of invertebrates' rather than 'number of mayflies'.

(iv) Candidates were asked to describe what the graph shows. Only a small number of candidates suggested that further from the mine there are more mayflies or referred to mayflies being poisoned by nickel. If the graph had shown a completely obvious upward trend then more candidates would have stated this. However most data gathered in the field does not show a perfect pattern so some thought needs to be given before writing answers about the findings of an investigation.

(f) Most candidates realised the advantages of recycling scrap metal instead of mining fresh supplies. However, they did not always express the ideas stated in the mark scheme clearly enough to gain credit.

(g)

(i) This question was intended to be a demanding one and this proved to be the case. Many candidates described the data given but did not go on to give any summary statements such as the pollution levels were highest at the beginning but there was still some pollution after ten years.

(ii) This question asked for an advantage and disadvantage of using mung beans as a means of measuring nickel pollution. Most candidates suggested it might be fast or cheap or that no special equipment would be needed. However the disadvantage required a little more thought and proved to be a more demanding question. The Examiners hoped to see answers along the lines that this method could not measure an actual concentration of a pollutant or that the mung beans may not be responding only to the presence of nickel.

(iii) Very few candidates suggested that the farmer would have to wait more than ten years before planting. In **(i)** the data showed that some pollution was still present so the common suggestion of ten years was not an answer worthy of credit.

(h)

(i) Many candidates went some way towards describing an appropriate procedure to find out if the Euphorbia plants did reduce nickel pollution in the soil. The answers however often lacked sufficient clarity to gain full credit.

(ii) This question asked candidates to comment on the dangers of introducing a new plant species to the environment. Again there were answers that were close to the ideas required but in some cases there was a lack of clarity so the Examiners could not award credit.

(iii) The candidates were evenly split between being in favour of or against continuing mining nickel. Most managed to give two creditworthy reasons in support of their position.

Question 2

(a) Candidates were asked to inspect a source of climate data and extract the appropriate information. For **(i)** most candidates correctly selected October and February; a minority gave more than one answer for the driest and wettest month. For **(ii)** most candidates either gave the correct range of months or stated all the months within the range. The answer to **(iii)** was calculated correctly at 112 days by most candidates.

(b)

(i) Candidates were asked to inspect a source of data and then explain three pieces of evidence that showed the effect of weevils on water hyacinth plants. Most candidates only described the evidence without giving any qualifying statements such as fewer leaves would mean less photosynthesis or growth.

(ii) Most candidates correctly selected fewer flowers as the evidence for reduced reproduction.

(iii) Candidates seemed to appreciate that weevils might have an effect on the ecosystem but their ideas were rarely expressed with clarity. Often a statement such as 'they pollute the water' was given without any further comment. This could not gain credit.

(c)

(i) The candidates readily appreciated the characteristics required for Siboney cattle to thrive in this environment and most were awarded maximum credit.

(ii) Many candidates drew and gave appropriate headings for their table of milk yields for one week gaining full credit. Some tables did not have spaces to record seven days of milk yield and some did not have a separate section for each type of diet.

(d)

(i) All possible disadvantages were suggested by candidates with the lack of milk and the high cost of buying animals most frequently suggested. A number of candidates just copied the information given without adding any of their own thus not gaining credit.

(ii)(iii) Nearly all candidates commented on the advantages of the plans and all the points on the mark scheme were seen regularly. Some candidates just copied the information given which could not be given credit.

(e) This question required candidates to use the source information to show how they might organise the farm layout shown in the diagram. There were surprisingly few references to rotation of crops or animals and it was evident at times that candidates had not appreciated that water hyacinth could not be planted in a field; it had to be harvested from the water channel. Very few referred to nitrogen fixation (by beans) or using crop wastes as a food for animals. As a consequence very few candidates gained maximum credit.