

CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Advanced Proficiency Examinations CAPE[®]

ENVIRONMENTAL SCIENCE SYLLABUS

Effective for examinations from May/June 2011

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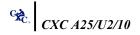
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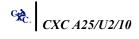
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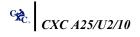


This document CXCA25/U2/10 replaces CXC A25/U2/04 issued in 2004.

Please note that the syllabus has been revised and amendments are indicated by italics.

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Please check the website <u>www.cxc.org</u> for updates on CXC's syllabuses.

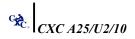


Introduction

The Caribbean Advanced Proficiency Examinations (CAPE) are designed to provide certification of the academic, vocational and technical achievement of students in the Caribbean who, having completed a minimum of five years of secondary education, wish to further their studies. The examinations address the skills and knowledge acquired by students under a flexible and articulated system where subjects are organised in 1-Unit or 2-Unit courses with each Unit containing three Modules. Subjects examined under CAPE may be studied concurrently or singly.

The Caribbean Examinations Council offers three types of certification. The first is the award of a certificate showing each CAPE Unit completed. The second is the CAPE diploma, awarded to candidates who have satisfactorily completed at least six Units, including Caribbean Studies. The third is the CAPE Associate Degree, awarded for the satisfactory completion of a prescribed cluster of seven CAPE Units including Caribbean Studies and Communication Studies. For the CAPE diploma and the CAPE Associate Degree, candidates must complete the cluster of required Units within a maximum period of five years.

Recognized educational institutions presenting candidates for a CAPE Associate Degree in one of the nine categories must, on registering these candidates at the start of the qualifying year, have them confirm in the required form, the Associate Degree they wish to be awarded. Candidates will not be awarded any possible alternatives for which they did not apply.





Environmental Science

RATIONALE

Science plays a major role in the evolution of knowledge by empowering us with the skills required for creative and independent problem-solving. It arouses our natural curiosity, encourages our ability to enquire, to pose questions, and to conduct research required to obtain answers. This approach leads to the construction of hypotheses, theories and laws that help us to explain natural phenomena, to understand human activities in relation to natural phenomena, and through this to meet the challenge of survival and progress in a diverse and changing world.

The environment and natural resource base of the Caribbean are critical for the welfare of Caribbean people. Natural resource and environmental management and conservation are pre-requisites for sustainable development in the region. Achieving sustainable development requires an appreciation of the value of natural resources and the environment, and the development of the knowledge base and skills required for effective management. A firm grounding in these skills, knowledge and attitudes is provided through a study of Environmental Science.

Environmental Science is an interdisciplinary subject which draws on the content of several disciplines to offer a balanced scientific and holistic perspective of environmental issues. It provides knowledge, skills and attitudes to identify, prevent and solve environmental problems and thereby prepares students for ultimate careers in diverse fields of relevance to environmental management and to sustainable development of the Caribbean Region.

This CAPE syllabus in Environmental Science presents a coherent course of study which provides a specific knowledge base of the environment and which facilitates the development of related skills and attitudes. The syllabus takes into account the requirements for tertiary education at regional and international institutions. It is intended for a wide range of students, including traditional sixth form students, part-time, mature and private students.

This syllabus will contribute to the development of the Ideal Caribbean Person as articulated by the CARICOM Heads of Government in the following areas: respect for human life and awareness of the importance of living in harmony with the environment; multiple literacies; independent and critical thinking and the innovative application of science and technology to problem solving. Based on the UNESCO Pillars of Learning, this course of study will also contribute to a person who will learn how to do, learn to live together and learn to transform themselves and society.





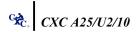
The syllabus aims to:

- 1. stimulate interest in the environment;
- 2. develop an understanding of the interdisciplinary and holistic nature of the environment;
- 3. develop knowledge and understanding of environmental issues and principles and the ability to apply these to environmental management, particularly in a Caribbean context;
- 4. develop the ability to identify critical research questions and formulate hypothesis or guiding statements.
- 5. develop the ability to collect, collate, analyze and interpret environmental data;
- 6. develop the ability to communicate environmental information and ideas logically and concisely in a variety of forms;
- 7. provide an understanding of interactions between people and the environment;
- 8. *increase an awareness of the importance of living in harmony with the environment;*
- 9. recognize and evaluate the socio-economic, political and ethical issues in Environmental Science;
- 10. foster positive attitudes, values and commitment to identifying, solving and preventing environmental problems;
- 11. develop an understanding of how natural resources and the environment affect quality of life and the quest for sustainable development in the Caribbean.

SKILLS AND ABILITIES TO BE ASSESSED

The skills and abilities which students are expected to develop on completion of the syllabus have been grouped under three main headings:

- (i) Knowledge and Comprehension;
- (ii) Application of Knowledge;
- (iii) Practical *Abilities*.



Knowledge and Comprehension

The examination will test candidates' skills and abilities to:

- (i) Define terms and explain concepts;
- (ii) describe processes;
- (iii) state principles and properties;
- (iv) explain interactions and inter-relationships.

Application of Knowledge

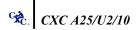
The examination will test candidates' skills and abilities to:

- (i) analyze and discuss different environmental situations;
- (ii) evaluate and justify options (for the use of resources);
- (iii) compare and contrast alternative solutions to environmental problems;
- (iv) select techniques and methodologies appropriate to different environmental situations;
- (v) suggest possible solutions to specific environmental problems;
- (vi) draw inferences from environmental data.

Practical Abilities

The examination will test candidates' skills and abilities to:

- (i) select techniques, designs, methodologies and instruments appropriate to different environmental situations;
- (ii) use instruments to measure environmental parameters;
- (iii) collect and collate data;
- (iv) analyze, interpret and present data;
- (v) *use quantitative techniques appropriately;*
- (vi) *develop appropriate solutions to specific environmental problems.*



PRE-REQUISITES OF THE SYLLABUS

Any person with a good grasp of the contents of the Caribbean Secondary Education Certificate (CSEC) Integrated Science or Physics or Chemistry or Biology or Geography or Agricultural Science syllabuses, or the equivalent, should be able to pursue the course of study defined by the syllabus. However, successful participation in the course of study will also depend on the possession of good verbal and written communication skills.

• STRUCTURE OF THE SYLLABUS

The subject is organised in two Units. Each Unit contains a body of knowledge and skills drawn from several disciplines that impact on the environment. Unit 1 addresses Ecology, Human Population and Natural Resource Use, while Unit 2 deals with Agriculture, Energy, and Environmental Pollution.

A Unit comprises three Modules, each requiring 50 hours. The total time for each Unit, is therefore, expected to be 150 hours. Each Unit can independently offer students a comprehensive programme of study with appropriate balance between depth and coverage to provide a basis for further study in this field.

UNIT 1: Ecology, Human Population and Natural Resources

- Module 1 Fundamental Ecological Principles
- Module 2 Human Population and the Environment
- Module 3 Sustainable Use of Natural Resources

UNIT 2: Agriculture, Energy and Environmental Pollution

- Module 1 Agriculture and the Environment
- Module 2 Energy *and the Environment*
- Module 3 Pollution of the Environment

In this syllabus, the specific objectives which are denoted by an asterisk (*) are particularly suitable for practical exercises. However, the project need not be limited to these objectives.

UNIT 1: ECOLOGY, HUMAN POPULATION AND NATURAL RESOURCES MODULE 1: FUNDAMENTAL ECOLOGICAL PRINCIPLES

GENERAL OBJECTIVES

On completion of this Module, students should:

- 1. understand the basic ecological concepts;
- 2. understand the processes that govern the interactions of organisms with the biotic and abiotic components of their environment;
- 3. understand the relationship between people and the environment;
- 4. acquire knowledge and develop practical and analytical skills.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. differentiate between key ecological terms and concepts;
- 2. explain the relationship between living organisms and their environment;

Ecology: species, population, community, ecosystem, biosphere, atmosphere, hydrosphere, lithosphere, habitat, niche, biome, ecotone.

- (i) The biotic and abiotic environments.
- (ii) Tolerance ranges and limiting factors.
- (iii) Ecological niches:
 - (a) fundamental niche;
 - (b) realised niche.

SPECIFIC OBJECTIVES

Students should be able to:

3. outline importance the of biogeochemical cycles;

EXPLANATORY NOTES

- Carbon Cycle. (i)
- Nitrogen Cycle. (ii)
- Phosphorus Cycle. (iii)
- Water Cycle. (iv)

Include basic chemical equations and formula for biogeochemical cycles.

- 4. Explain the significance of biogeochemical cycles to organisms;
- 5. explain how energy and nutrients flows within ecosystems;

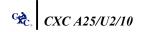
- discuss types of interactions between 6. organisms in communities;

- 7. explain how ecosystems are selfsustaining;
- 8. explain the process of natural selection and adaptation to the environment;

- (i) Productivity of producers and ecosystems.
- Food chains and webs. (ii)
- (iii) Trophic levels.
- Ecological pyramids. (iv)
- (i) Competition.
- (ii) Predator-prey.
- (iii) Symbiosis:
 - parasitism; (a)
 - (b) commensalism;
 - (c) mutualism.

Ecological succession and climax communities.

Natural selection, evolution and adaptation.



SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

9. determine population size using appropriate sampling methods;

Population sampling methods for moving and non-moving organisms (for example, quadrats, transects, capture, mark, release, recapture).

10. calculate species diversity;

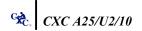
$$D = \frac{\sum n (n - 1)}{N (N - 1)}.$$

- Where D species Diversity
 - N total number of organism of all species
 - n total number of organism of a particular species
- (i) Diversity within species.
- (ii) Diversity between species.
- (iii) Community and ecosystem stability.
- (i) Biotic potential.
- (ii) Exponential population growth.
- (iii) Environmental resistance.
- (i) Human beings as part of the natural ecosystems.
- (ii) Benefits of natural ecosystems.
- (iii) Anthropogenic impact on ecosystems and *biodiversity* and the need to maintain its integrity.

Consider both terrestrial and aquatic (freshwater and marine) ecosystems.

- 11. analyse the relationship between species diversity and ecosystem stability;
- 12. identify factors affecting population growth in a natural ecosystem;
- 13. explain the concept of carrying capacity;
- 14. evaluate human interactions within natural ecosystems;

15. investigate at least two ecosystems in a territory;*



16.

- measure and discuss environmental parameters in a given habitat;*
- 17. *apply* scientific *method* to *experimental design and analysis;*

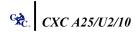
See suggested teaching-learning activities.

18. Present and interpret data using appropriate charts, table, graphs.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. *Define environmental science*
- 2. Formulate hypothesis, develop guiding statements and generate and interpret data.
- 3. Discuss current environmental issues and highlight the importance of adopting an interdisciplinary approach.
- 4. Sample an ecosystem to determine population density and distribution.
- 5. *Conduct study visits, to identify species diversity.*
- 6. Investigate environmental parameters in a *natural aquatic environment*.
- 7. Create models of existing ecosystems in a specific location.
- 8. Create food webs and analyse possible disruption of feeding relationships.
- 9. Study the source(s) and distribution of a country's freshwater supply and its level of dependence on natural water cycles.
- 10. Visit to an ecosystem to identify and quantify human use of its components.



RESOURCES

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Chiras, Daniel D.	<i>Environmental Science. Action for a Sustainable Future,</i> United States of America: The Benjamin/Cummings Publishing Company Inc., 1994.
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Ehrlich, P. and Ehrlich, A.	<i>The Population Explosion</i> , New York: Simon and Schuster, 1990.
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Jordan, C.	Conservation, New York: John Wiley and Sons, 1995.
Miller, G. Tyler	<i>Living in the Environment, Principles, Connections and Solutions</i> : Wadsworth Publishing, California, 1994.
Nebel, B. and Wright, R.	<i>Environmental Science: The Way the World Works,</i> New Jersey: Prentice Hall, 1997.
	The Cropper Foundation (TCF), 2009. Sustainable Development. Terms and concept: A reference for teachers and student. Port-of-Spain, Trinidad
	Biodiversity of the Caribbean. A learning Resource prepared for Eastern Caribbean States, Canada: EKOS Communications Inc. 2009.

Websites: <u>www.redlist.org/info/captions</u> <u>www.biomeso.net</u> <u>bioplan@undp.org</u>



UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

- 1. understand the historical and geographical trends in human population growth and consumption patterns;
- 2. understand the socio-environmental impacts related to population growth;
- 3. understand the factors that affect the growth rate of human populations;
- 4. appreciate the need for sustainable development;
- 5. acquire knowledge and develop practical and analytical skills.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. assess the relationship between people and the environment;
- (i) Adaptation of people to the environment (including but not limited to how people adapt to the environment, crops they grow, culture, clothes, shelter).
- (ii) Abiotic and biotic factors that affect the distribution of population and their activities.
- (iii) Dependence of people on ecological systems and processes.
- (i) Age and sex structure.
- (ii) Fertility rates.
- (iii) Mortality rates.
- (iv) Life span and life expectancy.
- (v) Immigration.
- (vi) Emigration.
- (vii) Doubling time.

2. explain the demographic characteristics of human population;

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UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT (conf'd)

SPECIFIC OBJECTIVES

Students should be able to:

- 3. describe historical trends in human population size;
- 4. describe the current geographical distribution of human population growth;
- 5. interpret demographic tables, graphs and charts;
- 6. calculate changes in demographic characteristics;

EXPLANATORY NOTES

Compare historical and current trends in human population growth.

Current geographical distribution of human population growth:

- (i) in developing nations;
- (ii) in developed nations.
- (i) Age and sex structure.
- (ii) Fertility rate, mortality rate, birth rate,
- (i) Population size and growth rate. Fertility rate; mortality rate; migration rate, birth rate.
- (ii) Percentage increase in population

(iii) Doubling time =
$$\frac{70}{\%}$$
 annual growth.

- (i) Culture.
 - (ii) Religion.
 - (iii) Level and cost of education.
 - (iv) Social and economic status of women.
 - (v) Availability of pension schemes.
 - (vi) Level of affluence.
 - (vii) Economic development.

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7. assess the factors affecting population growth rate;

UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT (cont'd)

geographical

consumption

SPECIFIC OBJECTIVES

Students should be able to:

- 8. assess the effectiveness of population control methods and measures;
- 9. assess the relationship between population growth and poverty;

current

in human

EXPLANATORY NOTES

Population Control Measures:

- (i) Direct Family Planning measures and methods, government policies
- (ii) Indirect Natural disasters (floods, earthquakes, volcanoes, hurricanes).
- (i) The Indices of poverty:
 - (a) access to education;
 - (b) access to health care;
 - (c) access to basic needs such as food, housing, water.
- (ii) Per capita, Gross Domestic Product and Gross National Product (GDP and GNP), Human Development Index (HDI), Gender Development Index (GDI).
- (iii) Environmental impacts of population growth (for example, *deforestation in* Haiti. Include social, biological, economic, physical considerations).
- (i) Consumption patterns as quantified by statistics on:
 - (a) per capita water consumption;
 - (b) per capita food consumption;
 - (c) per capita fuel consumption;
 - (d) per capita greenhouse gas emissions;
 - (e) per capita waste production.

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describe

patterns;

variation

10.

UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT (conf'd)

SPECIFIC OBJECTIVES

Students should be able to:

11. explain the principal ways in which people impact negatively on the environment;

12. explain how the impacts mentioned in Specific Objective 11 may be mitigated;

- 13. explain the environmental impacts of urbanisation;
- 14. explain the relationship between population growth and sustainable development.

EXPLANATORY NOTES

(ii) Current trends in per capita consumption particularly influenced by lifestyles in developed and developing countries.

Environmental impacts of over consumption in developed and developing countries.

- (i) Overexploitation.
- (ii) Habitat destruction.
- (iii) Pollution.
- (iv) Introduction of exotic species.
- (i) Change in lifestyles.
- (ii) The use of substitutes.
- (iii) Application of environmentally friendly technology.
- (iv) Efficient use of natural resources, for example, recycling. Refer to Module 3, Specific Objective 10.
- (i) Causes of urbanisation.
- Environmental impacts of urbanisation (including but not limited to sanitation, water supply, traffic congestion, housing, pollution, health care).
- (i) Concept of sustainable development.
- (ii) Goals of sustainable development.



UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT (cont'd)

- (iii) Population growth and changing consumption patterns as constraints to sustainable development in a finite world.
- (iv) Strategic Imperative for Sustainable Development #4 "Ensuring a Sutainable Level of Population" (Our Common Future, Brundtland Report, 1987).

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. Study a local population based on census statistics; generate population age structure, for all individuals and separately by sex.
- 2. Calculate crude birth rates, age-specific birth rates, total fertility rates, crude death rates, agespecific death rates, infant mortality rates, percentage annual increase in population size, and doubling times for populations.
- 3. Interpret World Population Data Sheets, as produced, for example, by the Population Reference Bureau Inc.
- 4. Arrange a debate on high population growth or high consumerism as principal causes of global environmental problems, using, for example, reports from the 1992 Rio Conference.
- 5. Conduct case studies of population size management and of related changes in consumption patterns.
- 6. Organise a debate on the definitions of development and sustainable development, and on the question of what constitutes an acceptable standard of living.
- 7. Discuss the main issues addressed by:
 - (i) the 1972 Stockholm Conference;
 - (ii) the 1980 International Union for the Conservation of Nature (IUCN) World Conservation Strategy;
 - (iii) the 1987 Brundtland Report (Our Common Future);

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UNIT 1 MODULE 2: HUMAN POPULATION AND THE ENVIRONMENT (cont'd)

- (iv) the 1992 United Nations Conference on Environment and Development (The Rio Conference);
- (v) the 1994 United Nations Conference on Small Island Developing States;
- (vi) the 2002 World Summit on Sustainable Development *Johannesburg*.

RESOURCES

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WWF, IUCN, UNEP	Caring for the Earth: A Strategy for Sustainable Living, 1981.
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ments/agenda21/index.htm	Biodiversity of the Caribbean. A learning Resource prepared for Eastern Caribbean States, 2009. Canada: EKOS Communications Inc.

GENERAL OBJECTIVES

On completion of this Module, students should:

- 1. be aware of the major 'natural resources' in the Caribbean;
- 2. understand the factors affecting natural resource use and the environmental impacts of their use;
- 3. be aware of measures and tools available for sustainable use and conservation of natural resources;
- 4. understand the value of natural resources;
- 5. understand the concept of ecological sustainability and implications for natural resource use;
- 6. acquire knowledge and develop practical and analytical skills.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. explain the term natural resources;
- 2. differentiate between renewable and non-renewable natural resources; exhaustible and inexhaustible resources;
- 3. differentiate between the consumptive and non-consumptive use of natural resources;

Temporal Dimensions and limitations placed by technology.

- (i) *Types and examples of natural resources: renewable and non-renewable.*
- (ii) *Types and examples of exhaustible and inexhaustible resources.*
- (i) Consumptive use (logging, fishing, quarrying).
- (ii) Non-consumptive use bioprospecting, ecotourism, research.

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SPECIFIC OBJECTIVES

Students should be able to:

4.

identify the major categories of natural
resources in Caribbean countries;

EXPLANATORY NOTES

- (i) Biodiversity:
 - (a) species (b) genetic
 - (c) Ecosystems: forest; coral reefs; wetlands; seagrass beds; mangroves; freshwater *and marine* ecosystems.
- (ii) Water as a resource, for example, waterfalls, lakes, streams, groundwater.
- (iii) Minerals and hydrocarbons: bauxite; gold; sand and gravel; oil; natural gas.
- (iv) Soil, landscape and seascape, (beaches, cliffs, mountains).
- 5. identify the location and distribution of natural resources in the Caribbean;
- 6. assess the importance of natural resources in the Caribbean;
- (i) Livelihood (Income generating activity).
- (ii) Foreign exchange earner.
- (iii) Food security.
- (iv) Raw material for industrial processes.
- (v) *Recreation*.
- (vi) Sacred and spiritual value.
- (vii) Ecosystem value.
- (viii) Intrinsic value.
- (ix) *Research and teaching.*

SPECIFIC OBJECTIVES

Students should be able to:

7. evaluate factors affecting natural resource use in the Caribbean;

EXPLANATORY NOTES

- (i) Political government policies on natural resource use:
 - (a) economic development policies;
 - (b) environmental and natural resources policies.
- (ii) Economic: role of foreign investment; export of natural resources as primary products; sectoral activities - tourism, agriculture, mining, manufacturing, national debt.

Refer to Specific Objective 10, Explanatory Note (iv).

- 8. access the environmental impact of natural resource use including tourism;
- (i) Biodiversity:
 - (a) species depletion and extinction;
 - (b) habitat disruption and destruction;
 - (c) disruption of ecosystem processes.

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SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

- (ii) *Water as a resource:*
 - (a) Pollution and depletion of surface and groundwater, degradation of water, depletion of aquifers. Human health risks (water borne disease)
 - (b) watershed destruction.
- (iii) *Minerals* and hydrocarbons:
 - (a) physical conversion of vegetation and land;
 - (b) transformation of landscape
 - (c) dust and noise pollution;
 - (d) pollution from the discharge of process chemicals;
 - (e) sedimentation and siltation;
 - (f) *beach loss and change in river course;*
 - (g) oil spills;
 - (h) *human health risks;*
 - (i) social dynamics (displacement of communities and introduction of new settlements).

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SPECIFIC **OBJECTIVES**

Students should be able to:

EXPLANATORY NOTES

- (iv) *Soil, landscape and seascape:*
 - transformation of natural (a) landscape to built environment;
 - (b) soil degradation, erosion and sedimentation; soil productivity
 - beach erosion (c)
 - (d) degradation and destruction of coral reefs, seagrass beds and mangroves
 - The broad concept of natural resource conservation including: management; rehabilitation; restoration; preservation; conservation (in-situ and ex-situ).
 - *Reasons* for resource conservation:
 - (a) ecological: depletion or degradation of natural resources and the threat to sustainable development; conservation of components of life support systems; conservation of endangered and threatened species;
 - ethical: sacredness; right to exist;
 - (c) aesthetical value

9. justify the need for (v) natural resource conservation;

Soil. landscape and (i) seascape:

- transformation (e) of natural landscape to (ii) built environment;
- (f) soil degradation, erosion and sedimentation; soil productivity
- (g) beach erosion
- (h) degradation and (b) destruction of coral reefs, seagrass beds and mangroves



10. describe measures and tools available for natural resource management and conservation;

- (i) Rates and techniques for exploitation of renewable resources; Sustainable Yield Management.
- Use of substitutes for nonrenewable resources; use of appropriate technology. Refer to Module 2, Specific Objective 12.
- (iii) Reduction and minimisation of waste recycling of solid, liquid and gaseous wastes.
- (iv) Use of economic instruments: user fees; taxes; penalties; incentives; economic valuation of natural resources; environmental accounting and greening of national budgets.
- (v) Land Use Planning and Zoning Regulation; Integrated Development Planning and Integrated Coastal Zone Management.
- (vi) Environmental Impact Assessments (A brief introduction to EIA as a Planning and decision making tool to natural resource management and conservation).

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- (vii) Protected Area Systems (International Union for the Conservation of Nature (IUCN) Classification):
 a. role;
 b. ecotourism
- (viii) Community Based Natural Resource Management (participation, monitoring and evaluation).
- (ix) Environmental legislation, policies and plans (Sustainable Development Plans, Natural Environmental Action Plans (NEAP), Forest Management Plans, Integrated Coastal Zone Management Plans; Enforcement and implementation.
- (x) Education, public awareness, advocacy and training. (Agenda 21, Chapter 36).
- (xi) International environmental and conservation agreements.
 - (a) United Nations Framework Convention on Climate Change (UNFCCC and Kyoto Protocol);
 - (b) United Nations Convention on Biological Diversity (UNCBD);
 - (c) United Nations Convention to Combat Desertification (UNCCD);

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SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

- (d) Specifically Protected Areas and Wildlife (SPAW);
- (e) *Ramsar Convention;*
- (f) *Marine Pollution (MARPOL).*

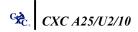
Refer to SO 10

- 11. analyse the effectiveness of measures implemented for natural resource management and conservation;
- 12. describe ways in which Indigenous People have used and managed their natural resources.
- Agriculture: rotation of fields during slash/burn activities, use of organic fertilizers, intercropping;
- (ii) Use of forest: timber and non-timber forest products (NTFPS);
- (iii) Fishing: traditional fishing methods
- (iv) Case studies from Belize, Dominica, Guyana, St. Vincent and the Grenadines and Suriname.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. Case studies of Community Based Natural Resources Management, for example, forest, wetlands.
- 2. Research on indigenous people and natural resources.
- *3. Field exercises: species identification; visit to industry; visits and assessment of community based natural resource management initiatives, visit to indigenous communities.*



- 4. Discuss the main issues relating to the natural obligation under UNFCCC, UNCCD and the UNCBD.
- 5. *Visits to or lectures by representatives of natural resource agencies.*
- 6. *View videos and slides of natural resource management activities and protected areas.*

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	WCD (World Commission on Environment and Development) Our Common Future, 1987. WWF (World Wildlife Fund) 2008. Local to Global Environmental Conservation. Agenda 21

Websites: <u>www.wri.org/wri/biodiv</u> <u>www.earthwatch.org</u> <u>www.canari.org</u> <u>http://cavehill.uwi.edu/cermes/CLMEPub/ENG/Brochure_Eng</u>. <u>www.panda.org</u>

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UNIT 2: AGRICULTURE, ENERGY AND ENVIRONMENTAL POLLUTION

MODULE 1: AGRICULTURE AND THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this Module, student should:

- 1. *understand the concepts, types and role of agriculture in the Caribbean;*
- 2. understand the environmental impacts of and threats to agricultural systems in the Caribbean;
- 3. have knowledge of environmentally sustainable practices in agricultural systems; in the Caribbean;
- 4. acquire knowledge, and develop practical and analytical skills.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. compare and contrast agricultural systems in the Caribbean;*
- (i) *Definition of agriculture.*
- (ii) Characteristics of Agricultural systems with respect to commercial and small scale farming including subsistence.
 - (a) scale of operation;
 - (b) inputs: agro-chemicals, labour, machinery and equipment, energy, financing;
 - (c) productivity of systems: yield per unit input, for example, tonnes per hectare;
 - (d) mariculture; genetic engineering;
 - *(e) aquaculture.*

UNIT 2 MODULE 1: AGRICULTURE AND THE ENVIRONMENT (conf'd)

SPECIFIC OBJECTIVES

Students should be able to:

3.

2. explain the roles of agriculture in the region;

EXPLANATORY NOTES

- (i) Food Security (production of food and non-food materials).
- (ii) *Production of materials for agroprocessing industries.*
- (iii) Economic:
 - (a) *livelihood (income generating activities);*
 - (b) foreign exchange earnings;
 - (c) contribution to Gross Domestic Product.
- (i) *Technological*:
 - (a) increased productivity;
 - (b) increased varieties;
 - (c) improved resistance to pest infestation;
- (ii) Environmental:
 - (a) health risks;
 - (b) threats to sustainable livelihood of communities;
 - (c) *land take (need for vast amounts of lands for agriculture);*
 - (d) *pollution from inappropriate use of agro-chemicals (pesticides;* fertilisers); *antibiotics and hormones in aquaculture and mariculture; eutrophication*

environment;

assess the impact of agriculture on the

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UNIT 2 MODULE 1: AGRICULTURE AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

- (e) habitat destruction; loss of biodiversity;
- (f) soil degradation: erosion; acidification; salinisation; waterlogging; soil compaction, monoculture leading to reduction in soil fertility;
- (g) waste production: waste disposal and management; solid and liquid wastes;
- (h) water degradation: sedimentation; changes in water discharge to coastal zone surface and ground water pollution;
- (i) land degradation: inappropriate use of land types; hillside farming, slash and burn agriculture;
- (j) reduced water availability for irrigation, mariculture and aquaculture;
- (k) *Climate change due to methane production.*
- (i) Ecological integrity.
- (ii) Economic viability.
- (iii) Social equity.
- (iv) Adaptability.
- (i) Natural disasters: flood, hurricane, volcano.
- agriculture;

explain the features of sustainable

5. *discuss threats to sustainable agriculture*;

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4.

UNIT 2 MODULE 1: AGRICULTURE AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

- (ii) *Climate change: temperature rise, sea level rise.* Change in precipitation patterns.
- (iii) External shocks: global markets, price fluctuations.
- (iv) Certification to meet international standards.
- (v) Importation of cheap agricultural products.
- (i) Contour farming.
- (ii) Terracing.
- (iii) Crop rotation.
- (iv) Conservation Tillage.
- (v) Agro-forestry.
- (vi) Pest control (biological and genetic) *and* Integrated pest management.
- (vii) Organic farming.
- (viii) Hydroponics.
- (ix) Post-harvest management: waste utilisation and waste minimisation.
- (x) *Genetic engineering.*
- (xi) Plant and animal breeding.

6. *evaluate environmentally sustainable practices in agricultural systems;**

7. present and interpret data using appropriate charts, tables and graphs.

UNIT 2 MODULE 1: AGRICULTURE AND THE ENVIRONMENT

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. *Conduct* field visits to agrochemical factories, agriculture, aquaculture and mariculture farms to observe and analyse their operations.
- 2. Provide the opportunities for students to identify agro-chemicals used in territory and analyse their composition.
- 3. Invite guest lecturers to discuss issues in agriculture.
- 4. Allow students to create models illustrating soil erosion.
- 5. Allow students to conduct fertiliser experiments on plants.
- 6. Conduct brain-storming sessions to explore entrepreneurial opportunities for use of un-used production (for example, fruit under trees; non-meat parts of livestock).
- 7. Collect and document information on land use in a country, to assess how prime agricultural land is being used.
- 8. Allow students to conduct investigations on waste production and management in an agricultural entity.
- 9. Conduct investigation on water quality at agriculture operations.
- 10. Give students assignments in which they compare soil types and fertility in different agricultural systems.
- 11. Conduct field trips to compare productivity of different farms.

RESOURCES

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UNIT 2

℃. CXC A25/U2/10

MODULE 2: ENERGY AND THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this Module, students should:

- 1. understand the nature of energy and its use;
- 2. understand the socio-economic and environmental impacts of provision and the use of energy.
- 3. appreciate the advantages of using renewable energy sources;
- 4. acquire knowledge and develop practical and analytical skills in the areas covered.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. describe the nature, form and conversion of energy;
- (i) Definition: energy, kinetic energy, potential energy, power.
- (ii) Units of measurement: Joule, MJ, TJ, GJ, Watt, MW, KWh.
- (iii) Types of energy: solar, heat, light, electrical, nuclear, chemical.
- (iv) Examples of energy and conversion, efficiency of conversion.
- (v) Renewable and non-renewable sources of energy.
- (i) Use of energy within societies.
- (ii) Socio-economic dependency on energy use.
- 2. explain the importance of energy to society;

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SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

3. describe the characteristics of various energy sources;*

Primary Energy Sources

- A. Non-renewable
- (i) Fossil fuels: location of reserves, extraction, transportation processing and uses.
- (ii) Nuclear Power: nuclear fission and nuclear fusion; use of nuclear fission, nuclear power plant (basic structure and operation).
- (iii) Nuclear fuel cycle
- B. Renewable
- (i) Solar energy: harnessing and use:
 - (a) active (photothermal);
 - (b) passive (solar cookers, solar furnaces);
 - (c) photovoltaic cells.
- (ii) Indirect solar power: principal features and methods of harnessing:
 - (a) wind energy;
 - (b) hydroelectric energy;
 - (c) biofuels: biomass fuel, biogas.
- (iii) Geothermal energy.
- (iv) Wave, tidal and ocean thermal energy.

SPECIFIC OBJECTIVES

Students should be able to:

Secondary Energy Source

Fuel cells: structure and process, Proton exchange fuel cell.

EXPLANATORY NOTES

- (i) Technological limitations
- (ii) Geographical restrictions.
- (iii) Reliability of supply.
- (iv) Economic (cost of production), political (energy policy of country) and social.
- (i) Conventional generation.
- (ii) Transmission.
- 5. describe the conventional generation and distribution of electricity;*
- 6. evaluate the use of renewable energy;*
- 7. discuss factors affecting electricity generating capacity and demand;
- (i) Generation rates.
- (ii) Demand patterns.
- (iii) Energy storage.
- (iv) Stock piling capability for fossil fuels.
- (v) Diversity of energy sources.
- (vi) Economic cost.
- (vii) Government policies.

- 8. *discuss* various *methods* of energy *conservation and improving efficiency*;
- (i) Definition: energy conservation, energy efficiency.
- (ii) Approaches to energy conservation (including but not limited to transportation energy conservation, domestic energy conservation, industrial energy conservation).

Improving energy efficiency:

- (i) Energy efficient buildings.
- (ii) Co-generation.
- (iii) Combined cycles.
- (iv) Use of alternative energy sources (for example, biofuels).
- (v) Use of renewable energy (for example, wind, solar, water).
- (vi) Technological (for example, types of lighting, appliances and machines).

Sustainable lifestyle (practices that reduce the demand on natural resources).

- (i) Environmental:
 - (a) global warming;
 - (b) pollution impact;
 - (c) habitat destruction.
- (ii) Socio-economic:
 - (a) health issues;
 - (b) dislocation of communities.

9. outline the impact of various forms of energy in the environment;

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

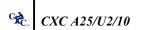
- 10. explain the total cost of energy use.
- (i) Political.
- (ii) Economic.
- (iii) Social.
- (iv) Environmental.
- (v) Technological.
- 11. interpret data using appropriate charts, tables and graphs.

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Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. Conduct field visits to renewable energy facilities, for example, wind farms, solar water heater manufacturers and photovoltaic (PV) installations.
- 2. Conduct research on renewable energy systems used in the country and the extent of their market penetration.
- 3. Invite guest lecturers to discuss renewable energy.
- 4. Use contour maps to evaluate loss of area in the country if global warming leads to sea level rise.
- 5. Construct a simple device to measure energy use.
- 6. Construct a simple renewable energy device, for example, a solar water heater, a solar crop dryer, a PV powered device, and a simple solar cooker.
- 7. Allow students to investigate diversity and percentage contribution to total annual generation capacity in your country.
- 8. Conduct investigations on energy use in home and school and recommend methods of improving energy use and conservation.
- 9. Assign students to conduct an assessment of energy efficiency in buildings with respect to the features that characterise an energy efficient building.
- 10. Construct a model to depict an energy efficient building.
- 11. Assign students to conduct an investigation on the energy use of various sectors.
- 12. Collect documentation on policies that govern energy use, transportation and extraction, and promote energy conservation and efficiency.



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Websites: <u>www.mhhe.com/environmentalscience</u> <u>www.worldresourcesinstitute</u> <u>www.eclac.org/publications</u>



GENERAL OBJECTIVES

On completion of this Module, students should:

- 1. be aware of the major types and sources of pollution;
- 2. understand the environmental impacts of pollution;
- 3. understand the methods available for monitoring, analyzing and mitigating pollution and its environmental impacts;
- 4. acquire knowledge and develop practical and analytical skills in the areas covered.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- 1. describe the general sources and nature of pollutants;
- (i) Definition of pollution and pollutant.
- (ii) Local examples of pollutants and incidences of pollution.
- (iii) Nature of pollutants: persistence, mobility, synergistic effects, toxicity.
- (iv) Movement through the environment.

Environmental receptors (micro-organisms, plants, animals, humans).

Environmental pathways (biotic and abiotic), feeding relationships, bioaccumulation and biomagnification.

- 2. identify environmental receptors of specific pollutants;*
- 3. describe the various pathways of pollution in the ecosystem and the biosphere;

SPECIFIC OBJECTIVES

Students should be able to:

4. outline the *underlying* causes of pollution;

EXPLANATORY NOTES

- (i) *Resource extraction, transportation, processing and use.*
 - inappropriate technology, industrialisation;
- (ii) *Population growth: behavioural pattern, lifestyle, consumption pattern.*
 - lack of environmental consciousness;
- (iii) Institutional Framework:
 - (a) Environmental standards, policies, legislation (Absence and limited implementation).
 - (b) Limited economic instruments (lack of incentives – tax rebates, limited implementation of pollution principles.
- (iv) Lack of environmental ethics.

A. Atmospheric Pollution

- (i) The Atmosphere.
 - (a) structure and composition;
 - (b) physical processes *and features* related to the movement of pollutants (*wind, air* effects of topography on the movement of pollutants).

5. outline the *underlying* causes of pollution;

6. *discuss* the major sources, impact and mitigation of pollution.*

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- (ii) Primary Air Pollutants:
 - (a) types: carbon monoxide; nitrogen oxides; sulphur oxides; suspended particulate matter; volatile organic compounds *(include formulae of pollutant)*;
 - (b) sources;
 - (c) environmental pathways and receptors;
 - (d) environmental impacts (for example, public health, Carbon Monoxide (CO) poisoning, acid rain).
- (iii) Secondary Air Pollutants
 - (a) types: photochemical smog and acid rain;
 - (b) mechanism of formation and characteristics including equations;
 - (c) environmental pathways and receptors;
 - (d) environmental impacts (for example, acidification of soil and water, damage to buildings).

SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

(iv) Global Impacts of Atmospheric Pollutants

Global Warming:

- (a) greenhouse effect and earth's heat balance;
- (b) sources of greenhouse gases: anthropogenic and natural;
- (c) greenhouse *effect* and global warming;
- (d) impacts of global warming (for example, sea level rise, increased temperatures, increased intensities of weather phenomena;

Ozone Depletion:

- (a) Ozone depleting substances and sources: natural and anthropogenic substances;
- (b) chemical equation of formation and destruction *of ozone*;
- Formation of Ozone

 $O_2(g) + hv O(g) + \rightarrow O^*(g)$

 $O^*(g) + O_2(g) + M(g) \longrightarrow O_3(g) + M^*(g) =$ heat

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

• Destruction of Ozone

$$CF_2C1_2(g) + hv \rightarrow CF_2C1(g) + Cl(g)$$

$$Cl(g) + O_3(g) \rightarrow ClO(g) + O_2(g)$$

or

 $20_3 (g) \rightarrow 30_2(g)$

Noise pollution:

- (a) sources: industrial; commercial;
 - (b) social; cultural; transportation;
 - (c) intensity measurement and monitoring;
 - (d) *health risks (for example, damage to ear drum, public health, stress).*
- (v) General Mitigative Measures and Monitoring:
 - (a) air quality monitoring methods;
 - (b) solutions (technological, education, public awareness, legislation and policy incentive, emission control and reduction methods);

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SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

B. Water Pollution

- (i) Properties of water:
 - (a) physical: colour, taste, odour, appearance, turbidity;
 - (b) chemical: pH, dissolved oxygen (DO) content, salinity.

Water pollutants and their sources: (sediment, heat, nutrients and biodegradable organic matter, pathogens, sewage and toxic chemicals). Sources (agriculture, municipal and domestic, industrial, atmospheric).

- (ii) Point and non-point sources.
- (iii) Factors affecting concentration of pollutants:
 - (a) volume of emission;
 - (c) volume of receiving water;
 - (d) residence time;

(b)

- (e) rate of degradation and removal of pollutants.
- (iv) Environmental pathways and receptors.
- (v) Environmental impacts:
 - (a) eutrophication;
 - (b) deoxygenation;

- (c) coral reef destruction;
- (d) fish kills;
- (e) public health issues.
- (vi) General mitigative measures and monitoring.
 - (a) solutions

SPECIFIC OBJECTIVES

Students should be able to:

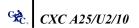
EXPLANATORY NOTES

- (i) technological (treatment of drinking water, treatment of sewage and industrial effluent);
- (ii) *education and public awareness;*
- (iii) *legislation and policy, for example, effluent discharge regulations.*
- (b) water quality monitoring (water methods quality parameters nitrates. phosphates, Biological Oxygen Demand (BOD); Chemical Oxygen Demand (COD);Total Suspended Solids (TSS); faecal coliforms. An understanding of the protocol for testing each parameter is required);

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C. Land Pollution

- (i) Sources: industrial; agricultural; municipal; domestic.
- (ii) Causes of land pollution:
 - (a) atmospheric fallout;
 - (b) waste disposal (domestic, industrial, open dumps, sanitary landfills);
 - (c) dumping of mineral extraction spoils;
 - (d) agricultural processes (see Unit 2 Module 1);
 - (e) oil spills.
- (iii) Environmental pathways and receptors.
- (iv) Environmental impacts (for example, reduced aesthetic quality, lowering of land value, health implications, change in land use).



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SPECIFIC OBJECTIVES

Students should be able to:

EXPLANATORY NOTES

- (v) General mitigative measures and monitoring
 - (a) Waste minimisation (reduction, recycling, reuse, rethink).
 - (b) Environmental Impact Assessments. (*Refer to Unit 1, Module 3, Specific Objective 10.*)
 - (c) Legislation, incentives and penalties.
 - (d) Public *awareness and* participation.
 - (e) *Public awareness and education.*
 - (f) Clean up of pollution (bioremediation and phytoremediation).
 - (g) Incineration.
 - (a) (h) Research and development (research on status of environmental components and development of policy).
- (i) Sources (medical and industrial waste).
- (ii) Toxic effects (carcinogenic, mutagenic, tetratogenic *effects*).
- (iii) Improper disposal methods.
- (i) United Nations Convention on Climate Change (UNFCCC) and Kyoto Protocol.
- (ii) Montreal Protocol.

- 6. analyse the *environmental* impacts of pollution from specific sources;*
- 7. assess *the effectiveness of* measures to mitigate environmental impacts of pollution;
- 8. *discuss* the importance of international conventions and agreements regarding pollution control;



SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

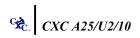
- (iii) International Convention for the Prevention of Marine Pollution (MARPOL).
- (iv) Cartagena Convention.
- (v) Basel Convention.
- (vi) United Nations Convention on Law of the Sea UNCLOS).
- 9. interpret data using appropriate charts, tables and graphs.

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Module, teachers are advised to engage students in the teaching and learning activities listed below.

- 1. Assign students to investigate and categorise local pollution problems.
- 2. Assign students to monitor individual waste production on a weekly basis.
- 3. Conduct research to compare emission from leaded, unleaded and diesel fuels.
- 4. Assign experimental work to investigate lead content of vegetation near highways.
- 5. Conduct field studies on the collection and disposal of garbage.
- 6. Collect information on industries and their potential to produce pollution.
- 7. Conduct research to analyse the effectiveness of local legislation to reduce greenhouse gases.
- 8. Conduct field studies on industries or factories and analysis of their processes with respect to developing waste reduction strategies.

Assign students to investigate respiration ailments in a community.

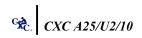


- 9. Assign students to analyse air and water quality in urban areas.
- 10. Review relevant literature to establish size and location of ozone hole.
- 11. Assign students to carry out water quality measurements: and faecal coliform: BOD, COD, TSS, pH.
- 12. Conduct an investigation on the categories and sources of pollutants in water bodies.
- 13. Conduct experiments to identify the relationship between DO and temperature.
- 14. Collect information on the level of sewage treatment at selected treatment plants.
- 15. Conduct soil sampling exercise for pollutants and their concentration levels (urban, agricultural and industrial areas).
- 16. Assign students to conduct home audit for sources and categories of pollutants.
- 17. Conduct investigations on the extent of recycling activities in the country, identification of waste that could be recycled.
- 18. Conduct brain-storming session on business opportunities based on use of waste as a resource.
- 19. Assign students to measure noise levels.
- 20. Assign students to develop strategic plans on climate change.
- 21. Encourage students to garner information on national policies on pollution control.
- 22. Assign students to collect data on environmental impact assessments and make recommendations.
- 23. Encourage students to view An Inconvenient Truth and read ITTC Report, Stern Report.

RESOURCES

Arms, K.	<i>Environmental Science</i> , Philadelphia: Saunders College Publishing (Harcourt Brace Publisher), 1994.
Chiras, D.	<i>Environmental Science. Action for a Sustainable Future</i> , United States of America: The Benjamin/Cummings Publishing Company Inc., 1994
Clarke, R.	Marine Pollution, Toronto: Oxford University Press Inc., 1997.
Cunningham, W. and Saigo, B.	Environmental Science, A global concern, McGraw Hill.
Enger, E. and Smith, B.	Environmental Science, A Study of Inter-relationships, New York: McGraw Hill, 2002.
Farmer, A.	Managing Environmental Pollution, London: Routledge, 1997.
Goodbody, I. and Thomas-Hope, E.	Natural Resource Management for Sustainable Development of the Caribbean, Canoe Press, University of the West Indies, Mona, 2002.
Ehrlich, P. and Ehrlich, A.	<i>The Population Explosion</i> , New York: Simon and Schuster, 1990.
Jordan, C.	Conservation, New York: John Wiley and Sons, 1995.
Miller, G.	Replenish the Earth, California: Wadsworth Publications, 1996.
Nebel, B. and Wright, R.	<i>Environmental Science: The Way the World Works</i> , New Jersey: Prentice Hall, 1997.
Reeve, R.	Environmental Analysis, New York: John Wiley and Sons, 1999.
Viessman, W. Jr., and Hammer, M.	Water Supply and Pollution Control, California: Addison Wesle 1998.

Website: <u>www.mhhe.com/environmentalscience</u> <u>http://www.basel.int/convention/about.html</u> <u>http://ozone.unep.org/publications/exemplary-projects</u> <u>www.occ.gov.uk/activities/stern</u> <u>www.imo.org/safety/mainframe</u>



• OUTLINE OF ASSESSMENT

Each Unit will be assessed separately. The scheme of assessment for each Unit will be the same. A candidate's performance on each Unit will be reported as an overall grade and a grade on each Module of the Unit. The assessment will comprise two components, external and internal.

EXTERNAL ASSESSMENT

(70%)

At the end of the academic year in which a Unit of the syllabus is taken, the student is expected to sit two written papers for a total of 4 hrs.

Paper 01 (1 hour 30 minutes)	The paper comprises forty-five compulsory, multiple-choice items, fifteen based on each Module.	(30%)
Paper 02 (2 hours 30 minutes)	The paper <i>comprises six compulsory</i> questions, <i>two based on</i> each Module.	(40%)

INTERNAL ASSESSMENT

(30%)

The Internal Assessment in respect of each Unit will contribute 30% to the total assessment of a candidate's performance on that Unit.

(i) Paper 03A

The assessment for each Unit will be in the form of a journal. The journal will comprise reports on site visits and laboratory exercises. The journal should focus on at least one specific objective from any of the three Modules in the Unit and incorporate the relevant practical skills.

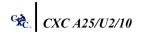
(ii) **Paper 03B**

This is an alternate to Paper 03A and is intended for private candidates.

MODERATION OF INTERNAL ASSESSMENT

Each year an Internal Assessment Record Sheet will be sent to schools submitting students for the examinations.

All Internal Assessment Record Sheets and sample of assignments must be submitted to CXC by May 31 of the year of the examination. A sample of assignments will be requested for moderation purposes by CXC. These samples will be re-assessed by CXC Examiners who moderate the Internal Assessment. Teachers' marks may be adjusted as a result of moderation. The Examiners' comments will be sent to schools.



Copies of the students' assignment that are not submitted must be retained by the school until three months after publication by CXC of the examination results.

ASSESSMENT DETAILS

External Assessment by Written Papers (70% of Total Assessment)

Paper 01 (1 hour 30 minutes - 30% of Total Assessment)

1. **Composition of the Paper**

The paper comprises forty-five multiple-choice items, fifteen items based on each Module.

2. Syllabus Coverage

- (i) *Knowledge of the entire syllabus is required*
- (ii) *The intention of this paper is to test candidates' knowledge across the breadth of the syllabus.*

3. **Question Type**

Questions may be based on diagrams, data, graph, *photographs* or prose.

4. Mark Allocation

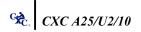
- (i) One mark will be assigned for each item.
- (ii) The *maximum* mark available for this paper is *forty-five and will be weighted to ninety*.
- (iii) This paper contributes 30% towards the final assessment.
- (iv) The marks will be awarded for Knowledge and Comprehension, Application of Knowledge and Practical Abilities.

5. Use of Calculators

Candidates will be allowed to use a non-programmable calculator in the examinations. Each candidate is responsible for providing his/her own calculator and to ensure that it functions throughout the examinations.

6. Use of Geometrical Instruments

Candidates are allowed to use geometrical instruments in the examinations. Each candidate is responsible for providing his or her own instruments.



Paper 02 (2 hours 30 minutes - 70% of Total Assessment)

1. **Composition of Paper**

The paper is arranged into three sections. Each section represents one of the three Modules of the Unit. Each section contains *two compulsory questions*.

2. Syllabus Coverage

- (i) *Comprehensive knowledge of the entire syllabus is required.*
- (ii) Each question may focus on a single theme or develop a single theme or several unconnected themes.

3. **Question Type**

Questions are of a free-response form and may be based on diagrams, data, graph, *photographs* or prose. *Responses* are to be written in the *separate* booklet provided.

4. Mark Allocation

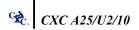
- (i) Each question is worth 20 marks and the number allocated to each sub-question will appear on the examination paper.
- (ii) *The maximum mark for this* paper is 120.
- (iii) *This paper* contributes 40% towards the final assessment.
- (iv) The marks will be awarded for Knowledge and Comprehension, Application of Knowledge and Practical Abilities.

5. Use of Calculators

Candidates will be allowed to use a non-programmable calculator in the examinations. Each candidate is responsible for providing his/her own calculator and to ensure that it functions throughout the examinations.

6. Use of Geometrical Instruments

Candidates are allowed to use geometrical instruments in the examinations. Each candidate is responsible for providing his or her own instruments.



INTERNAL ASSESSMENT

Internal Assessment is an integral part of student assessment in the course covered by this syllabus. It is intended to assist students in acquiring certain knowledge, skills, and attitudes that are associated with the subject. The activity for the Internal Assessment is linked to the syllabus and should form part of the learning activities to enable the student to achieve the objectives of the syllabus. During the course of study for the subject, students obtain marks for the competence they develop and demonstrate in undertaking their Internal Assessment assignments. These marks contribute to the final marks and grades that are awarded to students for their performance in the examination.

During the course of study for the subject, students obtain marks for the competence they develop and demonstrate in undertaking their Internal Assessment assignments. These marks contribute to the final marks and grades that are awarded to students for their performance in the examination.

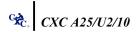
The guidelines provided in this syllabus for selecting appropriate tasks are intended to assist teachers and students in selecting assignments that are valid for the purpose of Internal Assessment. The guidelines provided for the assessment of these assignments are intended to assist teachers in awarding marks that are reliable estimates of the achievement of students in the Internal Assessment component of the course. In order to ensure that the scores awarded by teachers are not out of line with the CXC standards, the Council undertakes the moderation of a sample of the Internal Assessment assignments marked by each teacher.

The Internal Assessment component is compulsory. The assignment is assessed by the teacher, using Internal Assessment Criteria provided below.

The following are the skills that will be assessed:

- (i) the selection of techniques, designs, methodologies and instruments appropriate to different environmental situations;
- (ii) the collection and collation of data;
- (iii) the analysis, interpretation and presentation of such data;
- (iv) *the use of appropriate quantitative techniques;*
- (v) the development of appropriate models as possible solutions to specific environmental problems.

The Internal Assessment should relate to at least ONE specific objective in the Unit.



CRITERIA FOR THE INTERNAL ASSESSMENT

The following are the guidelines for assessing the journal.

- 1. The journal is internally assessed by the teacher and externally moderated by CXC.
- 2. Each candidate will be required to complete a journal in which he/she will be expected to demonstrate the practical skills listed on Page 53.

THE JOURNAL

The reports for a series of site-visits and laboratory exercises associated with the site-visits are recorded in the journal.

The journal will comprise:

- (a) an entry for each site visit
- (b) a report for the journal
- (c) a final report on the set of site-visits

Each student is expected to conduct and write a final report on a **minimum** of four (4) site visits and four (4) laboratory exercises.

- (i) Site visits should be based either on visits to **one** site where changes over a period of time are observed **OR** on a series of visits to different sites to compare and contrast similar processes or occurrences.
- (ii) Laboratory exercises should relate to each or any of the series of site-visits.
- (iii) The entries for the site-visits and the reports for the laboratory exercises **MUST** inform the final report for the journal. The final report must not exceed 1500 words.

Teachers are expected to work closely with students by providing feedback on all aspects of the project.

Students should be encouraged to develop the habit of keen observation, relevant and precise reporting, concise recording and the ability for critical thinking, problem-solving and decision-making.

Each student is required to keep a record (journal) for the reports on the laboratory exercises and a final report for entries on the site-visits.

It is recommended that the assessment criteria be available to candidates at all times.

(A) <u>Site-Visit</u>

The entry for each site-visit should be recorded using the format below:

(i)	Entry Number
-----	--------------

- (ii) Date
- (iii) Site (Location)

(viii)	Follow-up Activities	1 mark 10 Marks
(vii)	Comments	2 marks
(vi)	Observations	2 marks
(v)	Activities	4 marks
(iv)	Objective(s)	1 mark

The teacher is required to assess each site-visit for a maximum of 10 marks. The total from a maximum of 40 marks should be scaled to 10 marks. No fractional marks should be awarded.

(B) <u>Laboratory Exercise</u>

The areas that will be assessed in the report for each laboratory exercise are:

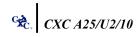
(a)	Planning and Designing;	4 marks
(b)	Observation and Recording;	5 marks
(c)	Manipulation and Measurement;	2 marks
(d)	Analysis and Interpretation;	6 marks
(e)	Reporting and Presentation.	3 marks
	Total	20 marks (Scaled to 10 marks)

The teacher is required to mark and award a score out of a maximum of 20 marks for each laboratory report and then scale to 10 marks. **No fractional marks should be awarded.**

These entries for the site-visits and the laboratory reports should inform the final report for the journal.

Laboratory exercises should be reported using the format below:

i) Title ii) Aim



- iii) Materials
- iv) Procedure
- v) Data Collection/Results vi) Discussion and Conclusions

(C) Final Report for Journal

The areas that will be assessed in the final report for the journal are summarised in the table below.

	Final Report for Journal	Marks
1.	Clarity of the statement of the real world problem being studied (project description)	2
2.	Definition of the scope of the project (purpose of project)	3
3.	Adequacy of information/data gathered and the appropriateness of the design chosen for investigating the problem	3
4.	Appropriateness of the literature review	5
5.	Presentation of data/Analysis of data	6
6.	Discussion of findings	8
7.	Conclusion	3
8.	Recommendations	4
9.	Communication of information	4
10.	Bibliography	2
Total		40

ASSESSING THE JOURNAL REPORT DESCRIPTORS FOR JOURNAL REPORT

1.	Problem Statement	2	
	• <i>Problem</i> clearly stated		1
	• <i>Problem</i> clearly stated and concise		2
2.	Purpose of Project	3	
	Purpose stated		1
	 Purpose stated and some variables identified 		2
	• Purpose stated and all variables identified		3
3.	Methods of Data Collection	3	
	• Data collection design described		1
	• Design clear, appropriate, carried out with few flaws		2
	• Design clear, appropriate, carried out without flaws		3
4.	Literature Review	5	
ч.	Literature review attempted	5	1-2
	Literature review appropriate		3-4
	 Literature review appropriate and comprehensive 		5
5.	Presentation of Data	2	
	 Used graphs, tables, figures and statistical symbols adequately Used graphs, tables, figures and statistical symbols creatively 		1 2
6.	Analysis of Data	4	
0.	Some analysis attempted	-	1
	Analysis adequately done		
	• Analysis used 2 or more approaches		2 3
	• Analysis used a variety of approaches or exceeded requirements of the course		4
7.	Discussion of Findings	8	
	Some findings stated		1
	All findings stated		2
	 Some findings stated and supported by data 		3
	 All findings stated and supported by data 		4
	 Some findings stated, supported by data and their interpretability addressed 		5
	 All findings stated, supported by data and their interpretability addressed 		6
	 Reliability or validity, and usefulness of some findings addressed 		7
	 Reliability or validity, and usefulness of all findings addressed 		8



8.	 Conclusion Conclusion clear and based on finding(s) Conclusion clear, based on finding(s) and valid Conclusion clear, based on finding(s), valid and related to purpose(s) of project 	3	1 2 3
9.	 Recommendations Few recommendations based on findings Most recommendations based on findings Recommendations fully derived from findings 	4	2 3 4
10.	 Communication of Information Information communicated in a fairly logical manner with several grammatical errors Information communicated in a logical manner with some grammatical errors Information communicated in a logical manner with few grammatical errors Information communicated in a logical manner with no grammatical errors 	4	1 2 3 4
11.	 Bibliography Number of references is less than 4 Number of references <i>is</i> greater than 4, written using a consistent convention 	2	1 2

Total

40 marks

The overall assessment of each student is based on the entries for the four site-visits (40 marks), four laboratory exercises (40 marks) and the final report for the journal (40 marks).

A total of 90 marks summarised in the table below:

Component	Raw Marks	Total Marks
4 site-visits	4 x 10 = 40 Scaled to 10	10
4 laboratory exercises	4 x 10 = 40	40
Final report	40	40
Total		90

GENERAL GUIDELINES FOR TEACHERS

1. The

teacher is required to mark the journal and final marks must be recorded out

^C€. CXC A25/U2/10

of 90.

- 2. The school must retain all journals for at least three months after publication of the results since journals may be requested by CXC for moderation purposes.
- 3. The specific objectives highlighted by an asterisk are suitable for Internal Assessment, but the assignments need not assess only these objectives;
- 4. The reliability of the marks awarded is a significant factor in the Internal Assessment, and has far reaching implications for the candidate's final grade. Teachers are asked to note the following:
 - (i) the marks awarded to the journal must be carefully transferred to the CXC Internal Assessment forms;
 - (ii) the teacher must allocate one-third of the total score for the Internal Assessment to each Module. <u>Fractional marks should not be awarded</u>. In cases where the mark is not divisible by three, then the allocation is as follows:
 - (a) When the remainder is 1 mark, the mark is allocated to Module 3;
 - (b) When the remainder is 2, then a mark is allocated to Module 3 and the other mark to Module 2.

For example, 35 marks are allocated as follows:

35/3 = 11 remainder 2 so 11 marks to Module 1 and 12 marks to each of Modules 2 and 3.

- (iii) the standard of marking should be consistent.
- 5. Candidates who do not fulfil the requirements of the Internal Assessment will be considered absent from the whole examination.



REGULATIONS FOR PRIVATE CANDIDATES

Candidates who are registered privately will be required to sit Paper 01, Paper 02 and Paper 03B. Detailed information on Papers 01 and 02 is given on pages 49 - 51 of this syllabus.

Paper 03B (Alternate to Internal School Based-Assessment) 30%-

This paper will be of two (2) hours duration and will consist of THREE questions as follows:

- (i) a practical question;
- (ii) a question based on data collection;
- (iii) a planning and design exercise.

This paper will constitute 30% of the overall assessment of the candidates performance on the Unit.

♦ REGULATIONS FOR RESIT CANDIDATES

Resit candidates must complete Papers 01 and 02 and Paper 03 of the examination for the year for which they re-register. Resit candidates may elect not to repeat the Internal Assessment component, provided they re-write the examination no later than two years following their first attempt.

Candidates may opt to complete an Internal Assessment (IA) for each Unit written or may opt to reuse another IA score which satisfies any of the conditions listed below.

- *(i) A candidate who re-writes the examination <u>in the same Unit</u> within two years may re-use the moderated IA score earned in the previous sitting within the preceding two years.*
- *(ii) Candidates re-using IA scores in this way must register as "Resit candidates" and <u>provide</u> <u>the previous candidate number.</u>*

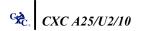
All resit candidates may enter through schools, recognized educational institutions, or the Local Registrar's Office.



♦ ASSESSMENT GRID

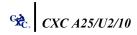
The Assessment Grid for each Unit contains marks assigned to papers and to Modules and the percentage contributions of each paper to the total score.

Papers	Module 1	Module 2	Module 3	Total	(%)
Paper 01	15 (raw) 30 (wtd)	15 (raw) 30 (wtd)	15 (raw) 30 (wtd)	45 (raw) 90 (wtd)	(30)
Paper 02	40	40	40	120	(40)
Paper 03A/03B	30	30	30	90	(30)
TOTAL	100	100	100	300	(100)



♦ GLOSSARY

<u>WORD</u>	DEFINITION/MEANING	<u>NOTES</u>
analyse	examine in detail	
annotate	add a brief note to a label	Simple phrase or a few words only.
apply	use knowledge/principles to solve problems	Make inferences/conclusions.
assess	present reasons for the importance of particular structures, relationships or processes	Compare the advantages and disadvantages or the merits and demerits of a particular structure, relationship or process.
calculate	arrive at the solution to a numerical problem	Steps should be shown; units must be included.
classify	divide into groups according to observable characteristics	
comment	state opinion or view with supporting reasons	
compare	state similarities and differences	An explanation of the significance of each similarity and difference
		stated may be required for comparisons which are other than structural.
construct	use a specific format to make and/or draw a graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram	comparisons which are other than
construct deduce	graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for	comparisons which are other than structural. Such representations should normally bear a title, appropriate
	graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram make a logical connection between two or more pieces of information; use data to arrive at a	comparisons which are other than structural. Such representations should normally bear a title, appropriate



WORD DEFINITION/MEANING

<u>NOTES</u>

derive	to deduce, determine or extract from data by a set of logical steps some relationship, formula or result	This relationship etc. may be general or specific.
describe	provide detailed factual information of the appearance or arrangement of a specific structure or a sequence of a specific process	Description may be in words, drawings or diagrams or any appropriate combination. Drawings or diagrams should be annotated to show appropriate detail where necessary.
determine	find the value of a physical quantity	
design	plan and present with appropriate practical detail	Where hypotheses are stated or when tests are to be conducted, possible outcomes should be clearly stated and/or the way in which data will be analyzed and presented.
develop	expand or elaborate an idea or argument with supporting reasons	
diagram	simplified representation showing the relationship between components.	
differentiate/ distinguish (between/ among)	state or explain briefly those differences between or among items which can be used to define the items or place them into separate categories.	
discuss	present reasoned argument; consider points both for and against; explain the relative merits of a case	
draw	make a line representation from specimens or apparatus which shows an accurate relation between the parts	In the case of drawings from specimens, the magnification must always be stated.
estimate	make an approximate quantitative judgement	
evaluate	weigh evidence and make judgements based on given criteria	The use of logical supporting reasons for a particular point of view is more important than the view held; usually both sides of an argument should be considered.

WORD DEFINITION/MEANING

<u>NOTES</u>

explain	give reasons based on recall; account for	
find	locate a feature or obtain as from a graph	
formulate	devise a hypothesis	
identify	name or point out specific components or features	
illustrate	show clearly by using appropriate examples or diagrams, sketches	
interpret	explain the meaning of	
justify	explain the correctness of	
investigate	use simple systematic procedures to observe, record data and draw logical conclusions	
label	add names to identify structures or parts indicated by pointers	
list	itemize without detail	
measure	take accurate quantitative readings using appropriate instruments	
name	give only the name of	No additional information is required.
note	write down observations	
observe	pay attention to details which characterize a specimen, reaction or change taking place; to examine and note scientifically	Observations may involve all the senses and/or extensions of them but would normally exclude the sense of taste.
outline	give basic steps only	
plan	prepare to conduct an investigation	
predict	use information provided to arrive at a likely conclusion or suggest a possible outcome	

WORD DEFINITION/MEANING

record	write an accurate description of the full range of observations made during a given procedure	This includes the values for any variable being investigated; where appropriate, recorded data may be depicted in graphs, histograms or tables.
relate	show connections between; explain how one set of facts or data depend on others or are determined by them	
sketch	make a simple freehand diagram showing relevant proportions and any important details	
state	provide factual information in concise terms outlining explanations	
suggest	offer an explanation deduced from information provided or previous knowledge. (a hypothesis; provide a generalisation which offers a likely explanation for a set of data or observations.)	No correct or incorrect solution is presumed but suggestions must be acceptable within the limits of scientific knowledge.
test	to find out, following set procedures	

NOTES

Western Zone Office 03 May 2010

CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Advanced Proficiency Examination CAPE®



Environmental Science

Specimen Papers and Mark Schemes/Keys

Specimen Papers:

Unit 1, Paper 01 Unit 1, Paper 02 Unit 1, Paper 03/2

Unit 2, Paper 01 Unit 2, Paper 02 Unit 2, Paper 03/2

Mark Schemes and Keys: - Uni

Unit 1, Paper 01 Unit 1, Paper 02 Unit 1, Paper 03/2

Unit 2, Paper 01 Unit 2, Paper 02 Unit 2, Paper 03/2



TEST CODE 02120010/SPEC/2010

CARIBBEAN EXAMINATIONS COUNCIL ADVANCED PROFICIENCY EXAMINATION ENVIRONMENTAL SCIENCE UNIT 1 SPECIMEN PAPER

Paper 01

90 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

- 1. This test consists of 45 items. You will have 90 minutes to answer them.
- 2. In addition to this test booklet, you should have an answer sheet.
- 3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
- 4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
- 5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

The interaction of plants and animals with components such as air and water describes

Sample Answer

- (A) a biome
- (B) a biosphere
- (C) an ecosystem
- (D) an ecological niche



The best answer to this item is "an ecosystem", so answer space (C) has been shaded.

- 6. If you want to change your answer, erase it completely before you fill in your new choice.
- 7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, omit it and go on to the next one. You may return to the omitted item later. Your score will be the total number of correct answers.
- 8. You may use a silent electronic calculator.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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4.

Item 1 refers to the following food chain.

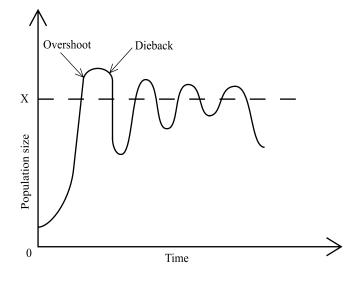
 $Grass \rightarrow grasshopper \rightarrow frog \rightarrow snake$

- 1. The original source of energy for the food chain is the
 - (A) frog
 - (B) grass
 - (C) sunlight
 - (D) grasshopper
- 2. Which of the following are characteristics of a biome?
 - I. Climate barriers determine its boundaries.
 - II. It encompasses interacting ecosystems.
 - III. It is the next level of ecological organisation above the ecosystem.
 - IV. It is usually confined to a relatively small geographical area.
 - (A) I and III only
 - (B) I and IV only
 - (C) I, II and III only
 - (D) II, III and IV only
- 3. The relationship between algae and the coral polyp is an example of
 - (A) mutualism
 - (B) parasitism
 - (C) competition
 - (D) commensalism

Which of the following factors will cause a decline in the population of organisms?

- I. Adverse climate conditions
- II. Food shortage and disease
- III. Predation and competition
- IV. Suitable habitat
- (A) I and III only
- (B) III and IV only
- (C) I, II and III only
- (D) I, II and IV only
- 5. An ecotone is BEST described as the boundary between
 - (A) two types of communities
 - (B) two types of ecological niches
 - (C) plant and animal communities
 - (D) two types of ecological communities

<u>Item 6</u> refers to the graph of population size vs time below.

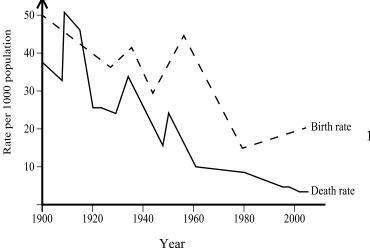


- 6. The broken line at X in the graph above represents the
 - (A) biotic potential
 - (B) carrying capacity
 - (C) environmental resistance
 - (D) maximum population size

GO ON TO THE NEXT PAGE

- 7. Succession is one of the most important ecological processes. Which of the following are sites where primary succession may occur?
 - I. At the edge of retreating glaciers
 - II. Sand dunes along sandy shores
 - III. The lava flows of volcanoes
 - IV. Abandoned pastures
 - (A) I and IV only
 - (B) II and III only
 - (C) I, II and III only
 - (D) I, II and IV only

Item 8 refers to the graph below which shows birth and death rates for the period 1900 - 2000 for a Caribbean country.



8. In which year was the LOWEST population growth rate recorded?

(A)	1910
(B)	1960
(C)	1980
(D)	2000

- 9. Which pair of organisms BEST illustrates the feeding relationship referred to as 'parasitism'?
 - (A) Rat \rightarrow Owl
 - (B) $Cow \rightarrow Tick$
 - (C) Tick \rightarrow Egret
 - (D) $Cow \rightarrow Egret$

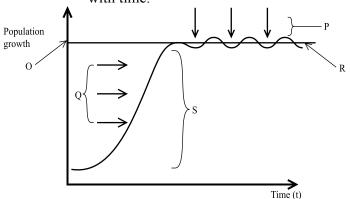
- **10**. Which of the following is TRUE about predator-prey relationships?
 - I. Predators help to keep prey populations in check.
 - II. Predators may help to drive natural selection in the prey populations.
 - III. Prey populations do not influence natural selection in predators.
 - IV. Predator-prey relationships are examples of commensalism.
 - (A) I and II only
 - (B) I and III only
 - (C) I and IV only
 - (D) I, II and IV only
- **11**. Which of the following types of islands would have the LOWEST biodiversity?
 - (A) Volcanic
 - (B) Small isolated
 - (C) Large continental
 - (D) Small continental
- 12. Traditionally, woodpecker (A) was found in relatively large numbers in a particular ecosystem. However, since the addition of a new species, woodpecker (B), its population has greatly decreased. This example can be used to illustrate
 - (A) genetic drift
 - (B) a realised niche
 - (C) a fundamental niche
 - (D) the competitive exclusion principle

Items 13 - 14 refer to the table below which shows the total number of various species within a marine community that has a total number of 100 individuals

Species	Total number of organisms
Cod	22
Haddock	28
Capelin	40
Shark	3
Harpseal	7

- Using the formula $D = \frac{N(N-1)}{\sum n(n-1)}$, the 13. species diversity (D) is
 - 2.50 (A) **(B)** 3.28 (C) 3.50 4.50
 - (D)
- 14. What percentage of the marine community is made up of haddock and shark?
 - 25% (A)
 - 28% **(B)**
 - (C) 31%
 - 35% (D)

Item 15 refers to the graph below which shows the variation of population growth with time.



15. The region labelled P on the graph indicates

- (A) biotic resistance
- carrying capacity **(B)**
- environmental potential (C)
- environmental resistance (D)

Item 16 refers to the following indices of the human population:

- I. Fertility rate
- II. Immigration rate
- III. Transition rate
- IV. Mortality rate
- 16. Which of the above are demographic indices of the human population?
 - I and II only (A)
 - I and III only (B)
 - I, II and III only (C)
 - I, II and IV only (D)

Item 17 refers to the following variables:

- Life expectancy I.
- II. Fertility
- III. Educational attainment
- Real GPD per capita IV.
- 17. Which of the variables above are used to determine the Human Development Index (HDI)?
 - I, II and IV only (A)
 - I. III and IV only **(B)**
 - (C) II, III and IV only
 - (D) I, II, III and IV
- 18. Which of the following indices of poverty is based on longevity, education and income for both men and women?
 - (A) Gross National Product (GNP)
 - Gross Domestic Product (GDP) (B)
 - Human Development Index (HDI) (C)
 - (D) Gender Development Index (GDI)
- 19. The difference between birth rate and death rate is called
 - (A) the fertility rate
 - (B) doubling time
 - the life expectancy (C)
 - (D) population growth

GO ON TO THE NEXT PAGE

- When the death rate of a country is higher
- than the birth rate, the population size
 - (A) decreases

20.

- (B) increases slowly
- (C) increases rapidly
- (D) remains the same
- **21**. The MOST successful method of controlling a country's population size is
 - (A) birth control
 - (B) natural disasters
 - (C) financial incentives
 - (D) government quotas on children produced

<u>Items 22 - 23</u> refer to the following table of population growth rates for Jamaica and Trinidad and Tobago in 2009.

Country	Population (million.)	Annual Growth Rate (%)
Jamaica	2.7	1.2
Trinidad and Tobago	1.3	0.3

22. The estimated population of Trinidad and Tobago for the year 2010 is

(A)	3 900
(B)	390 000
(C)	1 303 900
(D)	1 363 900

23. The estimated doubling time for Jamaica is

(A)	45 years
(B)	58 years

- (C) 69 years
- (D) 72 years

- 24. A country is MOST likely to be densely populated in which of the following areas?
 - I. Flat, lowland plains
 - II. Predominantly subsistence farming areas
 - III. Regions with intensive farming
 - IV. Deep humus-filled land
 - (A) I and II only
 - (B) I and III only
 - (C) I, II and IV only
 - (D) II, III and IV only

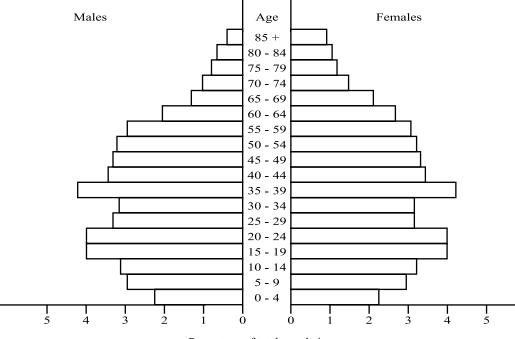
<u>Item 25</u> refers to the demographic statistics provided below.

Demographic Statistics for Country X

Population in 2007: 5 273 196 Population growth for 2008: 2.4% Population growth for 2009: 2.5%

25. Using the information above, calculate the population of Country X in 2009.

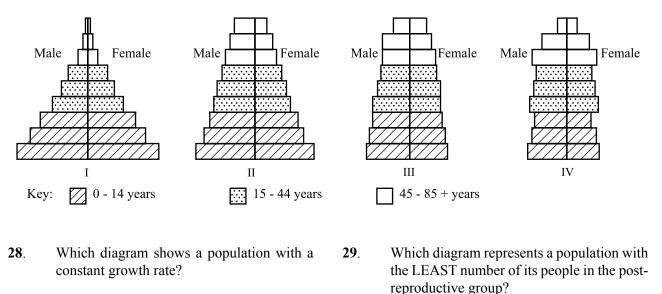
- (B) 5 405 026
- (C) 5 531 583
- (D) 5 534 746



Item **26** refers to the following population pyramid of Japan in 2002.

- Percentage of total population
- **26**. Which of the following statements BEST describes the information shown in the population pyramid?
 - (A) There is a high birth rate and a high death rate.
 - (B) More males live to an older age than females.
 - (C) Fertility is high as women are having more children.
 - (D) There is a low death rate and a falling birth rate.

- 27. The use of substitutes may help to reduce the environmental impacts of overexploitation by
 - (A) reducing pollution
 - (B) reducing the demand for a particular resource
 - (C) increasing revenue from the sale of substitutes
 - (D) reducing the cost of exploitation of a particular resource



<u>Items 28 - 29</u> refers to the diagrams I - IV below which represent the age structure of four different countries.

- (A) I
- (B) II
- (C) III
- (D) IV
- <u>Item 30</u> refers to the table below which shows the immigration and emigration statistics for four countries.

Country	Immigration per 1000	Emigration per 1000
Ι	25	18
II	40	30
III	10	20
IV	20	5

- **30**. Which of the above countries has a negative net migration?
 - (A) I and III only
 - (B) I, II and IV only
 - (C) I, III and IV only
 - (D) II, III and IV only

- **31**. The MAJOR natural resource found in Trinidad is
 - (A) oil

(A)

(B)

(C) (D) Ι

Π

III

IV

- (B) gold
- (C) bauxite
- (D) iron ore
- **32**. Which of the following BEST describes the importance of an Environmental Impact Assessment (EIA)?
 - (A) It is a legal requirement.
 - (B) It provides the costing for a proposed project.
 - (C) It must be done for the government's projects only.
 - (D) It examines the environmental feasibility of a project.

- **33**. Which of the following can be described as a renewable resource?
 - (A) Asphalt
 - (B) Beaches
 - (C) Minerals
 - (D) Mangrove forests
- 34. The international convention, commonly known as the Kyoto Protocol is
 - (A) CITIES
 - (B) UNCBD
 - (C) UNFCCC
 - (D) MARPOL

<u>Items 35 - 36</u> refer to the following territories:

- (A) Jamaica
- (B) Barbados
- (C) Guyana
- (D) Trinidad and Tobago
- **35**. Which of the of the countries above possesses large reserves of limestone as a natural resource?
- **36**. Which of the countries above possesses large expanses of virgin forests?
- 37. Mangroves are considered ecologically important because
 - (A) they add aesthetic value
 - (B) they provide employment
 - (C) the roots perform important functions
 - (D) they are used for recreational purposes

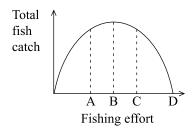
Items 38 - 39 refer to the following terms:

- (A) Quarrying
- (B) Animal husbandry
- (C) Ecotourism
- (D) Agriculture
- **38**. Which of the above activities may result in heavy metal contamination of water?
- **39**. Which activity would result in the water being polluted by faecal coliform?
- **40**. Which of the following is the BEST reason for the conservation of rainforests?
 - (A) They have aesthetic value.
 - (B) They provide employment.
 - (C) They are a source of fuel wood.
 - (D) They are a habitat for many organisms.
- **41**. Fires have destroyed many forested areas around the Caribbean. In some cases, pine trees are planted to replace the natural forest since pine trees grow faster and are more fire resistant than many native trees.

Which term BEST describes this approach to resource management?

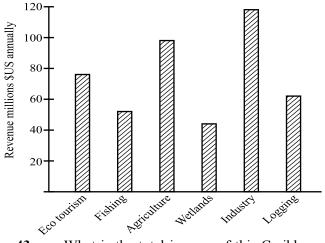
- (A) Restoration
- (B) Preservation
- (C) Rehabilitation
- (D) In-situ conservation

<u>Item 42</u> refers to the graph below which shows how total fish catch varies with fishing effort.



42. Which point on the *x*-axis indicates the level of effort which will produce the OPTIMUM sustainable yield?

<u>Items 43 - 44</u> refer to the graph below which shows the annual income distribution for a Caribbean country.



43. What is the total income of this Caribbean country?

- (A) 45 million
- (B) 46 million
- (C) 450 million
- (D) 460 million
- 44. What is the percentage income from nonconsumptive use of natural resources?

(A)	9.8
(B)	16.9

- (B) 16.9 (C) 26.7
- (C) 20.7(D) 38.7

Item 45 refers to the table below which shows per capita meat consumption for selected countries.

Country	Beef (kg)	Pork (kg)	Poultry (kg)	Mutton (kg)
India	1	0.4	1	1
China	4	30	6	2
Italy	26	33	19	2
United States	45	31	46	1

- **45**. Using the data in the table above, determine which of the following statements is true?
 - (A) The most populated countries consume the most meat.
 - (B) The least populated countries consume the most meat.
 - (C) More economically developed countries consume the most meat.
 - (D) Less economically developed countries consume the most meat.

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

02120010/SPEC/2010



TEST CODE 02120020/SPEC/2010

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

UNIT 1: ECOLOGY, HUMAN POPULATION AND NATURAL RESOURCES

SPECIMEN PAPER

PAPER 02

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

- 1. Do NOT open this examination paper until instructed to do so.
- 2. This paper consists of SIX questions, TWO from each Module.
- 3. Answer ALL questions.
- 4. Write your answers in the answer booklet provided.
- 5. You may use a silent, non-programmable, scientific calculator.

MODULE 1

Answer BOTH Questions.

1. Table 1 presents the species abundance of three species, X, Y, and Z, in two ecosystems, A and B.

TABLE 1:	SPECIES	ABUNDANCE IN TWO ECOSYSTEMS

	Species Abundance			
Ecosystem -	X	Y	Z	
А	9	4	2	
В	11	11	12	

(a) Define EACH of the following:

(i)	Ecosystem	
-----	-----------	--

- (ii) Ecosystem stability
- (b) Using the information in Table 1, calculate the species diversity for ecosystem A and ecosystem B. (3 marks)
- (c) Explain the relationship between species diversity and ecosystem stability.

(8 marks)

(4 marks)

- (d)(i) Species X, Y and Z are non-moving organisms. Describe a **named** method which is appropriate for sampling these organisms. (4 marks)
- (d)(ii) State ONE limitation of the method described in (d)(i). (1 mark)

Total 20 marks

2(a) Figure 1 illustrates the cycling of matter through an ecosystem.

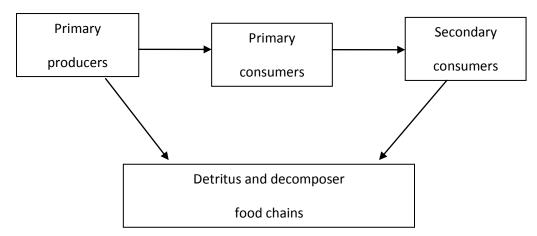


Figure 1. Cycling of matter through an ecosystem

- (i)Name ONE decomposer.(1 mark)(ii)Outline the importance of the decomposer in the cycling of matter illustrated
in Figure 1.(2 marks)Describe TWO ways in which human activities can disrupt the integrity of natural
ecosystems.(8 marks)
- (c) With reference to any **named** ecosystem, construct a food web to show the feeding relationships between the organisms. (4 marks)
- (d) The table below shows the number of organisms in a community.

Organism	Number
Mango trees	5
Caterpillars	60
Small birds	10
Hawks	5

Use the information in the table to construct a pyramid of numbers. (5 marks)

Total 20 marks

(b)

MODULE 2

Answer BOTH questions.

3. Table 2 presents data on world population size in 1990 and the estimated size for 2020.

	More Developed Countries (millions)	Less Developed Countries (millions)
Population in 1990	1247	4486
Estimated Population in 2020	1375	6548

TABLE 2: WORLD POPULATION SIZE

- (a) Calculate the estimated percentage growth in world population attributable to Less Developed Countries between 1990 and 2020. (5 marks)
- (b) Explain why this estimated growth in the population of Less Developed Countries should be a cause for concern. (4 marks)
- (c) State THREE environmental impacts that could be associated with the percentage growth estimated in 3(a). (3 marks)
- (d) Select any TWO environmental impacts you stated in (c) above and suggest TWO measures that may be taken to mitigate EACH impact. (8 marks)

Total 20 marks

- 4(a) Explain how culture influences the rate of growth of a population. (2 marks)
- (b) Table 3 shows the Human Development Index (HDI) of two countries for 2007.

Country	HDI
А	0.89
В	0.38

TABLE 3: HUMAN DEVELOPMENT INDEX

State THREE deductions that may be made regarding the relative achievements of BOTH countries based on their HDI presented in Table 3. (6 marks)

(c) Table 4 shows the total fertility rates for high and low income level countries.

TABLE 4: FERTILITY RATES

Year	High Income	Low Income
1965	5.8	7.5
1990	3.6	5.1
2000	2.1	4.6

(i)	Define the term 'fertility rate'.	(1 mark)
-----	-----------------------------------	----------

(ii) Draw a graph to illustrate the information provided in the table. (5 marks)

(ii) State THREE conclusions (inferences) that can be made from the graph drawn in (c)(ii) above.

(6 marks)

Total 20 marks

MODULE 3

Answer BOTH questions.

- 5(a) With reference to suitable examples, distinguish between 'consumptive use' and 'nonconsumptive use' of natural resources. (3 marks)
 - (b) The graph below shows the changes in the quantities of two natural resources, A and B, over a ten-year period.

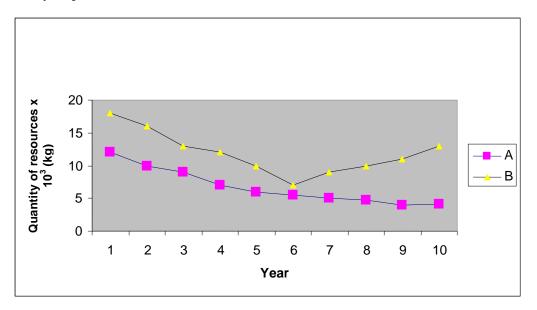


Figure 2. Quantities of two natural resources A, and B, over a ten-year period

(i)	Using actual values from the graph, describe the trend in the quantity of re	source B
	over the ten-year period.	(5 marks)
(ii)	From the graph drawn, identify the resource which is non-renewable and the resource which is renewable.	(2 marks)
(iii)	Justify your answer in b (ii).	(7 marks)
Sugges	t THREE ways by which the non-renewable resource can be conserved.	(3 marks)

Total 20 marks

(c)

- 6(a) State THREE functions of coral reef ecosystems in the Caribbean.
- (b) Explain how ANY THREE human activities impact on coral reef ecosystems in the Caribbean. (6 marks)
- (c) The table below gives the percentage coral reef cover and the percentage fishable resources for the south coast of an island between 1995 and 2005.

Yr	% Coral Reef Cover	% Fishable Resource
1995	50	70
1996	46	71
1997	41	68
1998	33	71
1999	25	64
2000	19	59
2001	12	47
2002	8	41
2003	15	32
2004	21	30
2005	27	38

TABLE 5: PERCENTAGE CORAL REEF COVER AND PERCENTAGE FISHABLE RESOURCES

(i) Plot a graph to show the information in the table.
(ii) Use the graph to determine the time lag between reef degradation and the collapse of the fishable resources and give ONE reason for the time lag.

(iii) Suggest TWO reasons for improvement in fishable resources associated with the recovery in coral reef ecosystems. (4 marks)

Total 20 marks

END OF TEST

02120020/CAPE/SPEC/2010

(5 marks)

(2 marks)

(3 marks)



TEST CODE 02120032/SPEC/2010

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

UNIT 1: ECOLOGY, HUMAN POPULATION AND NATURAL RESOURCES

SPECIMEN PAPER

PAPER 03/2

2 hours

INSTRUCTIONS TO CANDIDATES

- 1. This paper consists of THREE questions.
- 2. Answer ALL questions.
- 3. Write your answers in the answer booklet provided.
- 4. Graph paper is provided.
- 5. You may use a silent, non-programmable, scientific calculator

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02120032/SPEC/ 2010

Answer ALL questions.

Read the paragraph below and answer the questions that follow.

A forest concession was granted to a timber company to harvest timber for a period of thirty years. The concession was granted on the condition that the species of a tree lizard endemic to the area was protected. The university in the country was asked by the company to monitor the lizard population for the duration of the operation of the concession. The university was also required to make recommendations for the conservation and protection of the lizard population.

Table 1 presents the results of monitoring the lizard population for the last ten years of the concession.

Year	Lizard Population
1996	170
1997	130
1998	120
1999	115
2000	110
2001	130
2002	147
2003	169
2004	180
2005	200

TABLE 1: LIZARD POPULATION OVER TEN-YEAR PERIOD

- 1. The mark-release-recapture method was used to collect the data presented in Table 1.
 - (a) Why is this method suitable for the lizard population? (3 marks)
 - (b) Outline the mark-release-recapture method for collecting the data presented in Table 1. (7 marks)
 - (c) State TWO assumptions that must be made when using the mark-release-recapture method to estimate population size. (4 marks)
 - (d) Describe FOUR steps of a monitoring plan to track the lizard population. State ONE objective for EACH step described. (8 marks)
 - Use the information in Table 1 to plot an appropriate graph showing the variation in the lizard population during the period 1996 2005. (8 marks)

Total 30 marks

2. Figure 1 shows the age structure diagram for a country. The fertility rate of the country is at replacement level and its population size is 56.6 million.

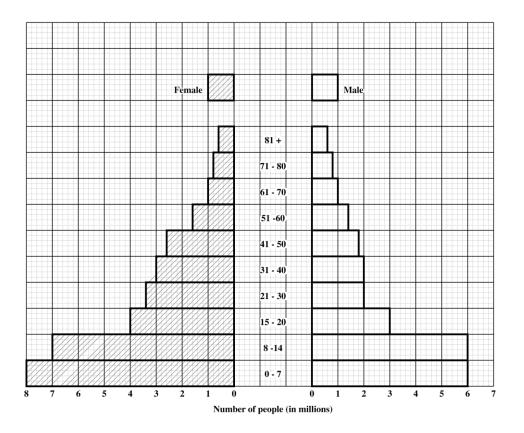
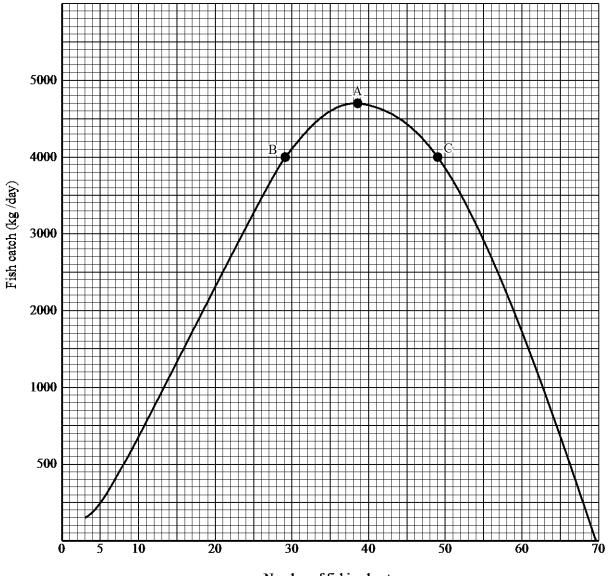


Figure 1. Age structure diagram

(a)	State what is meant by the terms		
	(i) (ii)	fertility rate replacement fertility rate.	(4 marks)
(b)	Use the	diagram to calculate	
	(i)	the number of people in the $41 - 60$ age group	(5 marks)
	(ii)	the percentage of the population in the pre-reproductive years.	(7 marks)
(c)	(i)	How is the population of the country expected to change over the next ten	years? (1 mark)
	(ii)	Justify your answer in (c) (i).	(4 marks)
(d)	Explain	how EACH of the following factors may affect fertility rates:	
	(i)	Educational opportunities	
	(ii)	Social and economic status of women	
	(iii)	Family planning services	(9 marks)

Total 30 marks

3 Figure 2 shows the effect of increased harvesting effort (number of fishing boats) on the daily fish catch.



Number of fishing boats

Figure 2: Effect of increased harvesting effort on the daily fish catch

(a)	(i)	Describe the trend observed in Figure 2.	(8 marks)
	(ii)	Using the graph, determine what fishing effort will produce a daily catch of of fish .	f 3500 kg (2 marks)
(b)	(i)	What is meant by the term 'maximum sustainable yield (MSY)' in relation harvesting of the fishing stock?	to the (2 marks)
	(ii)	At which of the three points, A, B or C, shown on Figure 2 should harvestiplace to achieve the maximum sustainable yield?	ing take (1 mark)
	(iii)	Give THREE reasons why it is best to harvest the fishing resource at the MSY.	(6 marks)
(c)	Explain Figure 2	the effect of EACH of the following on the harvesting of the fishing resour 2:	ce in
	(i)	Population growth	
	(ii)	Level of environmental awareness	(6 marks)
(d)	(i)	Recommend ONE conservation measure that may be used to improve the s fishing resource.	tatus of the (1 mark)
	(ii)	Give TWO reasons for the recommendation provided in (d)(i).	(4 marks)

Total 30 marks

END OF TEST

02120032/SPEC/2010



TEST CODE 02220010/SPEC/2010

CARIBBEAN EXAMINATIONS COUNCIL ADVANCED PROFICIENCY EXAMINATION ENVIRONMENTAL SCIENCE UNIT 2

SPECIMEN PAPER

Paper 01

90 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

- 1. This test consists of 45 items. You will have 90 minutes to answer them.
- 2. In addition to this test booklet, you should have an answer sheet.
- 3. Do not be concerned that the answer sheet provides spaces for more answers than there are items in this test.
- 4. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
- 5. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

Suspended particles in water cause

- (A) acidity
- (B) alkalinity
- (C) salinity
- (D) turbidity

 $\underbrace{\text{Sample Answer}}_{(A)}(B)(C) \blacksquare$

- The best answer to this item is "turbidity", so answer space (D) has been shaded.
- 6. If you want to change your answer, erase it completely before you fill in your new choice.
- 7. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, omit it and go on to the next one. You may return to the omitted item later. Your score will be the total number of correct answers.
- 8. You may use a silent electronic calculator.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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02220010/SPEC/2010

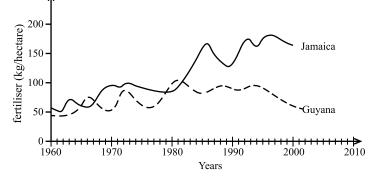
5.

- 1. Which of the following may cause soil degradation?
 - I. Leaching
 - II. Strip farming
 - III. Water logging
 - IV. Mono-culture farming
 - (A) I and II only
 - (B) I, II and III only
 - (C) I, III and IV only
 - (D) I, II, III and IV
- 2. Which of the following BEST describes subsistence farming?
 - (A) Large scale for profit
 - (B) Providing just enough for the farmer's own family
 - (C) Involving large amounts of inputs for example, fertilisers
 - (D) Involving few people and large amounts of land
- **3**. Which of the following are effects of the continuous use of fertilisers?
 - I. Few organisms in the soil
 - II. Reduced soil humus content
 - III. Poor crumb structure of soil
 - IV. Decreased soil mineral content
 - (A) I and II only
 - (B) I and III only
 - (C) I, II and III only
 - (D) I, II, III and IV
- 4. Which method of increasing soil fertility has the GREATEST environmental impact?
 - (A) Adding cow manure to the soil
 - (B) Ploughing a cover crop into the soil
 - (C) Planting pigeon peas between rows of other crops
 - (D) Adding inorganic fertiliser to the soil

- The farming of ocean fish is BEST described as
 - (A) apiculture
 - (B) aeroponics
 - (C) mariculture
 - (D) hydroponics
- 6. Which of the following are environmentally sustainable agricultural practices?
 - I. Agro-forestry
 - II. Contour farming
 - III. Integrated pest management
 - IV. Mono-culture farming
 - (A) I and III only
 - (B) I, II and III only
 - (C) I, II and IV only
 - (D) I, II, III and IV
- 7. Agriculture plays an important role in the economies of various countries. Which of the following are the MOST important economic roles played by agriculture?
 - I. Provides form of food security
 - II. Contributes to Gross Domestic Product (GDP)
 - III. Provides opportunity for scientific research
 - IV. Attracts foreign exchange
 - (A) I, II and III only
 - (B) I, II and IV only
 - (C) I, III and IV only
 - (D) II, III and IV only

- 8. Which of the following are DISADVANTAGES of aquaculture?
 - I. Large output of polluted water
 - II. High yield in small volume of water
 - III. Large inputs of land, feed and water needed
 - IV. Dense population vulnerable to disease
 - (A) I and II only
 - (B) I, II and III only
 - (C) I, III and IV only
 - (D) I, II, III and IV
- **9.** Which of the following may be used in a programme of integrated pest management?
 - I. Introduction of a non-native ladybird which eats the pest
 - II. Occasional spraying of broadspectrum pesticides
 - III. Planting of non-crop plants between crops
 - IV. Use of genetically engineered crops to resist disease
 - (A) I, II and III only
 - (B) I, II and IV only
 - (C) I, III and IV only
 - (D) II, III and IV only

<u>Items 10 - 12</u> refer to the graph below which shows fertiliser consumption for Guyana and Jamaica for the period 1960 - 2010.



- **10.** For the year 1970, the difference in fertiliser consumption between Jamaica and Guyana is approximately
 - (A) 30 kg/hectare
 - (B) 50 kg/hectare
 - (C) 70 kg/hectare
 - (D) 100 kg/hectare
- 11. Which of the following statements is correct?
 - (A) For the period 1990 2000, fertiliser consumption is higher for Jamaica than for Guyana.
 - (B) For the period 1990-2000, fertiliser consumption for both countries is directly proportionate.
 - (C) For the period 1990-2000, fertiliser consumption for both countries is the same.
 - (D) For the period 1990-2000, fertiliser consumption is higher for Guyana than for Jamaica.
- **12.** Which of the following processes may be linked to the sharp increase in fertiliser consumption for Jamaica in the 1980s?
 - (A) Salinisation
 - (B) Soil erosion
 - (C) Water logging
 - (D) Eutrophication

- 3 -

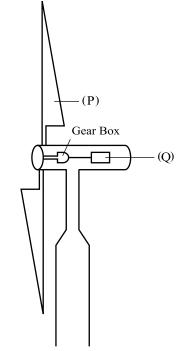
- **13.** Winkler's Test is commonly used when determining the effect of
 - (A) salinisation
 - (B) fertiliser run-off
 - (C) soil degradation
 - (D) heavy metal contamination
- 14. In the 1960s the 'Green Revolution' involved the widespread application of increased mechanisation, pesticide and fertiliser use, a general increase in farm size and widespread use of high-yield crop varieties.

Which of the following are likely to be consequences of the 'Green Revolution'?

- I. An increase in food production
- II. A long-term decrease in pest activity
- III. A long-term decrease in soil quality
- IV. An increase in agricultural biodiversity
- (A) I and II only
- (B) I and III only
- (C) II and IV only
- (D) III and IV only
- **15.** Which of the following is a likely disadvantage of the use of genetic engineering in agriculture?
 - (A) Increased dependence on agrochemicals
 - (B) Increased need for mechanisation on farms
 - (C) Unanticipated ecological effects on natural ecosystems
 - (D) More time is needed for the production of results

- **16.** Which of the following is an example of a renewable energy source?
 - (A) Coal
 - (B) Fossil fuel
 - (C) Nuclear energy
 - (D) Geothermal energy
- 17. The energy that matter has because of its mass and velocity is
 - (A) kinetic
 - (B) nuclear
 - (C) potential
 - (D) chemical

<u>Item 18</u> refers to the diagram of a wind turbine below.



18. The part labelled P is the

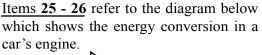
- (A) generator
- (B) drive shaft
- (C) rotor blade
- (D) electrical cable

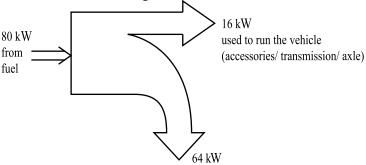
- **19.** Which of the following actions can increase the energy efficiency of a building?
 - I. Aligning building to maximise air flow
 - II. Using central air conditioning
 - III. Having large glass windows
 - IV. Using light coloured paints on the wall
 - (A) I and III only
 - (B) III and IV only
 - (C) I, III and IV only
 - (D) I, II, III and IV
- **20.** Which of the following are potential environmental impacts of wind energy?
 - I. Bird kills
 - II. Noise pollution
 - III. Water pollution
 - IV. Loss of biodiversity
 - (A) I, II and III only
 - (B) I, II and IV only
 - (C) I, III and IV only
 - (D) I, II, III and IV
- 21. In the Caribbean, many islands rely on the importation of fossil fuels to generate electricity for domestic and industrial use. The cost attached to this importation of fuel can be classified as
 - (A) social
 - (B) regional
 - (C) political
 - (D) economic

- **22.** Which of the following energy conversions shows the conversion of energy in the production of electricity from crude oil?
 - (A) Chemical \rightarrow mechanical \rightarrow heat \rightarrow electrical
 - (B) Chemical \rightarrow heat \rightarrow mechanical \rightarrow electrical
 - (C) Heat \rightarrow chemical \rightarrow mechanical \rightarrow electrical
 - (D) Mechanical \rightarrow light \rightarrow heat \rightarrow electrical
- **23.** Which of the following may be done in the home to help conserve energy?
 - I. Turn off the light when not in the room.
 - II. Unplug cell phone chargers and other devices when not in use.
 - III. Leave on the tap while brushing your teeth.
 - IV. Do not turn off the computer because it uses more energy on start up.
 - (A) I and II only
 - (B) I and III only
 - (C) II and IV only
 - (D) III and IV only
- 24. Which of the following may be adopted to promote the use of hybrid vehicles (a vehicle which uses alternative energy sources) in the Caribbean?
 - I. Charge no import duty on hybrid vehicles
 - II. Increase taxes on fuel for traditional vehicles
 - III. Increase taxes on gas and diesel engine vehicles
 - IV. Upgrade and increase the existing fuel stations to accommodate hybrid vehicles
 - (A) I and IV only
 - (B) I, II and IV only
 - (C) I, III and IV only
 - (D) I, II, III and IV

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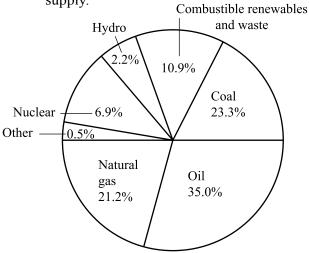




25. The energy efficiency of the engine is

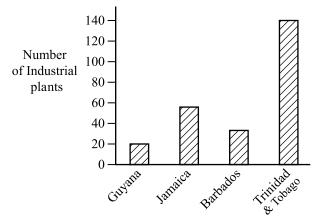
- (A) 20%
- (B) 50%
- (C) 70%
- (D) 100%
- **26.** The remaining 64 kW is
 - (A) used for braking
 - (B) lost as heat energy
 - (C) used for water cooling
 - (D) re-circulated into the engine
- 27. Water stored in a dam is an example of
 - (A) solar energy
 - (B) water energy
 - (C) kinetic energy
 - (D) potential energy

Item 28 refers to the following pie chart which represents global primary energy supply.



- **28.** The total percentage of global energy supplied by fossil fuels is
 - (A) 21.2%
 - (B) 35.0%
 - (C) 69.2%
 - (D) 79.5%

<u>Item 29</u> refers to the graph below which shows the number of Industrial plants in five Caribbean countries.

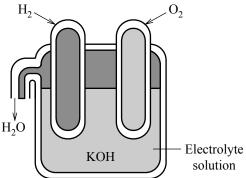


- **29.** Based on the graph, which Caribbean country will have the GREATEST demand for electricity?
 - (A) Guyana
 - (B) Jamaica
 - (C) Barbados
 - (D) Trinidad & Tobago

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Item **30** refers to the diagram below.



- **30.** The diagram shows the essential features of
 - (A) a fuel cell
 - (B) an electric motor
 - (C) a nuclear fusion reactor
 - (D) a nuclear fission reactor
- **31.** The BEST example of a point source of water pollution is
 - (A) storm water
 - (B) factory effluent
 - (C) acid precipitation
 - (D) agricultural run-off
- **32.** Ozone, O_3 , is
 - (A) a primary air pollutant in the troposphere
 - (B) a secondary air pollutant in the troposphere
 - (C) a primary air pollutant in the stratosphere
 - (D) a secondary air pollutant in the stratosphere
- **33.** Which international agreement was designed to protect the ozone layer?
 - (A) Kyoto Protocol
 - (B) Montreal Protocol
 - (C) Basel Convention
 - (D) Cartagena Convention

Item **34** refers to the equations below.

$$\operatorname{CF}_{2}\operatorname{Cl}_{2}(g) + \operatorname{hv} \to \operatorname{CF}_{2}\operatorname{Cl}(g) + \operatorname{Cl}(g)$$

 $\operatorname{Cl}(g) + \operatorname{O}_{3}(g) \rightarrow \operatorname{ClO}(g) + \operatorname{O}_{2}(g)$

- **34.** The equations above BEST describe the
 - (A) greenhouse effect
 - (B) process of oxidation
 - (C) process of carbonation
 - (D) destruction of the ozone layer
- **35.** On which of the following does the toxicity of a substance depend?
 - I. The amount of the substance the person has ingested, inhaled or absorbed through the skin
 - II. How frequently the person is exposed to the substance
 - III. The genetic make-up of an individual
 - IV. The percentage of individuals in the population who are affected by the chemical substance
 - (A) I and III only
 - (B) I, II and III only
 - (C) I, II and IV only
 - (D) I, III and IV only

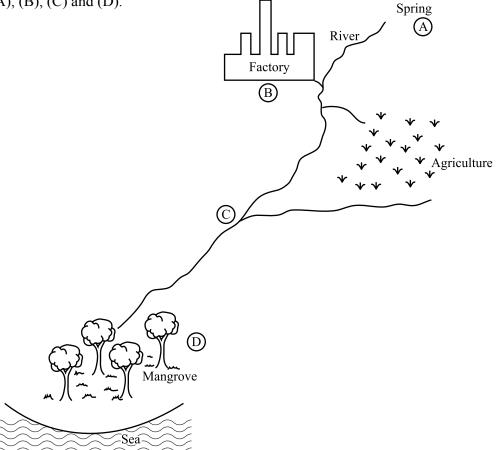
36. A synergistic interaction

- (A) either decreases or multiplies the harmful effect of a toxin
- (B) is an immediate or rapid harmful reaction to an exposure
- (C) reduces the harmful effect of a toxin
- (D) multiplies the harmful effect of a toxin

- **37.** Which of the following activities may result in an increase in pollution?
 - I. Individual
 - II. Recreational
 - III. Festival
 - IV. Tourism
 - (A) I and II only
 - (B) II and III only
 - (C) I, II and III only
 - (D) I, II, III and IV

- **38.** Which of the following should be considered when disposing hazardous waste?
 - I. Security of disposal site
 - II. Methods of transporting the waste to disposal site
 - III. Weight of the hazardous waste
 - IV. Geological activity
 - (A) I, II and III only
 - (B) I, II and IV only
 - (C) II, III and IV only
 - (D) I, II, III and IV

<u>Items 39 - 40</u> refer to the diagram below showing a section of a village with locations labelled (A), (B), (C) and (D).



- **39.** Which location on the diagram is the BEST location for a water treatment plant that produces potable water?
- 40. At which location on the diagram will the nitrates be in the HIGHEST concentration?

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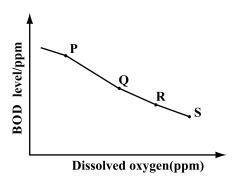
41. Mr James, a farmer, uses the river which runs through his property for irrigation. He suspects the water is being contaminated by raw sewage.

Which parameter will he have to monitor to determine if his suspicions are justified?

-9-

- (A) Turbidity
- (B) Total nitrates
- (C) Faecal coliform
- (D) Total suspended solids

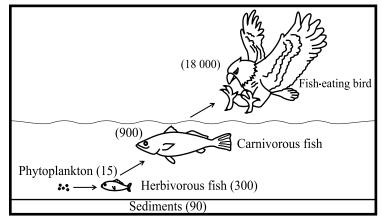
<u>Items 42 - 43</u> refer to the graph below which shows the relationship between biochemical oxygen demand and dissolved oxygen concentrations in a river. P to S represents values for BOD and DO from samples at four different points along the river.



42. Which sample was MOST LIKELY taken from the active decomposition zone?

- (A) P
- (B) Q
- (C) R
- (D) S
- **43.** Which sample was MOST LIKELY taken from a point in the river closest to the pollution source?
 - (A) P
 - (B) Q
 - (C) R
 - (D) S

<u>Items 44 - 45</u> refer to the diagram below which shows an aquatic food chain with the mecury concentrations at each level.



- 44. The process shown in the diagram is
 - (A) bioremediation
 - (B) biomagnification
 - (C) bioaccumalation
 - (D) phytoremediation
- **45.** The concentration factor for the mercury pollutant in the food chain is
 - (A) 15
 - (B) 325
 - (C) 1 200
 - (D) 12 000

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.



CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

UNIT 2: AGRICULTURE, ENERGY AND ENVIRONMENTAL POLLUTION

SPECIMEN PAPER

PAPER 02

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

- 1. Do NOT open this examination paper until instructed to do so.
- 2. This paper consists of SIX questions, TWO from each Module.
- 3. Answer ALL questions.
- 4. Write your answers in the answer booklet provided.
- 5. You may use a silent, non-programmable, scientific calculator.

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02220020/ SPEC/ 2010

MODULE 1

Answer BOTH questions.

1. Figure 1 shows the agricultural yield from a farm when inorganic fertilisers and organic fertilisers are used.

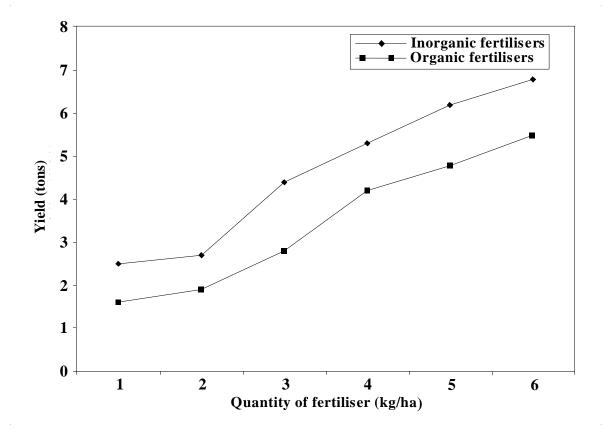


Figure 1. Yield and type of fertiliser used

- (a) With reference to Figure 1, state FIVE deductions that can be made about the agricultural yield from the farm. (5 marks)
- (b) Distinguish between 'organic fertilisers' and 'inorganic fertilisers'.

(3 marks)

(c) Discuss why, in spite of the trend shown in Figure 1, farmers are still being encouraged to increase their use of organic fertilisers over inorganic fertilisers.

Include SIX points in your response.

Total 20 marks

(12 marks)

- 2. Hillside farming has been a common occurrence for years in Toco Village. Recently residents of the village have observed increased cases of soil erosion and degradation of the water quality. Farmers have been planting the same crops for years and have complained of decreased yields and increased pest infestation.
 - (a) Residents in Toco Village were told by the agricultural extension officer that their farming practices were responsible for the increased cases of soil erosion and water quality degradation.

Explain why the officer said this to the residents. (6 marks)

(b) Farmers in Toco Village were advised to practise crop rotation in an effort to improve yields and reduce the problems caused by pest infestation.

Justify the advice given.

- (c) (i) Name ONE soil conservation method that is appropriate for the farmers in Toco Village. (1 mark)
 - (ii) BRIEFLY describe the method named in (c)(i) above.

(2 marks)

(6 marks)

(d) The turbidity of the river in Toco Village was monitored from 1990 – 2000. The table below provides the information collected.

Year	Turbidity
1990	5.5
1992	9.0
1994	27.2
1996	29.2
1998	16.4
2000	10.2

(i) Plot a graph to illustrate the information provided in the table. (4 marks)

(ii) The farmers implemented the soil conservation method identified in (c)(i) during this period. In what year was this method implemented? (1 mark)

Total 20 marks

MODULE 2

Answer BOTH questions.

- **3.** (a) Outline the process by which fossil fuels are formed.
 - (b) Figure 2 shows the annual consumption of fossil fuels by developing countries in 1990, 2000, 2003.

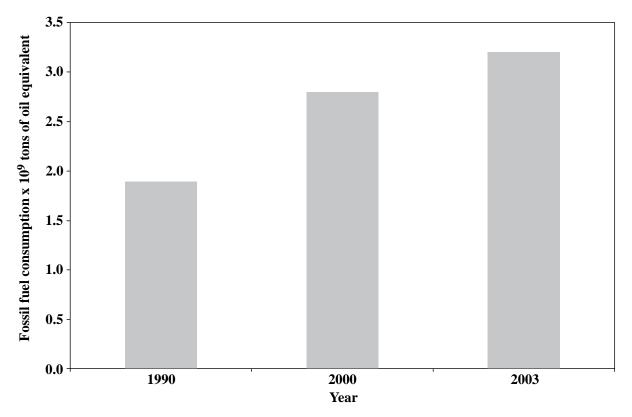


Figure 2. Annual consumption of fossils fuels by developing countries

(i) Compare the annual consumption of fossil fuels over the three years. (5 marks)
(ii) Describe ONE environmental and ONE social impact on developing countries as a result of the consumption pattern indicated in Figure 2. (8 marks)
(i) Define the term `demand management' in relation to energy use. (1 mark)
(ii) Explain how `demand management' can help to mitigate the impacts of fossil fuel consumption. (4 marks)

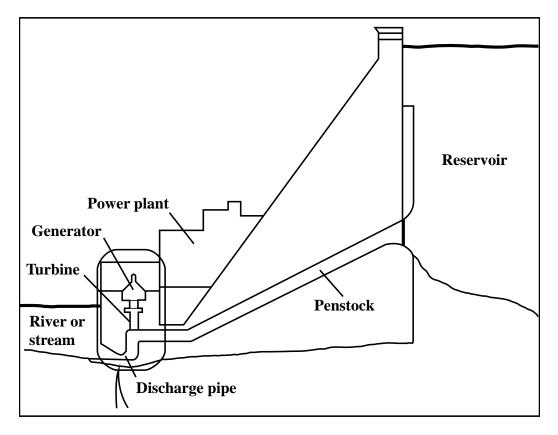
Total 20 marks

0222020/SPEC/2010

(c)

(2 marks)

4.(a) Figure 3 below shows a hydroelectric power plant.





- (a) Describe the energy conversion process occurring in the hydroelectric power plant, making clear in your description the meaning of the terms 'potential energy' and 'kinetic energy'.
 (4 marks)
- (b) State TWO advantages and ONE disadvantage of hydroelectric power generation. (3 marks)
- (c) Assess the suitability of (i) hydroelectricity AND (ii) solar energy to adequately meet the energy needs of developing countries. (8 marks)

Type of Energy	Percentage Use
Biomass	11.0
Coal	22.0
Geothermal, solar, wind	2.5
Hydropower	4.5
Natural gas	21.0
Nuclear	6.0
Oil	33.0

(d) The data below represent the percentage use of various types of energy in the world.

(i)	Plot a bar graph to illustrate the data in the table.	(4 marks)
()	3 1	(

(ii) What percentage of commercial energy used in the world is renewable? (1 mark)

Total 20 marks

MODULE 3

Answer BOTH questions.

5. Table 2 presents results from a monitoring programme to determine levels of the pesticide dieldrin present in an aquatic ecosystem. The pesticide concentration was measured in each organism that formed a part of a complete food chain.

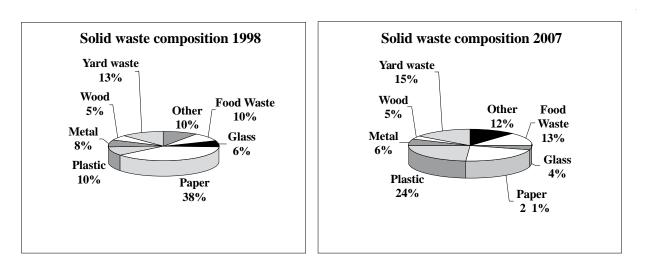
 TABLE 2: CONCENTRATION OF DIELDRIN IN AQUATIC ECOSYSTEM

Category of Organism	Organism	Dieldrin Concentration (ppm)
Producers	Algae, aquatic plant	0.05
Primary consumers	Small fish	0.3 – 1.2
Secondary consumers	Large fish	1.4 – 2.6
Tertiary consumers	Large bird	4.0 - 6.0

Concentration of dieldrin in water = 0.0002 ppm

- (a) State FIVE inferences that may be drawn from the data presented in Table 2. (5 marks)
- (b) Outline ONE environmental pathway of the pesticide. (3 marks)
- (c) Account for the difference in dieldrin concentration in the organisms presented in Table 2. (6 marks)
- (d) Describe TWO characteristics of pesticides that account for their environmental impact. (6 marks)

Total 20 marks



6. Figure 4 shows the solid waste composition for a Caribbean country in 1998 and 2007.

Figure 4. Solid waste composition for a Caribbean country, 1998 and 2007

(a)	(i) State TWO major changes in the composition of solid waste between 2007.	1998 and (2 marks)
	(ii) Explain the environmental significance of ONE of the changes in (i) a	bove. (2 marks)
	(iii) Which solid waste is the same in both years?	(1 mark)
(b)	Outline TWO reasons for the change in the composition of solid waste be and 2007.	tween 1998 (4 marks)
(c)	(i) What is meant by the term 'recycling'?	(2 marks)
	(ii) Name ONE type of waste that can be recycled.	(1 mark)
(d)	Caribbean countries are proposing recycling programmes for minimising of solid waste which they produce. Discuss FOUR advantages and FOUI disadvantages of these programmes.	

Total 20 marks

END OF TEST



CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

UNIT 2: AGRICULTURE, ENERGY AND ENVIRONMENTAL POLLUTION

SPECIMEN PAPER

PAPER 03/2

2 hours

INSTRUCTIONS TO CANDIDATES

- 1. This paper consists of THREE questions.
- 2. Answer ALL questions.
- 3. Write your answers in the answer booklet provided.
- 4. Graph paper is provided.
- 5. You may use a silent, non-programmable, scientific calculator.

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02220032/ SPEC/2010

-2-

Answer ALL questions.

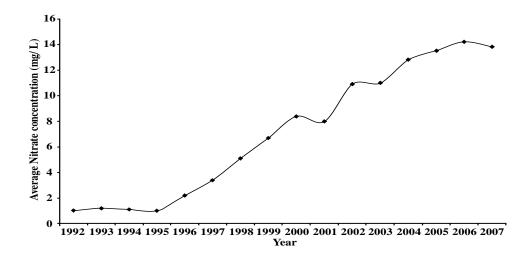
Read the paragraph below and answer the questions that follow.

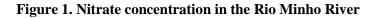
Tropic Farm has been in operation since 1970 producing bananas for the export market. Tropic Farm is located in the same region as the rural community of Maka Bush. Residents of this community depend on water from the Rio Minho River for domestic use. In 1995, Tropic Farm increased its production of bananas for the export market. Residents of Maka Bush claim that since 1995, the quality of the water in the Rio Minho has deteriorated.

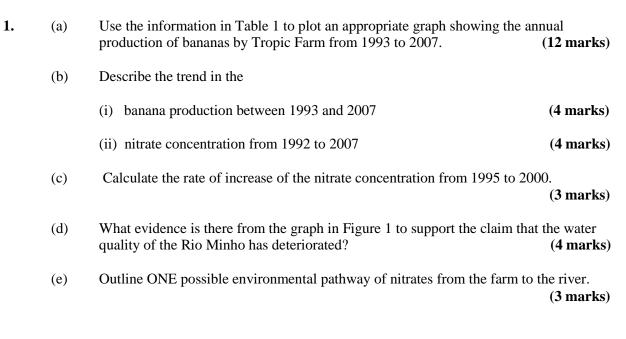
Table 1 presents production data from Tropic Farm for the years 1993 to 2007 while Figure 1 shows average annual nitrate concentration in the Rio Minho River from 1992 to 2007.

Year	Banana Production
1993	1400
1994	1450
1995	1500
1996	2200
1997	2500
1998	2800
1999	3000
2000	3200
2001	3100
2002	3600
2003	3700
2004	3900
2005	4100
2006	4200
2007	4000

TABLE 1: ANNUAL PRODUCTION OF BANANAS







Total 30 marks

-3-

- 2. (a) As part of its development drive, the national government has decided to invest in a hydroelectric power project on the Rio Minho River.
 - (i) Hydroelectric energy can be classed as a type of indirect solar energy. State TWO other energy sources that can also be placed in the same class.

(2 marks)

- (ii) Describe how a hydroelectric power plant works. (4 marks)
- (b) The residents of Maka Bush have received letters informing them of the planned development and clearly outlining the advantages of hydroelectric power to the nation.
 - (i) Provide FOUR advantages of hydroelectric power. (4 marks)
 - (ii) However, the residents of Maka Bush are very concerned about the possible negative impacts of this planned development, and take their concerns to the capital. Suggest FOUR concerns that the people in Maka Bush may have.
 (4 marks)
- (c) Having heard the concerns of the Maka Bush and other residents from the area, the national government provides some data on hydropower in the Caribbean to encourage the residents to get on board with the project. This data is provided in Table 2 below.

Country	Hydropower Generation,(billion kWh)			
	1997	2007		
Antigua and Barbuda	0.00	0.00		
The Bahamas	0.00	0.00		
Barbados	0.00	0.00		
Belize	0.07	0.18		
Dominica	0.02	0.03		
Grenada	0.00	0.00		
Guyana	0.00	0.00		
Jamaica	0.16	0.16		
ST. Kitts/Nevis	0.00	0.00		
St. Lucia	0.00	0.00		
St. Vincent and The Grenadines	0.02	0.02		
Suriname	1.30	0.90		
Trinidad and Tobago	0.00	0.00		

TABLE 2. GENERATION OF ELECTRICITY BY HYDROPOWERIN THE CARIBBEAN IN 2007

(i) Plot a bar graph to illustrate the data in Table 2, using ONLY the data for the countries with actual hydropower generation capability. (10 marks)

		(ii)	Describe the trend in electricity generation by hydropower in the Ca	ribbean.
				(3 marks)
		(iii)	What percentage of the electricity generated by hydropower was pro Belize and St. Vincent and The Grenadines in 2007?	oduced by (3 marks)
3.	(a)	Outline bodies.	THREE reasons why it is necessary to monitor the water quality of	water
				(3 marks)
	(b)	(i)	Identify THREE parameters, excluding nitrates , that should be meaprogramme to monitor the water quality of the Rio Minho River.	asured in a (3 marks)
		(ii)	Justify your choice of parameters to be measured in 3 (b)(i) above.	(6 marks)
	(c)	Outline	the procedure to test for THREE of these water quality parameters.	(12 marks)
	(d)	(i)	State THREE changes which may occur in a river ecosystem that ha concentration of nitrates.	as a high (3 marks)
		(ii)	Give ONE reason for EACH change stated in (d)(i).	(3 marks)

Total 30 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE – UNIT 1

SPECIMEN PAPER 2010

Item	Кеу	Cognitive	Syllabus
No.		Level	Objective
1	С	КС	Module 1.5
2	С	КС	Module 1.1
3	А	КС	Module 1.6
4	С	КС	Module 1.12
5	D	КС	Module 1.1
6	В	КС	Module 1.13
7	С	AK	Module 1.7
8	А	АК	Module 1.12
9	В	АК	Module 1.6
10	А	AK	Module 1.6
11	В	АК	Module 1.11
12	D	АК	Module 1.2
13	С	PA	Module 1.10
14	С	PA	Module 1.10
15	D	PA	Module 1.12
16	D	КС	Module 2.2
17	В	КС	Module 2.9
18	С	КС	Module 2.9
19	D	КС	Module 2.6
20	А	КС	Module 2.6
21	А	КС	Module 2.8
22	С	PA	Module 2.6
23	В	PA	Module 2.6

Item	Кеу	Cognitive	Syllabus
No.		Level	Objective
24	С	AK	Module 2.1
25	D	AK	Module 2.6
26	D	AK	Module 2.5
27	В	AK	Module 2.12
28	С	AK	Module 2.5
29	А	AK	Module 2.5
30	В	PA	Module 2.6
31	А	КС	Module 3.4
32	D	КС	Module 3.10
33	В	КС	Module 3.2
34	С	КС	Module 3.10
35	В	КС	Module 3.5
36	С	КС	Module 3.5
37	С	AK	Module 3.6
38	А	AK	Module 3.8
39	В	AK	Module 3.8
40	D	AK	Module 3.9
41	С	AK	Module 3.9
42	В	AK	Module 3.10
43	С	PA	Module 3.4
44	В	PA	Module 3.4
45	С	PA	Module 3.10

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CARIBBEAN EXAMINATIONS COUNCIL HEADQUARTERS

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

SPECIMEN PAPER

UNIT 1 - PAPER 02

MARK SCHEME

Specimen Paper

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective		mstructions	KC	AK	PS
1 (a) (i)	1.1	All of the <u>interacting organisms</u> in an area together with the <u>physical</u> <u>environment.</u>		2		
1(a) (ii)	1.11	The ability of biological communities to remain <u>stable</u> and <u>constant</u> over time.		2		
1 (b)	1.10	$D= \frac{N(N-1)}{\Sigma n(n-1)}$ Species diversity A = 2.4 Species diversity B = 3.09	1 mark formula, 1 mark for calculation and 1 mark for answer		3	
1 (c)	1.10;1.11	Ecosystem stability is dependent on species diversity; ecosystem stability increase as species diversity increases.	1 mark for each point		2	
		• Ecosystems are interconnected by feeding relationships, (1 mark) the higher the species diversity the more complex and interconnected the eco system (1mark)as a result it is more resistant to changes and can recover easily from disruptions (1 mark).			3	
		• Sometimes diverse communities contain keystone species, (1mark) and when these are removed associated species are also eliminated (1 mark) disrupting the ecosystem stability, in these cases species diversity makes the ecosystem less stable (1mark).			3	

Specimen Paper

Question Objective KC AK PS 1 (d) (i) 1.9 QUADRAT 1 mark Ar andom numbers table is used to select coordinates 1 mark Any THREE Points one mark each Any THREE Points one mark each A superal locations at the site. 1 (d) (i) 1.9 QUADRAT 1 mark Any THREE Points one mark each A A 1 mark A mathematical equation is used to calculate the percentage frequency or species diversity. OR I mark A A 0 R LINE TRANSECT I mark I mark Any THREE Points one mark each Any THREE Points one mark each		Syllabus	Suggested Response Instructions Marks				
1 (d) (ii) 1.9 1 (d) (iii) 1.9	Question	Objective		mstructions	KC	AK	PS
1 (d) (ii) 1.9 LINE TRANSECT 1 mark • The sampling area is demarcated Any THREE • The rope is marked and numbered at 0.5m or 1m intervals along its length. Any THREE • The species touching the line along the length of the transect is recorded. Any THREE 1 (d) (ii) 1.9 Difficulty accessing area under study due to the terrain.	1 (d) (i)	1.9	 A random numbers table is used to select coordinates The quadrat is placed on the ground in several locations at the site. The number of the species under investigation within the quadrat is recorded. A mathematical equation is used to calculate the percentage frequency or species diversity. 	Any THREE Points one			4
	1 (d) (ii)	1.9	 LINE TRANSECT The sampling area is demarcated The rope is marked and numbered at 0.5m or 1m intervals along its length. The rope is laid across the area of study. The species touching the line along the length of the transect is recorded. Difficulty accessing area under study 	Any THREE Points one			1
					4	11	5

Specimen Paper

QuestionObjectiveJosgester ResponseInstructionsKCAKPS2 (a) (i)1.5Earthworms, mushrooms, molds, bacteria.Any ONE 1 mark1II2 (a) (ii)1.5Decomposers break down organic matter, (1mark) releasing nutrients back into the soil (1 mark).Any ONE 1 mark1I2 (b)1.14•Improper disposal of non- biodegradable products: This practice can harm organisms and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase.I mark for the way and 3 marks for describing how it disrupts the ecosystem8•Pollution associated with agricultural and industrial activities: The pollutant bioaccumulae and biomagnify throughout food chains and food welsy these pollutants can harm organisms and can even kill some of them thus disrupting the ecosystem balance; the pollution can result in eutrophication.ANY TWO WAYS•Removal of recyclable organic material from the ecosystem: This practice reduces source of food for detrital organisms; it reduces the amount of nutrient systems processes, biogeochemical cycles and feeding relationships.ANY TWO WAYS		Syllabus Suggested Response Instructions Mark					
2 (a) (ii) 1.5 Decomposers break down organic matter, (Imark) releasing nutrients back into the soil (1 mark). 1 mark 2 2(b) 1.14 Improper disposal of non- biodegradable products: 1 mark for 1 This practice can harm organisms and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase. 1 mark for 8 • Pollution associated with agricultural and industrial activities: 3 marks for 8 The pollutant bioaccumulate and biomagnify throughout food chains and food webs; these pollutants can harm organisms and can even kill some of them thus disrupting the ecosystem balance; the pollution can result in eutrophication. ANY TWO WAYS • Removal of recyclable organic material from the ecosystem: Imaterial from the ecosystem: This practice reduces source of food for detrital organisms; it reduces the amount of nutrients available for nutrient cycles; it disrupts ecosystems processes, biogeochemical cycles and feeding Imate for	Question	Objective		mstructions	KC	AK	PS
2(b)1.14Improper disposal of non- biodegradable products:This practice can harm organisms and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase.I mark for the way and 3 marks for describing how it• Pollution associated with agricultural and industrial activities:I mark for the way and 3 marks for describing how it• Pollution associated with agricultural and industrial activities:ANY TWO WAYSThe pollutant bioaccumulate and biomagnify throughout food chains and food webs; these pollution can result in eutrophication.ANY TWO WAYS• Removal of recyclable organic material from the ecosystem:This practice reduces source of food for detrital organisms; it reduces the amount of nutrients available for nutrient cycles; it disrupts ecosystems processes, biogeochemical cycles and feeding	2 (a) (i)	1.5			1		
biodegradable products:This practice can harm organisms and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase.1 mark for the way and 3 marks for describing how it• Pollution associated with agricultural and industrial activities:1 mark for the way and 3 marks for describing how it8• Pollution associated with agricultural and industrial activities:ANY TWO WAYS8The pollutant bioaccumulate and biomagnify throughout food chains and food webs; these pollutants can harm organisms and can even kill some of them thus disrupting the ecosystem balance; the pollution can result in eutrophication.ANY TWO WAYS• Removal of recyclable organic material from the ecosystem:This practice reduces source of food for detrital organisms; it reduces the amount of nutrient savailable for nutrient cycles; it disrupts ecosystems processes, biogeochemical cycles and feedingI	2 (a) (ii)	1.5	matter, (1mark) releasing nutrients back		2		
and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase.1 mark for the way and 3 marks for describing how it• Pollution associated with agricultural and industrial activities:1 mark for the way and 3 marks for describing how it8• Pollution associated with agricultural and industrial activities:ANY TWO WAYS8The pollutant bioaccumulate and biomagnify throughout food chains and food webs; these pollutants can harm organisms and can even kill some of them thus disrupting the ecosystem balance; the pollution can result in eutrophication.ANY TWO WAYS• Removal of recyclable organic material from the ecosystem:This practice reduces source of food for detrital organism; it reduces the amount of nutrients available for nutrient cycles; it disrupts ecosystems processes, biogeochemical cycles and feeding4	2(b)	1.14					
			 and even kill some of them thus reducing potential food sources for others; it decreases ecological integrity and aesthetics and it can affect the rate of population increase. Pollution associated with agricultural and industrial activities: The pollutant bioaccumulate and biomagnify throughout food chains and food webs; these pollutants can harm organisms and can even kill some of them thus disrupting the ecosystem balance; the pollution can result in eutrophication. Removal of recyclable organic material from the ecosystem: This practice reduces source of food for detrital organisms; it reduces the amount of nutrients available for nutrient cycles; it disrupts ecosystems processes, biogeochemical cycles and feeding 	the way and 3 marks for describing how it disrupts the ecosystem ANY TWO		8	

Environmental Science Specimen Paper Paper 02 - Mark Scheme

Question Objective KC AK PS 2 (c) 1.5 Named ecosystem. 1 mark 1 mark 4 4 Food web showing interactions at two different trophic levels. 2 marks 2 marks 4 4		Syllabus	Suggested Response	Instructions		Marks	
2 (d) 1.5 PYRAMID Appropriate scale 1 mark HAWKS Correct placement of each organism 1 mark each 5 MANGO	Question	Objective		mstructions	KC	AK	PS
2 (d) 1.5 PYRAMID Appropriate scale 1 mark HAWKS Correct placement of each organism 1 mark each 5 MANGO	2 (c)	1.5	Food web showing interactions at two			4	
HAWKS Scale 1 mark 5 SMALL Correct placement BIRDS of each organism CATERPILLARS 1 mark each			Construction of food web.	1 mark			
	2 (d)	1.5	HAWKS SMALL BIRDS CATERPILLARS MANGO	scale 1 mark Correct placement of each organism			5
3 12 5					3	12	5

Specimen Paper

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective			KC	AK	PS
3 (a)	2.6	Total population increase = total population (2020) – total population (1990) .	1 mark			5
		Population increase = (6548 +1375) M - (4486 + 1247) M = 2190.	2 marks			
		Increase in population of less developed countries (6548 - 4486) M 2062.	1 mark			
		% growth in world population due to less developed countries.	1 mark			
		 <u>2062</u> = 94% 2190 In many of these countries the 				
(b)	2.7	standard of living is much lower than in the developed countries	1 mark			
		• A greater percentage of the population is at or below the poverty level as the country is unable to provide the basic needs for the population	1 mark		4	
		• The economic level of many of these countries will be unable to support the increased population size	1 mark			
		• Population growth in these countries will drive more people into poverty and increase the pressure on the environment	1 mark			

Specimen Paper

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective			KC	AK	PS
3 (c)	2.17	Increased pollutionPremature depletion of resourcesMore land use	1 mark each	3		
3 (d)	2.12	 Increase production of food to keep pace with population growth The use of technology to produce more food Introduction of government policies to support family planning. Government incentives for pollution reduction Lifestyle changes The use of substitutes 	Any FOUR points 2 marks each		8	
				3	12	5

Specimen Paper

	Syllabus	Suggested Response	Instructions		Marks	Marks		
Question	Objective		mstructions	KC	AK	PS		
4 (a)	2.7	The number of children a couple is expected to have may be determined by the culture of the society because some cultures promote high fertility rates and this in turn leads to high population growth rates. In these societies child labour contributes to the family's income.	Full explanation 2 marks; partial explanation 1 mark	2				
4 (b)	2.9	 The life expectancy of an infant born in country A is higher than that of an infant born in Country B The population of Country A is more educated than the population of Country B The GDP per capita in Country A is higher than in Country B There is a higher standard of living in Country A than in Country B 	2 marks for each deduction which shows comparison 1 mark if comparison is not indicated		6			
4 (c) (i)	2.5	• The average number of children born to each woman during her reproductive years.		1				

Specimen Paper

	Dbjective 2.5	Suggested Response	Instructions	KC	AK	PS
4 (c) (ii) 2.	2.5					10
4 (c) (iii)		 Graph: Axis - 1 mark Plotting of points - 2 marks Title - 1 mark The fertility rates for both low and high income level countries decreased during the period 1965 - 1990. The fertility rates for both low and high income level countries decreased during the period 1990 - 2000. The fertility rates for both low and high income level countries decreased during the period 1990 - 2000. The fertility rates for both low and high income level countries decreased during the period 1965 - 2000. The fertility rates for low income countries decreased less than that for 	2 marks for each conclusion		6	5
				3	12	5

Specimen Paper

QuestionObjectiveSuggested ResponseInstructions $\overline{\mathrm{KC}}$ AK5 (a)3.3Consumptive use of natural resources in which these resources are utilized and removed from other natural environments (e.g. catching fish for food).(1 mark) for consumptive use;35 (a)Non-consumptive use of natural resources does not require that the resources be removed from their natural habitat (e.g. use of forest resources for ecotourism).(1 mark) for non- consumptive use and (1 mark) for any correct example.35 (b) (i)3.2The quantity of resource B declined from a start of 18 x 10 ³ - kg up to Year 6 when the amount was 7 x 10 ³ - kg, this was followed by an increase from Year 7 to Year 10 when the amount was 13 x 10 ³ - kg.1 mark each2(ii)3.2Justification - Non-renewable B is renewable1 mark each2(iii)3.2Justification - Non-renewable resources which exist in fixed quantities and once used cannot be replaced.2 marks	PS
refers to use of natural resources in which these resources are utilized and removed from other natural environments (e.g. catching fish for food).consumptive use;Non-consumptive resources does not require that the resources be removed from their natural habitat (e.g. use of forest resources for ecotourism).(1 mark) for non- consumptive use and (1 mark) for any correct example.5 (b) (i)3.2The quantity of resource B declined from a start of 18 x 10 ³ - kg up to Year 6 when the amount was 7 x 10 ³ - kg, this was followed by an increase from Year 7 to Year 10 when the amount was 13 x 10 ³ - kg.1 mark each2(ii)3.2Justification - Non-renewable which exist in fixed quantities and once used cannot be replaced.2 marks	
a start of 18 x 10 ³ - kg up to Year 6 when the amount was 7 x 10 ³ - kg, this was followed by an increase from Year 7 to Year 10 when the amount was 13 x 10 ³ - kg. 1 1 1 2 (ii) 3.2 A is non-renewable B is renewable 1 mark each 2 (iii) 3.2 Justification - Non-renewable resources which exist in fixed quantities and once used cannot be replaced. 2 marks	
(iii)3.2B is renewable1 mark each2Justification - Non-renewable resources which exist in fixed quantities and once used cannot be replaced.2 marks1	5
which exist in fixed quantities and once 2 marks used cannot be replaced.	
The quantity of resource A decreased	
during exploitation but after exploitation 2 marks ceased the quantity of the resource remained the same after the eighth year.	
Renewable resources are those that can be replaced or replenished through 2 marks natural processes.	
Resource B replenished itself after exploitation. 1 mark	

Specimen Paper

	Syllabus	Suggested Pespense	Instructions		Marks	
Question	Objective	Suggested Response	instructions	KC	AK	PS
Question 5 (c)		Suggested Response Conservation of resources: (i) use of substitutes (ii) use of appropriate technology (iii) reduction of use (iv) use of economic instruments.	Instructions Any THREE 1 mark each			PS
				3	12	5

Specimen Paper Paper 02 - Mark Scheme

	Syllabus	Suggested Response	Instructions		Marks		
Question	Objective		mstructions	KC	AK	PS	
6 (a)	3.6	 Provide coastal and beach protection Provide nursery and feeding areas for fisheries. 	Any THREE 1 mark each.	3			
		3. Support recreation and tourist activities.					
		4. Support food fishery.					
6 (b)	3.7	 clearance of coastal vegetation and inland forests results in loss of vegetation cover soil erosion, an increase in the amount of sediment entering waterways and the corals become stressed and eventually die. Discharge of sewage into coastal water this contains bacteria which proliferate and kill the coral. Coral harvesting results in the removal of the coral as well as damage to the coral reef structure. 	TWO marks for each activity fully explained. 1 mark for partial explanation.		6		
6 (c) (i)	3.7	Graph: Axis - (1 mark) Plotting of points - (3 marks) Title - (1 mark)				5	
6 (c) (ii)	3.8	Lag time: 3 yrs Reason: Rate of replenishment (migration of reproduction)			1 1		

Specimen Paper Paper 02 - Mark Scheme

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	KC	AK	PS
Question 6 (c) (iii)	Syllabus Objective 3.8	 Suggested Response The improvement in coral reef ecosystem is manifested by increased coral cover, improved habitat, greater diversity and therefore an increase in fishable resources on the reef. Greater diversity leads to improved food resources for the fish. Increased coral cover will offer more protection to fish resources from predators leading to an increase in fishable resources. 	Instructions Any TWO 2 marks	КС		PS
				3	12	5

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CARIBBEAN EXAMINATIONS COUNCIL HEADQUARTERS

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

SPECIMEN PAPER

Unit 1 – Paper 03/2

MARK SCHEME

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	KC	AK	PS
1 (a)	1.10	Lizards are moving organisms (1) and it is difficult to count directly the number of organisms within a given area (1); they may not all be visible (1)		3		
1 (b)	1.10	Outline of the mark-release-recapture method:				
		- A sample of the population is captured. (1)				
		- Each individual in the sample is marked in a non-harmful way (1) and then released back into the general population (1)				
		- after an appropriate length of time organisms are recaptured and (1)				7
		- the number of marked organisms recaptured is noted (1)				
		- An estimate of the population is obtained by calculation using the following equation. (1)				
		no. of population = no. in recaptured sample				
		no. in first sample no. already mixed in recaptured sample (1)				

Environmental Science

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective	Suggested Response	mstructions	KC	AK	PS
1 (c)	1.10	Two assumptions that must be made when using the mark-release-recapture method to estimate population size:An appropriate time-scale for the population of marked and unmarked lizards to mingle.	Any two assumptions 2 marks each		4	
		• Marking does not affect or harm the species' chance of survival and reproduction.				
		• Each individual in the population has an equal chance or probability of being caught.				
1 (d)	1.19	Monitoring plan to keep track of the population	Any four steps 1 mark each			
		<u>Plan a visit to the site</u>				
		to observe the situationto evaluate and determine the next	One objective per step 1 mark			8
		steps	each			
		- to have discussion with the workers, managers and concession holder.				
		- To choose sampling sites and determine requirements for sampling and monitoring.				

Environmental Science

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	KC	AK	PS
1 (d) Cont'd		 <u>Review previous data collected</u> to get information on specific site peculiarities to familiarize oneself with previous limitations 				
		 <u>Plan number and time of visits</u> to undertake sampling to trap, mark and release animals to recapture and check numbers of lizards to observe if there are any new threats to the population and to make recommendations for dealing with these threats <u>Analyze population data</u> to calculate estimates of lizard population at each sampling time to establish database so that 				
		 information can be added to it and regular updates of the data to be made <u>Disseminate information</u> on status of monitoring and population data and other species information to assist others to be informed and participate in conservation efforts. 				

Specimen Paper Unit 1 Paper 03/2 Mark Scheme

	Syllabus]	Marks	Γ
Questio n	Objective	Suggested Response	Instructions	KC	AK	PS
1 (e)	1.22	250 200 100 100 0 96 97 98 99 00 01 02 03 04 05 100 100 0 100 0 100 100 100				

Environmental Science

Question Objective Suggested nesponse Instructions KC AK Title of Graph - 1 mark Labelling of axes - 2 marks Appropriate scales - 2 marks Plotting of points correctly - 5 marks Smooth curve - 2 marks Plotting of graphs 9 or more accurate points - 5 marks 7 - 8 " " - 4 5 - 6 " " - 4 3 - 4 " - 2 1 - 2 " " - 1 0 " " - 0		Syllabus	Suggested Response Instruc			Marks	
Labelling of axes – 2 marks Appropriate scales – 2 marks Plotting of points correctly – 5 marks Smooth curve – 2 marks Plotting of graphs 9 or more accurate points – 5 marks 7 - 8 " " – 4 " 5 - 6 " " – 3 " 3 - 4 " " – 2 " 1 - 2 " " – 1 "	Question		Suggesteu Response	Instructions	KC	AK	PS
9 or more accurate points – 5 marks 7 - 8 " – 4 " 5 - 6 " " – 3 " 3 - 4 " – 2 " 1 - 2 " " – 1 "			Labelling of axes- 2 marksAppropriate scales- 2 marksPlotting of points correctly- 5 marksSmooth curve- 2 marks				8
			9 or more accurate points - 5 marks 7 - 8 " - 4 " 5 - 6 " - 3 " 3 - 4 " - 2 " 1 - 2 " - 1 "				
					3	4	23

Environmental Science

	Syllabus	Suggested Response	Instructions		Marks		
Question	Objective		mstructions	KC	AK		
2 (a) (i)	2.2 2.2	The number of children a couple must have to replace themselves.	Incomplete definition	2			
(ii)	2.2	The average number of children born to each woman during her reproductive lifetime.	1 mark only	2			
(b) (i)	2.5	28+18+14+19=79	1 mark for answer and 4 marks for extracting information from chart			5	
(b) (ii)	2.5	Pre-reproductive years 0 – 14	1 mark				
		8+7+6+6=27	4 marks for extracting date; 1 mark for answer			7	
		Percentage = 27\56.6=47.7	1 mark				
(c) (i)	2.5	The population is expected to increase over the next ten years.				1	

<u>-</u>8<u>-</u>

QuestionObjectiveJuggsteel ResponseInstitutionsKCAKPS(c) (ii)2.5• The largest percentage of the population is in the pre-reproductive age group. • When these children mature they will become the parents of the next generation. • This group of parents will be larger than the previous group. • Even if the fertility rate remains at replacement level the population will still continue to grow.I mark for each underlined point4(d) (i)2.7;2.8Educational opportunities • Women with higher educational backgrounds marry later (1), delaying the birth of their first child reducing the birth of their first child reducing ways of up/firing their scala status, evidence shows that this lack of social status (1) results in high fertility rates: • In contrast women with scala status • In contrast women with scala status, evidence shows that this lack of social status (1) results in high fertility rates; • In contrast women with scala status, • Provides information on reproductive physiology (1) and contraceptives (1).I mark for each underlined point99• This information allows women to control ferifity pills.1 mark for each underlined 		Syllabus	Suggested Response Instr			Marks	
(d) (i)2.7;2.8Educational opportunities exposed to education and economic status(3 marks)4(d) (ii)2.7;2.8Educational opportunities their first child reducing their first child reducing their first child reducing their first child reducing their first child status, evidence shows that this lack of social status (1) results in high fertility rates (1).(3 marks)49(3 marks)1In mark for each underlined point99(3 marks)1 mark for each underlined point9(3 marks)1In ank for exposed to education and means to control their first social status, evidence shows that this lack of social status (1) results in high fertility rates (1).1Family Planning Services • Provides information allows women to control fertility rate (1) by the use of fertility pills.1This information allows women to control fertility rate (1) by the use of fertility pills.	Question	Objective		Instructions	KC	AK	PS
 Women with higher educational backgrounds <u>marry later (1)</u>, delaying the birth of their first <u>child reducing their childbearing years (1)</u>. Educated women control their fertility <u>by using contraceptives (1)</u>. Social and economic status In some societies women are <u>not exposed to education (1)</u> and other ways of uplifting their social status, evidence shows that <u>this lack of social status have the education and means to control their fertility rates (1)</u>. Family Planning Services <u>Provides information on reproductive (1)</u> This information allows women <u>to control fertility rate (1)</u> by the use of fertility pills. 	(c) (ii)	2.5	 population is in the pre-reproductive age group. When these children mature they will become the parents of the next generation. This group of parents will be larger than the previous group. Even if the fertility rate remains at replacement level the population will 	each			4
 In some societies women are <u>not</u> <u>exposed to education</u> (1) and other ways of uplifting their social status, evidence shows that <u>this lack of social</u> <u>status</u> (1) results in high fertility rates. In contrast women with <u>social status</u> <u>have the education</u> and means to <u>control their fertility rates</u> (1). Family Planning Services <u>Provides information on</u> <u>reproductive physiology</u> (1) and <u>contraceptives</u> (1) This information allows women <u>to</u> <u>control fertility rate</u> (1) by the use of fertility pills. 	(d) (i)	2.7;2.8	 Women with higher educational backgrounds <u>marry later (1)</u>, delaying the birth of their first <u>child reducing their childbearing years (1)</u>. Educated women control their 	1 mark for each underlined			
			 In some societies women are <u>not</u> <u>exposed to education</u> (1) and other ways of uplifting their social status, evidence shows that <u>this lack of social</u> <u>status</u> (1) results in high fertility rates. In contrast women with <u>social status</u> <u>have the education</u> and means to <u>control their fertility rates</u> (1). Family Planning Services <u>Provides information on</u> <u>reproductive physiology</u> (1) and <u>contraceptives</u> (1) This information allows women <u>to</u> <u>control fertility rate</u> (1) by the use of 	1 mark for each underlined point (3 marks) 1 mark for each underlined		9	
					4	9	17

Syllabus	Suggested Response Instructions		6		
Objective		mistructions	KC	AK	PS
3.4	 As the fishing effort increases the daily fish catch increases. The increasing trend continues up to a fishing effort of 35 boats after which as fishing effort increases daily catch decreases. The decreasing trend continues and reaches 0 when fishing effort is equal to 70 boats. The maximum daily catch is 4500 kg of fish with 35 boats operating. 	2 marks for each point fully described. Partial description 1 mark.			8
3.4	Fishing effort-25 boats.				2
3.10	MSY- The largest amount of a resource that can be harvested without causing a decline in the stock of the natural resource.		2		
3.10	Point B				1
3.10	 Harvesting at B will allow the stock to be sustained since it will be easy for it to recover. The minimum viable threshold will not be exceeded and the population will sustain its biomass. There will be enough members left to reproduce, replenish and sustain the population. 	2 marks for each reason fully explained. 1 mark for partial explanation.		6	1
	Objective 3.4 3.4 3.4 3.10 3.10	ObjectiveSuggested Response3.4• As the fishing effort increases the daily fish catch increases. • The increasing trend continues up to a fishing effort of 35 boats after which as fishing effort increases daily catch decreases. • The decreasing trend continues and reaches 0 when fishing effort is equal to 70 boats. • The maximum daily catch is 4500 kg of fish with 35 boats operating.3.4Fishing effort-25 boats. MSY- The largest amount of a resource that can be harvested without causing a decline in the stock of the natural resource.3.10Point B3.10• Harvesting at B will allow the stock to be sustained since it will be easy for it to recover. • The minimum viable threshold will not be exceeded and the population will sustain its biomass. • There will be enough members left to reproduce, replenish and sustain the	ObjectiveSuggested ResponseInstructions3.4• As the fishing effort increases the daily fish catch increases. • The increasing trend continues up to a fishing effort of 35 boats after which as fishing effort increases daily catch decreases. • The decreasing trend continues and reaches 0 when fishing effort is equal to 70 boats. • The maximum daily catch is 4500 kg of fish with 35 boats operating.Partial description 1 mark.3.4Fishing effort-25 boats. MSY- The largest amount of a resource that can be harvested without causing a decline in the stock of the natural resource.2 marks for each point fi hartial3.10Point B23.10• Harvesting at B will allow the stock to be sustained since it will be easy for it to recover. • The minimum viable threshold will not be exceeded and the population will sustain its biomass. • There will be enough members left to reproduce, replenish and sustain the2 marks for each point fully	ObjectiveSuggested ResponseInstructionsKC3.4• As the fishing effort increases the daily fish catch increases. • The increasing trend continues up to a fishing effort of 35 boats after which as fishing effort increases daily catch decreases. • The decreasing trend continues and reaches 0 when fishing effort is equal to 70 boats. • The maximum daily catch is 4500 kg of fish with 35 boats operating.2 marks for each point fully description 1 mark.3.4Fishing effort-25 boats. • The maximum daily catch is 4500 kg of fish with 35 boats operating.Partial description 1 mark.3.4Fishing effort-25 boats. • The largest amount of a resource that can be harvested without causing a decline in the stock of the natural resource.2 marks for each reason fully explained.3.10• Harvesting at B will allow the stock to be sustained since it will be easy for it to recover. • The minimum viable threshold will not be exceeded and the population will sustain its biomass. • There will be enough members left to reproduce, replenish and sustain the2 marks for each reason fully explained.	ObjectiveSuggested ResponseInstructionsKCAK3.4• As the fishing effort increases the daily fish catch increases. • The increasing trend continues up to a fishing effort of 35 boats after which as fishing effort increases daily catch decreases. • The decreasing trend continues and reaches 0 when fishing effort is equal to 70 boats. • The maximum daily catch is 4500 kg of fish with 35 boats operating.2 marks for each point fully described.3.4Fishing effort-25 boats. • The largest amount of a resource that can be harvested without causing a decline in the stock of the natural resource.223.10• Harvesting at B will allow the stock to be sustained since it will be easy for it to recover. • The minimum viable threshold will not be exceeded and the population will sustain its biomass. • There will be enough members left to reproduce, replenish and sustain the2 marks for each reason fully explained.6

	Syllabus Suggested Response		Instructions	Marks		
Question	Objective		mstructions	KC	AK	PS
3 (c) (i)	3.7	Population growth (3 marks)				
		 Increased population growth means more people potentially demanding more fish resource. As demand increases greater fishing effort will be expended to harvest more fish. If the resource is not carefully managed this could lead to resource over-harvesting and resource decline. 				
(c) (ii)	3.7	Level of environmental awareness (3 marks)				
		 People become more aware of the issues and the negative impacts of humans on natural resources. They become more inclined to practice resource harvesting and management techniques. This leads to more sustainable fishing efforts and better managed fish stocks. 			6	
(d) (i)	3.10	Develop protected areas			1	
(d) (ii)	3.10	 Protected areas will allow some areas to be managed for conservation. It allows for the maintenance and rehabilitation of habitats. It restricts and manages threats to the resource. Activity close to the protected area is limited. Protected areas provide safe breeding and feeding areas. 	2 marks each for any two reasons fully stated		4	
				2	17	11

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE – UNIT 2

SPECIMEN PAPER 2010

Item	Key	Cognitive	Syllabus
No.		Level	Objective
1	С	КС	Module 1.3
2	В	КС	Module 1.1
3	С	КС	Module 1.3
4	D	АК	Module 1.3
5	С	АК	Module 1.1
6	В	КС	Module 1.3
7	В	AK	Module 1.2
8	С	КС	Module 1.1
9	А	АК	Module 1.6
10	В	PA	Module 1.3
11	А	РА	Module 1.3
12	А	АК	Module 1.3
13	В	PA	Module 1.3
14	В	АК	Module 1.3
15	С	AK	Module 1.6
16	D	КС	Module 2.3
17	А	КС	Module 2.1
18	С	КС	Module 2.3
19	С	КС	Module 2.8
20	В	КС	Module 2.9
21	D	КС	Module 2.10
22	В	AK	Module 2.1
23	А	AK	Module 2.8

Item	Кеу	Cognitive	Syllabus
No.		Level	Objective
24	D	AK	Module 2.8
25	А	PA	Module 2.5
26	В	AK	Module 2.1
27	D	AK	Module 2.1
28	D	PA	Module 2.3
29	D	PA	Module 2.7
30	А	AK	Module 2.3
31	В	КС	Module 3.5
32	В	КС	Module 3.5
33	В	КС	Module 3.8
34	D	КС	Module 3.5
35	В	КС	Module 3.1
36	D	КС	Module 3.1
37	D	AK	Module 3.4
38	В	AK	Module 3.5
39	А	AK	Module 3.5
40	С	AK	Module 3.5
41	С	PA	Module 3.5
42	D	PA	Module 3.5
43	А	РА	Module 3.5
44	В	AK	Module 3.3
45	С	AK	Module 3.3

02220020/CAPE/MS/2010

CARIBBEAN EXAMINATIONS COUNCIL HEADQUARTERS

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

SPECIMEN PAPER

Unit 2 – Paper 02

MARK SCHEME

Question 1 (a)	Objective	Suggested Response	Instructions	KC	A T7	
1 (a)				ĸc	AK	PS
		 Deductions In both instances yield increased as the amount of fertilisers increased. The yield is consistently one ton greater when inorganic fertiliser is used as against organic fertiliser. The yield is consistently one ton less when organic fertiliser is used as against inorganic fertiliser. The rate of increase in yield is greater when organic fertilisers are used. The rate of increase in yield is less when inorganic fertilisers are used. It is more efficient in the long run to use organic fertilisers. 	Any FIVE deductions 1 mark each			5
(b)		 Inorganic or 'commercial' fertilisers are manufactured, with the main ingredients being nitrate, phosphates and potassium. Organic fertilisers include materials such as animal manure, green manure and compost that are applied to cropland as a source of plant nutrients. Organic fertilisers are naturally occurring plant and animal materials that release nutrients slowly as they decompose Organic fertilisers are complex and have variable compositions Inorganic fertilisers are manufactured with specific components and concentrations 	Any THREE points 1 mark each	3		

Environmental Science Specimen Paper Unit 2 Paper 02 Mark Scheme

Question Objective Suggested Response			Marks	
· · · · · _ · _	Instructions	KC	AK	PS
 1 (c) 1.3 Inorganic or commercial fertilisers are manufactured with the main ingredients being nitrate, phosphates ad potassium. Inorganic fertilisers are expensive and farmers will therefore need to expend large amounts of money to acquire them in sufficient quantities. Organic fertilisers are cheaper since they include materials that are usually considered waste materials on farms. They are also more readily available. Inorganic fertilisers are soluble and immediately available to the plants but they are highly mobile and the nutrients are quickly leached out of the soil. Therefore farms will require regular inputs which increase costs. Organic fertilisers are slow acting and long lasting since they release nutrients only upon decomposition. Organic fertilisers. Inorganic fertilisers easily can contaminate ground water and surface waters leading to eutrophication of surface waters. Organic fertilisers improve the soil structure by adding humus which increases the waterholding capacity as well as the soil microflora which are good for plant growth. While the use of inorganic fertilisers may result in higher production in the short term, for long term sustainability, in terms of cost and environmental problems, it is better to use organic fertilisers. 	Any SIX points fully discussed 2 marks each Partial discussion 1 mark each.	3	12	5

	Syllabus	Second 1 December 2	I		Marks	
Question	Objective	Suggested Response	Instructions	KC	AK	PS
2 (a)		 Farmers often clear the vegetation from hillsides before farming. This exposes the soil to erosion since the vegetation cover is removed and the roots are no longer in place to hold the soil particles together. Water runs downhill, and the faster it runs the greater is the loss of soil. As water runoff increases downhill, more soil will be washed downhill. This soil gets into the river and other water systems. Sedimentation levels increase erosion. When agrochemicals are used by farmers, these are easily leached into the waterways. 	Any SIX points 1 mark each.		6	
(b)		 When the same crop is grown continuously, pests for that crop tend to accumulate to destructive levels because they have an abundance of food source and favorable conditions. Rotating the crops will prevent an accumulation of pests for any one specific crop, thereby reducing the likelihood of pest infestation and pest damage. Different crops have different and specific nutrient requirements. Growing one crop continuously can deplete the soil of nutrients that are specifically required by that crop. The depletion of nutrients can result in decreased yields since over time, limited amounts of these nutrients would be available. However, when practised, it keeps the soil covered with vegetation. 	Any THREE points fully discussed 2 marks each Partial discussion 1 mark each.		6	
			1	1	1	

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective	Suggested Response	Instructions	KC	AK	PS
2 (c) (i)		Contour ploughing, terracing, strip farming	Any ONE 1 mark	1		
(ii)		Contour ploughing Ploughing and planting is done in rows across rather than up and down the sloped contour of the land. Each row planted along the contour of the land acts as a small dam to help hold soil and slow the runoff of the water.	Complete description 2 marks Partial description 1 mark.	2		
		Terracing Each slope is converted into a series of broad, nearly level terraces that run across the contour of the land.				
		Strip farming This is the planting of different kinds of crops in alternating strips along the contours of the land.				

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective			KC	AK	PS
2 (d) (i)	1.3;1.7	Turbidity in the Toco village river	from 1990 - 2000			4
2 (d) (ii)	1.7	Suitable scale: x-axis: 1 cm represent year; y-axis: 1 cm represents 2.5 NTI	its 1			1
				3	12	5

Specimen Paper Unit 2 Paper 02 Mark Scheme

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	KC	AK	PS
3 (a)	2.3	- Fossils fuels are formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundred of millions of years.		2		
(b) (i)	2.11	 For the years 1990 and 2000, annual fossil fuel consumption increased by 0.9 x 10⁹ tons of oil equivalent from 1.9 x 10⁹ tons of oil equivalent to 2.8 x 10⁹ tons of oil equivalent. (1 mark) This represents an average annual increase of 0.98 for the period 1990 to 2000. (1 mark) For the years 2000 and 2003 the total increase was 0.4 x 10⁹ tons of oil equivalent representing an average increase of 0.1 x 10⁹ tons of oil equivalent. (1 mark) The average annual fossil fuel consumption for the period 2000 to 2000 to 2000). (1 mark) For the years 1990 to 2003 the total increase was 1.3 x 10⁹ tons of oil equivalent. (1 mark) 	EACH point 1 mark			5

Environmental Science

Specimen Paper Unit 2 Paper 02

Mark Scheme

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	KC	AK	PS
3 (b) (ii)		 Environmental impact Acid rain Combustion of fossils fuels generates sulphur, nitrogen and carbon oxides These dissolve in precipitation and return to earth as sulphuric, carbonic and nitric acids. These acids negatively impact natural ecosystems such as forest. Built areas such as monuments and sculptures made of marble are particularly vulnerable. Global warming Emissions of carbon dioxide from the combustion of fossil fuels are said to be the cause of the increased concentration of carbon dioxide in the troposphere. This has led to an increased retention in solar energy in the atmosphere resulting in an increase in global temperatures called global warming. Global warming has the potential to cause sea level to rise inundating coastal areas of many countries. Other potential impacts of global warming include increase in the frequency and strengths of hurricanes, floods, droughts. 	Any ONE environmental impact identified 1 mark Complete description of identified environmental impact 3 marks Partial description 1 – 2 marks		4	
		1	i			

Environmental Science Specimen Paper Unit 2 Paper 02 Mark Scheme

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective	Suggested Response	Instructions	KC	AK	PS
Question 3 (b) (ii) Cont'd 3 (c) (i)	2.7	 Habitat destruction Harvesting, processing and distributing fossil fuels can also create environmental problems Coal mining methods, particularly strip mining and mountaintop removal, have been responsible for largescale habitat destruction. Offshore drilling can create a hazard for aquatic organisms. Oil spills on the ocean are responsible for the deaths of aquatic organisms and damage to miles of beaches. Fossils fuels also contain radioactive material mainly uranium and thorium that are released into the atmosphere during burning. Social impact Air Pollution Years of exposure to air pollution can break down the body's natural defenses causing or contributing to respiratory diseases such as lung cancer, asthma, chronic bronchitis and emphysema. Elderly people, infants, pregnant women, and people with heart disease, (1) asthma or other respiratory diseases are especially vulnerable to air pollution. Air pollution costs countries billions of dollars in health care costs and lost work productivity annually. There are also many premature deaths each year as a result of pollution-related lung diseases. 	Identification of social impact 1 mark Complete description of social impact 3 marks Partial description 1 - 2 marks	1	4	PS

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective	Suggested Response	Instructions	KC	AK	PS
3 (c) (ii)	2.7	• Operators generally use the least expensive generating capacity at first to satisfy demand, and then use additional capacity from more expensive or inefficient plants as demand increases.				
		• If demand significantly exceeds generating capacity, the additional demand may be satisfied by building additional plants.	Any FOUR points 1 mark each		4	
		• Alternately management activities may be used to dampen demand in such a way that the current generating capacity can satisfy demand.				
		• Consumers could be encouraged to modify their usage pattern so that domestic demand does not coincide with industrial demand.				
		• Consumers could also be encouraged to use more efficient appliances such as flurorescent light bulbs decreasing overall demand.				
		• Effective demand management can prevent the building of additional power plants and the habitat destruction and emission associated with power plants				
				3	12	5

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective	Suggested Response	mstructions	KC	AK	PS
4 (a)	2.1	• The water has potential energy due to the difference in height of the water level at the intake pipe and the position of the turbine.			4	
		• As the water flows down the intake pipe, its potential energy is converted to kinetic energy resulting in an increase in the speed of water.				
		• As the water flows through the turbine it causes a coil to rotate in a magnetic field and the kinetic energy of the water is converted to the rotational energy of the coil.				
		• The rotating coil generates a potential difference across the coil.				
(b)	2.3	• Thus the kinetic energy of the flowing water is converted into electrical energy which is a form of potential energy.				
		Advantages				
		 Hydropower generation has a moderate to high net yield and fairly low operating and maintenance cost. Hydropower plants rarely need to be shut down and do not emit carbon dioxide or other air pollutants such as nitrogen dioxides. They have life spans of 2 - 10 times those of coal or nuclear plants. In large systems dams are built across the natural flow of rivers. Large dams however can help in flood control and supply a regulated flow of irrigation water to areas below the dam. 	Any TWO advantages 1 mark each	2		
						l l

Question Objective Suggested Response Instructions KC AK 4 (b) cont'd Disadvantages Large dams cause water to backup flooding large areas of land destroying plant and animal habitat. Any ONE disadvantage 1 Dams destroy farmlands and displace people. Dams destroy farmlands and displace people. Imark each 1 If the dam breaks people and property downstream may be endangered. Over time the reservoir traps nutrient-rich silt preventing it from enriching agricultural lands downstream. TWO marks for each complete explanation 4 4 (c) Hydroelectricity • The energy potential of hydroelectricity depends on the size and volume flow of water bodies. If large river systems exist in a developing country there is the potential for substantial contribution of hydroelectricity to the energy needs of the country. This would require damming the Partial explanation Partial	4 (b)	backup destroying Any ONE disadvantage 1 mark each 1 displace from the r loss and ing water.	PS
cont'dLarge dams cause water to backup flooding large areas of land destroying plant and animal habitat.Any ONE disadvantage 1 mark eachDams destroy farmlands and displace people. Increased evaporation of water from the reservoir leads to serious water loss and increased salinity of the remaining water.Any ONE disadvantage 1 mark each1If the dam breaks people and property downstream may be endangered. Over time the reservoir traps nutrient-rich silt preventing it from enriching agricultural lands downstream.TWO marks for each complete explanation4(c)Hydroelectricity large river systems exist in a developing country there is the potential contribution of hydroelectricity to the energy needs of the country.TWO marks for each complete explanation4		destroying Any ONE disadvantage 1 1 mark each 1 displace from the r loss and ing water.	
The energy potential of TWO marks 4 hydroelectricity depends on the size for each and volume flow of water bodies. If complete large river systems exist in a explanation developing country there is the potential for substantial Partial contribution of hydroelectricity to explanation the energy needs of the country. 1 mark		ed. Over nt-rich silt	
river which is costly. For countries with large rivers because of the environmental damage and the high cost only small plants will likely be developed to supply local needs.	4 (c)	n the size for each bodies. If complete st in a explanation e is the ubstantial Partial ctricity to explanation country. 1 mark ming the countries e of the d the high l likely be	

QuestionObjectiveDiagested ResponseInstructionsKCAKPS4 (c) Cont'd•Many developing countries have small rivers which are able to generate small amounts of electricity. However, seasonal changes in volume flow make these small-scale systems unreliable. Hydropower therefore appears to have limited scope to supply the energy needs of these countries.Any TWO4•Solar energy solar energy is widely dispersed over the earth's entire surface which makes it available to all developing countries. Its intensity varies with latitude so that countries closer to the equator receive a greater intensity of solar energy. Its intensity also varies with season, cloud cover and time of day. The technology to utilize solar energy is well developed.Partial explanations 1 mark	Syllabus	Suggested Response	Instructions		Marks	
Cont'dsmall rivers which are able to generate small amounts of electricity. However, seasonal changes in volume flow make these small-scale systems unreliable. Hydropower therefore appears to have limited scope to supply the energy needs of these countries.Any TWO4•Solar EnergySolar energy is widely dispersed over the earth's entire surface which makes it available to all developing countries. Its intensity varies with latitude so that countries closer to the equator receive a greater intensity of solar energy. Its intensity also varies with season, cloud cover and time of day. The technology to utilize solar energy is well developed.Partial explanations 1 mark	Question Objective			KC	AK	PS
system must be available to generate electricity at nights, and on cloudy days when solar power output is low. The current technology used to trap the sun's energy is efficient but technological developments will improve efficiency of collection making it more cost effective. The initial cost of converting to solar	Question Objective 4 (c)	 small rivers which are able to generate small amounts of electricity. However, seasonal changes in volume flow make these small-scale systems unreliable. Hydropower therefore appears to have limited scope to supply the energy needs of these countries. Solar Energy Solar energy is widely dispersed over the earth's entire surface which makes it available to all developing countries. Its intensity varies with latitude so that countries closer to the equator receive a greater intensity of solar energy. Its intensity also varies with season, cloud cover and time of day. The technology to utilize solar energy is well developed. One problem of using solar energy to generate electricity is that a back-up system must be available to generate electricity at nights, and on cloudy days when solar power output is low. The current technology used to trap the sun's energy is efficient but technological developments will improve efficiency of collection making it more cost effective. 	complete explanations 2 marks each Partial explanations	KC	AK	PS

	Syllabus				Mark	
Questio	Objectiv	Suggested Response	Instructions	K	A V	P s
n	e			C	ĸ	5
Questio n 4 (d)	Objectiv e 2.3; 2.11	Suggested Response	Instructions Axis 1 Title 1 Bars 2	KC	AK	P S 4
(d) (ii)		18%				1
				3	12	5

Question Objective Suggested Response Instruction KC AK PS 5 (a) • All organisms have dieldrin concentration greater than that of the water. • The dieldrin concentration at each trophic level varies with organism. • The dieldrin concentration increases as the trophic level varies with organism. • Dieldrin concentration increases as the trophic levels increase. • Tertiary organisms have a minimum concentration 20 000 times greater than in the water. • Bioaccumulation and biomagnification are taking place. Any ONE 3 • I •		Syllabus	Suggested Response	Instructions		Marks	
(b) each inference (b) Dieldrin concentration at each trophic level varies with organism. (b) Dieldrin concentration increases as the trophic levels increase. (b) Tertiary organisms have a minimum concentration 20 000 times greater than in the water. (b) Bioaccumulation and biomagnification are taking place. Environmental pathways: Pesticide in air settles in soil and on crops. (c) Tertosion and leaching of soil cause pesticide to move into fresh water bodies such as river and oceans. OR OR (c) Pesticide in air dissolves in rain (precipitation). (c) This falls on soil and into water bodies (c) Swater (precipitation) percolates through soil, it may dissolve out	Question	Objective	Suggested Response	Instructions	KC	AK	PS
(b) trophic level varies with organism. • Dieldrin concentration increases as the trophic levels increase. • Tertiary organisms have a minimum concentration 20 000 times greater than in the water. • Bioaccumulation and biomagnification are taking place. Environmental pathways: • Pesticide in air settles in soil and on crops. • The pesticide is transferred to aquifers which flow to water bodies such as rivers. • The pesticide is transferred to aquifers which flow to water bodies such as river and oceans. OR • Pesticide in air dissolves in rain (precipitation). • This falls on soil and into water bodies • As water (precipitation) percolates through soil, it may dissolve out	5 (a)		concentration greater than that of	each			5
(b) the trophic levels increase. • Tertiary organisms have a minimum concentration 20 000 times greater than in the water. • Bioaccumulation and biomagnification are taking place. Environmental pathways: • Pesticide in air settles in soil and on crops. • Erosion and leaching of soil cause pesticide to move into fresh water bodies such as rivers. • The pesticide is transferred to aquifers which flow to water bodies such as river and oceans. OR • Pesticide in air dissolves in rain (precipitation). • This falls on soil and into water bodies shrough soil, it may dissolve out							
(b) concentration 20 000 times greater than in the water. (b) Bioaccumulation and biomagnification are taking place. Environmental pathways: Pesticide in air settles in soil and on crops. • Erosion and leaching of soil cause pesticide to move into fresh water bodies such as rivers. Any ONE at the pathway 3 marks • The pesticide is transferred to aquifers which flow to water bodies such as river and oceans. OR • Pesticide in air dissolves in rain (precipitation). • This falls on soil and into water bodies • As water (precipitation) percolates through soil, it may dissolve out Image: Concentration of the pathway 3 marks							
 Bioaccumulation and biomagnification are taking place. Environmental pathways: Pesticide in air settles in soil and on crops. Erosion and leaching of soil cause pesticide to move into fresh water bodies such as rivers. The pesticide is transferred to aquifers which flow to water bodies such as river and oceans. OR Pesticide in air dissolves in rain (precipitation). This falls on soil and into water bodies As water (precipitation) percolates through soil, it may dissolve out 			concentration 20 000 times greater				
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 Erosion and leaching of soil cause pesticide to move into fresh water bodies such as rivers. The pesticide is transferred to aquifers which flow to water bodies such as river and oceans. OR Pesticide in air dissolves in rain (precipitation). This falls on soil and into water bodies As water (precipitation) percolates through soil, it may dissolve out 			• Pesticide in air settles in soil and on		3		
aquifers which flow to water bodies such as river and oceans. OR • Pesticide in air dissolves in rain (precipitation). • This falls on soil and into water bodies • As water (precipitation) percolates through soil, it may dissolve out			pesticide to move into fresh water				
 Pesticide in air dissolves in rain (precipitation). This falls on soil and into water bodies As water (precipitation) percolates through soil, it may dissolve out 			aquifers which flow to water bodies				
 (precipitation). This falls on soil and into water bodies As water (precipitation) percolates through soil, it may dissolve out 			OR				
 As water (precipitation) percolates through soil, it may dissolve out 							
through soil, it may dissolve out							
			through soil, it may dissolve out				

	Syllabus	Suggested Response	Instructions	Marks			
Question	Objective	Suggested Response	mstructions	KC	AK	PS	
5 (c)	3.3	• The build-up of pesticide in an organism's body is due to a process known as bioaccumulation.	1 mark for EACH point		6		
		• Concentration of pesticide in producers will be higher than that in the water due to bioaccumulation.					
		• The primary consumer will ingest tissue with a greater concentration of pesticide					
		• Similarly secondary consumers will ingest tissue with an even higher concentration of pesticide.					
		• Hence the concentration of pesticide increased in organisms moving from lower to higher trophic level.					
		• This increase in concentration as the pesticide passes through successive levels of the food chain is known as biological magnification.					
5 (d)	3.3	Characteristics					
		 Persistence: this refers to the stability of the pesticide. Some pesticides are extremely stable and take many years to be broken down into less toxic forms. 	Any TWO characteristics described 3 marks each (1 mark for		6		
		 This allows their toxicity to increase in the environment and they are therefore able to affect a large range of organisms. 	(1 mark for characteristics and 2 marks for description)				

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective		mstructions	KC	AK	PS
5 (d) cont'd		 Mobility Pesticides do not stay where there are applied but tend to move through the soil, water and air sometimes over large distances. The more mobile a pesticide the greater the potential geographical impact. Synergistic Effect The effects of many pesticides are increased by interaction with other chemicals Synergism increases the toxicity of the chemical 				
				3	12	5

Syllabus	Suggested Response	Instructions		Marks	
Objective	Suggested Response	mstructions	KC	AK	PS
3.5; 3.9	 The percentage of plastics increases from 10% in 1998 to 24% in 2008. (1) The percentage of paper decreases from 38% in 1998 to 22% in 2008(1) 	ONE mark for each change			2
3.1	• Paper is biodegradable and in the environment it will be broken down completely by organisms.				2
	 Plastics are not biogradable and will continue to pollute the environment for an extended period. 				
3.9	Wood				1
3.1	 There has been an increase in consumption of raw materials and energy and in the manufacture, transport, sale and use of a wide variety of goods. More products such as toys, electrical and sporting goods are being made from plastics. Many are not designed to last very long and cannot be repaired. This results in a constant demand for the product since a replacement is often cheaper than repairing. Many industries rely on built-in obsolescence to maintain sales. 	Any TWO reasons fully explained 2 marks each Partial explanation 1 mark		4	
	Objective 3.5; 3.9 3.1 3.9	ObjectiveSuggested Response3.5; 3.9• The percentage of plastics increases from 10% in 1998 to 24% in 2008. (1)• The percentage of paper decreases from 38% in 1998 to 22% in 2008(1)3.1• Paper is biodegradable and in the environment it will be broken down completely by organisms.OR• Plastics are not biogradable and will continue to pollute the environment for an extended period.3.9Wood3.1• There has been an increase in consumption of raw materials and energy and in the manufacture, transport, sale and use of a wide variety of goods.• More products such as toys, electrical and sporting goods are being made from plastics. Many are not designed to last very long and cannot be repaired. This results in a constant demand for the product since a replacement is often cheaper than repairing. Many industries rely on built-in	ObjectiveSuggested ResponseInstructions3.5; 3.9• The percentage of plastics increases from 10% in 1998 to 24% in 2008. (1)ONE mark for each change• The percentage of paper decreases from 38% in 1998 to 22% in 2008(1)ONE mark for each change3.1• Paper is biodegradable and in the environment it will be broken down completely by organisms.OR• Plastics are not biogradable and will continue to pollute the environment for an extended period.3.9Wood3.1• There has been an increase in consumption of raw materials and energy and in the manufacture, transport, sale and use of a wide variety of goods.• More products such as toys, electrical and sporting goods are being made from plastics. Many are not designed to last very long and cannot be repaired. This results in a constant demand for the product since a replacement is often cheaper than repairing. Many industries rely on built-in	ObjectiveSuggested ResponseInstructionsKC3.5; 3.9• The percentage of plastics increases from 10% in 1998 to 24% in 2008. (1)ONE mark for each change• The percentage of paper decreases from 38% in 1998 to 22% in 2008(1)ONE mark for each change3.1• Paper is biodegradable and in the environment it will be broken down completely by organisms.OR• Plastics are not biogradable and will continue to pollute the environment for an extended period.Any TWO reasons fully explained 2 marks each3.1• There has been an increase in consumption of raw materials and energy and in the manufacture, transport, sale and use of a wide variety of goods.Any TWO reasons fully explained 2 marks each3.1• More products such as toys, electrical and sporting goods are being made from plastics. Many are not designed to last very long and cannot be repaired. This results in a constant demand for the product since a replacement is often cheaper than repairing. Many industries rely on builtin	ObjectiveSuggested ResponseInstructionsKCAK3.5; 3.9• The percentage of plastics increases from 10% in 1998 to 24% in 2008. (1)ONE mark for each changeONE mark for each changeII3.1• Paper is biodegradable and in the environment it will be broken down completely by organisms.ONE organisms.II3.1• Paper is biodegradable and will continue to pollute the environment for an extended period.II3.9WoodIIII3.1• There has been an increase in consumption of raw materials and energy and in the manufacture, transport, sale and use of a wide variety of goods.Any TWO reasons fully explanted 2 marks eachII4Paper tis is constant demand for the product since a replacement is often heraper than repairing. Many industries rely on builtinAny TWO reasons fully explanted 2 marks eachI

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective		mstructions	KC	AK	PS
6 (b) Cont'd		• Increase in the amount of packaging used, the development of refrigeration and of rapid transport networks have allowed products to be sent around the world which requires considerable packaging. Huge amounts of packaging, a large percentage of which is plastic, are used to make goods more attractive to the consumer.				
		• There has been an enormous rise in demand for convenience products, particularly for disposable consumer goods such as supermarket ready- made meals, disposable razors disposable baby diapers and pens, which are usually made from plastics.				
(c) (i)	3.5	• Recycling is defined as the collection and separation of materials from the waste stream and their subsequent reuse or processing to produce a marketable or resaleable product. (1)		2		
(ii)	3.5	Aluminium cans, plastic bottles	Any ONE 1 mark	1		
6 (d)	3.5	 Advantages Recycling some material such as paper, aluminium and drink cans help to conserve non-renewable resources by reducing demand. This also reduces reliance on raw materials from a single country or a group of countries. 	Any FOUR advantages 1 mark each		4	

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective			KC	AK	PS
6 (d)		• Reduction in demand through recycling will reduce production of goods and the associated energy consumption and emission of greenhouse gases.				
		• Recycling results in a reduction of pollution from extraction industries, producing processes and waste disposal.				
		• Recycling may result in reduced waste disposal costs, and the need for additional land-fill space				
		• Discarded paper, glass, metal, foam and plastic packing produce are a major cause or litter and require expenditure for collection and cleaning. By encouraging the use of recyclable containers to reduce packaging this problem will decline.				
		 Disadvantages The production of recycled materials is not determined by demand but by production of waste. This causes economic problems since the supply of recycled products cannot respond directly to changes in demand. Recycling may require sponsorship, 	Any FOUR disadvantages 1 mark each		4	
		which is not always readily available, to be able to operate.				

	Syllabus	Suggested Response	Instructions	Marks			
Question	Objective		mști actionș	KC	AK	PS	
6 (d) Cont'd		 Some material recovery may not be environmentally beneficial since energy and resources consumption may be greater than that required to produce new material. Space must be available to store 					
		material to be recycled which may be limited in both urban and domestic environment.					
		• Recycling of some materials may be detrimental to the environment. (Examples, paper, some older glass recycling plants, improper recycling of vehicle batteries).					
		• Recycled products have to complete with virgin raw material already established in the market.					
				2	12	r	
				3	12	5	

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CARIBBEAN EXAMINATIONS COUNCIL HEADQUARTERS

ADVANCED PROFICIENCY EXAMINATION

ENVIRONMENTAL SCIENCE

SPECIMEN PAPER

Unit 2 – Paper 03/2

MARK SCHEME

	Syllabus	Suggested Response				
Question	Objective		S	КС	AK	PS
1 (a)		1 1 1 1 1 1 1 1 1 1 1 1 1 1	Title of graph (1 mark) Labelling of axes (2 marks) Appropriat e scales on each axes (2 marks) Plotting of points (5 marks) Smooth curve (2 marks)			12

Syllabus		Suggested Beenenee	Instructions	Marks		
Question	Objective	Suggested Response	Instructions	КС	AK	PS
1 (b (i)		 Banana production was fairly constant between 1993 and 1995. 				
		• Banana production increased each year from 1995 to 2007.				
		• In 1995 Tropic farm produced 1 500 000 kg of bananas. This is an increase of 4 500 000 kg.	ONE mark		4	
		• This represents a doubling of production over the 12-year period.				
1 (b) (ii)						
		• Between 1992 and 1995 the nitrate concentration was relatively constant at about 1 mg/L.				
		• Between 1995 and 2007 the nitrate concentrate increased annually.				
		 In 2001 and 2003 there were some decreases in concentration to the previous years (2000 and 2002). 	ONE mark		4	
		• The annual concentration in 2007 was 15 mg/L. This is an increase of 14 mg /L when compared to the annual concentration in 1995. Or an overall 1400% increase in the concentration of nitrates during the period.	for each point			

	Syllabus	Suggested Personse Instructions		Marks			
Question	Objective	Suggested Response	Instructions	КС	AK	PS	
1 (c)		Extraction of data (1) from graph. Calculate <u>7 mg/L (1)</u> = 1.4 mg/L (1) year 5 yrs				3	
1 (d)		 Between 1992 and 1995 the nitrate concentration remained fairly constant at about 1 mg/L. This suggests that the normal or ambient nitrate concentration of the river before 1995 is about 1 mg/L based on the available data. Since 1995 the annual nitrate concentration has increased 	ONE mark for each point		4		
		 annually above the ambient value. Concentration of nitrates in water bodies such as river is usually low. 					
		• Since the nitrate concentration exceeds its ambient value and is higher than expected, the quality of the water between 1995 and 2007 is less than it was between 1993 an 1995.					

Environmental Science Specimen Paper Unit 2 Paper 03/2 Mark Scheme

Syllabus		Suggested Response	Instructions	Marks		
Question	Objective	Suggested Response	mstructions	КС	AK	PS
Question 1 (e)	Objective	 Nitrates are soluble in water. During periods of heavy rainfall, nitrates may be washed out of the soil on the farm. The nitrogen-rich water flows into gullies or along natural storm water channels. These water channels empty directly into the river or into streams leading to the river. 	Any THREE points 1 mark each	3	AK	PS
				3	12	15

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		mstructions	КС	AK	PS
2 (a) (i)	2.3	Wind energy; biofuels.		2		
(ii)	2.3	A dam is built across a river to create a large reservoir (1). A small amount of the water is allowed to flow through large pipes (1) and this turns a turbine (1) that is used to generate electricity (1).			4	
(b) (i)	2.3	High efficiency (1); low cost electricity (1); renewable energy source (1),; low levels of pollution associated with operations (1) long life span (1); can provide flood control below dam (1); provides irrigation water (1); reservoir useful for fishing and recreation (1).	Any FOUR 1 mark each		4	
(ii)	2.3	High construction costs (1); High environmental impact from flooding to create the reservoir (1); danger of collapse (1); uproots people from reservoir area (1); decreases in fish harvest below dam (1); decreases flow of silt to land below dam (1).	Any FOUR 1 mark each		4	

	Syllabus	Suggested Response	Instructions		Marks	
Question	Objective		instructions	КС	AK	PS
2 (c) (i)	2.11	Electricity generation by hydropower in the Caribbean in 2007	Title (1); axes (2); Scale (1); For EACH year all bars correct (6)			10

	Syllabus	Suggested Response	Instructions	Marks			
Question	Objective	Suggested Response		КС	AK	PS	
2 (c) (ii)	2.11	 <u>Trend</u> Suriname produced a significant amount of electricity using hydropower. Small island such as Antigua, Barbados, Grenada and St. Lucia 	Any THREE points 1 mark each			3	
		 did not use hydropower for electricity generation. St. Vincent and Grenada used hydropower to generate a small amount of electricity. Jamaica and Belize used hydropower to generate a moderate amount of electricity. 					
(iii)	2.11	Belize & St. Vincent 0.18 + 0.02 = 0.20 billion kWh (1) Total for Caribbean = 0.18 + 0.03 + 0.16 + 0.02 + 0.9 = 1.29 billion kWh (1) % for Belize & St. Vincent = 0.2/1.29*100 = 15.5% (1)				3	
				2	12	16	
L				2	12	16	

QuestionObjectiveSuggested ResponseInstructions3 (a)3.5(i) identify changes in water qualityAny THREE 1 mark each3	AK	PS
(i) identify changes in water quality		
over time		
(ii) Identify specific existing or emerging water quality problems(iii) Gather information to design		
specific pollution prevention or remediation programmes		
(iv) Respond to emergencies such as chemical spills		
(v) Determine whether programme goals such as compliance with pollution regulations or implementation of effective control actions are being met.		
(b) (i) 3.5 Parameters: Any THREE Phosphates, ammonium/ammonia chemical oxygen demand; total suspended solids; biochemical oxygen demand; dissolved oxygen; coliform (total/faecal)		3
 (ii) 3.5 Phosphates Phosphorous in small quantities, is essential for plant growth and metabolic reactions in animals and plants. It is the nutrient in shortest supply in most fresh waters, with even small amounts causing significant plant growth and having a large effect on the aquatic ecosystem. 		

	Syllabus	Suggested Despense	Instructions	Marks			
Question	Objective Sugge	Suggested Response	Instructions	КС	AK	PS	
		 Biochemical Oxygen Demand (BOD) This is a measure of the biodegradable organic content of waste. Biological oxygen demand means the amount of dissolved oxygen used for respiration during the aerobic metabolism of an energy source (e.g. organic matter) by bacteria or microorganisms. 	TWO marks for each parameter		6		
		Chemical Oxygen Demand (COD)					
		 This is a measure of the total organic content of waste, both degradable and refractory. 					
		 Chemical oxygen demand means the amount of oxygen required for maximum oxidation of the organic matter in a sample of the waste. This has implications for the availability of nutrients to aquatic organisms. 					
		Total Suspended Solids (TSS)					
		 This means all solids that are suspended in a sample of waste but are not dissolved. 					
		- Total suspended solids are identified as the portion of a waste sample that does not pass through a glass fiber filter (i.e. non- filterable).					

	Syllabus	Suggested Response	Instructions	Marks			
Question	Objective	Suggested Response	Instructions	КС	AK	PS	
3 (b) Cont'd		 This has implications for the colour and turbidity of the water which may affect photosynthesis of aquatic plants and ultimately reduce the productivity of the aquatic ecosystem. 					
(c)	3.5	Phosphates					
		A sample of water is filtered to remove suspended particulate matter (1). A test solution containing molybdate ions is added that forms a complex with phosphate (1). On addition of ascorbic acid, an intense blue colour occurs (1). The level of phosphate can be measured by comparing the colour obtained in the water sample with a range of colours obtained from known phosphate concentrations (1). OR The level of phosphate can be measured by using a spectrophotometer (1).					
		Biochemical oxygen demand (BOD) A sample of water is collected and the initial concentration of oxygen in the mixture is measured by gas-sensing electrode OR by a Winkler titration (1). The bottles are placed in an incubator at 20°C for 5 days (1). After 5 days, the concentration of oxygen in the mixture is again measured (1). The BOD is calculated from the difference between these two measurements (1).	FOUR marks for each parameter			12	

	Syllabus	Suggested Response	Instructions	Marks			
Question	Objective			КС	AK	PS	
3 (c) Cont'd		Chemical oxygen demand (COD)					
Cont'd		A sample of water is collected and mixed with a strongly acid solution of potassium dichromate (1). The mixture is heated under reflux conditions for 2 hours (1) OR the mixture is heated in a tightly closed glass container for 2 hours (1). After heating, the orange colour of the potassium dichromate will change to different shades of green depending on the level of COD present (1). The COD level can be measured by comparing the colour obtained in the water sample with a range of colours obtained from known COD concentrations (1). OR The COD level can be measured by using a spectrophotometer (1).			6		
						l	

	Syllabus	Suggested Response	Instructions	Marks		
Question	Objective			КС	AK	PS
3 (c) Cont'd		Total suspended solids (TSS) A glass fiber filter with pore size 0.45 µm is dried and weighed (1). A known volume of the water sample is passed through the filter under vacuum (1). The filter is dried in an oven at 105°C and reweighed (1). The TSS is calculated from the difference between the two masses, expressed per litre of water (1).			6	
3 (d)(i) 3 (d) (ii)	3.6	Change: increased growth of aquatic vegetation. Reason: increased nutrient availability. Change: decreased diversity of				
		organisms in the river. Reason: death due to lack of oxygen. Change: decreased number of organisms.	1 mark for EACH change 1 mark for EACH		6	
		Reason: death due to entrophic conditions. Change: foul odor develops.	reason			
		Reason: death and decay of organism				
				3	12	15