

CARIBBEAN EXAMINATIONS COUNCIL

**REPORT ON CANDIDATES' WORK IN THE
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®**

MAY/JUNE 2012

ENVIRONMENTAL SCIENCE

GENERAL COMMENTS

In Unit 1, overall performance was comparable with that of 2011 with 94 per cent of candidates achieving Grades I–V. In terms of module performance, candidates did best on Module 3 (Sustainable Use of Natural Resources), followed by Module 1 (Fundamental Ecological Principles) and then Module 2 (Human Population and the Environment).

In Unit 2, 92 per cent of the candidates achieved Grades I–V compared with 93 per cent in the 2011.

Candidates performed best on Module 1 (Agriculture and the Environment), followed by Module 2 (Energy and the Environment) and then Module 3 (Pollution and the Environment).

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

Overall, candidates' performance was best on Module 3 followed by Module 1 and then Module 2.

Module 1: Fundamental Ecological Principles

Question 1

Candidates were provided with a graph which showed the variation of the population of duckweed, *lemna minor* with the concentration of agrochemicals in the effluent discharged from agricultural turns in close proximity to the duckweed.

Part (a) tested candidates' understanding of the concept of *limiting factor*. Very few candidates were able to adequately explain the concept. Candidates also did not pay attention to the fact that the question stated *other than agrochemicals* and many used this as an example.

Part (b) required candidates to describe the trend in population size of the duckweed shown in the graph. Most candidates were unable to interpret the data from the graph and therefore could not accurately describe the trend.

Part (c) required candidates to use the information in the graph to explain why the effluent concentration resulted in the observed trend and to explain how the variation in the duckweed population may impact on the population of other aquatic species. This part of the question was poorly done; most candidates were unable to interpret the data and therefore were not able to provide accurate explanations.

Question 2

Part (a) required candidates to distinguish between *gaseous biogeochemical cycles* and *sedimentary biogeochemical cycles* and to give examples of each. This part was well done with most candidates correctly distinguishing between the two types of cycles and giving correct examples.

Part (b) tested candidates' understanding of the *ten per cent rule* for the transfer of energy between trophic levels. Candidates were also required to state this rule and use it to explain why it is more efficient for humans to eat corn than to eat beef.

Candidates' performance on this question was less than satisfactory with less than 40 per cent of those who attempted the question scoring greater than 50 per cent of the available marks. Most candidates were unable to apply their knowledge of the ten per cent rule.

In Part (c), candidates were expected to use a pie chart showing forest area in three Caribbean countries to determine which two countries had a combined total of 50 per cent deforestation, which country would most likely have experienced the greatest loss of biodiversity, and to identify and justify the choice of a country where secondary ecological succession was least likely to occur.

Candidates' performance on this question was satisfactory; most of them were able to determine which two countries had a combined total of 50 per cent deforestation; they were also able to use the pie chart to identify the country with the greatest loss of diversity and the country where secondary ecological succession was least likely to occur, giving correct reasons for their choice.

Module 2: Human Population and the Environment

Question 3

Part (a) required candidates to define *per capita CO₂ emissions*. Candidates' performance on this part was satisfactory with most of them providing an accurate definition.

Part (b) required candidates to use the data in the table to calculate the total CO₂ emissions for the two countries and to use calculators to determine in which of the two countries the CO₂ emissions would have the greater impact on the environment.

Candidates' performance on this part was satisfactory. Many candidates were able to calculate the correct total carbon dioxide emissions and to determine the country where the emission of carbon dioxide would likely have the greater impact.

In Part (c), candidates were given the statement *When assessing the relationship between people and their environment, consideration must be given to abiotic and biotic factors* and were required to explain how extremes of temperature and fertile soil can affect the distribution and activities of human populations. This part was satisfactorily done with most candidates being able to provide accurate explanations.

Part (d) required candidates to discuss why some people believe that poverty tends to encourage population growth. Candidates' performance on this part of the question was poor. Too few candidates were able to expand on their points and make the connection between the statement and their discussion. There were too many assumptions and too little facts in the discussions presented.

Question 4

Part (a) presented information on environmental impacts of over-consumption of natural resources in two countries and candidates were required to determine in which country there would be a greater impact on natural habitats and in which country there would be a greater displacement of native species, giving reasons for their choices. This part was very well done, with the majority of candidates being able to adequately justify their choices.

Part (b) required candidates to outline one way in which a change in lifestyle could mitigate the environmental impacts of over-consumption of natural resources; this part was well done, with most candidates being able to outline one appropriate lifestyle change.

Part (c) required candidates to define the term *sustainable development*. This part was well done with most candidates correctly defining the term.

Part (d) required candidates to explain how fertility rates may impact on a country's ability to achieve sustainable development; this part was not very well done. Most candidates were only able to provide a partial explanation and were therefore only awarded some of the allocated marks.

Part (e) required candidates to suggest, with justification, an appropriate fertility rate that would allow Caribbean countries to achieve sustainable development. While the majority of candidates were able to suggest an appropriate fertility rate, they were not able to adequately justify the suggestion.

Module 3: Sustainable Use of Natural Resources

Question 5

Part (a) required candidates to study the graphic information presented on tree density variation for three Caribbean countries and to use the information to make deductions. Candidates did not perform very well on this part; they demonstrated limited skills at reading graphs and making deductions from graphs.

Parts (b) (i) and (ii) tested candidates' understanding of the concept of consumptive versus non-consumptive use of natural resources. Most candidates performed very well on this part of the question; candidates were able to provide accurate examples of consumptive use of natural resources important to the Caribbean as well as to adequately explain the environmental impacts of tourism as a non-consumptive use of beaches.

In Parts (b) (iii) and (iv), candidates were required to comment on the appropriateness of conservation measures. Performance on this part was satisfactory with some candidates being able to identify which measure was appropriate. However, quite a few candidates did not link the measures to the proposed development.

Question 6

For Part (a) (i), most candidates were able to give correct examples of renewable and non-renewable natural resources.

Part (a) (ii) was poorly done as only a few candidates were able to discuss the effect of geographical and technological factors on the use of natural resources and give suitable responses as required by the question.

Candidates' performance on Part (b) was less than expected. Too many candidates did not demonstrate adequate skills at reading and interpreting the data that was presented in the table. Candidates had difficulty describing the patterns in population growth and gravel extraction and also in explaining the relationship between population growth and gravel extraction as illustrated in the table. Candidates were not able to suggest appropriate ways to mitigate the negative impacts on the environment due to gravel extraction.

Paper 031 – School-Based Assessment (SBA)

Students' performance on the SBA was satisfactory. Teachers must be reminded that journal entries are to be based on either field visits to one site where changes over time are observed or visits to different sites to compare and contrast similar processes or occurrences. This was done by most students. However, there are still some students with insufficient site visits.

In general, most students submitted an adequate number of laboratory exercises which were mostly well done. In a few instances, the spread of the laboratory exercises was too narrow and the laboratory exercises chosen were 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, planning and designing and analysis and interpretation.

The quality of the journals submitted was satisfactory. However, there were some students who were unable to link journal entries and laboratory exercises to specific objectives and conduct appropriate, complementary and supporting activities. Teachers and students should be reminded that the laboratory activities should be associated with the site visits and not treated as independent activities that are not related.

Paper 032 – Alternative to School-Based Assessment

Question 1

In Part (a), candidates were provided with diagrams of two ecological pyramids and were required to describe how energy flows within an ecosystem, and state, with a reason, which diagram represented a pyramid of biomass. While most candidates were able to accurately describe how energy flows within an ecosystem, only a few candidates were able to correctly identify the pyramid of biomass and give a supporting reason.

In Part (b), candidates were required to use the data on a predator and prey population presented in a table to draw a graph and compare the trends in the population size of the two populations. They were also asked to describe ways in which predation may benefit the prey population. Many candidates had difficulty plotting the graph to represent the data and comparing the trends in the population size of the two populations. However, most candidates were able to correctly describe ways in which predation benefited the prey population.

In Part (c), candidates were required to discuss three ways in which human activities can disrupt the integrity of natural ecosystems. Candidates' performance on this part was good with most candidates being able to adequately describe ways by which human activities disrupt the integrity of natural ecosystems.

Question 2

Part (a) tested candidates' understanding and knowledge of the human development index (HDI) and gender development index (GDI).

Too few candidates demonstrated an understanding of HDI and GDI and the role of these indices in assessing the relationship between population growth, development and poverty. Only a few candidates were able to state three deductions regarding the relative achievement of both countries based on their HDI and GDI.

Part (b) required candidates to discuss how improving access to education for women in less developed countries (LDCs) can contribute to the lowering of the population growth rate of LDCs. This part of the question was very well done by most candidates.

Part (c) required candidates to use the data provided to calculate the estimated percentage growth in the world population attributable to LDCs between 1995 and 2025. Candidates were also required to state the implications of this estimated population growth for an LDC. This part of the question was not done very well. It was obvious from the responses that candidates did not know how to do the calculation and did not understand how the estimated population growth rate could affect population growth in an LDC.

Question 3

Part (a) required candidates to use the information in a graph to compare changes in the quantity of two resources over a ten-year period; this part was poorly done as most candidates were unable to interpret and make deductions from the graph.

Part (b) required candidates to state two reasons why bioprospecting is considered a non-consumptive use of natural resources; only a few candidates demonstrated knowledge of bioprospecting.

Part (c) required candidates to explain how population growth and public awareness can affect the manner in which a country uses its natural resources; this part was very well done by most candidates.

Part (d) required candidates to discuss how the use of environmental legislation can assist efforts for the conservation and protection of natural resources; this part was very well done by most candidates.

UNIT 2

DETAILED COMMENTS

Paper 01 – Multiple Choice

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

Paper 02 – Essay Questions

Module 1: Agriculture and the Environment

Question 1

Part (a) required candidates to state three characteristics of subsistence agricultural systems and most candidates were able to correctly state the characteristics.

Part (b) required candidates to discuss reasons why natural disasters were threats to sustainable agriculture. Most of the responses to this part were very good with the majority of candidates correctly discussing reasons why natural disasters threatened sustainable agriculture.

Part (c) (i) required candidates to make three deductions about the impact of agriculture on the environment from a pie chart; this part proved difficult for most candidates. Many candidates simply copied the percentages from the chart for their answer.

Part (c) (ii) required candidates to determine the total impact of agriculture on the environment. This part was poorly done by most candidates.

Part (c) (iii) required candidates to provide three reasons why land degradation in the chart was as high as 42 per cent. Most candidates were unable to identify practices that would lead to land degradation and to explain why these practices would lead to land degradation.

Question 2

Part (a) required candidates to state four features of sustainable agriculture; this part was well done with most candidates correctly stating features of sustainable agriculture.

Part (b) required candidates to make four deductions about the use of different types of pest control methods from the data provided in a stacked bar chart. Most responses were good because they included correct and appropriate deductions.

Part (c) required candidates to explain why a decline in agricultural production may be detrimental to the economy of some Caribbean countries. This was satisfactorily done with some candidates being able to provide adequate explanations.

Part (d) required candidates to discuss why agro-forestry and conservation were considered environmentally sustainable agricultural practices. The responses to this part were very good.

Module 2: Sustainable Energy Use

Question 3

Part (a) (i) required candidates to define the term *energy efficiency*; this was poorly done as most candidates were unable to correctly define the term.

Part (a) (ii) required the candidates to use the data provided in a bar chart to determine the percentage of energy output that was in a beneficial form. This response was good as most candidates were able to read the graph and perform the required calculation.

Part (a) (iii) required candidates to use the bar chart to determine how much energy was lost as unnecessary energy waste. This part was poorly done as candidates were unable to do the calculation correctly.

Part (a) (iv) required candidates to suggest three ways in which the country could improve its energy efficiency. Most candidates provided responses that were good, suggesting appropriate ways that could be used to improve energy efficiency.

Part (b) (i) required candidates to define the term *kinetic energy* and this was poorly done as most candidates were unable to provide a correct definition.

Part (b) (ii) required candidates to explain, using a suitably labelled diagram, how wind energy is harnessed to produce electricity. The responses provided were good and contained clear, well and fully labelled diagrams illustrating a windmill, along with appropriate text to explain how the windmill worked to generate the electricity.

Question 4

Part (a) required candidates to provide two reasons why a small Caribbean country would consider diversifying its energy sources and using less fossil fuels. This part was very well done, with most candidates being able to suggest appropriate reasons.

Part (b) (i) required candidates to define the term *renewable energy*. This part was very well done by candidates.

Part (b) (ii) required candidates to identify and justify suitable sources of renewable energy for the island depicted in a diagram. This question was very well done with the majority of candidates accurately identifying, with appropriate justification, suitable sources of renewable energy.

Part (c) (i) required candidates to determine, from a graph, what percentage of commercial energy is derived from renewable sources. This part was poorly done as most candidates were unable to perform the calculation correctly.

Part (c) (ii) required candidates to compare the amount of commercial energy obtained from renewable energy in the United States with that of the rest of the world and to suggest a reason for the difference. This part was not well done as only a few candidates were able to adequately make the comparison and suggest a suitable reason.

Module 3: Pollution of the Environment

Question 5

Part (a) (i) required candidates to define the term *BOD*; this part was poorly done as most candidates were unable to provide a correct definition.

Parts (a) (ii) and (iii) required candidates to use their understanding of BOD and the processes which occur in a sewage treatment plant to determine from the graph provided the number of times the sewage treatment plant malfunctioned, explaining how they arrived at this number. These parts were poorly done as most candidates were unable to give the accurate number of times the plant malfunctioned and explain the method used to determine the answer.

Part (a) (iv) required candidates to identify from the graph the first and last days of the longest plant malfunction. This was poorly done as most candidates were unable to identify the first and last days.

Part (a) (v) required candidates to use the graph to determine the average BOD concentration when the plant was operating normally. This was done very poorly with the majority of candidates unable to determine when the plant was operating normally.

In Part (b), candidates were given a diagram and asked to describe the pathway of heavy metal pollution in the river. Candidates were also required to explain why the concentration of heavy metals is much higher in oysters in the swamp at the mouth of the river than in the water higher up the river. Candidates' responses were satisfactory for this part as most of them were able to correctly describe the pathway and provide an adequate explanation for the difference in concentration.

Question 6

Part (a) required candidates to define the term *pollutant*; this part was well done as most candidates were able to correctly define the term.

Part (b) required candidates to discuss the statement *the institutional framework within a country can be an underlying cause of air pollution*. This part was poorly done as most candidates did not understand the term *institutional framework*.

Part (c) (i) required candidates to describe the formation of acid rain using appropriate chemical equations. This part was not well done as most candidates were only able to provide a partial description and the responses were not clear and concise.

Part (c) (ii) required candidates to outline an experimental method to determine if there was an acid rain problem in an entire country. This part was poorly done by most candidates as they were unable to correctly describe the experimental techniques required to conduct the investigation.

Paper 031 – School-Based Assessment (SBA)

There was an improvement in the overall performance on the SBA and also in the quality of journals submitted.

Some students conducted the requisite number of site visits. However, there are still too many students with insufficient site visits. Teachers and students must be reminded that formal entries are to be based on either field visits to one site where changes over time are observed or visits to different sites to compare and contrast similar processes or occurrences.

Teachers and students need to spend more time developing the following laboratory skills:

- Manipulation and measurement
- Analysis and interpretation
- Planning and designing

Teachers need to ensure that students always use the most appropriate data collection techniques and a variety of formats to present data.

Paper 032 – Alternative to School-Based Assessment

In this paper, there is room for 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.

Question 1

Part (a) required candidates to describe the characteristics of a small dairy farm with respect to inputs and productivity. This part of the question was very well done by most candidates.

Part (b) tested candidates' ability to present data in a graphical form. While candidates' performance on this part of the question was fair, some candidates had difficulty plotting a suitable graph to illustrate the data.

Part (c) required candidates to suggest ways in which the farmer whose waste management practices were presented in the stimulus could be improved and to discuss an environmental impact which could result if the waste management practices were not improved. Most candidates performed poorly on this part as they seemed unfamiliar with waste management practices.

Part (d) required candidates to study the scenario that was presented and name environmentally sustainable practices the farmer could implement to address his use of the steep hill for the new expansion and also to discuss an environmental impact that may occur if the farmer does not implement any of the practices that were identified. Candidates' performance on this part of the question was good with most of them being knowledgeable about the topic of environmentally sustainable practices.

Question 2

Part (a) (i) required candidates to interpret data on a graph by describing the trends in energy use of the farmer; this part was poorly done as most candidates were unable to interpret the data in the graph correctly.

Part (a) (ii) required candidates to use the pattern of the graph to make a projection; this part was poorly done as candidates were unable to calculate the number of 50-watt hour solar panels required to meet the projected electricity needs of the farm.

Part (a) (iii) required candidates to explain how photovoltaic cells converted solar energy into electricity; this part was poorly done as most candidates did not know how photovoltaic cells converted solar energy into electrical energy.

Part (a) (iv) required candidates to justify the accuracy of the statement *Petroleum can be described as indirect solar power*. This part was poorly done by most candidates who were unable to provide reasons to justify the accuracy of the statement.

Part (b) required candidates to state factors which affected electricity-generating capacity and demand and to use a labelled diagram to describe the conventional generation of electricity. This part was very well done by most candidates who provided accurate factors that affected electricity-generating capacity and demand, and were able to use a labelled diagram accurately to describe the conventional generation of electricity.

Question 3

Part (a) tested candidates' understanding of the greenhouse effect and the role and composition of greenhouse gases. Most candidates did well on this part of the question. Candidates demonstrated that they were knowledgeable about the topic of the greenhouse effect.

Part (b) required candidates to use the data presented to calculate the average weekly methane emissions and to record the data in an appropriate table. Candidates were also required to plot a bar chart to represent the average weekly methane emissions. Candidates' performance on this part of the question was satisfactory with some of them being able to correctly calculate the average weekly methane emissions and to present the information in the form of a bar chart.

Part (c) required candidates to provide reasons why the farmer should try and capture the methane emissions from his dairy cattle and to outline a method that the farmer could use to capture the methane emissions from his cows.

Candidates' performance on this part was poor; most candidates were unable to give reasons for the capture of the methane emissions and to outline a method for capturing the methane emissions.