SECTION A- LIVING ORGANISMS IN THE ENVIRONMENT

SECTION A is designed as an introduction to the rest of the syllabus. The idea is for students to be involved in working outside the classroom in order to study the interrelationships between organism and their environment and to appreciate the variety and complexity of these relationships.

General Objectives
Students should demonstrate :

1. an understanding that there is both diversity and similarity of form in living organisms;
2. an understanding that there is interdependence between living organisms and their environment;
3. an understanding that there is a flow of energy through living organisms within an ecosystem;
4. an understanding that materials are recycled in nature
5. an ability to apply knowledge of the interrelationships of organisms and their environment to identify environmental problems.

SECTION A - LIVING ORGANISMS IN THE ENVIRONMENT *CXC 20/G/SYLL 02*

SPECIFIC OBJECTIVES		CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	INTER-RELATIONSHIPS
Students should be able to:				
1.1	Group living organism according to observed the similarities and differences	Visible characteristics such as hairiness, colour,: shape, venation, number of legs and wings. Common names of organisms and groups are acceptable.	*Observe organisms in their natural habitat. Construct tables to record observations*	
2.1	Identify the relative positions of producers and consumers in the food chain and relate the positions to their modes of feeding	Include limitations of food chains in supporting trophic levels. construct simple pyramids		
2.2	identify, from a selected habitat, a food chain containing at least four organisms;	Terrestrial and aquatic (marine and freshwater) habitats.	*Construct food chains and webs using organisms* in *selected habitats.*	

2.3 2.4	Identify, from the selected habitats, a herbivore, carnivore and omnivore; Identify, from the Selected habitats, Predator or prey Relationships	Not to be confined to familiar domestic animals.		Chem.-fermentation
2.5	Construct a food include different levels;	Use of examples from the habitat(s) investigated. Students may be required to interpret a food web containing unfamiliar examples.	*investigate different trophic levels in food webs.*	
2.6	Explain the role of decomposers;	Role of fungi and bacteria in converting complex compounds to simple substances.	*Action of mould on bread*	
2.7	discuss the advantages and disadvantages of special relationships to the organisms involved;	Symbiosis: parasitism, commensalism, mutualism simple treatment with local examples, *such as lice and ticks*, epiphytes on trees, nitrogen fixing bacteria in roots of legumes. Give names of partners.	*Observations from a large tree. Examine root nodules.*	INTER-RELATIONSHIPS
2.8	discuss the interdependence of organisms within a food web;			*Chemistry – Nitrogen compounds and hydrocarbons*
	SPECIFIC OBJECTIVES Students should be able to:	CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	
3.1	explain energy flow within a food chain or		*Illustrate with* nitrogen *and carbon cycles*	

4.1 5.1	web explain, with examples, the continual re-use of materials in nature; apply the principles and concepts involved in interrelationships between organisms and their environmentt to Caribbean situations.			

SECTION B - LIFE PROCESSES

The life processes are largely illustrated in humans and flowering plants because these are the two groups with which students are most familiar, and about which they should have some degree of understanding. Comparisons with other organisms should be included where appropriate. Details of anatomical structure are only important in so far as they illustrate the relationships between structure and function.

There should be a focus on the interdependence of the processes in maintaining the organism in a healthy state.

GENERAL OBJECTIVES

Students should demonstrate:

1. Knowledge of the structure of an unspecialized cell and an appreciation of the functions of the main cell structures and of cell specialization;

2. understanding that nutrition is the means by which living organisms obtain their energy and material requirements, and this occurs in different ways;

3. understanding that respiration is the means by which energy is made available for carrying out life processes;

4. understanding of the necessity for transport mechanisms and for storage in living organisms;

5. understanding of the processes by which living organisms get rid of metabolic waste and regulate body fluid concentration;

6. understanding of the mechanisms and an appreciation of the role(s) of movement in living organisms;

7. understanding that organisms detect and respond to changes in their external and internal environment;

8. understanding that organisms increase in mass, size and complexity during their lives;

9. understanding of the processes by which life is perpetuated.

SECTION B LIFE PROCESSES (cont'd)

SPECIFIC OBJECTIVES		CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	INTER-RELATIONSHIPS
Students should be able to:				
1.1	draw and label simple diagrams to show the structure of unspecialized plant and animal cells;	Cell wall, cell membrane, nucleus, cytoplasm, vacuoles mitochondria, chloroplast. Details of structures as seen in electron micrographs not required.	*Construct models using plasticine or other materials found around the home or laboratory.*	***Physics-Osmosis.*** *Chemistry – Osmosis*
1.2	state the functions and explain the importance of the following structures: cell wall, cell membrane, nucleus and Chromosomes, cytoplasm, mitochondria, vacuoles, chloroplast;	Simple treatment only, for example chromosomes carry genetic information in the form of DNA.		
1.3	differentiate between plant and animal cells;	Reference to plant cells characterized by the presence cell wall, large vacuoles chloroplasts.	*Examine* a *variety* ***of cells,*** for *example,* ***cells of Allium*** *(onion), Rhoeo* ***discolor,Elode,*** ***prepared*** *slides* ***of*** *blood cells and skin. Construct models.*	
1.4	explain the importance of cell sjecialization in multi-cellular organisms;	Examples of tissues from both plants and animals. Consideration that a number of different tissues come together to form organs and organ systems.		

1.5 1.6 2.1 2.2 2.3	explain the processes of diffusion and osmosis using an experimentalt approach; discuss the importance of diffusion and osmosis in living systems; distinguish between heterotrophic and autotrophic nutrition; describe photosynthesis as the process by which green plants manufacture organic substances from inorganic substances; relate the structure of the leaf of a flowering plant to function in photosynthesis;	Importance of diffusion and osmosis in transporting substances in and out of cells and from one cell to another in all living organisms. Reference to the cell membrane as a selectively permeable membrane. Simple inorganic substances used by plants compared to complex organic substances consumed *by animals and fungi.* Simple treatment involving an equation to summarize the process; the evolution of oxygen as a result of the splitting of water by light energy; the subsequent reduction of carbon dioxide to a carbohydrate and the chloroplast as the site of the reactions. Mention the fate of products. The external features and the internal structure of a dicotyledonous leaf as seen in cross section under the light microscope	Carry *out simple* investigations *to illustrate the* movement *of particles (molecules and* ions). *Test for evolution of oxygen using water plant.* *Draw and label* the external features and the internal	*Physics -Osmosis Diffusion. Chemistry Particulte nat**ure of** matter.* ***Physics-Osmosis.*** *Chemistry – Osmosis* Chemistry *-water, nitrogen, carbon dioxide, starch, sugars, proteins.*

2.4			structure of a dicotyledonous leaf as seen in cross section under the light microscope	
		Use of foliage leaves of onion or chives (escallion) variegated leaves.		
2.5	carry out simple controlled investigations to demonstrate that light .and chlorophyll are necessary conditions for photosynthesis;		Tests for end products, starch or reducing sugar.	
	perform tests to distinguish among food substances;	Starch, protein, lipids, reducing and non - reducing sugars; chemical and physical properties (solubility) of carbohydrates, proteins, lipids; hydrolysis and condensation (dehydration synthesis).	*Test for proteins (Biuret), fats (grease spot, ethanol and water), starch (iodine), reducing sugars (Benedict's Solution). Note the necessity for hydrolysis and neutralization in testing for non- reducing sugars.*	
2.6				
	describe and relate to *specific* regions of the human alimentary canal, the intake of food, its breakdown into small molecules, its absorption and egestion;	Mastication and the role of teeth in the mechanical breakdown of food to be included. Simple diagrams of the alimentary canal and internal structure of a tooth required.	*Examination of dissection of a small mammal.*	
2.7				
		Inclusion of catalysis.		
2.8	explain the role importance of enzymes;			
		Candidates may be asked to deduce from tables and graphs the effects of temperature and pH on enzyme activity.		
2.9	investigate the effect of temperature and pH on the activity of the enzymes catalase or amylase;			
	describe what happens to the	Transport to the liver and assimilation to be included, that is, how products are used and		

		what happens to excess.		
2.10	products of digestion after their absorption; discuss the importance of a balanced diet in humans;	Sources of the components of a balanced diet (including vitamins A and C; iron and calcium), uses, the results of their deficiency or surplus and the effects of age, sex and occupation on dietaryneeds. Discussionon vegetarianism.		
2.11	discuss the importance of minerals in plants nutrition using nitrogen and magnesium as examples;	Emphasis on the importance of nitrogen in the formation of proteins and magnesium in the formation of chlorophyll	Investigate the effect of the lack of nitrogen on seedlings planted in clean sand using inorganic or organic fertilizers as a control.	
3.1		Involvement of enzymes in releasing Energy. Distinguish between respiration and breathing.		
3.2	state that respiration takes place at the level of the cell;	Simple treatment. An equation to show the raw materials and final products of aerobic respiration is required.		
3.3	describe the process aerobic respiration;	Inclusion of the concept of currency for the role of ATP: cells earning ATP as a result of energy-producing reactions and spending it on reactions requiring energy.		
3.4	state the function of ATP (adenosine triphosphate) in energy transfer; distinguish between aerobic and	Include a consideration of fatigue, the production of lactic acid in muscle, alcohol and carbon dioxide in plants.	Simple investigations comparing rate	Chemistry-Reactions involved in baking dough.

3.5	anaerobic respiration;	Temperature change to be included.	of respiring yeast in unboiled and boiled water. Carry out simple controlled investigations and interpret results	
3.6	demonstrate knowledge and understanding of the products of respiration;	Simple diagrams to show the relationship between the trachea, the bronchi and lungs and the diaphragm and ribcage required.	*Use models of the thorax*	
3.7	describe and explain the importance of breathing in humans and gaseous exchange in flowering plants;	The necessity for a continual supply of oxygen and the removal of waste products to be included. Emphasis on mechanisms increasing surface area humans, fish and plants.		
3.8	identify characteristics common to gaseous exchange surfaces;	For example, nicotine addiction, damage to the lining of the lungs, cancer causing effects and reduction in the oxygen carrying capacity of the blood. No further details required.		
4.1	discuss the effects of cigarette smoking;	The limitations of simple diffusion. Comparison with single celled organism such as the amoeba. The relationship between surface area and volume (the problems of large cells and the concept of osmotic potentials).		
4.2	explain the need for transport systems in multicellular organisms;	illustrate by examples.		

4.3	identify the types of materials which need to be transported in animals and plants;	Structure and function of the heart. Names of blood vessels supplying only major organs required.	*Draw diagrams to show differences in the structures of arteries, veins and capillaries.*	
4.4	describe the structure and function of the circulatory system in humans;		*Examine external and internal features of fresh or preserved specimens of mammalian hearts.*	
4.5		Diagrams of red and white blood cells required.		
4.6		Diagrams required.		
4.7	describe the composition and functions of blood in transport;			
4.8	describe the structure of xylem vessels, sieve tubes and companion cells;	Transpiration stream from roots to leaves to be included.	*Observe small herbaceous plant placed in coloured water.*	
4.9	explain how the structure of xylem vessels suits them for their function;			
	describe the process involved in transpiration;	Light, humidity, and air movements should be included. Explanation of evapotranspiration and relative humidity.	*Carry out controlled investigations*	
	demonstrate the effects of external factors on transpiration			

4.10 4.11 ___ 5.1 5.2 5.3 5.4 5.5 5.6	state the function of phloem in the transport system of plants; discuss the importance of food storage in living organisms; identify the products stored and the sites of storage; _____ discuss the importance of excretion in living organisms; give examples of substances excreted by animals and plants; state the means by which excretory products are eliminated from plants and animals; relate the structure of the kidney to its osmoregulatory and excretory	Storage as a means of overcoming the need for continuous food intake or manufacture, providing for periods of scarcity, providing for special functions, for example, production of sexual or vegetative reproductive structures, development of embryos. Roots, stems, leaves, fruits, seeds in plants; the liver, fat deposits in animals to be included. Detailed structures of storage organs not required. _____ For example, carbon dioxide, urea, water, oxygen, and calcium oxalate. Leaf fall, loss of bark and storage in plants; lungs and urinary systems in humans to be included. Highlight structure of the urinary system and a tubule; The function of the parts. Homeostasis; negative feedback to be included. Simple treatment: root length, cuticle thickness, water storage.	*Carry out food tests for starch, sugars and oil of storage organs.* _____ *Observe*	

	functions;		*xerophytic plants.*	
6.1	explain the role of the hormone ADH in osmoregulation;	The distinction should be made between: (i) growth movement as shown by germinating seedlings, for example, *Zea mays* or bean; (ii) whole movement as illustrated by animals		
	discuss adaptation in plants to conserve water;			
6.2	use examples to distinguish between growth movements in plants and movement in animals		*Examine a skeleton*	
6.3		Functions to include protection, support, locomotion, blood formation.		
6.4	relate the structure of the skeleton to its functions in humans	The relationship between the bones and muscles of a limb. Behaviour of antagonistic muscles; types of joint, action at moveable joints.	*Simple line drawing to show the relationship*	
6.5	describe the mechanism of movement in a human limb;	Differences in the neural spine, the relative sizes of the neural canal and transverse processes and articulating surfaces. Stress the functions of the various surfaces and projections.	*Examine and make drawing of mammalian vertebrae;*	
6.6	draw, label and annotate a simple diagram of the long bones of a fore or hind limb;	Comparison with flowering plants with reference to nutrition and reproduction.		
___	distinguish between cervical, thoracic and lumbar vertebrae	_____	_____	

7.1 7.2	discuss the importance of locomotion in animals; _____	The response of stems and roots of seedlings to light and gravity. Relate observations to the behaviour of plants in natural situations.	*Carry out controlled investigations; make observations; record and report as appropriate*	
	define 'stimulus' and 'response'; describe the response of: (i) green plants to unilateral stimuli of light and gravity	The response of invertebrates for example, millipedes, earthworms or woodlice.	*Construct simple choice chambers. Record observations*	
7.3 7.4		Reference to investigations with green plants and invertebrates in specific objective 7.2.		
7.5	(ii) invertebrates to variations in light intensities, temperature and moisture	Emphasis on the coordinating function of the brain and spinal cord an1 the roles of sensory and motor neurones.		
7.6	define receptors and effectors; explain why the response to stimuli is important for the survival of organisms; explain the relationship between the receptor, the central nervous system and the effector;	Use of simple flow diagrams to show the pathway along which the impulse travels in a reflex. Diagrams showing the cross section of a spinal cord and spinal nerves not required.	*investigate changes in pupil size in response to changes in light intensity, using mirrors, and the knee jerk reflex.*	
7.7	distinguish between a cranial and a	Cerebrum, cerebellum and medulla. Mention of the role of the medulla and the autonomic		

7.8	spinal reflex, for example, (i) the pupil reflex; and	nervous system in controlling the heart and breathing rates.		
7.9	(ii) the knee jerk reflex;	Cross section or longitudinal section of the eye required.		
7.10	describe the functions of the main regions of the brain;	Long and near sightedness; the use of corrective lenses; glaucoma.	*Examine dissected eyes of a mammal.*	
7.11	identify the main sense organs and the stimuli to which they respond;	Temperature control as an example of homeostasis.		
7.12	relate the structure of the human eye to its functions as a sense organ;	----------		
7.13	explain sight defects and their corrections;	The thyroid; the pancreas; the adrenals; the gonads and the pituitary.	----------	
___		Pancreas; the adrenals. (B2.9)		
8.1	describe the function of the human skin in temperature regulation; ----------	_____	_____	
8.2	recall the location of selected endocrine glands in humans; describe the role of the hormones of selected endocrine glands; _____	Examples could involve measuring changes in length, mass or surface area using roots, leaves, or other suitable material or counting the number of leaves in a named plant from seedling to fruiting plant. Plant growth substances and auxins to be included. Also hormones secreted by pituitary gland, thyroid and gonads.	*Conduct simple exercises to investigate patterns growth.* *Draw and interpret graphs (growth curves, histograms), from given data.*	
	perform and make deductions from simple investigations designed to demonstrate growth in			

9.1	living organisms;	Explanation that sexual reproduction leads to variation in the off-spring while asexual reproduction is conservative - offspring identical to the parent.		
9.2	state the functions of selected substances in controlling growth and development in living organisms;	Male and female reproductive systems. Functions of the various parts.		
9.3		The roles of oestrogen and progesterone and the effect of pregnancy on the menstrual cycle to be included.	*Label annotate given diagrams*	
9.4	compare sexual and asexual reproduction;	Include implantation, functions of the amnion, placenta and umbilical cord.		
9.5	describe the structure and function of the reproductive systems in humans;	For example, natural, barrier, hormonal and surgical methods Consider social aspects. Invite input from family planning department or organization.		
-----	describe the menstrual cycle;	----------		
9.6				
9.7	outline the mechanism for bringing gametes together, their fusion and the development of the embryo in humans;	Pollination, growth of the pollen tube and fertilization as distinct processes.	---------- *draw Label and annotate local specimens.*	
9.8	discuss the advantages and disadvantages of various methods of birth control;			

9.9	compare the structure of an insect pollinated flower and a wind pollinated flower and relate these to their functions in pollination; describe the means by which gametes are brought together and their fusion to form the zygote of a flowering plant;		*Collect samples of a fertilized ovary at different stages of development and compare to the ovary of a flower of the same species.*	
9.10	relate the structure of the fruit and seed to the structure of the flower in a dicotyledonous plant;	Include breakdown of food stores and translocation to growing points.	*Draw, label and annotate the external and internal structures of a seed.* *Use food tests to compare the food substances found in cotyledons before and after germination.*	
9.11	describe the structure of a dicotyledonous seed; describe the processes taking place within a seed during germination; describe fruit structure including adaptations for seed dispersal;	At least one example each of water, wind and animal dispersal. Mention of the importance of dispersal.	*Draw examples of fruits and seeds to show adaptations for dispersal.*	

SECTION C - CONTINUITY AND VARIATION

The teaching of Section C should highlight the implications of variation. The simple treatment of meiosis is deliberate; what is important is that the consequences of the process

should be appreciated. Use of this knowledge for improved efficiency in agriculture should be considered.

GENERAL OBJECTIVES

Students should demonstrate:

1 . an understanding of the role of mitosis in growth;

2. an understanding oft he perpetuation of life by asexual and sexual means;

3. some understanding of the mechanisms by which the characteristics of organisms are determined;

4. an understanding of the importance of genetic variation in species and how these traits can be altered;

5. an understanding of the social and ethical implications of genetic engineering.

SPECIFIC OBJECTIVES		CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	INTER-RELATIONSHIPS
1.1	outline the process of mitosis;	Emphasis on its importance for maintaining species chromosome number. Mention the replication of chromosomes. Names of stages are not required.	Construct models	
1.2	describe the role of mitosis in growth;			
2.1	explain the role of mitosis in asexual reproduction;	Include at least two examples of asexual reproduction in plants such as sugarcane cuttings and Bryophyllum leaves.		
2.2	explain why asexual reproduction gives rise to genetically identical offspring;	Cloning as the reproduction of populations of genetically identical individuals.		
2.3	outline the process of meiosis;	Simple treatment to include only homologous pairs, separation of homologous chromosomes and subsequent separation of	Construct models	

		chromatids. (Names of stages not required.)		
2.4	state the importance of halving of chromosome number in the formation of gametes. meiosis ; fertilization	Simple treatment only’ Meiosis Diploid ⇌ haploid		
2.5	explain the role of gametes in the transmission of inheritable genetic characteristics;	Production of gametes in rneiosis leads to variation.		
2.6	distinguish between continuous and discontinuous variation	Example: foot size, presence or absence of horns in cattle, pod size, tongue rolling and leaf size.	Carry out a survey on appropriate characteristics for example observe and record the range of variation in a particular feature of any kind of organism.	
3.1	describe a chromosome as a length of DNA sections of which are genes;			
3.2	explain the meaning of terms: gene, allele, dominant, recessive, incomplete dominance, genotype, phenotype;			
3.3	use genetic diagrams to explain the inheritance of a single pair of characteristics;	One example from the following: Sickle cell anaemia, blood groups, albinism.		
3.4	predict the results of crosses involving one pair of alleles;	Include pedigree charts		

		dominant, recessive and co-dominant; Chemistiy of lead and rnercury toxic effects on living organisms.		
3.5	describe the mechanism of sex determinations in humans;			
4.1	investigate the impact of environmental factors on genetically identical organisms;	Genetic variation is inheritable, environmental variation is not.		
4.2	explain why genetic variation is important;			
4.3	define natural selection as a process by which a population remains well adapted to its habitat;	Explanation that natural selection normally preserves useful adaptations.		
4.4	describe one example of a single characteristic which can be changed by natural selection;	The peppered moth		
4.5	distinguish between natural and artificial selection;	Mention plant and animal breeding. Humans select traits to suit their needs.		
-----	----------	----------		
5.1	state that genetic engineering can be used to change the traits of an organism;	Changing the traits of organism by inserting material from a different organism. Include food and medical treatment.		
5.2	discuss the possible advantages and disadvantages of humans changing the characteristics of organisms through genetic engineering.	Social, ethical and ecological implications.		

SECTION D - DISEASE AND ITS IMPACT ON HUMANS

A disease is a condition in which the health of an organism is impaired. Several diseases common in the Caribbean variously affect:

(a) the quality of life of its people, for example, through sexually transmitted diseases and alcoholism;

(b) the efficiency of its human resources, for example, through deficiency, vector-borne and physiological diseases;

(c) its economy, for example, through reducing agricultural production.

The purpose of this section is to make students sufficiently aware of the problems and their implications so ihat they can recognize and deal with them in their own environments.

The study of the historical development of the control of at least one disease would help students to become aware of the changing nature of science.

GENERAL OBJECTIVES

Students should demonstrate:

1. a knowledge of the major groups of diseases which occur in living organisms;
2. an understandingof the principles of disease control;
3. an appreciation of the social and economic importance of disease control.

SPECIFIC OBJECTIVES		CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	INTER-RELATIONSHIPS
Students should be able to:				
1.1	distinguish among pathogenic, deficiency, hereditary and physiological diseases;	Include at least one example of each.		
1.2	treatment and control related to the differences among the four main groups of diseases;	The role of diet and exercise in controlling hypertension and diabetes (B2. 10) to be included.		
2.1	explain the role of vectors in the transmission of disease;			

2.2	identify the stages in the life history of a mosquito or housefly	Include habitat and mode of life of each stage	*Collect eggs and larvae of mosquitoes and houseflies. Make observations and drawings of metamorphosis.*	
2.3	suggest appropriate methods of control of each stage of the life history of a named vector	Mosquito or housefly	*Display and interpret incidence of these diseases in the territory.*	
2.4	discuss the transmission and control of AIDS and other sexually transmitted disease;	implications of STD's. (B4). Include causative agent.		
2.5	describe the role of blood in defending the body against disease;	Include clotting, the role of phagocytes and natural immunity. (B4.2; B4.4)		
2.6	explain how the principles of immunization are used in the control of communicable diseases;	As is demonstrated by artificial immunity via vaccines. (B4.2; B4.4)		
3.1	discuss the physiological, social and economic effects of drug abuse.	Include alcohol and one illegal drug. Mention the abuse of prescription drugs for example, diet pills, tranquilizers, steroids, caffeine, antibiotics. (B7.5; B7.7)		
3.2	Discuss the social and economic implications of disease in plants and animals.	Emphasize loss of productivity' loss of human life, livestock and agricultural crops; implications of STDs.	*Display and interpret statistical data for local examples.*	

SECTION E - ENVIRONMENT AND HUMAN ACTIVITIES

This section is intended to lead students to a fuller appreciation of the inter-relationships between organisms and their environment. It is expected that a quantitative approach will be used where appropriate.

Humans are a part of this environment and must, therefore, show a sense of responsibility for its maintenance and improvement. The section offers scope for developing positive attitudes towards the environment.

GENERAL OBJECTIVES: Students should demonstrate an:

1 . understanding of the importance of the physical environment to living organisms;

2. ability to undertake a simple ecological study;

3. understanding of the factors that affect the growth of populations;

4. appreciation of the finite nature of the world's resources;

5. understanding of the effects of human activities on the environment.

SPECIFIC OBJECTIVES		CONTENT/EXPLANATORY NOTES	SUGGESTED PRACTICAL ACTIVITIES	INTER-RELATIONSHIPS
Students should be able to:				
1.1	distinguish between the following pairs of terms: I. physical and biotic factors, II. environment and habitat III. population and community	Environment-physical and biotic Factors. Habitat - type of place where a particular organism is found. Population - single species within a particular habitat Community - variety of species in a particular habitat.		
1.2	discuss the importance of the physical environment to living organisms;	Consider terrestrial and aquatic habitats; importance of soil in providing water, mineral, nutrients and oxygen, importance of air in providing	*Investigate different soils - constituents, air, water- holding capacity, humus.*	

		various raw materials, oxygen, carbon dioxide, nitrogen (SO A4. 1); role of microorganisms.		
2.1	carry out simple ecological study;	Habitats may include a tree, wall, or small pond.	*Use quadrats to integrate the distribution of species in a particular habitat Estimate the density of a partic ular species.*	
2.2	choose most appropriate sampling methods for a particular study;	Consider the use of quadrats, transects bottles, jars, nets.		
3.1	discuss the factors that affect the growth of natural population;	Include competition for food and space,; effects of disease pests, natural disasters.	*Research projects information, data collection and analysis.*	
3.2	illustrate using examples that human populations are subject to the same constraints as other natural populations;	Effects of population growth on food, resources, prevalence of disease.		
4.1	describe various resources and their limits	Energy and mineral resources.		
4.2	discuss the importance of and difficulties encountered in recycling manufactured materials;	Consider biodegradeable and non-biodegradeable materials, collection, transport and storage; note economic factors.		
5.1	discuss the negative impact of human activity on the environemnt;	Consider pollution by agricultural practice such as use of chemical fertilizers; products of industrialization and improper garbage disposal. Refer specifically to impact on	*Research projects information, data collection and analysis.*	

5.2 5.3	discuss the implications of pollution of marine and wetland environments; discuss means by which environment could be conserved; and restored.	small island states. Consider effect of the change in practices; example, use of natural fertilizers in agriculture; conservation methods; Education; monitoring strategies.		

GUIDELINES FOR SCHOOL-BASED ASSESMENT

APPENDIX 1

RATIONALE

School-Based Assessment (SBA) 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 critical to the subject. The activities for the School-Based Assesment are linked to the "Suggested Practical Activities" and should form part of the learning activities to enable the student to achieve the objectives of the syllabus.

During the course of study of the subject, students obtain marks for the competence they develop and demonstrate in undertaking their SBA 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 the SBA. These guidelines are also intended to assist teachers in awarding marks according to the degree of achievement in the SBA 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 SBA assignments marked by each teacher.

School-Based Assessment provides an opportunity to individualize a part of the curriculum to meet the S needs of students. It facilitates feedback to the students at various stages of the experience. This helps to build the self confidence of the students as they proceed with their studies. School-Based Assessment further facilitates the development of essential investigative and practical skills that allow students to function more effectively in their chosen vocation. School-Based Assessment therefore, makes a significant and unique contribution to the development of relevant skills of the students. It also provides an instrument for testing them and rewarding them for their achievements.

SBA assessments should be made in the context of normal practical coursework exercises. It is not intended that the exercises used for assessment should be artificial and meaningless. Assessments should only be made after candidates have been taught the skills and given enough opportunity to develop them. Although CXC requires the reporting of only 1 8 tests of practical skills for moderation, teachers are reminded that there is no upper limit to the number of assessments that should be conducted during the course of normal teaching.

The General Aims of this syllabus can only be achieved by using a practical approach and skills that are not being assessed for CXC at a particular time should, therefore, not be neglected. Note also that not all practicals are used for assessment. Students should be given the opportunity to develop their skills and to feel free to ask for assistance without penalty.

PROCEDURES FOR CONDUCTING SBA

Safety

Teachers should observe all the following safety precautions before conducting laboratory work:

1. Investigations involving human blood and other fresh human material (for example, cheek cell, saliva) should NOT be conducted.

2. Extreme care should be taken when handling live animals. Wild rodents should not be handled since they pass on disease by biting or through their urine. These diseases include leptospirosis.

3. A fire extinguisher or fire blanket must be readily accessible. Both teacher and student should know how to use them. The extinguisher purchased should be appropriate for a biology laboratory.

4. A first aid kit should be kept in the laboratory and should be checked regularly.

5. Corrosive solutions and inflammable solvents (for example, concentrated acids, alcohols) should be clearly labeled as such and handled with great care and should be locked away when not in use.

6. Candidates should know the correct way to light and use a bunsen burner. Flints rather than matches are safer to use.

7. Electrical equipment and fittings should be regularly checked and serviced. Electrical outlets should be properly labelled (example 110v and 220v).

8. A laboratory safety manual should be available.

Audio-Visual Aids

The dynamic nature of biology requires the teacher to make use of a variety of resource materials as teaching aids. Audiovisual aids are particularly useful to reinforce and deepen understanding.

Resource materials are available for use with:

1 . Film projectors;
2. Slide projectors;
3. Overhead projectors;
4. Videotape machines;
5. Tape recorders;
6. CD-ROM and other interactive media.

Cost might prohibit departmental ownership but hardware may be kept in a common pool for use within a school or among a group of schools.

Sources of materials include:

1. overseas information services, for example, USIS, UNESCO, High Commissions;
2. government ministries;
3. the media: television, radio, newspapers;
4. the Internet.

Ecological Practical Work

Substantial portions of Sections A and E of this syllabus need to be taught outside the classroom. Many of the expected exercises could be carried out within the school grounds or on waste or parkiand nearby. For example, Objectives El .2 and 1 .3 can be achieved with any soil, and comparisons are recommended. A comparison of the soil from a footpath across the school field with that from a grassed area nearby should show the effects of trampling, e.g. reduced air space, changes in the rate of water percolation, etc. For objectives Al .1; 2. 1 ; 2.3; 2.4; E2.5 soil organisms or the arthropods, etc. associated with a tree can be used.

PROCEDURE FOR CONDUCTING PRACTICALS

In preparation for SBA practical, *it* is recommended that the teacher should undertake the tasks below.

1.

(i) Select the practical work to be done, which should fit in with the normal work being done in that class. The task selected should be related to a given syllabus objective and may be chosen from the Suggested Practical Activities". An exception can be made for planning and design.

(ii) List the materials including quantities and equipment that will be needed for each student.

(iii) Carry out the experiment beforehand, if possible, to ascertain the suitability of materials and the kind of results (observations, readings) which will be obtained noting especially any unusual or unexpected results.

(iv) List the steps that will be required by the candidates in performing the experiment. From this it will be clear to the teacher how the candidates should be arranged in the laboratory, whether any sharing of equipment or materials is necessary, the skills which can be assessed from the practical, and the instructions to be given.

(v) List the skills that may be assessed (example observation/recording/reporting, analysis and interpretation). No more than two practical skills should be assessed from any one activity.

(vi) Select the skills to be assessed on this occasion. Skills other than those required for that term on the CXC mark sheet should also be included for teaching purposes.

(vii) Work out the criteria for assessing each skill. This will form the basis of a mark scheme and/or a checklist.

2. The teacher should **carry out the assessment and record the marks.**

This is the most critical step in the assessment process. For a teacher to produce marks that are reliable, the marking must be consistent for all candidates and the marks should reflect the standard of performance at the level. The teacher must be able to justify the marks, and this occurs when there is a fixed set of conditions, factors or criteria for which the teacher looks. Marks should range from 0 to 10 and no more than 4 marks should be assigned to any one criterion.

Marks should be submitted to CXC on a yearly basis on the SBA form provided. The forms should be dispatched through the Local Registrar, to reach CXC by June 30 of the first year, and April 30 of the

year of the examination. The SBA form for each year should be completed in duplicate the original for submission to CXC and the copy to be retained by the school.

ASSESSMENT OF SKILLS

School Based Assessment will test skills under the profiles Experimental Skills and Use of Knowledge (Analysis and Interpretation only). Both qualitative and quantitative work should be included. Eighteen practicals over the two year period would be considered the minimum number for candidates to develop their skills and on which to base realistic assessments. For the purposes of the SBA, no more than two practical skills should be assessed from any one activity. **The following thirteen topics are considered essential for the development and evaluation of skills in order to complete adequately the practical requirements for the biology course:**

(i) Photosynthesis

(ii) Respiration

(iii) Diffusion or Osmosis

(iv) Food tests

(v) Enzyme action

(vi) Transpiration

(vii) Response

(viii) Locomotion

(ix) Growth

(x) Reproduction

(xi) Dispersal

(xii) Genetics

(xiii) Field work

Each skill must be tested foul- times over the two-year period except for the Planning and Designing skill which must be assessed twice. Students should be encouraged to do corrections so that misconceptions will not persist. As the assessment of certain skills, especially those requiring on-the-spot observation, involves looking at several behaviours, teachers are advised to select not more than two skills to be assessed in any activity. The practical exercises selected for assessment should make adequate demands on the candidates

and the skills assessed should be appropriate for the exercises done. For the assessment of written work, the practical selected should be one that can be completed in the time allotted and the notebooks should be collected at the end of the period.

Candidates who have not been assessed over the two-year period will be deemed absent from the whole examination. Under special circumstances, candidates who have not been assessed over the entire two year period may, at the discretion of CXC, have their marks pro-rated (adjusted proportionately).

The assessment will be conducted during terms 1 -5 of the two-year period following the programme indicated in the Table below.

SKILLS	Year 1	Year 2	
	No. of Assessments	No. of Assessments	No. of Assessments
Observation/Recording/Reporting	2	2	4
Drawing	2	2	4
Manipulation/Measurement	2	2	4
Planning and Designing	-	2	2
Analysis and Interpretation	2	2	4
Total No.of Skills	8	10	18

Criteria for the Assessment of Each Skill

This syllabus is grounded in the philosophy and methodology of all science disciplines. The teaching strategies that are recommended for its delivery are dictated by the scientist's approach to a task. A problem to be identified will be examined in the light of available evidence and suggestions or hypotheses as to its solution formulated. These will then be tested by repeated practical observations, modified or discarded as necessary, until a hypothesis that does offer a solution is found.

The history of scientific thought shows that new ideas replace old ones that were previously accepted as factual. Students must be made to realize that no solution is final and infallible since modifications are continually made in light of new knowledge and technology.

The following are examples of how to conduct assessments of the skills listed under Experimental Skills and Use of Knowledge (Analysis and Interpretation)

TASKS	ASSESSMENT CRITERIA
Experimental Skill:	
(a) Observation/Recording/Reporting	
Candidates should be able to make observations and record/report them by:	
(i) presenting diagrams of models and specimens;	**Descriptions, tables or diagrams:** Method clearly described, logical sequence of activities, adequate details; tables, diagrams appropriately neat.
(ii) summarizing data, using mean, median and range; by constructing tables, graphs, histograms, maps and pie charts;	**Accuracy of observations/recordings:** Significant changes recorded; extent or degree of change recorded; original and final condition compared; condition of control included (if relevant).
(iii) presenting written reports of investigations.	**Format:** Aims, apparatus, materials. All present in the correct sequence; correct content under each heading.
(Candidates are to be encouraged to use all senses or extensions of them, for example, hand lens).	**Language and expression:** Correct tense and voice. Few or no grammatical errors.
(b) Drawing	
Candidates should be able to:	
1.make large, clear representations of appropriate labelling accurate line specimens, with and annotations;	**Clarity:** Clean continuous lines of even thickness in pencil with no shading or unnecessary details; reasonable size. **Accuracy:** Faithfulness of reproduction; structures are typical of specimen; proportions are reasonable. **Labelling/Labelling lines:** Neat, drawn with a ruler; labelling lines are straight and do not cross one an other. There is the inclusion of magnification, view or section where appropriate; there is a title.

(c) **Manipulation/Measurement** Candidates should be able to: (i) use basic laboratory equipment with competence and skill, handle selected measuring devices and take accurate readings; (ii) prepare biological materials for observation or investigation; (iii) handle living things with care.	 Extent of facility in using pH paper, thermometer, metre rule, quadrat, measuring cylinder, watch or clock or other timing device, cobalt chloride paper and balances. Correct handling of equipment for collecting specimens
(d) Planning/Designing Candidates should be able to: (i) suggest hypotheses on the basis of observation(s); (ii) design methods to test their own or other hypotheses.	 Hypotheses should include an problems on which they are based. Inclusion of apparatus and materials to be used; Description of procedures; suggestions of controls where appropriate; **Statement of expected results and limitations.**
(e) **Analysis and Interpretation** Candidates should be able to: 1. identify and explain relationships and patterns; 2. draw logical conclusions and make Inclusion of the following: predictions from observations and data.	 include labels and annotations of structures. Inclusion of the following: (i) the limitations of the observations and data; (ii) the relationship between results and original hypothesis.

WORD /TERM	DEFINITION/MEANING	NOTES
annotate	add a brief note to a label	Simple phrase or a few words only.
apply	use knowledge of principles to solve problems	Make inferences and conclusions; UK
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 structures relationships, or process; UK
calculate		

