

# ENVIRONMENTAL MANAGEMENT

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Paper 5014/01

Paper 1

## General comments

There was a great range in quality of performance, from candidates who maintained the flow of perfect or near perfect answers to all parts of all questions, to those who struggled over the majority of questions, and managed only the occasional convincing answer. For most, the total mark out of 40 for **Section A** was on a par with the individual marks for **Questions 5** and **6** in **Section B**. For better or for worse, the standard established early in the examination tended to be maintained throughout. Time issues with this paper are now much reduced from what they were in its first two sessions. Examples of candidates genuinely struggling to complete the examination in the time allowed were rare.

In **Section A**, **Questions 1, 3** and **4** performed in similar ways; in each, one part proved to be significantly more awkward for the majority of candidates, but the other parts were more regularly answered comfortably and well. **Question 2** was the exception; it caught out candidates with inadequate knowledge of the location of oil deposits and their transport. In **Section B**, the general standard of answers to **Question 5** in many Centres was slightly better than that to **Question 6**. One of the main reasons for this was that the final two parts of **Question 6(f)** were the least well answered questions on the whole paper. Despite being named in the syllabus, only a minority of candidates seemed to know what was meant by community forestry, agro-forestry or sustainable harvesting of hardwoods.

Some areas for improvement in examination technique remain. There has never been any need to repeat the question; candidates should be advised always to begin to answer the question in the first sentence. When most candidates equate filling all the lines with a full answer to the question, this advice has added importance. The lines left in the booklet are for guidance only and cannot take full account of variations in size of writing and precision of expression between candidates. It is only to be expected that there will be occasions when candidates feel the need to write more. They can continue their answers in spaces below the lines (where they exist), or in empty spaces at the bottom of the page or at the end of the booklet. More attention could have been paid to the number of marks available for the answers. When describing from a source provided, such as from the photographs in **Questions 4(a)(i)** and **6(a)(i)**, the number of marks suggested the number of features that needed to be observed and described. These questions were both worth three marks; common answers to **6(a)(i)**, along the lines of 'a lot of vegetation with many trees and grasses', were never going to offer description that was sufficiently full to claim all three marks. In fact, candidates should be advised to describe more fully than they believe is necessary for the number of marks, to allow for the occasions when the points they make do not match up with those in the mark scheme.

Answers to questions worth four or more marks needed to contain some breadth or depth in order to be full and effective. Answers to **Questions 1(a)(iii)**, **2(b)** and **5(a)(iv)** suffered from an over-concentration on one element only, or at best two. In **5(a)(iv)**, many candidates, after having explained validly enough how trees slow down water movement towards the river, then filled up the lines using reverse information for areas without tree cover. Instead they should have looked for other explanatory factors relevant to the area shown in the diagram, such as variations in agricultural land uses, particularly the fields without crops and ploughed up and down the slope. The four mark **Question 5(e)(ii)** offered an opportunity to provide depth through reference to an example, such as the Nile Valley in Egypt supporting the benefits of living with floods, or Bangladesh or a home country example to illustrate just how devastating effects of a big flood can be.

## Comments on individual questions

### Section A

#### Question 1

In **part (a)(i)** quite a number of candidates skirted around the problem, unable to show that they clearly recognised that water resources were concentrated in South China while there was twice as much cultivable land in North China. Better progress was made with answers to **part (a)(ii)** for the south to north transfers using canals. Two mark answers dominated in **(a)(iii)**, because many candidates did not try to go beyond great cost and direct effects on the environment. Great cost was rarely related to the need for so many tunnels under the higher land between river valleys. Those candidates who continued the search for more problems, in order to provide either the depth or breadth needed for a four mark question, were most likely to refer to the difficulties of working in remote and inhospitable regions such as the Tibetan Plateau. Again in **part (b)** two mark answers were more common than those worth three marks; typically the range of points or their elaboration were insufficient for the needs of a three mark question.

#### Question 2

Candidates with good topic knowledge and understanding sailed through all parts of this question. Some of the others stumbled in the first part and never recovered. When none of the three items in the key were identified correctly in **part (a)(i)**, it was an ominous sign for answers to the remaining parts. Folded rocks was too vague an answer for upfold or anticline in **(a)(ii)**. Many answers to **part (a)(ii)** were about obtaining the oil, not its discovery. When drilling was mentioned in these answers, often it was not in the correct context of trial drilling, the only certain way to prove the existence of oil underground. It was in their answers to **part (b)** that weak candidates were most likely to claim one or two marks, usually for referring to melting of the frozen ground and interference with ecosystems. Only more knowledgeable candidates seemed able to assemble either the range or depth of relevant explanation required for a four mark answer.

#### Question 3

In **part (a)**, as in other three mark questions on this paper, one and two mark responses were more common than three mark answers. This reflected either general description without any reference to yields or fertiliser amounts, or partial description frequently without any reference to the levelling off or slight decline in crop yields after about 100 kg of fertiliser per hectare. **Part (b)** was the best answered part, with a much higher chance than in other four mark answers of adequate content for all the marks. Precise explanation for what happens when excess nitrates reach water courses was regularly given. **Part (c)** discriminated ruthlessly well between able and weak candidates. The former referred to organic fertilisers such as manure and compost, farming techniques such as mixed farming and crop rotation, and the use of nitrogen fixing crops such as legumes. In contrast, sometimes after mentioning manure or compost, many weaker candidates drifted away from the question theme of 'alternatives to chemical fertilisers'. High yielding varieties of seeds were used in many answers, but without candidates considering what was needed for their high yields to be maintained.

#### Question 4

Failed answers in **part (a)(i)** fell into one or two categories, either no direct description from the photograph, or seeing an ecosystem which was not there to see on the photograph, such as tundra. On the other hand, those candidates, who looked and concentrated on describing the characteristics of the trees and forest that could actually be seen, often described more features than were needed for all three marks. **Part (a)(ii)** was the least well answered part of this question, with many answers suffering from a continuation of the description from the previous part, without any attempt to explain adaptations to the taiga climate. For some candidates confusion with tundra also continued. Candidates with knowledge and understanding soon claimed all the marks, most commonly with references to conical shape for the snow to slide off and/or for flexibility in strong winds, evergreen nature to take advantage of the short growing season, and needle leaves to reduce water loss. Virtually every candidate gave the correct answer of solar in **(b)(i)**. Most found it easy to claim two marks in **(b)(ii)**, one for the general disadvantage of days without sunlight and one for the general advantage of clean or non-polluting. However, the third mark proved to be more elusive for all but a few, mainly the ones who considered the National Park or northerly location.

## Section B

### Question 5

The best answers to **part 5(a)(i)** were infiltration and runoff. Most candidates knew these two water cycle processes. Those candidates who also knew percolation and groundwater flow tended to answer **part (a)(ii)** the best; although these names were not essential for claiming the marks, they were a sign of greater candidate understanding than answers from those who merely tried to explain based upon what the diagram showed. In **part (a)(iii)** some placed the letter I too far away from the trees, often within the precipitation above the forested part. **Part (iv)** was less well answered. One common failing was to answer in general terms about variations in surface run-off, instead of giving answers based on what this diagram showed. The result was that the influences of factors such as relief, rock type and land use were explained in complete isolation from the diagram. Another failing was to concentrate on just one factor, most often tree interception, and fill most of the lines first by referring to areas with trees and then reversing the comments for areas without trees, without adding anything new to the explanation. The superior quality of some answers stood out, when forest was compared with farm land, and grass and crop growing areas were compared with fields ploughed up and down the slope. Credit was given for clear references to different areas on the diagram, where they were used to illustrate differences in speed for precipitation reaching the river.

It was not difficult for candidates to find three sufficiently different reasons why people live next to rivers in **part (b)**. A few candidates, however, left the Examiner to do too much of the work by stating 'source of water' or similar without identifying any specific uses.

Most answers to **(c)(i)** accurately included immediate effects, although in a few the immediate was ignored as subsequent effects on people's health and water supplies dominated. In **(c)(ii)**, one mark answers for the river transporting toxic materials further downstream were more common than two mark answers, in which candidates added explanation to the relevant stated information. In stronger answers candidates either commented on the size of the slick or on the failure of officials to act more quickly to stop or disperse it. Answers which failed to score any marks referred to transfers of the smoke cloud by winds, instead of focusing on the toxic leak into the river. Some candidates carried the focus on air pollution and wind transfers into **part (c)(iii)** with similarly poor results. Whilst there were few problems with candidate understanding of the term 'international', some again failed to apply their answers to this example; many failed to mention Russia in their answers. Without the naming of Russia, answers tended to be general and unconvincing. In only a few answers were other issues referred to, such as the slowness of the Chinese authorities to pass on information about the leak. One and two mark answers were more common than those worth three marks. The quality of answers to **part (c)(iv)** directly reflected how well individual candidates had read and studied the information in the boxes. Those who supported their negative answers with a broad range of points gave the better answers worth three marks or more. However, the majority were content to make only a couple of points, typically referring to chemicals in river bed sediments and in fish (with consequences for the food chain), and worth two marks. Those who had made little study the information were the ones most likely to try to defend positive answers about the accuracy and reliability of both statements, with few opportunities to progress beyond one mark at best.

The temperature graph in **part (d)(i)** was accurately and neatly completed by the overwhelming majority of candidates. The biggest disasters were from those who insisted on drawing a bar graph; they spent a lot of time for little reward. 'Drawing a line graph' was the instruction in the question; even without this, candidates could have been expected to know that temperature values (being continuous data) are always shown by a line in climate graphs. June to September or October, or summer, were the acceptable answers in **part (d)(ii)**; a minority of candidates gave too restricted a range of months, for some as little as one month. **Part (d)(iii)** was well understood in terms of water accumulation during the wet season after months of dry weather. Supporting answers with values from the graph was the best way to ensure full marks. Some, however, used values only to support the statement given in the question without any attempt to answer it. Worse still were answers focused on explaining why the floods were greater in June and July! April and May were considered to be equally good choices in **part (iv)**; once chosen, as they were by most candidates, explanation proved to be straightforward. The most obvious answer to **part (v)** was irrigation; drought resistant varieties of seeds was another possibility. The main weakness of answers to this part was not choice of method, but description that was adequate for all three marks, which was often lacking.

The best answers to **part (e)(i)** stated two benefits that were clearly different such as fertile silt deposits and topping up water stores (both surface and underground) for use during dry months of the year. Another common answer was a crop like padi that is grown in standing water. Vaguer answers about crops being watered were limited to one mark at best. In **part (ii)**, most candidates chose bad effects. Many answers

contained the breadth necessary for three or four marks to be awarded to them. Although good effects was the minority choice, some well explained answers were seen, which went well beyond the two benefits already stated in answers to the previous part. Particularly strong were answers based on examples such as the Ganges, Indus and Nile. However, merely repeating statements from the previous answer gained no new credit until it was extended to include explanation. Although most candidates focused more on explaining only one viewpoint, there were many sensibly balanced answers in which the need for good flood control was stressed in order to obtain maximum benefits.

**Question 5** examined familiar, previously visited, topic areas, for which the great majority of candidates were well prepared. As always, the key to a high total mark was consistency of answering between the different parts, which included answering well those parts worth four marks. Some candidates let too many marks slip away by giving answers to **(a)(iv)**, **(c)(iv)** and **(e)(ii)** which were too brief or too narrow in their coverage.

### Question 6

Successful answers to **part (a)** had to be based on what could be observed from the photograph. Of course, knowledge of savanna vegetation was helpful, but only provided that it did not take over and dominate the answer. There were, for example, references to variations in vegetation cover between wet and dry seasons and information about baobab trees that could not receive any credit. However, the trees in leaf indicating that it was the wet season was credited. Candidates who concentrated on describing what could be seen, such as the mixed cover of grasses, bushes and trees dotted around, soon reached full marks with only a small amount of further supporting detail.

In **part (b)(i)**, one way of claiming the first mark was by simply naming the process 'photosynthesis'. Up to three more marks were available for more detailed explanation about how it works. Three of the possible four marks for this part were regularly claimed by candidates. Likewise candidates could gain up to four marks for their answers to **(b)(ii)**. These were claimed much less frequently since the sources for continued supplies of nutrients, such as from rock weathering, nutrient recycling or new surface deposits like river silt, did not make up the main part of most answers. Instead the majority of candidates spent too much time describing the role of plant roots in absorbing nutrients. Full and effective answers to both parts allowed good candidates with real knowledge and understanding to be identified.

One mark answers to **part (c)(i)** were as common as two mark answers, because of candidate failure to mention energy flows from the producer to the consumer shown. Yet virtually every candidate understood how the diagram showed part of a food chain. **Part (c)(ii)** was well answered, with most not only mentioning a possible consumer of the giraffe, but also taking the food chain to the tertiary consumer level with references to humans or to the decomposers at the end of the food chain. This was probably the best answered part of the second question.

The underlying message in the diagram used in **part (d)** was that the Earth's land area and basic natural resources such as rock, solar energy and water had remained the same, while the human population had massively increased, resulting in a decrease in natural flora and fauna and its replacement by a large area of agricultural land. The increase shown in the amount of carbon dioxide was a reflection of forest clearances and use of resources not shown, notably fossil fuels. The questions in **parts (i)** and **(ii)** fed into **part (iii)**, and gave candidates the opportunity to demonstrate how well they understood the main message. Accurate answers to **part (d)(i)** were solar energy, water, the Earth's land area and rock. The worth of quite a few answers was reduced by the inclusion of carbon dioxide. The best answers to **part (d)(ii)** included reference to the decrease in size and extent of the Earth's natural ecosystems of plants and animals, however expressed. The main answer spoiler here was 'Earth's land area', when stated without any qualification about some of it having been taken into agricultural use. A few candidates attempted to give increases instead of decreases. The effectiveness of many answers to **part (d)(iii)** was reduced by list-like statements such as 'great increase in number of people' and 'increase in agricultural land' without any comment or information use that would have demonstrated understanding. Answers to these three parts led to wide mark variations between candidates, with all marks from zero to four in regular use.

Although there was considerable variation in answer quality in **parts (e)(i)** to **(e)(iii)**, the mark distribution between candidates was more regular. The shortest and clearest answers to **(e)(i)** were those in which the candidates used the most appropriate terms 'hunting' and 'collecting' (or 'gathering'). Without the use of these terms, it was sometimes difficult to work out exactly what the candidate meant; these made up many of the one mark answers. Some answers obviously strayed into cultivation and pastoral farming, which made it more difficult (but not impossible) for them to gain marks in **(e)(ii)**. The most clearly acceptable answers in this part were minimal environmental impact or sustainability (however expressed) for advantage and the variability of food supplies or limited opportunities for advance (however expressed) for disadvantage.

Examiners marked the many other answers suggestions on their merits. Despite a few answers of 75%, most answers to **(e)(iii)** were correct, either 25% or one quarter (the preferred way for candidates in some countries to express the answer). In the final **part, (e)(iv)**, the full range of marks was in regular use. As in the earlier six mark question in **part (b)**, candidates were allowed a four to two ratio of marks between the two parts, which enabled particularly strong answers to one part to be more adequately rewarded. Much less candidate confusion between fertilisers and pesticides was observed than in previous examinations. Some of the fullest answers were for the choice of 'new varieties of seeds and animals', especially if references were made to both high yielding and genetically modified varieties. Conversely, many of the weakest answers were for 'modern technology' with unsubstantiated references to faster and more efficient food output quite widespread. The disasters came from candidates who did not use any of the three reasons shown in the bullet points on the diagram.

In **parts (f)(i)** and **(iii)** not all candidates interpreted the graphs correctly to arrive at the answers 'other temperate forests' and 'tropical rain forest', although the majority did. For many these were the only two marks in **part (f)**. Too many candidates ignored the all-important 'between ecosystems' part of the question when answering **part (ii)**. Instead they gave reasons for increasing percentage losses of forests in general. Even among candidates attempting to answer the question set, there was a dearth of precise information about any of the ecosystems in relation to opportunities for people and agriculture, either favourable or unfavourable. Without real knowledge of any of the three techniques named in **part (iv)**, the best that most candidates could hope for was one mark for replanting trees. Some tried to work out or guess what community forestry and agro-forestry meant, but rarely did they get any further than planting trees. The choice of easy as the basis for answering **part (v)** often followed on from non-scoring answers to **part (iv)**. In contrast, answers based on knowledge in **(iv)**, often about selective logging of hardwood trees, were typically followed by strong answers about the difficulties of controlling logging companies and individuals tempted by high profits and good incomes. Their answers stood out as beacons of light among the dark mass of weak answers.

Most candidates finished **Question 6** with a lower mark than the one obtained from answering **Question 5** as a result of the poor finish in **part (f)**. As usual, this type of summary applied less to able, high scoring candidates, whose performances between the two questions were more balanced. Also candidates from a few Centres bucked the general trend, especially when either community forestry and selective logging were well known by their candidates.

# ENVIRONMENTAL MANAGEMENT

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Paper 5014/02

Paper 2

## General comments

This paper invited candidates to consider environmental issues and methods of gathering and interpreting data in the context of the densely populated city of Mumbai, India. 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 marks awarded were deserved. The mathematical and graphical questions did pose some difficulties but for a minority of candidates.

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

Overall the pattern of this paper is very similar to past papers and Centres should work through past papers to help candidates see how to make the best use of the information given for each question.

## Comments on specific questions

### Question 1

**This question related to the ship breaking activity in Mumbai and asked about working conditions and the consequences for the local environment with reference to pollution and in particular the nearby Mangrove habitat.**

- (a) (i) Nearly all candidates could calculate the weekly earnings of both men and women given the daily amount.
- (ii) Most candidates could suggest why Mumbai was a chosen destination for ships to be sent to be broken up; although many mistakenly thought that the question was about why ships needed breaking up in the first place.
- (iii) Most candidates scored one mark here by making reference to the recycling aspects of the materials from the ships, but rarely did they go on to qualify why this was a good idea such as that it would reduce the need to mine for new resources or that it would reduce the depletion of limited resources.
- (iv) The majority of candidates again were only scoring one mark here and it shows the need for candidates to take notice of the number of marks available for each question. The mark gained was for the poor safety aspect of the work and a second mark was available for an example of the sort of accident that could have happened or maybe reference to the long working hours of the ship breakers. Some candidates misread the question imagining that the workers somehow travelled to work by boat and so lost marks by talking about safety at sea.
- (b) (i) and (ii) Nearly all candidates correctly identified site 2 as the most polluted and 1 as the least.
- (iii) The information that was needed to identify PAH measurement as possibly inaccurate was the data for site 3 compared to site 2 in which the trend appears reversed for PAH compared to the other materials. Many candidates got tied up with **how** the numbers were reported which is not **using** the information itself and so was not answering the question. Another common mistake was to talk about its relationship to its danger level.
- (iv) Most candidates chose the correct answers here but many wrongly picked the highest and lowest figures rather than those, which were furthest **away** from danger levels, above and below, which were Organotin and Heavy metals respectively.

- (v) Most candidates were able to give two effects but many lost marks by being too vague.
- (c) (i) A simple bar chart was asked for here and most candidates gained 3 of the 4 marks, the mark most often lost was for not labelling the axes.
- (ii) Candidates had to see that the highest bar on the chart was at site C where the ship breaking was taking place. Surprisingly a significant number of candidates missed this.
- (iii) The evidence that was needed here was a recognition of the proportion of the substance at the other sites **compared to** site C where the substances were being released. Very few candidates were capable of seeing this relationship and simply quoted the substance with the highest figures.
- (d) (i) Since most of the substances are below toxic levels in the mangroves the answer here had to involve bioamplification along food chains. Only Organotin could be discussed as killing by itself. Very few candidates referred to this process, although some scored one mark for references to food chains.
- (ii) This question wanted a reason why the Port Authorities should continue to let ship-breaking go ahead given its problems already mentioned. Many candidates could quote economic advantages.
- (iii) This was poorly answered due again to vagueness in candidates answers; good answers were those who gave specific actions that could be taken to limit the impact of the toxic substances on the environment.

## Question 2

**This question shifted emphasis to peoples' living conditions in the slums of Mumbai and why it is difficult to bring about change.**

- (a) (i) Here again candidates are failing to notice that two marks are available and most only scored one usually for the point that the slums offer job opportunities. Cheap housing was the most common second mark. Many candidates could not get away from "fishing" issues; the question only said it **used** to be a **small** fishing village; it is now a commercial area and has many small industries.
- (ii) Most candidates saw that these many small industries would keep employment high. However some misread the question as high *unemployment*.
- (iii) Most candidates could quote two diseases along with their transmission route. Any reasonable disease related to water was accepted. The most common mistake was related to diseases carried by organisms, such as bilharzia being carried by snails, where the vector was omitted or was wrongly identified.
- (iv) Most candidates saw that these open drains would flood in the monsoon months. Answers talking about increase in mosquitoes etc. did not gain credit nor those talking about the effect of the cold and wet directly on people.
- (b) (i) Most candidates could quote that the permanent nature of the slum would make it difficult for the authorities and that the redevelopment would be expensive.
- (ii) Many candidates suggested that the people might lose out if the authorities tried to "help" them by an increase in the cost of basic needs, such as housing. Some candidates correctly made reference to the distrust of authorities.
- (iii) Most candidates could see here that the reason that people might not be able to move out of the slum would be tied up with a lack of money, due to their work being low paid. Many also talked about family ties, which was an acceptable argument.

### Question 3

This question shifted emphasis to the issue of recycling and to using experiments to explore the city's management of waste materials.

- (a) (i) (ii) and (iii) This question was a straightforward judgement on the best experimental methods. From plan 1 which only sampled one site for one hour and did not weigh the material to plan 2 which increased the number of sites to four, the time to three hours and recording the weight. Finally plan 3 was improved by weighing the plastic as well as the cardboard. Most candidates were able to identify these improvements, although some vague answers lost marks, the most common was to state that the improvement was to simply use more candidates which would not necessarily make any improvement.
- (b) Most, but not all, candidates were capable of this calculation, however some lost a mark by not giving the **total**, calculating the amount for plastic and for cardboard and then not adding the two figures together.
- (c) (i) Many candidates could argue that burning and burying of waste was a bad idea but vague references to "pollution" were not credited without some description of the particular pollution caused by burning or burying. Many candidates could also talk about the lack of space for burying the increased amount of waste predicted.
- (ii) Many candidates knew the biological process of decomposition, but by no means all.
- (iii) Most candidates could see the disadvantages of bad smells and problems with animals related to the brick tanks but few could see any advantage, such as less transport costs of taking waste to landfill and less landfill with all its consequent problems. Many got confused with the park composting pits.
- (d) (i) The judgement of where to put the four thermometers was marked very liberally but certain places were discounted such as **in** buildings or on the road. Given this many candidates scored two marks although many only got one.
- (ii) Few candidates knew how to check for accuracy and most answers were related to reliability issues and talked about repeating measurements or they discussed validity with references of where to take measurements. Answers to do with *fair testing* and keeping factors constant were accepted and any description of careful use of the thermometers.
- (iii) Many good tables were drawn although some candidates could not combine the **four** thermometers (volunteers) and the **eight** readings in their tables. Many did not label their tables with temperature or units of degrees.
- (e) Many candidates could quote two factors for the two marks involved with pros of tree planting compared to the air conditioning units, which would use electricity, be more expensive and cause pollution.