CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE ADVANCED PROFICIENCY EXAMINATION MAY/JUNE 2010

ENVIRONMENTAL SCIENCE

GENERAL COMMENTS

Environmental Science is a two-unit subject with each unit consisting of three Modules — Unit 1: Fundamental Ecological Principles, People and the Environment and Sustainable Use of Natural Resources and Unit II: Sustainable Agriculture, Sustainable Energy Use and Pollution of the Environment. Both units are examined by three papers. Paper 01 and 02 are external examinations, while Paper 03 is the internal assessment and is examined internally by the teacher and moderated by CXC.

This is the second year that Paper 01 of both Units 1 and 2 consisted of multiple choice items. Paper 01 consisted of 45 compulsory multiple choice questions with 15 items based on the contents of each module. This paper contributed 30 per cent to the total score for the unit.

Paper 02 consisted of nine questions, three based on each module. Candidates were required to answer two questions from each module. Each question contributed 20 marks to the total of 120 marks for the paper. This paper contributed 40 per cent to the total score for the unit.

Paper 03, the Internal Assessment, contributed 90 marks or 30 per cent to the total for the unit. Unit 1 was examined by a single project while Unit 2 was examined by a journal comprising site visits and laboratory exercises.

There was an improvement in the number of candidates who demonstrated the breadth of knowledge necessary to perform well. There were still, however, a few candidates whose responses were inadequate, especially where they were required to infer relationships, read graphs, distinguish between terms and explain interactions and interrelationships. Greater attention to basic principles is still required.

Too many candidates continue to struggle with questions requiring the use of higher-order cognitive skills. Some candidates showed a fundamental lack of knowledge of the definitions of key scientific and environmental terms. It is recommended that in preparing for the examination, greater emphasis be placed on key scientific and environmental terms and on providing guidance and practice in responding to questions which require the use of higher-order cognitive skills. In both units, spelling was poor throughout, particularly of some scientific terms.

DETAILED COMMENTS

UNIT 1

Paper 01 – Multiple Choice

Paper 01 consisted of 45 multiple-choice items with 15 items from each module. Candidates' performance on this paper was very good.

Paper 02 – Essay Questions

Candidates performed best in Module 2, followed by Module 3 and then Module 1.

Module 1 - Fundamental Ecological Principles

Question 1

In Part (a) of this question, candidates were required to distinguish between 'primary ecological succession' and 'secondary ecological succession'. Most candidates were able to distinguish between the two.

In Part (b) (i), candidates were required to use Figure 1, which was provided, to describe the trend in variation of the alligator population. Candidates were required to use specific values. Part (b) (ii) required candidates to use the information in Figure 1 to determine the carrying capacity of the river. Part (b) (iii) required candidates to use Figure 1 to determine the year in which the carrying capacity was most likely to be achieved. Candidates' performance on this part of the question was poor. Too many candidates were unable to read and interpret the data in Figure 1.

In Part (c), candidates were required to read a statement provided on the phosphorous cycle and the carbon cycle and suggest four reasons to support the statement. Overall, candidates' performance on this question was poor. Candidates did not understand the significance of the difference between the two biogeochemical cycles.

Question 2

Table 1 in Question 2 presented results of a sampling procedure to determine the species of mangroves in three ecosystems, A, B and C.

In Part (a) (i), candidates were required to use the information in Table 1 along with the equation provided to calculate the species diversity for Ecosystem B. In Part (a) (ii), candidates were required to rank the three ecosystems in decreasing order of species diversity. In Part (a) (iii), candidates were required to state which of the three ecosystems was the most stable. In Part (a) (iv), candidates were required to suggest four reasons to support the ranking given in Part (a) (ii).

In Part (b), Table 2 provided results of an ecological study where three amphibians were observed in a grassland ecosystem. Candidates were required to study the information and suggest three inferences that could be made about the competition taking place among amphibians in the grassland ecosystem.

Candidates' performance on this question was good. Most candidates were able to calculate the species diversity of the ecosystems and to rank them in order of decreasing species diversity. Candidates were also able to make appropriate inferences from Table 2.

Question 3

In Part (a) of this question candidates were required to define the term 'ecological niche'. Too many candidates were unable to provide the correct definition. Figure 2 illustrated a predator-prey relationship in a research plot in a savannah. Candidates were required to study Figure 2 and answer the questions.

In Part (b) (i), candidates were required to describe the trend shown in Figure 2. Candidates were required to use specific values in their answer. In Part (b) (ii), candidates were required to state the month in which the population size of the predator was equal to 200. In Part (b) (iii), candidates were required to state the size of the prey population in month 11. In Part (b) (iv), candidates were required to suggest two reasons why the predator population successfully regulated the population of the prey.

Candidates generally performed poorly on this part of the question. Some candidates were unable to read the data from the graph; most candidates described the data without identifying the trends.

In Part (c), the following statement was provided: 'Every living organism has limits to the environmental conditions it can endure'. Candidates were required to provide three reasons to support the statement. Most candidates were able to provide three appropriate reasons.

Overall, candidates' performance on this question was poor.

Module 2: People and the Environment

Question 4

In Part (a) of this question, candidates were required to define the term 'poverty'. This part was well done by most candidates. Part (b) of this question was based on information provided in Figure 3 which showed the percentage of the world's population affected by lack of access to selected social facilities.

In Part (b) (i), candidates were required to use Figure 3 to identify the percentage of the world's population that lacked access to adequate sanitation facilities. Responses to this part of the question were satisfactory.

In Part (b) (ii), candidates were required to calculate the number of people who lack access to adequate housing and electricity. Responses to this part of the question were good.

In Part (b) (iii), candidates were required to determine how many more people lacked access to clean drinking water than to enough food for good health. Responses to this part of the question were generally satisfactory.

Part (c) presented two statements. In Part (c) (i), candidates were required to suggest one reason someone might say Statement 1. In Part (c) (ii), candidates were required to suggest four reasons to support Statement 2. Responses to this part of the question were generally satisfactory.

This was the most popular question in this module. Overall, candidate's performance on this question was very good.

Question 5

Part (a) of this question presented information on an ecological footprint in Figure 4. Candidates were required to study Figure 4 before answering the questions. In Part (a) (i), candidates were required to determine the total ecological footprint for the country with the largest per capita footprint. In Part (a) (ii), candidates were required to calculate the per capita ecological footprint for the country with the smallest total footprint. In Part (a) (iii), candidates were required to describe the trends observed in Figure 4. Candidates were required to use specific values from Figure 4 in their answer. Part (a) of this question posed some difficulty for candidates. Candidates did not read the graph properly. Many candidates did not pay attention to the fact that there were two axes and only read values from one axis. Some candidates appeared confused by the term 'ecological footprint'.

In Part (b) (i), candidates were required to describe two ways in which people impact negatively on the environment. Candidates were required to use three specific examples to illustrate each way.
For Part (b) (ii), candidates were required to suggest one mitigation measure for each way in which the negative impact can be caused. Relevant specific examples were required in the response. Many candidates were able to name at least two ways but were unable to give specific illustrative examples.

Overall candidates' performance on this question was satisfactory.

Question 6

Part (a) of this question required candidates to construct an age structure diagram from the data provided in Table 3. This presented difficulty to many candidates. Many candidates were unable to determine appropriate scales while some drew inappropriate graphs (mainly line graphs) to represent the data.

In Part (b) (i), candidates were required to suggest a country that would have an age structure diagram similar to the one that was drawn in (a). For Part (b) (ii), candidates were required to determine if the estimate of the likely rate of population growth in Country X would be high, medium, low or negative. Most candidates recognized and correctly identified a developing country but could not correctly determine that the estimate of the likely rate of population growth would have been high.

In Part (b) (iii), candidates were required to use the age structure diagram that was drawn in Part (a) to explain their response in Part (b) (ii).

Part (c) (i) required candidates to define the term 'total fertility rate'. Many candidates could not define 'total fertility rate' as an estimate of the average number of children a woman will have during her child-bearing years.

In Part (c) (ii), Table 4 was given with information on the average global fertility rate. Candidates were required to study Figure 4 and outline the trend in average global total fertility rate as shown in Table 4. Many candidates failed to observe that the trend showed that over time, the global total fertility rate declined in both developed and developing countries, with the fertility rate in developing countries always higher than the rate in developed countries.

Candidates were required to discuss three factors that would have contributed to the trend observed in Table 4. While many candidates were able to identify the factors that may have contributed to the observed trend they did not discuss these factors adequately.

Overall, candidates' performance on this question was satisfactory.

Module 3 - Sustainable Use of Natural Resources

Question 7

In this question, candidates were presented with Figure 5 which showed a traditional agricultural practice of indigenous peoples in a Caribbean country.

In Part (a) (i), candidates were required to identify the traditional agricultural practice. In Part (a) (ii), they were required to outline how this type of agricultural practice was carried out. These two parts of the question were fairly well done by candidates.

For Part (a) (iii), candidates were presented with a statement 'Indigenous forest dwellers often cause tropical forest destruction because of their traditional agricultural practices.' Candidates were required to indicate whether they agreed or disagreed with the statement. They were required to provide three reasons to support their answer or position. Many candidates could not give reasons to support the position taken. This question provided an opportunity for candidates to apply their knowledge of the slash and burn method of traditional agriculture and to explain how they felt this method impacted on the environment. Candidates either failed to display an understanding of the method or confused the issues with those associated with commercial agriculture.

Part (b) required candidates to study Figure 6 before answering the questions. In Part (b) (i), candidates were asked to describe the trend illustrated in Figure 6. In Part (b) (ii), candidates were required to state the year in which employment in the fisheries sector was greatest. In Part (b) (iii), candidates were required to state the total percentage employment of the forestry sector in 2003 and 2004. Candidates demonstrated limited skills at reading graphs and making deductions from graphs. As a result, many candidates performed poorly on this part of the question.

Part (c) provided candidates with a situation in which an Environmental Impact Assessment (EIA) was required. Candidates were asked to justify the request of the Environmental Protection Agency (EPA). Candidates were required to give two points in their answer. This part of the question was fairly well done by candidates and many demonstrated an understanding of what an EIA is and the role of an EPA.

Overall, candidates' performance on this question was generally satisfactory.

Question 8

Part (a) of this question required candidates to study Figure 7 which showed the amount of fish harvested from traditional marine fishing grounds in Country X. In Part (a) (i), candidates were required to describe the trends in fish harvest shown in Figure 7. In Part (a) (ii), candidates were required to determine in which year the maximum yield of fish was obtained. Part (a) (iii) required candidates to suggest two reasons for the trends shown in Figure 7. Part (a) (iv) required candidates

to identify the production level at which they would recommend that the country continue to harvest its fish resource. Candidates were required to provide three reasons for their recommendation.

Part (a) (ii) was well done by most candidates. Overall, too many candidates failed to demonstrate adequate skills at reading graphs and making deductions from graphs. Many candidates had difficulty reading the graph and describing the trends. Most candidates simply described the data without giving specific trends. Candidates were also challenged to give reasons for the trends that were shown. Most candidates were however able to correctly indicate the level of production they would recommend for the country to continue harvest and also give reasons for their recommendation.

Part (b) of this question required candidates to outline two factors that the government of the Caribbean country may have considered before making a decision to grant permission to private investors to exploit its gold resource. Candidates' performance in this part of the question was very satisfactory.

The overall performance on this question was satisfactory.

Question 9

In this question, candidates were presented with Figure 6 that showed the contributions to the economy made by natural resources over a three-year period for a Caribbean country and were required to study Figure 6 before answering the questions. In Part (a) (i), candidates were required to describe the trends in the contribution made by natural resources in Country P. For Part (a) (ii), candidates were required to determine the percentage contribution made by forestry in Year 1. In Part (a) (iii), candidates were required to calculate the difference in percentage contributions made by minerals in Year 1 and Year 3.

Many candidates had difficulty reading the graph and describing the trends. Most candidates simply described the data without giving specific trends.

In Part (b), candidates were required to suggest three reasons to convince a group of students that the conservation of beaches as a natural resource is necessary for the country. Too many candidates struggled with this part of the question. Candidates did not demonstrate that they were familiar with the role and function of beaches. Too many of them simply identified tourism as the only reason why beaches should be conserved.

Note: the conservation of beaches could be justified for the following reasons:

- Ecological
- Ethical
- Aesthetic
- Economic

Part (c) required candidates to justify the usefulness of (i) education and awareness and (ii) legislation in the management and conservation of beaches in the Caribbean. Candidates demonstrated satisfactory performance on this part of the question. However, too many candidates used the term beach very much in the colloquial sense. This resulted in many candidates stating that fishes live on the beach and that the beach is a habitat for fishes.

The Internal Assessment

General Comments

It is important to emphasise the paragraph below:

> The Internal Assessment is an integral part of student assessment and is intended to assist students in acquiring certain knowledge, skills and attitudes that are associated with the subject. The Internal Assessment must relate to at least **ONE** Specific Objective stated in the syllabus. The following must be assessed by the Internal Assessment for **each** Unit:
>
> - The collection and collation of data;
> - The analysis, interpretation and presentation of such data;
> - The selection of techniques, designs, methodologies and instruments appropriate to different environmental situations;
> - The development of appropriate models as possible solutions to specific environmental problems.

In general, the required criteria were applied effectively.

There was a noticeable increase in the evidence of primary data collection and a reduction in the use of secondary data. Candidates are encouraged to continue to design projects that will encourage the collection, collation and use of primary data.

A reminder for teachers: The CXC criteria at the bottom of the Moderation Sheet **must** be applied **at all times** when recording and distributing marks to the three modules. A remainder of one mark must be allocated to Module 3. For a remainder of two marks, one mark is allocated to Module 2 and one to Module 3. Care should be taken when compiling total scores. Moderators detected many errors in the total scores submitted for students.

The major areas of concern are the literature review and communication of information. While some candidates were able to communicate the information in a fairly logical manner with few grammatical errors, there were still too many candidates who presented information with several grammatical errors. This reduced the overall quality of the final report.

Detailed Comments

There was improvement in the overall standard of the Internal Assessment submissions. A substantial number of candidates submitted work that was of a very high standard. The overall quality and content can be improved by choosing topics that lend themselves to a more scientific and investigative approach.

In general, the required criteria for this component were effectively applied. The literature review is still an area of concern in many of the pieces submitted. Too often, the literature review is either irrelevant or inadequate. There is an immediate need for candidates to improve their writing and expression skills. Poor written expression severely affects the quality of the report and at times is not reflective of what is expected at the CAPE level.

One major concern was the way in which the titles of projects were written. Titles were frequently misleading and written in the form of an objective. The purpose of the project was also not 'concise' and often did not have, or sometimes did not clearly state the variables and/or objectives of the research. Note that objectives should be **SMART**, that is, **S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**ime-bound.

The literature review, in many instances, was merely a listing of the literature, without much discussion. Candidates also need to pay attention to the format used for citations.

The methodology frequently did not describe how the variables/objectives would be measured or observed and recorded. Also, students very frequently used a questionnaire survey that was inappropriate and, where appropriate, the questions were not formulated to yield the information pertaining to the stated objectives.

Some of the work submitted for Internal Assessment did not demonstrate adequate field investigation and did not demonstrate much creativity and skills in the presentation of data; often the presentation was limited to a number of graphs of similar type, graphs that were inappropriate, and photographs without titles. Candidates are encouraged to use the other available formats for presentation of data such as tabulation, cross-section, field sketch and line transect.

Analyses were fairly adequate, based on the data presented. However, analyses could have benefited from more variation in techniques (other than percentages).

The discussion of findings, in some instances, lacked depth of interpretation and very few showed validity and reliability. Often they were not based on actual findings of the particular research but, instead, on some generalized information on the topic, perhaps from research on a similar topic or from the literature.

The conclusion often revisited the purpose. However, as was true of the discussion of findings, the conclusion was often based on generalized information on the topic but not the actual findings in the research. It would be helpful here to recall some of the most significant findings.

In a few instances, recommendations were based on limitations. It is more appropriate to address this category of recommendation in the methodology. In general, similar to the discussion of findings, recommendations were not based on actual findings of the particular research but, instead, on some generalized information on the topic, perhaps from research on a similar topic or from the literature.

Communication of information was satisfactory in some instances. However, it would be helpful to use the jargon/terminology of Environmental Science in order to improve the overall quality of the Internal Assessment projects. It is noted, however, that there are still many instances where candidates demonstrated a very poor standard of writing and communication skills for the CAPE level.

In several instances, the conventional format for references was not applied. Additionally, textbooks and websites were intermixed. In some cases, for website references, only the search engine was mentioned.

Some areas in which projects in Unit 1 may be improved are:

- Each activity of the Internal Assessment should relate to at least ONE specific objective.
- The research title should be more concise and focused.
- The purpose of the project should be clearly outlined and the variables should be clearly defined.
- Data collection, in some instances, was inadequate and should be addressed.
- Diagrams and illustrations need to be more appropriate and better integrated into the text to increase their effectiveness.
- Comprehensive data analysis is required and this should make use of appropriate statistical tools to improve the results.
- Discussion of findings, conclusion and recommendations should be based **only** on what was presented in the literature review and the data that is collected, presented and analysed. No new material should be introduced in the discussions.
- Greater attention should be paid to the literature review. This is still one of the weak areas in Internal Assessment pieces submitted for moderation.
- Conclusions must be clear, based on findings, valid and related to the purpose of the project. In addition, recommendations must be based on findings and must be fully derived from findings.
- Bibliographic references should be written using a consistent convention. In addition, there should be at least four up-to-date references.

Paper 03/2 – Alternative to School-Based Assessment

There was some improvement in candidates' responses to questions in this paper. However, there is still need for greater improvement in the depth and breadth of coverage with respect to certain areas of the syllabus. Greater effort must be made by candidates to improve their ability to organize, apply and communicate information and to demonstrate an understanding of the practical solutions to environmental problems.

Question 1

In Part (a), candidates were expected to use the information provided in Table 1 to plot an appropriate graph showing the variation in the size of the population of tanagers from 1998 to 2007. In Part (b) (i), candidates were asked to describe the variation of the tanager population between 1998 and 2007. In Part (b) (ii), candidates were required to suggest plausible explanations for the variation in tanager population identified in (b) (i). In Part (c), candidates were required to use their graph to estimate the carrying capacity of the ecosystem for tanagers.

Candidates' performance on this question was generally good. Some candidates had difficulty plotting an appropriate graph to represent the data and estimating the carrying capacity.

Question 2

This question required candidates to evaluate the impact of the following actions on the tanager population:

(a) the introduction of new species;
(b) clearing of an area of forest;
(c) presence of the visitors;

Candidates' performance on this question was not satisfactory. Candidates could not evaluate the impacts that were identified on the population.

Question 3

This question required candidates to design a monitoring plan to determine the impact of the development on the tanager population.

Too many candidates failed to provide a response that was satisfactory. Candidates should note that a monitoring plan could include aspects of the following:

- determination of a sampling schedule
- identification of a specific location within a mapped area
- recording of initial numbers of nests and sightings of the tanager
- recording the prevailing conditions at data collection points and times
- introduction of specific conservation measures to reduce threats as the monitoring progresses
- determination of final count of nests, hatchlings and adults
- preparation of education and awareness component and monitoring of its effectiveness
- any other relevant information as necessary.

The overall performance of candidates in this question was not satisfactory.

DETAILED COMMENTS

UNIT 2

Paper 01- Multiple Choice

Paper 01 consisted of 45 multiple-choice items with 15items from each module. Candidates' performance on this paper was very good.

Paper 02 – Essay Questions

Candidates performed better in Module 1 than in Module 2 or Module 3. Performance on Module 2 was superior to performance on Module 3.

Module 1 - Sustainable Agriculture

Question 1

This question tested candidates understanding of biological pest control. Part (a) (i) required candidates to describe the trend in Figure 1 which was provided. This part was done well by most of the candidates who identified the trends and discussed them. For Part (a) (ii), candidates were required to state three pieces of information necessary for the use of biological pest control; this part was generally done well.

In Part (a) (iii), candidates were required to suggest three reasons why the method of control was recommended. This part was also done well by most candidates. Part (a) (iv) required that candidates explain why the biological control agent should always be maintained at level C. Most candidates did not understand the need to maintain a balance between the biological control agent (predator) and the pest (prey) to afford continuous pest control. This part of the question was poorly done.

Part (b) required candidates to suggest two reasons for the use of chemical pest control methods. This part was generally well done. Candidates demonstrated an awareness of the issues around chemical control and the advantages of its application.

The overall performance on this question was very good.

Question 2

This question tested candidates understanding in three main areas: genetic engineering in agriculture, changes in the size of land under agriculture and the corresponding workforce, and the reasons for practising sustainable agriculture. The question also tested candidates' ability to read a graph and identify and explain trends.

Part (a) required candidates to distinguish between genetic engineering and plant and animal breeding; this part was not done very well. Candidates were able to define the terms but were unable to distinguish between them.

Note

- Genetic engineering is the **laboratory manipulation of genetic material** (genes) to create desirable characteristics in an offspring.
- Plant and animal breeding involves **selecting individuals with favourable** characteristics and **allowing them to reproduce naturally** to produce offsprings with the desirable characteristics.

Part (b) (i) required candidates to describe the trend in Figure 2 which was provided; this part was generally well done.

In Part (b) (ii), candidates were required to state the year in which the average size of farms was four hectares; this part was well done by most candidates — many were able to correctly read the particular data point from the graph.

Part (b) (iii) required candidates to give reasons for the trends in Figure 2; this part was challenging for many candidates. For Part (c), candidates were required to suggest reasons for the practice of sustainable agriculture; this part was poorly done. Candidates were generally unable to identify two reasons for practising sustainable agriculture.

The overall performance on this question was generally satisfactory.

Question 3

This question tested candidates' understanding of conservation tillage and its use as well as mechanization in agriculture. It also tested their ability to identify and explain trends in graphical data, using actual values from the graph.

Part (a) (i) required candidates to comment on the causes of soil degradation as shown in Figure 3 which was provided; this part was generally well done, with strong responses including trends from the graph along with actual data read from it.

In Part (a) (ii), candidates were required to state what mechanism caused the least soil degradation and for Part (a) (iii), they were to state what percentage of soil degradation was caused by soil erosion. These parts were well done with the majority of candidates providing correct answers.

Part (b) required candidates to give two reasons why conservation tillage would be a good measure for reducing soil degradation. The responses provided were generally weak. A significant number of candidates confused the term 'conservation tillage' with regular tillage.

For Part (c) (i), candidates were required to state what is meant by mechanization in agriculture; this part was well done. Many candidates had a general idea of what is meant by mechanization in agriculture. Part (c) (ii) required candidates to suggest four reasons why farmers may not wish to increase the level of mechanization in their farming operations. This part was well done.

Module 2 - Sustainable Energy Use

Question 4

Part (a) (i) required candidates to describe the trend in the rate of light bulbs in Figure 4 which was provided; performance on this part was satisfactory. For Part (a) (ii), candidates were required to state in what year were there sales of five million fluorescent bulbs. In Part (a) (iii), candidates were required to state how many bulbs were sold when sales for both types of bulbs were equal. Parts (a) (ii) and (a) (iii) were well done as most candidates were able to read the graph correctly.

Part (a) (iv) required candidates to suggest reasons for the trends observed in Figure 4; this part was not done very well as most candidates were unable to provide appropriate reasons for the observed trends. In Part (b) (i), candidates were required to state what is meant by 'combined cycle'; this part was poorly done as most candidates were unable to correctly define the term.

For Part (b) (ii), candidates were asked if they would recommend the use of combined cycles for energy generation and to suggest reasons for their answers. Performance on this part was extremely poor as most candidates were unaware of the term 'combined cycle'.

Question 5

This question tested candidates understanding of the factors influencing the location of conventional electricity facilities as well as the environmental impacts of electricity generation. The question also tested candidates' ability to identify and explain trends from data in tabular form.

Parts (a) (i) required candidates to outline the trend in Table 1 which was provided and Part (a) (ii) required candidates to suggest one reason for the trend in (a) (i). These parts were poorly done. Candidates were not able to identify trends from the data in the table. A number of candidates also failed to include specific values in their responses, even though it was stated in the question.

Part (b) (i) required candidates to justify placing a conventional electricity generation plant close to a swamp in a coastal zone. This part of the question presented considerable difficulty to many candidates. This appeared to be due to their inability to understand what was required of them in the question. Many responses provided reasons why a power plant should NOT be sited close to a swamp. In addition, most candidates did not demonstrate a clear understanding of the term '*conventional electricity generation facility'*.

Part (b) (ii) required candidates to outline the environmental impacts to be considered before implementing the conventional electricity generation facility. Many candidates were aware of the environmental impacts of electricity generation and were able to correctly situate these impacts in the context of the question — in a coastal zone, close to a swamp.

Question 6

This question tested candidates understanding of the factors influencing the demand for energy in developing countries as well as the environmental impacts of increasing energy demand. The question also tested candidates understanding of different mitigation methods to relieve these negative environmental impacts and their ability to identify and explain trends from graphical data.

In Part (a), candidates were required to outline the overall demand pattern shown in Figure 5 which was provided. Candidates were generally unable to identify trends from the data in the graph. This graph had three different series and candidates often confused them. In addition, although the question asked for trends, many candidates simply quoted the values of the different data points.

For Part (b), candidates were required to suggest three reasons for the demand pattern in (a); this was very well done. Most candidates were able to provide three valid reasons for the general trends identified in the graph.

In Part (c), candidates were asked to identify and discuss the environmental concerns with regard to the energy demand pattern in Figure 5; for Part (d), they were required to make a recommendation for each concern discussed in (c). Parts (c) and (d) were done very well. Candidates demonstrated an excellent grasp of the environmental issues surrounding fossil fuel use in the Caribbean. In addition, many were able to provide suitable recommendations to mitigate these negative effects.

Module 3 - Pollution and the Environment

Question 7

This question tested candidates understanding of a number of issues associated with air pollution: primary and secondary air pollutants, ozone as a pollutant, acid rain and its effects on vegetation. Candidates' ability to interpret and make inferences from graphical data was also tested.

In Part (a) (i), candidates were required to list two primary air pollutants; this part was generally well done. Most candidates were able to provide two primary air pollutants. For Part (a) (ii), candidates were asked why nitrogen dioxide was considered a secondary pollutant. Many candidates were unable to provide an explanation.

In Part (b) (i), candidates were required to state the conditions under which ozone is not considered to be a pollutant and in Part (b) (ii), they were required to explain the response given in (b) (i). Many students were able to answer Part (b) (i) correctly but were unable to explain their response.

Part (c) (i) required candidates to outline the formation of acid rain; this part was poorly done. Many candidates were unable to correctly outline the formation of acid rain. In Part (c) (ii), candidates were required to explain how acid rain results in the destruction of vegetation. This part was generally well done; most candidates were able to correctly explain how acid rain destroys vegetation.

In Part (d), candidates were provided with a graph, Figure 6, which was used to answer the questions that followed. In Part (d) (i), candidates were asked to identify the experimental site and the control site; this part was done very well, with most candidates correctly identifying both sites.

For Parts (d) (ii) and (d) (iii), candidates were asked to determine the days on which construction began and the days on which construction ended. Most candidates were able to identify these two days correctly. In Part (d) (iv), candidates were required to explain how they arrived at the answers for (d) (i) and (d) (ii). Performance on this section was satisfactory.

Question 8

In Part (a), candidates were provided with the results of a monitoring exercise in a graph, Figure 7.

Part (a) (i) required candidates to state the distance from the sewage plant where the dissolved oxygen concentration is lowest. For Part (a) (ii), they were required to state the lowest dissolved oxygen concentration in the river and in Part (a) (iv), they were required to determine the distance from the sewage plant where the river is completely without fish. Performance on Part (a) was satisfactory as most candidates were able to identify the various data parts on the graph.

In Part (b) (i), candidates were provided with Table 2 and asked to complete the table by providing the name of three water pollutants and one source of each pollutant. Most candidates were able to identify the names of the water pollutants, however, a significant number of candidates were unable to state the sources of the water pollutants.

In Part (b) (ii), candidates were required to outline how two of the pollutants in (b) (i) impact the environment. Performance on this part was very good; most candidates were able to describe the effect of water pollutants on the environment.

In Part (c), candidates were required to explain how a shark can have dangerous levels of mercury without coming into direct contact with the mercury and although the concentration of mercury in the ocean is extremely low. This part was poorly done as most candidates confused the terms bio-accumulation and bio-magnification.

In Part (d), candidates were provided with a table showing different methods for the determination of nitrates in water and the characteristics of these methods. Part (d) (i) required candidates to recommend, with reasons, one of the methods for a new laboratory while Part (d) (ii) required that they state the most important factor to consider when making the recommendation in (d) (i). In Part (d) (i), most candidates were able to correctly identify the best method for the new laboratory. However, in Part (d) (ii), a significant number of candidates failed to identify ‘cost’ as the most important factor.

Question 9

This question tested candidates understanding of bioremediation, the function of incineration, and its advantages and disadvantages as a waste disposal method. Candidates’ ability to interpret and make inferences from graphical data was also tested.

Part (a) (i) required that candidates define the term bioremediation and this was generally well done. Most candidates were aware that bioremediation involved removal of chemicals by biological means.

In Part (a) (ii), candidates were requested to look at the graph provided in Figure 8 and determine how long it took for the TPH level to drop to 60 per cent if its initial level. Performance on this part was very good as most candidates were able to read the information correctly from the graph.

In Part (a) (iii), candidates were required to determine from the graph the loss in actual TPH concentration by the end of the study; performance in this part was poor as candidates did not do the actual calculation but simply took a number from the graph.

In Part (a) (iv), candidates were asked to state how they knew that it was the new bacterial culture that accomplished the reduction shown in Figure 8. This was not done very well. Most candidates could not clearly explain why the loss in TPH observed in the graph could be associated with bacterial activity. Many candidates simply stated that the TPH in the experimental graph declined, but failed to indicate the vital information that *the killed control did not*.

In Part (b) (i), candidates were required to outline the functioning of incineration as a solid waste disposal technique. In Part (b) (ii), candidates were asked to discuss the following proposal. "Incineration is being considered in a number of Caribbean as an alternative to open landfills as a waste disposal technique".

Parts (b) (i) and (ii) were generally well done by the candidates. Most were able to outline the manner in which an incinerator functions, as well as provide well-developed pros and cons for incineration.

Paper 03/1 - Internal Assessment

The overall quality of the submissions for this unit was satisfactory. In most instances, an introduction to the journal was included. This was very useful in indicating the scope and purpose of the entries to the reader. This also helped to focus the students in making appropriate observations and interpretative comments. There was evidence of improvement in students' analysis and interpretation of results.

For the moderation process, it is important that teachers submit the mark schemes used for the laboratory exercises. These were missing in some instances.

The topics chosen for the journal were generally appropriate to the subject area and level of examination but the topics were rarely stated. While there were some reports that were grossly simplistic, others displayed superficial treatment of the topic, whether stated or implied.

It was often difficult to determine how many of the journals and laboratory exercises were organized. Justification for site selection was rarely stated. In too many instances, the laboratory exercises were not related to the site visits, and, in some instances, the site visits were not related to each other; it is clear in the syllabus guidelines that these should be interrelated.

Interpretative comments in the journals needed more depth; this can be achieved by using the laboratory results to help explain field observations.

In general, scores in Unit 2 were higher than scores in Unit 1, perhaps because Unit 2 is more structured in terms of journal entries and laboratory exercises.

Laboratory Exercises

Overall improvement was noted in the quality and relevance of laboratory exercises. In general, most students submitted an adequate number of laboratory exercises with satisfactory coverage of the criteria to be moderated. Only in a few instances were the spread of the laboratory exercises too narrow and the laboratory exercises chosen too simple for the level of examination.

While most students' work demonstrated adequate coverage of the skills to be assessed, there is still room for improvement in the areas of manipulation and measurement, and to a lesser extent, analysis and interpretation.

The laboratory exercises were mostly well done, although many were not related to the site visits. One area that needs improvement in the laboratory exercises is observation and recording. While in most cases, results were recorded, very few had descriptions of the actual laboratory observations.

For Unit 2, it is important to note that laboratory exercises should relate to each or any of the series of site visits.

Journal

Overall, there was improvement in the quality of journals submitted. The area of greatest improvement was reflected in students providing the required number of journal and laboratory entries. There were some students who were unable to link journal entries and laboratory exercises to specific objectives and conduct appropriate, complementary and supporting activities. Students should be reminded that the laboratory activities should be associated with the site visit and not treated as independent activities that are not related.

Students' inability to link objectives of site visits to the specific objectives in the syllabus resulted in many journals and laboratory activities reflecting objectives and activities related more to Unit 1 than to Unit 2. Students should always state and be guided by the specific objectives of the syllabus and the objectives for their journal activity. Students should always choose appropriate and adequate follow-up activities, present laboratory activities and journal entries in sequence and pay attention when writing chemical formulae for elements, compounds and ions.

There was improvement in the area of interpretative comments. This may be further improved if candidates develop the "habit of keen observation, relevant and precise reporting, concise recording and the ability for critical thinking, problem solving and decision making".

It cannot be overemphasised that the syllabus requires that journal entries should be based on either field visits to **one** site where changes over time are observed **OR** on visits to different sites to "compare and contrast similar processes or occurrences". In a few of the submissions, candidates visited different sites and so could not make valid comparisons since they examined different processes and occurrences and thus there was no basis for comparisons.

Paper 03/2 – Alternative to School-Based Assessment

Generally, there was improvement in the depth and breadth of coverage with respect to certain areas of the syllabus. However, greater effort must be made by candidates to improve their ability to organize, apply and communicate information.

Question 1

This question tested candidates' understanding of the way environmental testing can be used to deduce the source of environmental problems; the nature of eutrophication and its effects on marine environments and the mitigation methods that can be used to prevent it. Candidates' ability to analyse data in graphical and tabular form and interpret trends was also tested.

In this question, candidates were provided with a table which showed the results of a monitoring exercise of water samples.

In Part (a) (i), they were required to state what land use activity was responsible for the fish kills and in Part (a) (ii), they were asked to explain the answer provided for (a) (i).

Parts (a) (i) and (ii) were very poorly done by most of the candidates. Most of them could not recognize that the fish kills were as a result of eutrophication caused by nutrient run-off from the sugar plantation. Candidates did not combine the information from the map and the table to give a reasonable conclusion.

In Part (b) (i), candidates were required to describe the trend in the organic matter results in Table 1 and in Part (b) (ii) they were required to suggest a reason for the trend. Parts (b) (i) and (b) (ii) were not done very well. Most candidates were unable to identify the trend in organic matter results given in the table. This was because the candidates discussed the trends in *nitrate concentration* rather than that of the Biological Oxygen Demand (BOD), which would have been the correct parameter to give information on organic matter contamination in water. This indicated a lack of understanding of the major water pollution parameters and how they are measured.

In Part (c) (i), candidates were required to state the name of the process that caused the fish kills and in Part (c) (ii), they were required to explain how this process resulted in the fish kills. Parts (c) (i) and (ii) were generally well done, with most candidates naming eutrophication as the answer to Part (c) (i); however for Part (c) (ii), some candidates were unable to explain how eutrophication works.

For Part (c) (iii), candidates were asked to recommend and outline a mitigation method to prevent future fish kills. Part (c) (iii) was not done well, with most candidates unable to identify a suitable mitigation strategy.

Question 2

This question tested candidates' ability to present data in graphical form as well as to identify and describe trends from this data. In addition, the question also tested candidates' understanding of the functions of mangrove forests in the environment.

In Parts (a) (i), (ii) and (iii), candidates were required to use the results in Table 2 which was provided to plot a suitable graph, describe the trend in the graph and determine the slope of the graph from results 12 to 20. The performance on these parts was satisfactory. Most candidates were able to present the data in the table in graphical form as required in Part (a) (i). Some candidates were unable to extract the trends from the data as required in Part (a) (ii) and most candidates were unable to determine the slope of the graph for Part (a) (iii).

In Part (b) (i), candidates were required to indicate on the graph the period of the fire that destroyed a significant portion of the mangrove forest and give reasons to support their answer in Part (b) (ii).

Parts (b) (i) and (ii) were not well done. Most candidates were not able to identify when the fire occurred as required in Part (b) (i). The graph showed a sharp rise in nitrate concentration in Month 12, which is when the fire probably took place. Many candidates instead chose Month 40, which is when the nitrate concentration started to decline rapidly. Candidates were confused about the role of the mangrove in the nitrate concentration in the river and this was reflected in their answers. In Part b (ii), many candidates described the function of the mangrove in general and did not relate it to the manner in which it would affect a river — as was clearly the intent of the question.

Question 3

In Part (a) (i), candidates were required to define the term 'aquaculture'; this part was very well done with most candidates being able to correctly define aquaculture. For Part (a) (ii), candidates were required to use the sketch map provided to suggest a location for an aquaculture business; this part was done very well with most candidates being able to identify a suitable location for the aquaculture business.

In Part (a) (iii), candidates were required to outline the process of tilapia aquaculture and in Part (a) (iv) to provide two advantages and two disadvantages of aquaculture; this part was done very well with most candidates correctly outlining the process of aquaculture and providing appropriate advantages and disadvantages of aquaculture.

In Part (b) (i), candidates were provided with Table 1 which showed world data on wild and farmed fisheries and were required to plot a suitable bar chart to display the data in the table. For Part (b) (ii), they were asked to suggest and plot appropriate values for the year 2010.

Part (b) (i) was satisfactorily done with many candidates correctly representing the data in graphical form. Part (b) (ii) was not very well done; most candidates were unable to suggest and plot appropriate values for 2010.