ENVIRONMENTAL MANAGEMENT

Paper 5014/11
Paper 1

Key messages

Most candidates used diagrams and information well to engage with the questions; however, a number of responses showed a reliance on simply restating this information and thus did not receive credit.

Candidates responded well to the level of response (six-mark) questions within the paper, although candidates should avoid vague responses or simply producing a list.

Most candidates plotted graphs accurately, although in some cases axes were not labelled correctly reducing the potential credit gained. It is also expected that the format of a graph is followed if examples are provided, such as the width of bars on a bar graphs.

Responses showed a good understanding of key terms, although some definitions cited lacked detail and providing examples proved challenging. There was confusion as to the definition of the term 'biomass'.

General comments

Candidates engaged well with the paper and there were few examples of candidates not attempting questions across the whole cohort. Answers were generally comprehensive and candidates used the space allocated to them for their responses.

Calculations were completed well, including appropriate units where required.

Comments on specific questions

Section A

Question 1

(a) (i) Most candidates successfully used the information from the table to identify the type of volcano in the photograph.

(ii) The information in the table was used to identify the types of dangers inhabitants in the town would face.

(iii) Applying the context of the question, candidates successfully identified ways loss of life could be reduced, such as the use of alarms or sirens.

(iv) A wide variety of reasons were accepted in the mark scheme to describe why people continue to live in volcanic areas; these include economic reasons as well as cultural.

(b) This was less well understood, candidates were expected to provide an explanation of the formation of volcanoes at destructive plate boundaries.

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Question 2

(a) (i) Candidates were required to complete the missing bar on the graph. Responses were required to be plotted correctly with an equivalent width to the existing bars. It was not expected for shading to be comparable in this case.

(ii) Using the data in the graph, candidates correctly stated the mass of plastics in the ocean. Units were not required as these were supplied on the answer line.

(iii) Requiring a comparison of plastic waste in different countries, credit could be achieved through the citation of specific figures or relative amounts.

(b) Good responses identified concepts such as the level of development in a country, the ease of recycling within countries (and the implementation of laws) as well as the size of the population.

(c) Candidates were well prepared for this question on the problems of plastics in the ocean and answered with a level of confidence, although some responses need to avoid being too general in content.

Question 3

(a) (i) Candidates were required to plot the data to complete the graph and complete the line. This proved accessible to the cohort.

(ii) Using a specific range of data from the graph, candidates needed to understand the range required rather than quoting overall trends or information.

(iii) Providing an explanation for the difference in annual average temperature at different locations proved difficult for some candidates.

(b) (i) A recall-based question, allowing candidates to demonstrate knowledge of the impact of human activities on global temperatures. A wide variety of responses were considered creditworthy.

(ii) A more challenging question for the cohort, expected responses included the impact of economic development for some countries and its ramifications.

Question 4

(a) (i) Using the information on the map, candidates were required to provide detail on migration patterns. These were expected to be linked to specific points on the compass.

(ii) Candidates were expected to provide an estimation using the scale provided. The use of a ruler would be beneficial in such calculations.

(iii) This question required candidates to suggest a reason. Access to water was the most likely reason as the migration occurs in the dry season.

(b) (i) A question requiring a level of interpretation and understanding by the candidate, strong responses included addressing all three statements. These provided a good framework to shape the response**.**

(ii) A challenging question for some candidates, an understanding of both the needs of the people and the wildlife was required to gain full credit.

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Section B

Question 5

(a) (i) Most candidates were able to interpret the diagram and identify that fresh water was 3% of the total.

(ii) Candidates were able to explain the defined term, although some responses would have benefited from greater precision.

(iii) Most candidates correctly stated that the water was frozen.

(iv) The completion of the pie graph was successfully attempted by most candidates. Most candidates correctly used the key within their answers.

(v) This question gave candidates the opportunity to provide a more extensive answer, which was evident in many responses. Many candidates were able to cite a variety of pollution sources and how they are created.

(b) (i) A wide range of potential answers were accepted and candidates readily utilised the information within the diagram.

(ii) The identification of an appropriate water storage scheme proved to be more challenging, with many candidates not stating one that was a result of human activity.

(iii) Most candidates were able to correctly identify the potential for hydroelectric power.

(iv) This question, testing knowledge of terms from the water cycle, was extremely well answered by the cohort overall.

(v) Many candidates understood the impact of the removal of woodland on flooding, although they found the increase in the town's area to be more challenging and sometimes repeated their response from the previous part.

(c) (i) Comparing the data from the four pie graphs was completed well by most candidates, almost all correctly identified Bangladesh.

(ii) Most candidates gave the correct answer.

(iii) Most candidates were able to complete the calculation correctly.

(iv) A good number of candidates understood the difference in infrastructure between a developed country and a developing country but often focussed on the requirement of water for agriculture. Fewer candidates identified the use of water for toilets, washing machines and other household equipment.

(d) (i) Candidates were able to read the data from the map, and correctly identified an appropriate neighbour to Cameroon.

(ii) Most candidates were able to describe the distribution of the area affected by drought, although some struggled to articulate this clearly.

(iii) The ranking of countries in order was completed accurately by most candidates.

(e) Candidates had differing success in answering this level of response question. Some responses were misdirected and described why some areas had drought where others did not, rather than the effects on people. Correct responses varied in detail. The statements from some candidates were simplistic or in a list form.

Some candidates only focussed on the use of water in agriculture and how this would affect people, whereas other candidates also included comments on investment in water storage infrastructure and the degree of development of a country.

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Question 6

(a) (i) A question requiring use of information from a table. Most candidates correctly identified a type of subsistence farming.

(ii) Candidates understood farming types where animals are grazed.

(iii) While described in a number of ways, most candidates understood and were able to state the difference between commercial and subsistence farming.

(iv) A more challenging question, responses were very varied, few identifying the correct classification.

(b) (i) Most candidates described the location of the river. Vague terms such as *near* and *close* should be avoided. Many candidates showed good practice by describing location points using the points of the compass.

(ii) Most candidates were able to select the correct places within the table.

(iii) Candidates were skilled at finding evidence from the table to meet the requirements of the question. Most achieved full credit.

(c) (i) Candidates were asked to choose two from three methods of increasing agricultural yields. Most candidates chose pesticides and demonstrated a good understanding of the impact of pesticides and explained this well.

The use of irrigation was described but many responses did not articulate how it would increase yields or the fact that it would only have an impact when soil water was in short supply. High yielding varieties of seeds was covered less often, and many candidates did not adequately explain how they increase yield. Some confused the term 'variety' with a 'range' of different seeds used.

(ii) This question was answered well and clearly many candidates were well prepared to answer on the topic of eutrophication. Alternative responses relating to soil fertility were often only given in more general terms.

(d) (i) A challenging question attempted by most candidates. Some responses were a reiteration of the information from the diagram and showed little understanding that could be credited. The role of the plastic sheeting was misunderstood by many, missing its role to reduce evaporation from the soil and to reduce weed growth.

(ii) Most candidates identified that the system provided control of water availability, although they were challenged to gain full credit. A range of different responses were given credit.

(e) (i) Utilising graphical data, most candidates gave a detailed description, many providing dates and quantities. Weaknesses in some responses included a lack of a summative sentence of the overall trend rather than the more detailed analysis of the changes within the plots.

(ii) Most candidates correctly identified the appropriate five-year period.

(iii) Most responses showed good skills in plotting and completing the graph accurately using the data provided.

(iv) While most candidates completed the calculation correctly some did not gain credit as the units were omitted. A reminder was provided as part of the question instructions.

(v) Candidates found this question challenging. Many responses were too general, referring to environmental concerns with insufficient detail to gain credit. There was some confusion over the term 'green revolution', some equating it to the introduction of GM crops, others describing it as a political revolution.

(f) (i) While most candidates understood the term 'renewable energy source', they had difficulty in defining it succinctly.

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(ii) Most candidates were able to calculate the percentage of people in Burkina Faso and Nepal that rely on sources other than fuelwood, obtaining the data from the text at the start of the question.

(iii) Generally, there was a level of confusion over the term 'biomass' and some responses, although correct, did not necessarily apply to all forms. Many referred to, or compared their answers to fuelwood, which had been the focus of the earlier parts of the question.

A number of candidates mistakenly stated that biomass emits no pollution, although the higher achieving responses often identified carbon capture from crops during photosynthesis. Some candidates also cited the land needed to grow fuel crops and the potential impact on food crops as well as habitat loss through land clearance.

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ENVIRONMENTAL MANAGEMENT

Paper 5014/12
Paper 1

Key messages

Candidates engaged well with questions involving the use of diagrams and information. Some responses however, were a restatement of this stimulus material and thus did not receive credit.

The plotting of graphs was a skill that was demonstrated to a high standard overall, although it is important for candidates to fully label axes and follow the style of any existing plots if completing a graph. For example, when completing a bar graph it is expected that bars should follow the width of any bars already drawn.

Candidates generally showed confidence in their answering of the level of response six-mark questions. These provide the opportunity for candidates to discuss a topic at more length and provide a range of reasons why. It is important that both sides of an argument or situation are debated to obtain the higher levels of credit. It is expected that responses for this type of question should involve extended writing rather than a list of bullet points.

Responses showed a good understanding of key terms although definitions should be precise.

General comments

Candidates generally found the paper accessible. Candidates should be encouraged to attempt all questions. Handwriting was generally of good quality.

Candidates should always include appropriate units of measurement where required.

Comments on specific questions

Section A

Question 1

(a) (i) Attempted by most candidates, although some did not describe the changes to the appearance of the mine over time, namely the increase in depth of the excavation and the removal of rock in layers.

(ii) Using the information from the picture, most identified the vehicle, although some did not describe its use in transporting material for processing.

(b) With three separate parts, candidates needed to identify a reason for the company investing in the three activities. A wide range of possible responses were accepted, including social responsibility or legislation (for re-landscaping), the prevention of pollution (for water treatment) and cost benefits (for new technology). Most candidates achieved some credit.

(c) Candidates provided a wide range of creditworthy reasons why mines may close. To obtain full credit it was expected that these would be distinct from each other. Possibilities included the exhaustion of reserves, government action and impacts of the world market. Lack of workers was not accepted as it would be possible to recruit new miners from another area. The impact of natural disasters/mine collapses was given credit if described appropriately.

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Question 2

(a) (i) While most candidates understood the diagram, many did not identify that the Santa Fe Dam would be filled with snow melt in the spring.

(ii) Most responses correctly identified two reasons for the dams, identifying both the control of water to prevent flooding and storage for later use.

(iii) This question proved challenging for most candidates. Mismatches such as the large supply of water in a low population area or the abundant supply in the spring when demand is greater during the summer both received credit.

(iv) Most candidates demonstrated a good understanding of processes within the water cycle.

(b) Few candidates achieved full credit here although many identified issues to do with pollution from factories or sewage. Responses that purely focussed on eutrophication did not achieve full credit. Few responses included the straightening of the rivers or the use of concrete channels, the latter being stated within the stimulus material.

Question 3

(a) (i) The graph required some skill in identifying the date with the lowest amount of ozone. This was achieved by many of the higher performing candidates.

(ii) A challenging question requiring the candidates to understand the meaning of the data shown in the graph. Many incorrectly described the trend within the graph whereas the question required a review of ozone levels in relation to the maximum and minimum recorded in the previous 35 years. The higher achieving responses identified that the 2014 figures were typically within the lower 50% of the range at most points in the year though sometimes fell below the minimum recorded.

(b) Most candidates were able to describe strategies to reduce the hole in the ozone layer, although some responses lacked structure and were confused in content. Catalytic converters for cars were credited if they were linked with an appropriate ozone depletion gas.

(c) While many candidates understood the need for international cooperation, it was often poorly articulated. Credit was given for the impact of the hole in the ozone layer on organisms. Most identified the impact on humans but few included the impact on vegetation.

Question 4

(a) (i) A graphical question requiring candidates to plot data accurately. It was expected that the width of the bar would correspond with those already supplied.

(ii) Using data from the graph, most candidates correctly completed the calculation.

(iii) Most candidates estimated the population of Peru that lived in Lima correctly.

(b) (i) Candidates provided a wide range of potential reasons for rural poverty which were creditworthy. Many identified the poor income of farmers, the lack of employment opportunities, lack of education and large families.

(ii) Most candidates provided a good range of suggestions. It was expected that a general suggestion such as ‘give them jobs’ would be supplemented with an example of how this would occur in practice. Most identified the range of pull factors that needed to be addressed.

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Section B

Question 5

(a) (i) Using numerical data from the table, most candidates were able to correctly identify the biome with the largest surface area as being desert.

(ii) Again using the data in the table, this subtraction was accessible to most candidates.

(iii) A calculation requiring the addition of data from the table, this was answered correctly by most candidates.

(b) Using the map, candidates were required to describe the locations of the tropical rainforests. Most candidates who attempted the question gained credit, although this was achieved in a variety of ways; reference to the Equator, the Tropics and precise locations in continents being the most common.

(c) (i) Candidates were required to complete the two missing bars in the graph using the data provided. It was expected that bars would be the same width as those already present within the graph. Candidates were not penalised for differences in shading. Most candidates were able to interpret the scale and apply it correctly.

(ii) A question requiring candidates to describe the rainfall pattern from the graph in the stimulus material. A good number of responses achieved full credit; some focussing on naming the months which have the highest or lowest values, others naming the dry season, while others stated numerical values. All approaches were credited.

(iii) Although there was relatively little variance in temperature throughout the year, August and September were slightly higher values and either was accepted.

(iv) Attempted by most candidates, although some candidates incorrectly attempted to calculate the average temperature rather than complete a calculation of the range of the data provided, which was of average temperatures.

(d) (i) Candidates were required to name the two layers shown on the diagram of tropical rainforest. This proved challenging for many; responses often taking inspiration from other labels within the diagram if unsure. The concept of the emergent layer was not widely known amongst the responses provided.

(ii) Most candidates were able to interpret the scale and estimate the height of the tallest tree.

(iii) A more challenging question in two parts. Many responses simply stated the role of roots rather than why the trees had buttress roots in this scenario. The best responses correctly identified the need to support the tall trees and that roots are shallow and cover a large area to maximise nutrient uptake. Typically, there is little issue in sufficiency of water.

Similarly, a number of candidates had difficulty in describing the need for drip-tip leaves. The need to shed water was commonly cited but not the need to maximise photosynthesis or the fact that the climate had high (regular) precipitation.

(e) Most candidates understood causes for deforestation in tropical rainforests. Credit was given for distinctly different reasons rather than for different products manufactured from the timber.

(f) (i) Candidates were required to draw a bar graph accurately including the use of an appropriate scale and labelled axes. Candidates should be encouraged to make use of a significant proportion of the graph grid, rather than a small section. A common error was the omission of labelled axes.

(ii) Using the data from the table, candidates had little difficulty in performing a subtraction to calculate that there had been a decrease in rainforest area by 11%.

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(iii) While many candidates focussed on the negatives (loss of fuelwood, food sources, etc.), some higher achieving candidates also identified positives (new employment opportunities, availability of timber, etc.). Some candidates described how the loss of trees would impact on the amount of oxygen produced (by photosynthesis) and the influence of broader climate issues. These were not credited as they have broader impacts rather than just on the local people.

(g) This question was more challenging for many candidates. The concept of sustainable harvesting of hardwoods was not well understood by many. The strongest responses identified the opportunity to allow smaller trees to mature, with selective felling within forests. Higher achieving candidates also identified some of the challenges in monitoring forest to prevent illegal and inappropriate exploitation of the forests. They also identified that forests may be cleared for reasons other than for harvesting hardwoods.

(h) A level of response question, candidates could choose to write about two management methods from four options. Some responses showed a clear knowledge of the subjects chosen and how they might improve sustainability. Weaker responses merely stated a definition of the method with little expansion on how the techniques would be applied within this context.

While candidates generally understood about fuelwood planting and reforestation, a number of those who chose agro-forestry or community forestry provided poorer descriptions or understandings.

Question 6

(a) Most candidates had little difficulty in completing the passage with the appropriate words provided. There was a clear understanding of the topic.

(b) Describing the location of volcanoes proved to be more challenging for many candidates. Most identified they were mainly located on plate boundaries, and could provide examples of areas of major clusters. Few responses described volcanoes located in the middle of plates (such as the African plate).

(c) (i) Most candidates attempted to label the diagram of the volcano, but few achieved full credit.

(ii) The completion of the pie graph provided few difficulties for candidates. There were a few accuracy errors but the majority identified that the whole of the circle needed coverage. A few candidates did not link their graph to the key.

(iii) There was a significant difference in the quality of response to this question. Many candidates identified that there were opportunities to predict the eruption which are not possible with earthquakes and that as a result the area may be evacuated. Some candidates did not appear to appreciate the impact a volcano may still have. The widespread nature of an earthquake was also commonly recognised.

(d) (i) As with other similar graph questions, candidates were expected to draw bars of the same width as the ones already present. There were few plotting errors, but despite the prompt within the question a number of responses did not include a label on the *y*-axis.

(ii) Most candidates identified the three months correctly. All three were required to gain credit.

(iii) The calculation in this question did not cause many candidates difficulty.

(iv) Most candidates gained some credit in this question, identifying the risk of attack to visitors and/or the risk of incorrect food to the animals. Fewer candidates correctly identified the impact of visitors on the behaviour of the animals or indeed how feeding them would change their behaviour and encroach on the visitors.

(e) (i) Most responses identified that geothermal energy was a renewable resource and most also identified the reduction in air pollution. Some responses lacked detail, simply citing ‘pollution’. Some responses also included benefits compared to wind and solar power as well as benefits when compared to fossil fuels.

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(ii) This question was answered well by many candidates, it was clear that this was a topic that was clearly understood, although some responses still gave examples of geothermal energy and tourism. Most understood about the potential for fertile soils and how this would improve productivity and also the opportunity to extract valuable minerals. Fewer responses included ideas about the impact of traditional practices and family history in an area.

(f) (i) A wide range of responses were accepted as a definition provided they considered the minimal impact on the ecosystem.

(ii) Most candidates were able to extract the relevant information from the stimulus material to identify the opportunities for employment as well as increased income for full credit.

(iii) Responses showed some confusion, suggesting that some candidates thought that the whales were kept captive. Most responses identified that as the whales generated economic benefits this would encourage their conservation. Others identified that the activities increased the education of the tourists increasing their awareness for retaining the whales.

(g) A level of response question allowing candidates to complete a more extended piece of writing. There was a significant difference in the quality of the answers provided. The strongest responses provided a range of ways in which damage may occur and in some cases cited specific examples. Poorer responses tended to focus on one issue.

Some candidates produced their responses in short bullet points or lists. While these were credited, this approach limited the level of credit awarded.

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ENVIRONMENTAL MANAGEMENT

Paper 5014/21
Paper 2

Key messages

Read the source material and the question carefully.
Use data from either graphs or tables to help describe trends or patterns.
Avoid statements such as 'use the same amount of chemical' without any further detail. Candidates should always make suggestions using precise terminology such as concentration, volume or mass.
Both axes of any graph should be fully labelled with units.

General comments

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

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

Candidates may benefit from working through past papers to help see how to make the best use of the information given and apply their knowledge in context.

Comments on specific questions

Question 1

(a) (i) Most candidates gave the correct answer, 1 677 000.

(ii) This calculation was not always carried out by an appropriate method. Many candidates divided their answer to **(a)(i)** by 6.5 million to give the correct percentage of the population of Tennessee living in the four cities listed in the table. Some candidates divided their answer to **(a)(i)** by 6.5 or 65 000 000.

(iii) Nearly all the candidates presented the population data for the four cities in the correct rank order, from highest to lowest.

(b) (i) Candidates gave a wide range of suggestions of factors the scientist could control. Many of the answers were inappropriate and did not gain credit as the context of the investigation had not been carefully thought about.

(ii) Most candidates realised that plot **A** was required to allow a comparison to be made. This was also identified as a control experiment.

(iii) Most candidates correctly selected at least one difference between plot **A** and plot **B**. A small number of candidates described the information given without pointing out any differences.

(iv) Candidates that gave the correct answer gained full credit. Candidates that calculated the difference between the two plots as 0.4 gained partial credit.

(v) Many candidates suggested that repeating the field trial could be a method of checking the results. All the other points on the mark scheme were only rarely suggested.

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(c) (i) Many candidates did correctly suggest that the yellow spots might be caused by factors other than a zinc deficiency. Other candidates gave answers that lacked detail.

(ii) Most candidates found it difficult to describe a suitable sampling technique that could be used to check the plants in a field.

(iii) Candidates found it difficult to suggest advantages to the farmer of adding zinc at the same time as fertiliser. However, saving time and fuel were suggested by some candidates.

Question 2

(a) (i) Candidates often explained that switchgrass was a renewable source of energy. Only a small number of candidates gave clear descriptions of the idea that the crop would be carbon neutral.

(ii) Candidates often identified transport costs as a factor to determine the distance between farms and the biorefinery. The other points on the mark scheme were also seen regularly.

(iii) The candidates that could think about this question from the state authority's point of view usually suggested one or two correct answers. There were a large number of suggestions that lacked detail and did not gain credit.

(b) (i) Most candidates completed the table correctly.

(ii) Many candidates found this question challenging. Those who gained credit successfully used the data and information to compare the two different crops.

(c) (i) Many candidates suggested a selection process that involved random selection of the farms to be sampled.

(ii) Most candidates suggested at least one advantage of carrying out a survey by telephone.

(iii) Most candidates suggested a form of subsidy to farmers to encourage more farmers to grow switchgrass.

(iv) Some candidates only suggested that less fossil fuels would be burnt. A small number of candidates described the other points on the mark scheme, gaining more credit.

Question 3

(a) Nearly all the candidates attempted to answer this question. However, the role of bacteria in maintaining soil fertility was not clearly explained in most cases. The candidates that did give relevant details of the nitrogen cycle gained full credit.

(b) (i) Many candidates plotted the graph correctly. Both axes must have complete labels including units (as shown in the data table) to gain full credit.

(ii) Most candidates correctly described the trend shown in the graph.

(iii) Most candidates gave the correct value from their graph. A small number of candidates did not indicate how they had selected this value on their graph as instructed by the question.

(iv) Most candidates gave two or three reasons why farmers wanted crops to grow long roots.

(c) Most candidates were able to partly describe how to restore land after mining has finished, gaining some credit.

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ENVIRONMENTAL MANAGEMENT

Paper 5014/22
Paper 2

Key messages

Read the source material and the question carefully.
Use data from either graphs or tables to help describe trends or patterns.
Avoid statements such as 'use the same amount of chemical' without any further detail. Candidates should always make suggestions using precise terminology such as concentration, volume or mass.
Both axes of any graph should be fully labelled with units.

General comments

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

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

Candidates may benefit from working through past papers to help see how to make the best use of the information given and apply their knowledge in context.

Comments on specific questions

Question 1

(a) (i) Most candidates gave the correct answer, 849 000.

(ii) Most candidates divided their answer to **(a)(i)** by 6.5 million to give the percentage of the population of Tennessee living in the five counties listed in the table. Some candidates divided their answer to **(a)(i)** by 6.5 or 65 000 000.

(iii) Nearly all the candidates presented the population data for the five counties in the correct rank order, from highest to lowest.

(b) (i) Most candidates correctly calculated average values for aluminium and selenium and entered them in the table.

(ii) Most candidates calculated the range for sulfate and selenium correctly. A number of candidates stated the range but did not carry out the calculation.

(iii) Nearly all the candidates correctly named **B** as the stream which had the lowest concentration of pollutants.

(iv) Most candidates were able to recognise the relationship between pH and the concentration of pollutants in the three streams and describe it.

(v) Although most candidates correctly named stream **A** as the most polluted, some of the reasons given lacked specific detail.

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(c) Only a small number of candidates were able to suggest how low concentrations of selenium could cause the death of fish in streams. Many candidates suggested, wrongly, that it lead to eutrophication.

(d) (i) Many candidates understood the concept of a control and explained the need to compare the water samples from the streams that were not polluted with mine water.

(ii) Candidates' attempts to calculate the cross sectional area of Stream **F** met with varying success. The most successful responses estimated the number of whole 0.1 m^2 squares within the grid provided and entered this calculation into the table.

(iii) Some candidates seemed to misread the question, answering a different question, possibly about the speed of the lowest velocity and the size of the largest cross sectional area.

(iv) Most candidates gave detailed accounts of how the scientist could measure the velocity of each stream using the equipment listed. Some candidates' accounts appeared to be measuring the whole length of a stream instead of a measured distance. Good use was made of the marker poles to identify start and finish lines. There were also clear descriptions of the need to synchronise starting the stopwatch with the release of the float at the first marker pole, and stopping the stopwatch when the float passed the second marker pole. A number of candidates wrote about repeating the method several times and calculating an average. Good use was made of the notebook to record the time and calculate the velocity, with many candidates concluding their answers with the equation for the calculation of velocity.

(v) Most candidates completed the table by multiplying their answer to **(d)(ii)** by 0.18.

(e) There were some convincing advantages suggested for reducing pollution in a stream by adding limestone rocks. There were references to limestone being a cheap rock and that putting it in the stream was a straightforward, quick strategy. Disadvantages included flooding and the fact that limestone rocks were not a permanent solution as the limestone would dissolve. The strongest answers stated that limestone would not remove the pollution, with weaker answers stating wrongly that it would.

(f) (i) A number of candidates did not answer the question set. Instead of writing about the advantages and disadvantages of constructing a wetland to reduce pollution, they seemed to be writing about the advantages and disadvantages of wetlands. The more successful answers suggested, as advantages, that it used natural processes instead of chemicals but a disadvantage was the expense of construction.

(ii) Only a small number of candidates were able to select all correct five months (May to September inclusive) and give reasons related to bacteria needing high temperatures and moisture to remove pollutants. A number of candidates seemed to think that bacteria worked best in low temperatures.

(iii) Those candidates who read the question carefully and revisited the climate data in the table wrote successful explanations involving rainfall and/or the seasons in Cumberland county.

Question 2

(a) (i) Nearly all the candidates described how total coal production was decreasing in Tennessee between 2008 and 2012.

(ii) Many candidates gave a number of reasons for the change in coal output between 2008 and 2012. There were frequent references to fall in demand, depletion of coal reserves and the move towards the use of renewable energy.

(b) (i) Nearly all candidates presented a bar graph that was plotted correctly. There were some graphs with no, or incomplete, axes labels.

(ii) Most candidates used their graph to successfully estimate the likely number of miners employed in 2013.

(iii) There were some good reasons suggested for the decline in the number of miners in recent years. These included increased use of machinery, less coal underground to mine and mines closing.

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(c) All of the examples of environmental damage listed in the mark scheme were frequently provided by candidates. A number of candidates included examples about the effect of mining on local people, this indicated that they had not read the question carefully and the examples did not gain credit.

(d) Some candidates thought mining would stop completely in the next few years, others thought it would not. A number of candidates put both points of view and then stated which one they supported. There were many thoughtful responses from candidates who selected information from the fact sheet and presented their own ideas as to why this might be good or bad for the future of coal mining in Tennessee.

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