

**MINISTRY OF EDUCATION  
CURRICULUM GUIDELINES**

***BIOLOGY***

**GRADES – 10, 11, 12**

**DEPARTMENT OF EDUCATION  
2010**

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# MINISTRY OF EDUCATION

## MISSION STATEMENT

The mission of the Department of Education is to provide all persons in The Bahamas an opportunity to receive an education that will equip them with the necessary beliefs, attitudes, knowledge and skills required for work and life in a democratic, Christian society.

## THE PHILOSOPHY

The Department of Education embraces a philosophy that all human beings have an undeniable right to an education, one that will enable them to understand their privileges and responsibilities in the community. The following principles are grounded in the Philosophy:

- (i) A belief in the ability of the teaching/learning process to unlock and draw out the fullest potential of the individual;
- (ii) An uncompromising commitment to the pursuit of excellence by teachers, learners and all who are associated with educational enterprises;
- (iii) A belief in the value of the differing gifts and aptitudes of individuals, and in the importance of these differences in an inter-dependent society;
- (iv) An appreciation of the natural and cultural heritage of The Bahamas;
- (v) A recognition of The Bahamas as a part of a wider world community with which it must interact productively.

## THE CURRICULUM

The curriculum developers have adopted, in part, the philosophies of John Dewey that “Knowledge is based on experience caused by the learner being in an active relationship with the environment” and Constructivism by Jean Piaget who proposes that “the learner should be in an environment where they are engaged in questioning, hypothesizing, investigating, debating, analyzing and evaluating.”

## ASSUMPTIONS

The Curriculum Guidelines are based on the assumptions that follow:

- (i) Students want to learn.
- (ii) The physical classroom environment as well as experiences both inside and outside the classroom affect learning.
- (iii) Students have the capacity to construct mental interpretations and concepts of the instructional experiences.
- (iv) Students have the prerequisite knowledge and skills as outlined in the Appendix IV.

## DESIGN

The design used for the curriculum guidelines include components of several designs, namely:

- (i) **Backward** – initially, the knowledge, skills and attitudes required of students exiting secondary school after completing a three-year Biology Course of study were identified. These served as the basis for the selection of learner outcomes/specific objectives, content, instructional strategies and methods of assessment in the document.
- (ii) **Skills-based** – the content is used to develop skills. Consequently, learner outcomes give focus to skills.
- (iii) **Spiral** – skills and concepts are developed at each grade level (and as far as possible in successive units).
- (iv) **Multidisciplinary** – most skills are applicable in other disciplines in particular, Language Arts, Mathematics, Geography, Family Life as well as Family and Consumer Sciences. Cross references are made to highlight complementary and supplementary information in other subjects (as well as units).
- (v) **Flexible** – it allows teachers the latitude to modify the guidelines to accommodate students of high and low ability levels as well as students of different learning styles.
- (vi) **Authentic** – the examples, problems and formative assessment used are relevant to the students' common experiences.

## OVERVIEW

### INTENT

It is intended that the

1. curriculum would be used by teachers throughout The Commonwealth of The Bahamas to provide a measure of standardized instruction;
2. students having completed the three-year course of study as outlined, will have common knowledge, skills and attitudes relative to a variety of Science topics from the biological science disciplines;
3. students completing this course of study should exhibit a level of Scientific literacy that would enable them to function in first-year tertiary level Biology Courses;
4. student-focused instructional activities facilitate students in assuming responsibility for their learning;
5. the use of these guidelines will provide students with many opportunities and experiences to develop identified skills that are assessed formatively thereby preparing students for summative assessment of the skills in the Bahamas General Certificate of Secondary Education Examinations, thereby increasing their level of success in these examinations.

## **PLANNING**

Teachers are encouraged to use the curriculum as a guideline for planning lessons. The sequence of learner outcomes in the scope of work allows a number of closely related learner outcomes to be included in one lesson. An example would be an investigation in which several skills (formulating hypothesis, designing and conducting an investigation, using scientific equipment and materials, recognizing and controlling variables, making observations, predicting, collecting and processing data, drawing relevant conclusions) are included. It is important that the learner outcomes included in one lesson facilitate students in developing concepts.

In an effort to place more emphasis on students' active involvement in the teaching-learning process, there are a number of activities that require students to do research or set up investigations, prior to a lesson. It is therefore suggested that when Schemes of Work are developed, such activities requiring prior planning are indicated in an appropriate timeline. Similarly, many opportunities are provided for group work and cooperative learning. It is important that planning includes ample lead time prior to presentations being made.

It is recognized that no curriculum guidelines would perfectly suit the pace at which all students master the information and skills. Consequently, there are several activities and/or similar skills outlined for a topic/sub-topic. It is suggested that teachers may omit some of the activities for classes that readily acquire the information and skills while more activities might be used with classes that need more reinforcement. Alternatively, if scheduling makes time a constraint, the number of activities and/or the number of learner outcomes addressing the same skill for a topic may be reduced. While this flexibility allows modifications to meet students' needs, teachers are advised to ensure that this does not lead to insufficient time being allotted to complete the course of study or a speedy completion with excessive "revision" time.

It is essential that lesson planning should be based on students' need to develop defined skills and/or attitudes as well as knowledge.

The time allocation in the curriculum is based on two 70-minute lessons per week or three lessons of 50 minutes each per week for thirty (30) weeks per year.

## **INSTRUCTIONS**

Throughout the curriculum guidelines there is a dual focus to the suggested instructional strategies: that they engage students actively in the learning process and that they are varied to allow students of different learning styles to benefit. Teachers are therefore encouraged to use the strategies indicated, or similar ones.

A concerted effort has been made by science curriculum committees to avoid duplication of information being taught at more than one school level and in more than one subject. While teachers are encouraged to ensure that students derive the maximum benefits from each lesson, care should be taken to avoid automatically re-teaching information and concepts that have been designated to junior high school curricula.

In the same manner that there are many common features of the Bahama Islands there are significant differences geographically and in terms of availability of resources. Teachers are therefore encouraged to include local examples in their planning and instructions.

Formative assessment is an integral part of effective planning for instruction and as such should be ongoing. Hence, a variety of means of assessing activities, skill development and learner outcomes are included in the curriculum. It is suggested that these, or similar methods, are used to assess students' progress in the identified skills, knowledge and attitudes. The traditional methods of assessment utilizing tests containing structured questions and objective/multiple choice questions similar to those used on the Bahamas General Certificate of Secondary Education Examinations should be used more as summative assessments for the end of unit, mid-term and end of term assessment.

## **EVALUATION**

As this is a draft document to be used and then evaluated, an evaluation form is included. Since the curriculum is being phased in, it is important that teachers complete and submit the Evaluation Form for tenth grade at the end of the first year. Similarly, forms for eleventh and twelfth grades should be remitted at the end of the second and third years respectively. This would enable revisions to be made to each section after the year has passed; thereby avoiding a lengthy and tedious major revision of the whole curriculum at the end of three years.

## **INTRODUCTION**

### **RATIONALE FOR SCIENCE EDUCATION IN THE BAHAMAS**

To provide opportunities that engage and expose all students in The Bahamas to the methodology of acquiring scientific knowledge, attitudes and skills which will enhance critical thinking, problem-solving and organizational skills. In so doing, students will be prepared to work in varied scientific and technological careers in the global environment, as well as realize the impact that they make on the natural world and appreciate the need for conservation.

### **OVERARCHING GOAL**

To become critical thinkers, problem-solvers, innovators, visionaries, scientifically and technologically literate citizens who will appreciate, interpret and conserve the natural environment.

## **SUB-GOALS**

- ◆ To develop analytical and evaluative skills thus becoming critical thinkers.
- ◆ To engage in scientific inquiry (including use of the scientific method) as a means of becoming problem solvers.
- ◆ To utilize creativity expressions to demonstrate the application of scientific knowledge and principles.
- ◆ To utilize scientific knowledge and the awareness of technological advances as a means of functioning effectively in the world.
- ◆ To formulate, present and defend arguments based on facts.
- ◆ To develop an appreciation for the safe and sustainable use of resources.
- ◆ To obtain the basic knowledge, skills and attitudes that are necessary for success in Biological Courses of study at the tertiary level.
- ◆ To develop skills that are necessary for success in entry level Biology-related jobs/careers.

## **FOCUS**

It is increasingly obvious that in this age of information, no single course of study can provide students with all of the basic information of that discipline. It is therefore necessary, that students are equipped with the skills for acquiring information and processing the information as well as making decisions based on the processed information. The scientific method applied to problem solving highlights the skills that prepare students for life in the community. It is therefore important that all students are provided with extensive opportunities to develop these skills.

The combination of topics ensures that students who complete the three year course of study, have a wide background in plant and animal physiology, cell biology and ecology.

## **GENERAL OBJECTIVES**

1. Use materials and scientific equipment correctly and safely.
2. Make observations.
3. Utilize classification process.
4. Make inferences and draw conclusions.
5. Communicate information.
6. Recognize relationships.
7. Measure accurately.
8. Make predictions.
9. Collect, process and interpret data/information.
10. Formulate hypotheses.
11. Recognize and control variables.
12. Design, conduct and evaluate scientific investigations.
13. Formulate models.
14. Apply principles and concepts (scientific & technological) to make products.
15. Make informed, responsible and wise decisions.
16. Pursue new knowledge.
17. Demonstrate critical thinking.

## **RATIONALE FOR INCLUSIONS**

Members of the Curriculum Revision Committee reviewed Biology curricula from Canada, United Kingdom and United States of America. A comparative analysis was done for these areas: focus, format, goals, methodologies and content. The results of this analysis were used, in part, to inform this document.

Questionnaires designed to seek the input of the public were prepared and distributed to educators, students and other members of the community in Abaco, Mangrove Cay – Andros, Berry Islands, Bimini, Cat Island, Crooked Island, Harbour Island, New Providence and San Salvador. The analysis of data from the completed questionnaires was used in preparing this document.

As there is no existing Biology Curriculum, the BGCSE Biology Syllabus 1996 is used for comparison in three areas:

### **(i) Deletions**

- Characteristics of living organisms are covered in the Primary Science Curriculum.
- Classification of organisms is a part of the General Science Curriculum.
- The Water, Carbon and Nitrogen Cycles are included in the General Science Curriculum.
- Food chains and webs are included as topics in the General Science Curriculum but are integrated in the ecosystems units in this document.
- The Conch and Maize have been moved to the General Science Curriculum.
- Contraceptives have been designated to Junior High School curricula as well as Health and Family Life Curriculum.

### **(ii) Additions**

- A brief section on plant excretion has been included for completion in comparative physiology.
- Bio-Technology has been included in the curriculum in keeping with content in curricula studied from other countries.
- Food safety, food additives, role of microbes in food have been included to reflect the need for emphasis to be placed on the relationship between diets and healthy lifestyles.

### **(iii) Modifications**

- Parts of a flowering plant, external differences between monocotyledons and dicotyledons are covered in the Primary Science Curriculum. The internal structure of monocotyledonous roots, stems, leaves; dicotyledonous roots, stem, leaves are included in Plant Anatomy.
- Ecology has been expanded to include a woodland (pine forests, coppice, drought resistant), biodiversity, national parks and protected areas, and fisheries management.
- Cell diversity and organization have been relegated to Junior High School Curricula. Cell Biology has been expanded to include use of macromolecules in the structure and functions of cells, details of meiosis, function of important ions in the cell, Nucleic acids (DNA & RNA) a basic description of structure and function, and genetic engineering.

- Food nutrients and the digestive system have been designated to the Junior High School Curricula while human dentition has been designated to the Primary Science Curriculum. However, the specialization of dentition and alimentary canals of carnivores and herbivores are included in this document. Simple chemical composition of food nutrients is included.
- Fishing is included with a focus on technology as a means of maintaining sustainable catch, instead of fishing gear which is included in Social Studies.
- Agriculture is also included with a focus on the use of technology to maintain yields needed to feed an increasing population instead of focusing on the effects on the environment of bad agricultural practices.
- The Human Physiology has been expanded in several topics. Respiration includes the formation and dissociation of ATP as well as the control of breathing. Blood groups have been added to the Circulatory System. The Lymphatic System has been included. The structure of the Human Reproductive System is included in the Junior High School Curricula. However, the development and release of human gametes, structure of gametes, and use of technology in fertilization have been added to the Reproduction Section. Human Growth and Development has defined guidelines. Sexually Transmitted Infections are included in this document. However, with the exception of AIDS the diseases are different from those included in the Junior High School Curricula. The knee joint and muscles have been added as additional effector organs.

(iv) **Format**

- The format of the Scope and Sequence allows referencing to the extent to which skills are targeted at each grade level. It also indicates the depth of content to be covered and the order of sub-topics.
- The Scope of Work includes learner outcomes, content, student activities, resources and assessment strategies. The learner outcomes have been placed in the first column as a means of emphasizing their importance. A final column has been included with suggested methods of assessment for the learner outcomes and instructional activities. This serves to reinforce focus on the identified skills. In addition, the varied methods of assessment included, represent an attempt to satisfy the overwhelming input from the Public Perception Questionnaire that assessment should not be based exclusively on tests.

## SCOPE AND SEQUENCE – TOPICS & CONTENT

STRAND	GRADE 10	GRADE 11	GRADE 12
ENVIRONMENTAL BIOLOGY	<p><b>Mangrove Ecosystems</b> (distribution, abiotic factors, zonation, identification, food webs, reproduction, adaptations of mangroves, role/importance of mangroves, economic importance mangroves, threats to and protection of);</p> <p><b>Coral Reef Ecosystems</b> (distribution, abiotic factors, reef formation, food webs, adaptations of reef organisms, economic importance, threats to and protection of);</p> <p><b>Rocky Shores</b> (abiotic factors, zonation, adaptations, importance of, threats to);</p> <p><b>Sandy Beaches</b> (abiotic factors, zonation, adaptations of sandy beach organisms, importance of, beach erosion, threats to and protection of);</p> <p><b>Pine Forests or Coppice or Drought-Resistant Woodland</b> (description of each type, islands where each type of vegetation is found, detailed study of one type of inland vegetation – inhabitants, food webs, threats, protection).</p>	<p><b>Air Pollution</b> (main pollutants- exhaust fumes, carbon dioxide, sulphur dioxide, CFCs, sources, effects, control);</p> <p><b>Land Pollution</b> (main pollutants, sources, effects, control);</p> <p><b>Water Pollution</b> (main pollutants - sewage, oil, metals and chemicals, agricultural chemicals - pesticides and fertilizers, sources, effects, control, bioaccumulation, eutrophication, effects of marine debris);</p> <p><b>Ozone Depletion</b> (cause, effects, control);</p> <p><b>Global Climate Change</b> (greenhouse effect, “enhanced” greenhouse effect, global warming, cause, effect, control).</p>	<p><b>Biodiversity:</b> Importance of, threats to and protection of biodiversity in The Bahamas (habitat destruction, pollution, exotic/invasive species, over-harvesting);</p> <p><b>National Parks and Protected Areas:</b> Marine Reserve Networks in The Bahamas (existing and proposed locations), objectives and benefits, Terrestrial Parks and Preservation;</p> <p><b>Fisheries Management:</b> Status and conservation of: Nassau Grouper (<i>Ephinephalus striatus</i>), Queen Conch (<i>Strombus gigas</i>), Spiny Lobster <i>Panulirus argus</i>), Bone Fish, and Stone Crab.</p>

## SCOPE AND SEQUENCE – TOPICS & CONTENT

STRAND	GRADE 10	GRADE 11	GRADE 12
<b>CELL BIOLOGY &amp; GENETICS</b>	<p><b>Cells:</b> distinguish between Prokaryotes and Eukaryotes; organelles (identifying cell parts in detail); specialization of cells; activity of enzymes in cells.</p> <p>Reproduction in simple organisms including binary fission in bacteria and amoeba, budding in yeast, spore production in fungi.</p> <p>Diffusion, osmosis and active transport.</p>	<p><b>Transport in cells:</b> Turgidity and plasmolysis;</p> <p><b>Structure of cells:</b> proteins, macromolecules, interconversions of carbon based compounds.</p> <p><b>Genetics:</b> Cell division (mitosis and meiosis);</p> <p><b>Monohybrid inheritance</b> (complete, incomplete and codominance).</p>	<p><b>Nucleic acids</b> DNA (structure and function) and RNA function</p> <p><b>Genetic engineering:</b> biotechnology (general definition, genetically modified foods, basics of stem cell research);</p> <p><b>Variation:</b> mutations, random assortment, continuous and discontinuous variation.</p>
<b>NUTRITION AND FOOD SUPPLY</b>	<p><b>Feeding in animals:</b> comparing the gut and teeth of different animals.</p> <p><b>Agriculture:</b> Effects of deforestation and over-use of chemicals, value of technology for food production (herbicides and pesticides); examples of drip irrigation, hydroponics, genetic engineering); selected staple crops e.g. maize &amp; soya.</p> <p><b>Fishing:</b> Effects of overfishing, illegal methods of fishing, their effects on marine ecosystems, economic gains of fishermen vs. the long-term effect on marine organisms;</p> <p>Aquaculture/mariculture (definition, need for, organisms raised, methods used, advantages, disadvantages).</p>	<p><b>Nutrients in food:</b> (Elements that make up organic food nutrients; food tests for proteins, sugars and vitamin C content);</p> <p><b>Photosynthesis:</b> (definition and word and chemical equations), Limiting factors affecting photosynthesis (effects of temperature, light intensity, carbon dioxide concentration and availability of water on rate of photosynthesis);</p> <p><b>Comparison</b> of respiration and photosynthesis;</p> <p><b>Mineral requirements for plants</b> (Importance of nitrogen ions, magnesium ions, phosphorus and potassium for various functions; sources of each mineral; deficiency signs for each mineral).</p>	<p><b>Food Safety:</b> Food Contamination, Prevention of food contamination;</p> <p><b>Food Additives:</b> Types of additives (including preservatives), their purpose, health problems associated with additives;</p> <p><b>Role of Microbes in Food Production:</b> brewing, making yoghurt, bread.</p>

## SCOPE AND SEQUENCE – TOPICS & CONTENT

STRAND	GRADE 10	GRADE 11	GRADE 12
<b>PLANT ANATOMY AND PHYSIOLOGY</b>	<p><b>Structure of root, stem and leaf:</b> (Internal and external diagrams, significance/function of these structures);</p> <p><b>Adaptations of root, stem and leaf:</b> in local plants;</p>	<p><b>Transport in plants</b></p> <p><b>Transpiration:</b> (Definition, mechanism of transpiration, effects of temperature, humidity and light intensity on transpiration rate, use of photometer, wilting process);</p> <p><b>Translocation</b> (Definition, vascular bundle involved, use of translocated sugar in plant);</p> <p><b>Excretion in plants</b> shedding leaves, tannins.</p>	<p><b>Tropism</b> geotropism, phototropism, role of auxins;</p> <p><b>Asexual Reproduction:</b> natural vegetative – e.g. tubers, runners, stolons, bulbs rhizomes; artificial – grafting/budding, marcotting/air layering, cuttings;</p> <p><b>Sexual Reproduction</b> –structure &amp; function of flowers, wind and insect pollinated flowers, pollination, fertilization, germination (role of enzymes), fruit and seed development, seed dispersal;</p> <p><b>Differences</b> between asexual and sexual reproduction, advantages and disadvantages of asexual and sexual reproduction.</p>
<b>ANIMAL ANATOMY AND PHYSIOLOGY</b>	<p><b>Respiration – Aerobic and Anaerobic</b> Definition of respiration, types of respiration, word and chemical equations of aerobic respiration and anaerobic respiration (yeast and muscle cells), comparison of aerobic and anaerobic respiration;</p> <p><b>Economic</b> importance of anaerobic respiration in yeast (baking, brewing).</p>	<p><b>Blood And Circulatory System</b> Structure and function of human heart, heart beat, pulse rate, artificial pace makers, cardiovascular diseases, Blood composition and functions, blood cells origin, life span &amp; destruction, Blood clotting, blood groups, blood vessels, circulation of blood;</p> <p><b>Lymphatic System</b> Diagram of the lymphatic system, location of lymph vessels and lymph nodes, functions of the lymphatic system;</p> <p><b>Comparison</b> of blood, lymph, and tissue fluid.</p>	<p><b>Reproduction in Humans:</b> Structure of male and female gametes, development and release of sperms, development of the ovum (Graafian follicle to corpus luteum), fertilization, stages of gestation (zygote to birth), in vitro fertilization, Bioethics;</p> <p><b>Growth and Development</b> main features at each stage of development – from birth to old age;</p> <p><b>Population growth</b>, economic and social effects;</p> <p><b>Sexually Transmitted Infections</b> (Chlamydia, monilia, trichomonas, herpes, HIV/AIDS).</p>

## SCOPE AND SEQUENCE – TOPICS & CONTENT

STRAND	GRADE 10	GRADE 11	GRADE 12
<b>ANIMAL ANATOMY AND PHYSIOLOGY (cont'd)</b>	<p><b>ATP</b> (formation, function, and storage of ATP in cells, structure of;</p> <p><b>Human respiratory system:</b> (structure, mechanism of breathing, control of breathing rate, gas exchange, diseases of the respiratory system).</p>	<p><b>Excretion</b> Definition of excretion; examples of metabolic waste; organs of excretion, location; structure and function of the kidneys, structure and function of the nephron; kidney failure (transplant and dialysis).</p> <p><b>Homeostasis</b> The kidneys and osmoregulation, control of blood-glucose, the skin and temperature regulation.</p>	<p><b>Endocrine System:</b> Distinguish between endocrine and exocrine glands, compare endocrine and nervous systems, Endocrine glands (pituitary, thyroid, adrenal, pancreas, testes, ovaries), the hormone secreted, effects of too little/too much hormone;</p> <p><b>Nervous System</b> central nervous, brain, spinal cord, peripheral nervous systems - 3 types of neurons, reflex arcs, reflex action,</p> <p><b>Sense organs:</b> skin, eye, ear, structure and function;</p> <p><b>Effector organs:</b> arm – flexor and extensor muscles, elbow joint, action of flexing, leg - flexor and extensor muscles, knee joint, action of flexing, role of cartilage, ligaments and tendons.</p>

## SCOPE OF SKILLS GRADES 1 – 12

OBJECTIVES	GRADES 1 – 6	GRADES 7 – 9	GRADES 10 – 12
Use materials and scientific equipment correctly and safely.	√	√	√
Make observations.	√	√	√
Utilize classification process	√	√	√
Make inferences and draw conclusions	√	√	√
Communicate information.	√	√	√
Recognize relationships (including spatial).	√ (mainly spatial)	√	√
Measure accurately.	√	√	√
Make predictions.	√	√	√
Collect, process and interpret data/information.	√ (not collection)	√ (not collection)	√ (not collection)
Formulate hypotheses.	√	√	√
Recognize and control variables.			√
Design, conduct and evaluate scientific investigations.	√	√	√
Formulate models.	√	√	√
Apply principles and concepts (scientific & technological) to create products.		√	√
Make informed, responsible and wise decisions.	√	√	√
Pursue new knowledge.	√	√	√
Demonstrate critical thinking.	√	√	√

## SCOPE AND SEQUENCE (SKILLS)

### Use materials and scientific equipment correctly and safely

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Make a quadrat to survey organisms in an aquatic, coastal or terrestrial ecosystem.</li> <li>• Make a fish trap (bottle) to capture fish in a rocky shore or sandy beach.</li> <li>• Make nets or traps to sample small invertebrates in a terrestrial ecosystem.</li> <li>• Make a line transect.</li> <li>• Use quadrats, line or belt transects to record the distribution of plants on the rocky shoreline.</li> <li>• Use equipment to measure temperature (air, sand surface, 10 cm below surface, water), wind direction and wind speed at 3 points along the transect.</li> <li>• Use quadrats, line or belt transects to record the distribution of plants on a sandy shoreline.</li> <li>• Prepare slides of plant and animal cells.</li> <li>• Use methylene blue to stain yeast suspension on microscope slide.</li> <li>• Use a thermometer to measure the temperature of water baths with cold, warm and hot water (enzyme investigations).</li> <li>• Use apparatus to demonstrate selectivity of the cell membrane.</li> <li>• Use apparatus and materials to demonstrate osmosis.</li> <li>• Use a microscope to view the internal structures of a monocotyledonous leaf on a prepared slide.</li> </ul>	<ul style="list-style-type: none"> <li>• Use materials to illustrate turgidity and plasmolysis in plant cells.</li> <li>• Use apparatus and materials safely in performing food tests.</li> <li>• Use apparatus and materials correctly and safely in an investigation to determine the form in which food is stored in leaves of a plant.</li> <li>• Use apparatus and materials correctly and safely in an experiment to investigate whether light is needed in the production of starch by photosynthesis.</li> <li>• Use apparatus and materials correctly and safely in an investigation to determine whether chlorophyll is needed in the production of starch by photosynthesis.</li> <li>• Use a potometer or the weighing method to determine the transpiration rate of a plant.</li> <li>• Use materials correctly and safely to determine from which surface of the leaf transpiration occurs faster.</li> <li>• Use a scalpel or other cutting utensil to dissect the heart of a mammal.</li> <li>• Use a magnifying lens to observe the structure of the heart.</li> <li>• Use a stethoscope to investigate heartbeat.</li> <li>• Use a microscope to view prepared slides of blood.</li> <li>• Use a scalpel or other cutting utensil to dissect a kidney.</li> </ul>	<ul style="list-style-type: none"> <li>• Use equipment for an investigation to extract DNA.</li> <li>• Use a ruler to investigate reaction time of classmates to stimuli.</li> <li>• Use a scalpel, razorblade or scissors to dissect various types of flowers.</li> <li>• Use a microscope to observe pollen and ovules of a dissected flower.</li> <li>• Use materials to investigate what makes pollen grains produce a tube.</li> <li>• Use a microscope to observe prepared slides of ova and spermatozoa.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

Use materials and scientific equipment correctly and safely

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"><li>• Use materials and apparatus to demonstrate the production of carbon dioxide during aerobic respiration.</li><li>• Use apparatus and materials provided to demonstrate anaerobic respiration.</li></ul>		

## SCOPE AND SEQUENCE (SKILLS)

### Make observations

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Identify the locations of coral reefs on a map of the world and a map of The Bahamas.</li> <li>• Compare photographs of bleached coral and healthy coral.</li> <li>• Observe the diversity of organisms in the coral reef ecosystem in a virtual field trip.</li> <li>• Draw and label the basic features of <i>Thalassia</i>.</li> <li>• Observe special features of the substrate of a rocky shoreline.</li> <li>• Observe special features of the substrate of a sandy shoreline.</li> <li>• Observe invertebrates in their habitat on a sandy shoreline.</li> <li>• Examine prepared slides of plant and animal cells with microscope.</li> <li>• Observe cell organelles on photographs or transparencies.</li> <li>• Observe a diagram of a bacterial cell and identify cell parts.</li> <li>• Observe yeast cells reproducing under a microscope.</li> <li>• Observe mould using a magnifying glass or a sample on a slide using the microscope.</li> <li>• Make observations of the action of an enzyme in different pH, temperature conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Make observations of plant tissue in solutions of different concentrations.</li> <li>• Observe the effects of varying the concentration of solutions on plant tissues.</li> <li>• Compare the appearances of a cell that is reproducing with the appearances of one that is not reproducing.</li> <li>• Observe diagrams showing stages in mitosis.</li> <li>• Observe prepared slides of the cross-section of an ovary / testis.</li> <li>• Observe diagrams showing stages in meiosis.</li> <li>• Observe inherited monohybrid traits of students in the classroom.</li> <li>• Observe inherited traits of plants and animals in the schoolyard.</li> <li>• Observe photographs of human homologous chromosomes.</li> <li>• Observe results of food tests on various food samples.</li> <li>• Observe and record colour of each reagent before and after reaction with leaf.</li> <li>• Observe and record colour of both leaves (different conditions) tested for starch.</li> <li>• Observe plant photographs or specimens showing mineral deficiencies.</li> <li>• Observe the part of the vascular bundle which is responsible for the movement of water through a celery stalk.</li> <li>• Observe what occurs when the bark is ringed / removed from the stem region of a tree trunk.</li> <li>• Observe the external and internal appearance of the human heart.</li> </ul>	<ul style="list-style-type: none"> <li>• Observe diagrams of RNA and DNA.</li> <li>• Observe pictures or samples of genetically modified foods.</li> <li>• Observe photographs or diagrams showing random assortment of chromosomes.</li> <li>• Observe photographs of different organisms in different habitats and their adaptations which help them to survive there.</li> <li>• Observe food labels to determine food additives in commonly used foods.</li> <li>• Observe various types of tropisms.</li> <li>• Observe what happens when the tip of a plant shoot is cut off.</li> <li>• Observe posters, transparencies or a human torso model showing endocrine glands.</li> <li>• Observe posters, transparencies and a model of the human brain.</li> <li>• Observe diagrams or prepared microscope slides of neurons.</li> <li>• Observe responses in an experiment to investigate reaction time of classmates to various temperatures.</li> <li>• Observe responses in an experiment to investigate reaction time of classmates to stimuli.</li> <li>• Observe a poster and model of human eye and specimen of a mammalian eye.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Make observations

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Observe the spreading of a coloured material in water at different temperatures of water. Observe position of coloured water in osmosis experiment.</li> <li>• Observe the dentition of various types of mammalian feeders.</li> <li>• Observe the alimentary canals of various types of mammalian feeders.</li> <li>• Observe the external features of a maize and hibiscus or sea grape leaf.</li> <li>• Observe the internal structures of a dicotyledonous leaf on a prepared slide using a microscope.</li> <li>• Observe prepared slides of T. S. monocotyledonous stem.</li> <li>• Observe the internal features of a longitudinal-section of a dicotyledonous stem.</li> <li>• Observe the internal features of a cross-section of a monocotyledonous root.</li> <li>• Observe the internal features of a cross-section of a dicotyledonous root.</li> <li>• Compare the internal features of monocotyledonous and dicotyledonous roots.</li> <li>• Observe the internal feature of a mitochondrion and explain how it is adapted for respiration.</li> <li>• Observe the change in colour of lime water when exhaled air is added to it.</li> <li>• Observe photographs of the lungs of smokers and non-smokers.</li> </ul>	<ul style="list-style-type: none"> <li>• Observe the internal structure of a mammalian heart.</li> <li>• Observe cross sections of blood vessels.</li> <li>• Observe prepared slide of blood smear to identify the components of blood.</li> <li>• Observe a comparative table showing composition of blood in the renal artery and vein.</li> <li>• Observe/examine the internal structure of a dissected kidney.</li> <li>• Observe diagrams of a nephron and dialysis machine/outfit.</li> </ul>	<ul style="list-style-type: none"> <li>• Compare the skin's sensitivity to touch on various locations on the body.</li> <li>• Observe what happens to the pupil of the eye when in bright light.</li> <li>• Observe a poster and model of the human ear.</li> <li>• Observe diagrams and a model of the elbow joint.</li> <li>• Observe reproductive organs (stigma, anthers), petals, sepals of flowers in diagrams and posters or models.</li> <li>• Observe the parts of dissected flowers.</li> <li>• Observe a variety of flowers to determine the agent responsible for pollination.</li> <li>• Observe local fruits and seeds to determine method of dispersal.</li> <li>• Observe a diagram of the placenta and umbilical cord, examining their special features.</li> <li>• Observe photographs or posters of fetuses in different stages of development.</li> <li>• Observe diagrams showing humans at different ages.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Utilize the classification process

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Classify organisms in a mangrove ecosystem according to phylum.</li> <li>• Make a key identifying hard and soft coral on pictures or diagrams of a Bahamian reef.</li> <li>• Classify the invertebrates found on sandy shores.</li> <li>• Identify examples of simple organisms that reproduce by binary fission.</li> <li>• Draw conclusions about the speed of reproduction, number of offspring produced and resemblance of offspring to parents.</li> <li>• Classify vertebrates into feeding groups based on dentition and gut.</li> <li>• Classify the main threats to agriculture in The Bahamas.</li> <li>• Classify types of fishing grounds.</li> <li>• Classify examples of respiration as aerobic or anaerobic.</li> <li>• Classify modifications of dicotyledonous leaves according to the type environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Classify waste as bio-degradable and non-biodegradable.</li> <li>• Classify water pollutants.</li> <li>• Classify proteins in the cell.</li> <li>• Compare and contrast mitosis and meiosis.</li> <li>• Distinguish between the sex and other homologous chromosomes in humans.</li> <li>• Compare and contrast the structure of the three types of blood vessels.</li> <li>• Differentiate between veins and arteries.</li> <li>• Compare blood plasma, lymph, and tissue fluid.</li> <li>• Compare and contrast excretion in plants and humans.</li> </ul>	<ul style="list-style-type: none"> <li>• Classify molecules which are components of nucleic acids (DNA &amp; RNA).</li> <li>• Classify examples of variation as continuous or discontinuous.</li> <li>• Classify common food additives.</li> <li>• Classify plant growth responses.</li> <li>• Distinguish between exocrine and endocrine glands.</li> <li>• Classify simple reflex actions as spinal or cranial reflexes.</li> <li>• Distinguish between simple reflexes and conditioned reflexes.</li> <li>• Classify given muscles as extensor or flexor.</li> <li>• Classify reproductive structures in plants as sexual or vegetative.</li> <li>• Classify a variety of flowers according to the type of pollination.</li> <li>• Classify local fruits and seeds according to dispersal methods.</li> <li>• Classify STDs by the agents causing them.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Make inferences and draw conclusions

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Form a conclusion that a bacterial cell is a prokaryote cell.</li> <li>• Draw conclusions about the speed of reproduction, number of offspring produced and resemblance of offspring to parents.</li> <li>• Formulate a conclusion on the optimal pH for an enzyme to work.</li> <li>• Formulate a conclusion on the optimal temperature for an enzyme to work.</li> <li>• Formulate a conclusion from the experiment on osmosis.</li> <li>• Make inferences and draw a logical conclusion on the selectivity of the cell membrane.</li> <li>• Infer why it is better to breathe through the nose than through the mouth.</li> <li>• Make inferences or draw conclusions on effects of smoking on the respiratory system.</li> </ul>	<ul style="list-style-type: none"> <li>• Make an inference/draw a conclusion as to the major pollutant in the sea.</li> <li>• Draw a conclusion on the effects of solutions of different concentrations on plant tissue.</li> <li>• Draw conclusions to verify predictions on nutrients present in food samples.</li> <li>• Form a conclusion on the form in which food is stored in leaves of a plant.</li> <li>• Form a conclusion on whether light is needed in the production of starch by photosynthesis.</li> <li>• Form a conclusion on whether chlorophyll is needed in the production of starch by photosynthesis.</li> <li>• Draw conclusions, on the function of named minerals in plants.</li> <li>• Formulate a conclusion on which surface allows a faster rate of transpiration.</li> <li>• Make inferences/conclusions as to the affect of exercise on pulse rate.</li> <li>• Draw a conclusion on the blood pressure range for the class.</li> <li>• Make inferences about the functions of the kidney based on the composition of blood in the renal artery and renal vein.</li> </ul>	<ul style="list-style-type: none"> <li>• Use data to form a conclusion on the harvesting of groupers.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult lobsters.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult conchs.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult bonefish.</li> <li>• Form an inference as to the meaning of the term “genetically modified crops”.</li> <li>• Based on a survey conducted, draw conclusions on the extent to which best food safety practices are carried out.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Communicate information

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Make an annotated outline drawing of the profile of a mangrove ecosystem showing zonation and the features of each zone.</li> <li>• Use a picture-graph to show the relative abundance of organisms in each phylum represented.</li> <li>• Create a visual display showing how the features of each type of mangrove is adapted to its environment/zone.</li> <li>• Construct a mangrove food web using data collected from field survey and other resources.</li> <li>• Make an oral presentation explaining the role of mangroves in land-building.</li> <li>• Participate in a debate on mangrove wetlands versus wastelands.</li> <li>• Prepare a brochure or multimedia presentation highlighting the importance of mangrove ecosystems.</li> <li>• Create a song, poem, rap or infomercial that promotes the awareness of the threats to mangrove ecosystems.</li> <li>• Prepare a speech to persuade members of the community to implement measures to preserve one identified mangrove ecosystem on the island, to be given at a town meeting.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the terms “pollution” and “pollutant”.</li> <li>• Write a short story to highlight the negative effects of smog.</li> <li>• Explain the greenhouse effect.</li> <li>• Debate the validity of the statement that greenhouse gas emissions have direct negative affects on humans and other organisms.</li> <li>• Make an oral presentation on what may happen to small islands/cays as a result of climate change/global warming.</li> <li>• Create a poster representing the causes, process and effects of ozone depletion.</li> <li>• Describe the effects of “heavy” metals on marine food chains.</li> <li>• Explain the effects of pesticides on the marine food chains.</li> <li>• Explain the effects of oil spills.</li> <li>• Describe the threats to the marine environment caused by marine debris.</li> <li>• Explain the process of eutrophication.</li> <li>• Explain the effects of solutions of different concentrations on plant tissue.</li> <li>• Explain the importance of water to cells.</li> <li>• Write a report on an experiment to investigate the effect of a given environmental factor on the rate of transpiration.</li> <li>• Describe inter-conversions of substances in cells.</li> <li>• Explain how the gender of a baby is determined.</li> <li>• Make an oral and visual presentation describing monohybrid inheritance.</li> </ul>	<ul style="list-style-type: none"> <li>• Use drama, music, art and/or technology tools to demonstrate ways to minimize the impact of human activities on the environment.</li> <li>• Explain the role and importance of methods of measuring populations of organisms.</li> <li>• Explain the functions of National Parks.</li> <li>• Describe (simply) the process of producing plants from cloning tissue.</li> <li>• Make an oral presentation describing the structure of DNA.</li> <li>• Describe the process of cloning an adult cell.</li> <li>• Describe (simply) the process of genetic engineering.</li> <li>• Make a poster or pamphlet promoting the benefits of GM foods.</li> <li>• Describe how random assortment of chromosomes contribute to variations of features in species.</li> <li>• Explain how sexual reproduction leads to variation in a population.</li> <li>• Create a poster to educate the public of the importance of food safety.</li> <li>• Explain the role of microbes in the manufacture of foods.</li> <li>• Explain the role of auxins in tropic responses.</li> <li>• Explain using a visual presentation, the importance of maintaining a specific amount of a hormone in the body.</li> <li>• Describe the role of the skin in homeostasis.</li> <li>• Explain the process of seeing.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Communicate information

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Identify the locations of coral reefs on a map of the world and a map of The Bahamas.</li> <li>• Make an annotated drawing/chart of a coral polyp showing its structures and the functions of those structures.</li> <li>• Create a news article explaining the benefits of coral reefs.</li> <li>• Design a concept map to show the role of zooxanthellae in coral reefs.</li> <li>• Construct a coral food web showing producers, primary, secondary and tertiary consumers.</li> <li>• Locate on a map of the island on which you live, likely areas for rocky shoreline ecosystems to be located.</li> <li>• Make an annotated outline drawing of the profile of a typical rocky shoreline ecosystem showing zonation and the features of each zone.</li> <li>• Create a cartoon showing benefits derived from the rocky shoreline.</li> <li>• Locate on a map of the island on which you live, likely areas for sandy shoreline ecosystems to be located.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the difference in the composition of blood in the pulmonary artery compared with the other arteries.</li> <li>• Describe the functions of the lymphatic system.</li> <li>• Create a flow diagram to explain the role of the skin in controlling body temperature.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the process of hearing.</li> <li>• Describe the role of the ear in maintaining balance.</li> <li>• Explain the functions of skeletal muscles.</li> <li>• Explain how nerves cause muscles to contract.</li> <li>• Prepare a brochure to encourage persons to use vegetative propagation for home-gardening.</li> <li>• Describe the sequence of events from pollination to fruit and seed formation.</li> <li>• Outline the route taken by a spermatozoon from its site of production to its release from the male's body.</li> <li>• Make an annotated diagram of the pathway taken by an ovum after it is released from the ovary until it is implanted into the uterine lining.</li> <li>• Defend the legality and morality of cloning.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Communicate information

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Make an annotated outline drawing of the profile of a sandy shoreline ecosystem showing zonation.</li> <li>• Make a graphic organizer to show the distribution of invertebrates in the zones of a sandy shoreline.</li> <li>• Describe the main flora and fauna found in a named forest and relate their adaptations to the forest.</li> <li>• Construct a possible food web for the forest ecosystem.</li> <li>• Prepare a cartoon, poem, skit, song or rap to demonstrate the importance of the forest ecosystem.</li> <li>• Create a role play in which students represent different organelles as well as describe their structure and function.</li> <li>• “Sell a cell” – students must sell parts (market their importance) of a cell.</li> <li>• Make annotated diagrams to show budding.</li> <li>• Make annotated diagrams to show spore formation.</li> <li>• Dramatize the process of active transport of molecules across a membrane.</li> <li>• Make a presentation on the use of technology in food production in The Bahamas.</li> <li>• Describe the arrangement of tissues in the vascular bundles in leaves.</li> <li>• Participate in a debate “stem cell banks are disadvantageous to plants and humans”.</li> <li>• Create a graphic organizer to summarize aerobic respiration in both yeast and muscle cells.</li> </ul>		

## SCOPE AND SEQUENCE (SKILLS)

### Communicate information

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"><li>• Create a graphic organizer to summarize anaerobic respiration in both yeast and muscle cells.</li><li>• Describe what makes the internal features of a mitochondrion suitable for respiration.</li><li>• Make an annotated diagram of the nose/nasal passages and pharynx.</li><li>• Dramatize the changes in gaseous composition of blood as it approaches and leaves the alveoli.</li><li>• Create a visual presentation to show the passage of an oxygen molecule from the air to a capillary in the lungs.</li></ul>		

## SCOPE AND SEQUENCE (SKILLS)

### Recognize relationships

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Relate the type of mangrove found to the abiotic conditions in an imaginary transect from the sea inward.</li> <li>• Show the relationship between locations of coral reefs and abiotic factors which are needed for coral reefs to thrive.</li> <li>• Show the relationship between the features of the invertebrates surveyed and their adaptations to the environment/zone of a sandy shoreline.</li> <li>• Show the relationship between the features of plants observed and their adaptations to the environment/zone.</li> <li>• Explain the relationship of the cell parts to their function.</li> <li>• Demonstrate the relation between diffusion and osmosis.</li> <li>• Explain the relationship between the dentitions of an omnivore, carnivore and herbivore and their diet.</li> <li>• Use models to explain the relationship between size and shape of teeth in each dentition to the type of diet.</li> <li>• Relate the appearance of each internal structure of a leaf to its function in photosynthesis.</li> <li>• Describe the relationship between the carbon dioxide concentration and breathing rate and depth.</li> <li>• Recognize and explain the relationship between the structure of the alveolus and gas exchange.</li> <li>• Explain the relationship between cigarette smoking and lung disease.</li> </ul>	<ul style="list-style-type: none"> <li>• Relate the use of CFCs to the depletion of the ozone layer.</li> <li>• Explain the relationship between clean water and a healthy lifestyle.</li> <li>• Relate the properties of water to its functions in cells.</li> <li>• Demonstrate the relationship between amino acids and proteins.</li> <li>• Relate the properties of protein to its function in cells.</li> <li>• Relate the properties of carbohydrates to their function in cells.</li> <li>• Relate the structures of the heart to their functions.</li> <li>• Relate the operation of structures of the heart to the sound produced during beats.</li> <li>• Describe how the features of each type of blood cell are adapted for their functions.</li> <li>• Relate the composition and state of blood to its functions.</li> <li>• Describe the relationship between the Lymphatic and Circulatory Systems.</li> <li>• Make a correlation between ADH concentration and urine production.</li> <li>• Recognize and describe the relationship between diet and blood glucose levels.</li> <li>• Relate the results from the investigation on the effects of insulation on heat loss to the ability of the skin to maintain body temperature.</li> <li>• Relate the results from the investigation on the effects of body size on heat loss to the ability of large and small animals to conserve heat.</li> </ul>	<ul style="list-style-type: none"> <li>• Relate the external parts of the brain to their function(s).</li> <li>• Make a model to show the relationship between the Central Nervous System and Peripheral Nervous System.</li> <li>• Relate the parts of the eye to their function(s).</li> <li>• Relate the parts of the ear to their function(s).</li> <li>• Relate the structure of the semi-circular canals to their function in orientation.</li> <li>• Relate the structure of the floral parts of a named flower to their function.</li> <li>• Relate the events in the ovary during a menstrual cycle to the differences in hormone levels during a cycle.</li> <li>• Relate the structure of the placenta to its role in absorption, gas exchange, and excretion.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Measure accurately

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Measure temperature and wind speed on a rocky shoreline.</li> <li>• Use a thermometer to measure the temperature of cold, warm and hot water baths.</li> <li>• Measure and record temperatures of water in diffusion experiments.</li> <li>• Measure materials needed for osmosis experiment.</li> <li>• Measure number of breaths for partner for 30 seconds.</li> <li>• Measure the circumference of inflated balloons to compare the lung capacity of students.</li> </ul>	<ul style="list-style-type: none"> <li>• Measure length and width of potato/carrot strips.</li> <li>• Measure the water level or weight loss in an experiment.</li> <li>• Record measurements.</li> <li>• Measure accurately the pulse rate of students.</li> <li>• Use a thermometer to accurately measure temperature of water in insulated and non-insulated flasks.</li> </ul>	<ul style="list-style-type: none"> <li>• Measure materials for the investigation to extract DNA.</li> <li>• Measure time in an experiment to investigate reaction time of classmates to various temperatures.</li> <li>• Measure temperature in an experiment to investigate reaction time of classmates to various temperatures.</li> <li>• Measure accurately the length of a seedling.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Make predictions

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Predict how energy distribution and energy use will be altered through changes in the food web of a mangrove ecosystem.</li> <li>• Predict the outcome of an experiment using plastic sandwich bags/visking tubing, iodine and starch, to show selectivity of the cell membrane.</li> <li>• Predict the effects of deforestation on farmland.</li> <li>• Predict the products of anaerobic respiration.</li> <li>• Predict the effect specific factors (e.g. different types of exercise) have on breathing rate.</li> <li>• Predict the direction in which oxygen and carbon dioxide molecules move across gas exchange surfaces based on the principles of diffusion.</li> <li>• Predict the effects of smoking on gas exchange.</li> </ul>	<ul style="list-style-type: none"> <li>• Predict what would happen to a sample of red blood cells when placed in solutions of varying concentrations.</li> <li>• Predict which nutrient(s) can be found in given foods.</li> <li>• Predict the effect of a plant losing too much water.</li> <li>• Predict the effects of exercise on pulse rate.</li> <li>• Predict how conditions of the body affect average pulse rate.</li> <li>• Describe the expected observations for the sample if it were taken from a diabetic or non-diabetic.</li> <li>• Predict the meaning of homeostasis.</li> <li>• Make predictions about the effect of insufficient/excess ADH on urine production.</li> </ul>	<ul style="list-style-type: none"> <li>• Predict the effects of decreasing biodiversity in local ecosystems.</li> <li>• Predict what a “fruit stand” will look like in 2050.</li> <li>• Predict the likely outcome of stem cell research on some illnesses.</li> <li>• Predict how changes in chromosomes might lead to variations.</li> <li>• Predict what happens to the pupil of the eye when in dim light.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Collect, process and interpret data/ information

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Measure temperature (air, rock surface, water), wind direction and wind speed (at 3 points along the transect) of a rocky shoreline.</li> <li>• Count and record the number of each type of organism found in quadrat and transect studies of a rocky shoreline.</li> <li>• Measure the distribution of a named mollusk in the various zones of a rocky shore.</li> <li>• Count and record the number of each type of organism found in quadrat and transect studies of a sandy shoreline.</li> <li>• Measure and record temperatures of water in diffusion experiments.</li> <li>• Calculate the percentage of the total consumption of each food that is met by the quantity of it produced locally.</li> <li>• Record in order according to quantity, the annual catch for each of six marine organisms in Bahamian waters (that are commonly used as food).</li> <li>• Calculate the percentage catch of each of the (six) marine organisms that is exported.</li> <li>♦ Find out the percentage composition of nutrients for each of the (six) marine organisms (seafood).</li> <li>• Construct a pie-graph to show the proportion of nutrients for each seafood.</li> <li>• Use measurements obtained for each classmate to calculate the average breathing rate per minute for the class.</li> </ul>	<ul style="list-style-type: none"> <li>• Analyse data from a sample survey to ascertain the extent to which CFCs are used in the community.</li> <li>• Estimate the size of a bead (representing fish) population.</li> <li>• Calculate the rate of increase in average temperature/sea level per decade.</li> <li>• Analyse data collected from an investigation to ascertain the knowledge and response level of persons to “climate change”.</li> <li>• Count the items in each group of water pollutants.</li> <li>• Calculate the percentage of items collected which comprise the major pollutant.</li> <li>• Draw bar graphs showing the change in length of plant strips.</li> <li>• Solve problems based on information given for monohybrid inheritance, complete dominance.</li> <li>• Solve problems based on information given for monohybrid inheritance, incomplete dominance.</li> <li>• Solve problems based on information given for monohybrid inheritance, co-dominance.</li> <li>• Analyse data from a survey of an inherited phenotypic trait in humans.</li> <li>• Solve monohybrid inheritance problems for sex-linked traits.</li> <li>• Construct a histogram to show the class’ blood pressure data.</li> <li>• Determine the average range of blood pressure using data from a graph.</li> <li>• Calculate the average pulse rate at rest.</li> <li>• Calculate the average pulse rate after exercise.</li> </ul>	<ul style="list-style-type: none"> <li>• Estimate the size of a bead (representing fish) population.</li> <li>• Collect data on juvenile and adult grouper in habitat and nurseries.</li> <li>• Construct graphs to show the catches of grouper in The Bahamas over the last 3 decades.</li> <li>• Collect data on juvenile and adult lobsters in their habitat.</li> <li>• Construct graphs to show the catches of lobster in The Bahamas over the last 3 decades.</li> <li>• Collect data on juvenile and adult conchs in old and new middens.</li> <li>• Construct graphs to show the catches conch in The Bahamas over the last 3 decades.</li> <li>• Collect data on juvenile and adult bonefish in their habitat.</li> <li>• Construct graphs to show the catches of bonefish in The Bahamas over the last 3 decades.</li> <li>• Calculate the rate of growth for a seedling.</li> <li>• Interpret percentile graphs showing height or weight of humans at different ages.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Formulate hypotheses

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Formulate a hypothesis on the number of species present in a reef ecosystem.</li> <li>• Formulate a hypothesis on the pH conditions under which the enzyme catalase works best.</li> <li>• Formulate a hypothesis on the temperature at which the enzyme catalase works best.</li> <li>• Formulate a hypothesis on the direction in which each of the following will move through plastic sandwich bag/visking tubing: iodine, starch and water.</li> <li>• Formulate a hypothesis about the effect of different factors on the rate of breathing.</li> </ul>	<ul style="list-style-type: none"> <li>• Formulate a hypothesis as to the aspects of climate change that will affect The Bahamas.</li> <li>• Formulate a hypothesis as to the most common pollutant in the sea/beach.</li> <li>• Formulate a hypothesis as to traits that are inherited.</li> <li>• Formulate a hypothesis as to how traits are inherited.</li> <li>• Formulate a hypothesis as to why certain traits are more common in males.</li> <li>• Form a hypothesis on materials needed for photosynthesis.</li> <li>• Formulate a hypothesis on whether chlorophyll is necessary for photosynthesis.</li> <li>• Formulate a hypothesis as to how plants excrete waste.</li> <li>• Formulate a hypothesis on the effect of named factors on the volume and composition of urine.</li> <li>• Formulate a hypothesis on whether insulation affects the rate at which organisms lose heat.</li> </ul>	<ul style="list-style-type: none"> <li>• Formulate a hypothesis on a plant's growth response to one stimulus.</li> <li>• Formulate a hypothesis on the response(s) of a plant to sunlight.</li> <li>• Formulate a hypothesis on a seedling's response to gravity.</li> <li>• Formulate a hypothesis on the role of root and shoot tips in tropisms.</li> <li>• Formulate a hypothesis as to the rate of population growth on the island.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Recognize and control variables

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Identify and control variables in an experiment to determine the pH conditions under which the enzyme catalase works best.</li> <li>• Identify and control variables in an experiment to determine the effect of temperature on enzyme action.</li> <li>• Identify and control variables in an experiment to demonstrate aerobic respiration in plant parts.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and control variables an investigation to determine the form in which food is stored in leaves of a plant.</li> <li>• Identify and control variables in an experiment to investigate whether light is needed in the production of starch by photosynthesis.</li> <li>• Identify and control variables in an experiment to show that chlorophyll is essential for the production of starch.</li> <li>• Identify and control variables in an experiment to prove that transpiration occurs mainly through the leaves of a plant.</li> <li>• Identify and control variables in an investigation to determine from which surface of the leaf more water vapour is lost.</li> <li>• Identify and control variables in an experiment that investigates how the rate of transpiration is affected by a given environmental factor.</li> <li>• Identify and control variables in valuate an experiment to determine the effect of insulation on heat loss.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and control variables in a sample survey to determine the extent to which best food safety practices are used.</li> <li>• Identify and state how variables will be controlled in an experiment to investigate the response(s) of a plant to sunlight.</li> <li>• Identify and state how variables will be controlled in an experiment to investigate a seedling's response to gravity.</li> <li>• Identify and state how variables will be controlled in an experiment to verify the role of root and shoot tips in tropisms.</li> <li>• Identify variables in an experiment to test the sensitivity of the ears to sounds.</li> <li>• Identify and state how variables will be controlled in an experiment to verify a condition is necessary for germination.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Design, conduct and evaluate scientific investigations

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Plan, conduct and evaluate an experiment to determine the pH conditions under which the enzyme catalase works best.</li> <li>• Plan, conduct and evaluate an experiment to determine the effect of temperature on enzyme action.</li> <li>• Design, conduct and evaluate an experiment to determine the effects of temperature on the rate of diffusion.</li> <li>• Conduct an experiment to show osmosis.</li> <li>• Plan, conduct and evaluate an experiment to investigate the effects of temperature on rate of osmosis.</li> <li>• Conduct and evaluate an experiment to demonstrate selectivity of cell membrane using plastic sandwich bags.</li> <li>• Design, conduct and evaluate an experiment to demonstrate aerobic respiration in parts of a plant.</li> <li>• Design, conduct and evaluate an experiment to demonstrate aerobic respiration in animals.</li> <li>• Design, conduct and evaluate an experiment to demonstrate anaerobic respiration in yeast.</li> <li>• Design, conduct and evaluate an experiment to determine the effect of different types of exercise on the rate of breathing.</li> <li>• Plan, conduct and evaluate an experiment to determine lung capacity.</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct a sample survey to ascertain the extent to which CFCs are used in the community.</li> <li>• Conduct and evaluate an investigation to compare dust pollution in different areas.</li> <li>• Design, conduct and evaluate an investigation to ascertain the knowledge and response level of persons to “climate change”.</li> <li>• Conduct and evaluate an investigation to determine the types of pollutants found on beaches.</li> <li>• Investigate water pollutants from a suspected polluted source.</li> <li>• Conduct and evaluate an investigation to determine the effects of varying concentrations of sugar solution on plant tissue.</li> <li>• Conduct food tests on samples to determine the presence of the nutrients in each sample.</li> <li>• Conduct an experiment to compare the amount of Vitamin C in juices.</li> <li>• Conduct and evaluate an investigation to determine the form in which food is stored in leaves of a plant.</li> <li>• Design, conduct and evaluate an investigation to determine whether light is necessary for photosynthesis.</li> <li>• Conduct and evaluate an experiment to show that chlorophyll is essential for the production of starch.</li> <li>• Design, conduct and evaluate an experiment to prove that transpiration occurs mainly through the leaves of a plant.</li> <li>• Conduct and evaluate an investigation to determine from which surface of the leaf more water vapour is lost.</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct and evaluate an investigation to extract DNA.</li> <li>• Conduct a survey to determine the extent to which food, plants and animals in the community are products of biotechnology.</li> <li>• Design and conduct a small survey to determine the extent to which best food safety practices are used.</li> <li>• Design an experiment to investigate the response(s) of a plant to sunlight.</li> <li>• Design an experiment to investigate a seedling’s response to gravity.</li> <li>• Design an experiment to verify the role of root and shoot tips in tropisms.</li> <li>• Design, conduct and evaluate an experiment to investigate reaction time of classmates to various temperatures.</li> <li>• Conduct investigations to show reproduction in plant tubers and the Bryophyllum plant.</li> <li>• Design and conduct an investigation to show reproduction by stem cuttings.</li> <li>• Design an experiment to identify conditions needed for germination to occur.</li> <li>• Conduct and evaluate an experiment to determine the rate of growth for a seedling.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Design, conduct and evaluate scientific investigations

GRADE 10	GRADE 11	GRADE 12
	<ul style="list-style-type: none"><li>• Design, conduct and evaluate an experiment to investigate the effect of a given environmental factor on the rate of transpiration.</li><li>• Design an investigation to determine whether a sample of urine is from a diabetic or non-diabetic.</li><li>• Design, conduct and evaluate an experiment to determine the effect of insulation on heat loss.</li><li>• Design, conduct and evaluate an experiment to investigate the effect of body size on heat loss.</li></ul>	

## SCOPE AND SEQUENCE (SKILLS)

### Formulate model

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Construct a 3D model of a plant cell with its organelles.</li> <li>• Design, make and use models to demonstrate reproduction by sporulation.</li> <li>• Make model dentitions.</li> <li>• Use models to explain the relationship between size and shape of teeth in each dentition and the type of diet.</li> <li>• Make a model of an alimentary canal.</li> <li>• Use models to explain the relationship between size and shape of the alimentary canal and the type of diet.</li> <li>• Create a model of a hydroponics system and explain how it works.</li> <li>• Construct a model of the human respiratory system to demonstrate breathing.</li> </ul>	<ul style="list-style-type: none"> <li>• Make a model to explain the process of eutrophication.</li> <li>• Make a model to represent a molecule of glucose.</li> <li>• Construct a model of the human heart.</li> <li>• Produce a model of a blood vessel (using PVC piping) to show fat deposited.</li> <li>• Create a life-size model or display illustrating the circulation of blood through the human body.</li> <li>• Use a simple model to explain the difference in the composition of blood in the pulmonary artery compared with other arteries.</li> <li>• Construct a model representing a nephron to demonstrate ultrafiltration.</li> <li>• Make a diagram or model of a nephron to show its role in osmo-regulation.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a model of the double helix structure of DNA.</li> <li>• Make a model to show the relationship between the Central Nervous System and Peripheral Nervous System.</li> <li>• Make a model that functions as the semi-circular canals.</li> <li>• Make a model of the knee joint to show movement of the leg.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Apply principles and concepts (scientific & technological) to make products

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Use the wood from buttonwood to make a household item.</li> <li>• Develop a product using conch shells.</li> <li>• Design a gadget to monitor reproduction rate of yeast or to provide a timed release of a “fungicide”.</li> <li>• Prepare a brochure to show the advantages and disadvantages of mariculture and support its use in The Bahamas as a means of increasing the food needed.</li> <li>• Prepare a brochure to show a proposed plan for sustainable harvesting of one commercially harvested seafood species in The Bahamas.</li> <li>• Identify one challenge to large-scale production of a named potential staple crop and suggest a solution to the challenge.</li> <li>• Apply the principle of surface area and rate of transpiration to suggest one technological application.</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare a brochure or cartoon encouraging everyone to do their part by committing to environmentally beneficial practices.</li> <li>• Design a filter for particulate air pollutants.</li> <li>• Design and construct a model that may be used by householders or a small business to reuse one of the named land pollutants.</li> <li>• Design a product to contain an oil spill.</li> <li>• Suggest a gadget or toy that could make use of the principle of osmosis or diffusion.</li> <li>• Design a product that would allow consumers to test the validity of nutrient information on food packages.</li> </ul>	<ul style="list-style-type: none"> <li>• Based on research, folklore or experience, suggest a food additive prepared from locally-grown plants.</li> <li>• Based on common stimuli of “chemicals” design or suggest a means of “odour-blind” or “taste-blind” persons detecting odours and tastes respectively.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Make informed, responsible and wise decisions

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Develop a personal plan to inform peers of the value of mangrove ecosystems.</li> <li>• Make a personal decision to refrain from purchasing products and supporting activities that cause a negative impact on the coral reef ecosystems.</li> <li>• Write a personal pledge to help conserve the local forest.</li> <li>• Ensure personal enclosed environments are not conducive to the growth of moulds.</li> <li>• Resolve to buy Bahamian food products keeping a record of products bought.</li> <li>• Begin and maintain a backyard/container garden.</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt practices that do not contribute to air pollution.</li> <li>• Formulate a personal commitment to become a good steward of the environment in utilizing “green” practices.</li> <li>• Advocate for green spaces as a means of contributing to sustainable rainfall.</li> <li>• Increase use of tube’s in the diet as a source of carbohydrates.</li> <li>• Research and practice wise dietary choices necessary for maintaining healthy kidneys.</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid practices that negatively impact biodiversity.</li> <li>• Become a member of the Bahamas National Trust or an environmental group which supports National parks and protected areas.</li> <li>• Make a personal position statement on the use of GM foods.</li> <li>• Make a personal commitment to read food labels/avoid certain food additives.</li> <li>• Use artificial methods of vegetative reproduction.</li> <li>• Adopt practices to maintain healthy eyes.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Pursue new knowledge

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Research the importance of mangrove ecosystems.</li> <li>• Research the natural and man-made threats to mangrove ecosystems.</li> <li>• Research natural and man-made threats to coral reefs.</li> <li>• Conduct research to determine threats to the rocky shoreline ecosystems.</li> <li>• Research the importance of the sandy shoreline.</li> <li>• Research the threats to the sandy shoreline.</li> <li>• Research the importance of the terrestrial ecosystem to man and wildlife.</li> <li>• Research the positive and negative effects of the use of certain types of chemicals in farming.</li> <li>• Conduct research to find out the percentage of foods consumed that are produced locally.</li> <li>• Research use of hydroponics in The Bahamas or Caribbean.</li> <li>• Research the annual catch for economically important marine organisms in Bahamian waters.</li> <li>• Research trends in fishing industry over last three decades.</li> <li>• Research use of aquaculture/mariculture in The Bahamas or the Caribbean.</li> <li>• Research the economic importance of yeast.</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct research to identify the main air pollutants.</li> <li>• Research data on the rate of ozone depletion.</li> <li>• Find out the principle of greenhouses.</li> <li>• Review articles on the greenhouse effect.</li> <li>• Research the rate of increase in average temperature/sea level.</li> <li>• Conduct research to determine the efforts of government to reduce carbon dioxide emissions in the country.</li> <li>• Investigate the use of alternative energy sources that would reduce greenhouse gas emissions.</li> <li>• Conduct research to determine the extent to which schools educate students towards reversing global warming factors.</li> <li>• Research what may happen to small islands/ bays as a result of climate change/global warming.</li> <li>• Research the importance of fats in cells.</li> <li>• Research the common causes and effects of heart disease.</li> <li>• Research cardiovascular diseases.</li> <li>• Research how artificial pacemakers stimulate heart contractions.</li> <li>• Research the significance of blood groups in transfusions.</li> <li>• Research how plants excrete waste.</li> <li>• Research dietary practices necessary for maintaining healthy kidneys.</li> <li>• Research benefits of broad bio-diversity.</li> <li>• Investigate how human activities can influence and modify the biodiversity in natural systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Research benefits of broad bio-diversity.</li> <li>• Investigate how human activities can influence and modify the biodiversity in natural systems.</li> <li>• Research the importance of biodiversity to the stability and resiliency of local ecosystems.</li> <li>• Conduct research (Internet or interviews) to determine the effectiveness of three parks in meeting their objectives.</li> <li>• Read a published report on the state of marine ecosystems in The Bahamas and write an article summarizing its findings.</li> <li>• Find out common methods of measuring populations.</li> <li>• Interview local fishermen and/or hold panel discussion with local fishermen and fisheries officer to identify the major challenges faced by the local lobster fishermen and vendors.</li> <li>• Conduct research to find out the relationship between the structure of DNA and mutations.</li> <li>• Research methods of cloning.</li> <li>• Conduct a sample survey to determine the extent to which food, plants and animals in the community are products of biotechnology.</li> <li>• Find out the advantages and disadvantages of genetically modified foods.</li> <li>• Conduct research on the use of human embryos for stem cell research.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Pursue new knowledge

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Research lung diseases caused by smoking.</li> </ul>		<ul style="list-style-type: none"> <li>• Research how changes in chromosomes cause variations.</li> <li>• Design and conduct a small survey to determine the extent to which best food safety practices are used.</li> <li>• Research common food additives found on the labels of certain foods.</li> <li>• Research the commercial uses of microbes in the production of food products.</li> <li>• Find out about the operation of the autonomic nervous system.</li> <li>• Research the scientific and economic impact of biotechnology on human reproduction.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Demonstrate critical thinking

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Suggest methods of conservation.</li> <li>• Suggest benefits derived from the rocky shoreline.</li> <li>• Make a position statement on the need to monitor identified threats to local rocky shorelines.</li> <li>• Suggest possible threats to the ecosystem.</li> <li>• Suggest methods of reducing threats.</li> <li>• Create a pamphlet to persuade peers to value the terrestrial ecosystem.</li> <li>• “Sell a cell” – students must sell parts (market their importance) of a cell.</li> <li>• Compare the positive and negative effects of the use of chemicals by subsistence farmers.</li> <li>• Suggest staple crops to be grown (animals raised) in The Bahamas.</li> <li>• Suggest means by which threats to Agricultural Industry in The Bahamas might be reduced or eliminated.</li> <li>• Propose a plan for The Bahamas to become more self-sufficient in food production.</li> <li>• Suggest explanations for the trends in fishing industry over the last three decades.</li> <li>• Create an infomercial on the short term economic gain of overfishing vs. the long-term adverse effects.</li> <li>• Advocate for sustainable harvesting of popular marine seafood.</li> </ul>	<ul style="list-style-type: none"> <li>• Analyze the efforts of government to reduce carbon dioxide emissions in the country.</li> <li>• Debate the validity of the statement that greenhouse gases emissions have direct negative affects on humans and other organisms.</li> <li>• Analyze the efforts of schools to educate students towards reversing global warming factors.</li> <li>• Critically analyse the information read on what may happen to small islands/ bays as a result of climate change/global warming.</li> <li>• Suggest methods of controlling the main land pollutants.</li> <li>• Suggest methods of controlling common water pollutants.</li> <li>• Suggest methods of containing and cleaning oil spills.</li> <li>• Justify the statement “ions are responsible for the basic living functions.”</li> <li>• Suggest how variation in a species might occur.</li> <li>• Justify the importance of meiosis being a “reduction division”.</li> <li>• Summarize the process of photosynthesis.</li> <li>• Suggest limiting factors of photosynthesis.</li> <li>• Compose an equation to represent the process of photosynthesis.</li> <li>• Suggest factors that would affect the rate of transpiration.</li> <li>• Suggest how leaves of certain plants are adapted to prevent excessive water loss by transpiration.</li> <li>• Suggest the part of the vascular bundle that is responsible for food transport.</li> <li>• Suggest the destination and use of food manufactured in leaves.</li> </ul>	<ul style="list-style-type: none"> <li>• Justify the importance of biodiversity.</li> <li>• Write a case study outlining how humans have altered a specific ecosystem and/or create an action plan or propose a course of action to maintain or increase the sustainability of local ecosystems.</li> <li>• Suggest ways to minimize the impact of human activities on the environment.</li> <li>• Critically assess the value of national parks and protected areas in The Bahamas.</li> <li>• Analyze the trends of catches of commercially important grouper in The Bahamas over the last 3 decades and suggest implications of these trends.</li> <li>• Suggest measures for conservation of the local grouper populations.</li> <li>• Analyze the trends of catches of commercially important lobster in The Bahamas over the last 3 decades and suggest implications of these trends.</li> <li>• Suggest measures for conservation of the local lobster populations.</li> <li>• Analyze the trends of catches of commercially important conch in The Bahamas over the last 3 decades and suggest implications of these trends.</li> <li>• Suggest measures for conservation of the local conch populations.</li> <li>• Analyze the trends of catches of commercially important bonefish in The Bahamas over the last 3 decades and suggest implications of these trends.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Demonstrate critical thinking

GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> <li>• Prepare a brochure to show the advantages and disadvantages of mariculture and supporting its use in The Bahamas as a means of increasing the food needed.</li> <li>• Propose a plan for The Bahamas to have sustainable fisheries for one seafood.</li> <li>• Justify modifications of dicotyledonous leaves as adaptations to aquatic/halophytic/ xerophytic environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Justify: “body size affects the rate at which an organism loses heat.”</li> </ul>	<ul style="list-style-type: none"> <li>• Suggest measures for conservation of the local bonefish populations.</li> <li>• Suggest measures for conservation of the local crab populations.</li> <li>• Suggest benefits that have been derived from knowledge of the structure of DNA.</li> <li>• Critically assess the advantages and disadvantages of cloning animal embryos.</li> <li>• Suggest ways in which cloning might benefit humans.</li> <li>• Prepare a proposal for the education of adults in the community on the basis of biotechnology and bioethics.</li> <li>• Prepare a position on GMFs.</li> <li>• Suggest how natural selection changes the phenotypic ratio of a population.</li> <li>• Suggest how artificial selection changes the phenotypic ratio of a population.</li> <li>• Suggest how natural selection causes resistance to certain chemicals.</li> <li>• Suggest ways to prevent food contamination.</li> <li>• Justify the statement that the structure of the eye concentrates light on the fovea.</li> <li>• Justify the statement that the structure of the ear concentrates sound on the oval window.</li> <li>• Evaluate methods of artificial vegetative propagation.</li> <li>• Summarize the events of fertilization.</li> </ul>

## SCOPE AND SEQUENCE (SKILLS)

### Demonstrate critical thinking

GRADE 10	GRADE 11	GRADE 12
		<ul style="list-style-type: none"><li>• Suggest factors that influence the growth rate in humans.</li><li>• Compare population growth rates in three countries and any measures taken by governments to control the growth rate.</li><li>• Suggest economic implications of rapidly growing populations.</li><li>• Suggest social implications of rapidly growing populations.</li><li>• Write a statement outlining personal views on the scientific and economic impact of bio-technology on human reproduction.</li><li>• Defend the legality and morality of cloning.</li></ul>

# STANDARDS AND BENCHMARKS

## GRADE: 10

### Use materials and scientific equipment correctly and safely.

- ◆ Use quadrats, line or belt transects to collect data and record the distribution of plants in an aquatic, coastal or terrestrial ecosystem.
- ◆ Use apparatus and materials to demonstrate osmosis.
- ◆ Prepare slides of plant and animal cells.
- ◆ Use a microscope to view the internal structures of a monocotyledonous leaf on a prepared slide.

### Make observations.

- ◆ Observe mould using a magnifying glass or a sample on a slide using the microscope.
- ◆ Make observations of the action of an enzyme in different pH or temperature conditions.
- ◆ Observe the external features of a maize and hibiscus or sea grape leaf.
- ◆ Observe changes in the colour of lime water when exhaled air is added to it.

### Utilize classification process.

- ◆ Classify organisms in a mangrove ecosystem according to phylum.
- ◆ Classify vertebrates into feeding groups based on dentition and gut.
- ◆ Identify examples of simple organisms that reproduce by binary fission.
- ◆ Classify modifications of dicotyledonous leaves according to the type of environment.

### Make inferences and draw conclusions.

- ◆ Form a conclusion that a bacterial cell is a prokaryote cell.
- ◆ Formulate a conclusion on the optimal temperature for an enzyme to work.
- ◆ Formulate a conclusion from an experiment on osmosis.
- ◆ Draw conclusions about the speed of reproduction, number of offspring produced and resemblance of offspring to parents.

### Communicate information.

- ◆ Construct a coral food web showing producers, primary, secondary and tertiary consumers.
- ◆ Locate on a map of the island likely areas for rocky shoreline ecosystems to be located.
- ◆ Make annotated diagrams to show spore formation.
- ◆ Describe the arrangement of tissues in the vascular bundles in leaves.
- ◆ Describe the passage of an oxygen molecule from the air to a capillary in the lungs.

### Recognize relationships.

- ◆ Describe the relationship between the features of plants observed in a coastal aquatic or terrestrial ecosystem and their adaptations to the environment/zone.
- ◆ Explain the relationship between the dentitions of an omnivore, carnivore and herbivore and their diet.
- ◆ Describe the relationship between the carbon dioxide concentration and breathing rate and depth.
- ◆ Demonstrate the relationship between diffusion and osmosis.

### Measure accurately.

- ◆ Use a thermometer to measure the temperature of water baths with cold, warm and hot water.
- ◆ Measure materials needed for osmosis experiment.
- ◆ Measure number of breaths for partner for 30 seconds.

# STANDARDS AND BENCHMARKS

## **Make predictions.**

- ♦ Predict the outcome of an experiment to show selectivity of the cell membrane using plastic sandwich bags/visking tubing, iodine and starch.
- ♦ Predict the effects of deforestation on farmland.
- ♦ Predict the effect specific factors (e.g. different types of exercise) have on breathing rate.

## **Collect, process and interpret data/information.**

- ♦ Count and record the number of each type of organism found in quadrat and transect studies.
- ♦ Construct a pie-graph to show the proportion of nutrients for a major seafood.
- ♦ Use measurements obtained for each classmate to calculate the average breathing rate per minute for the class.

## **Formulate hypotheses.**

- ♦ Formulate a hypothesis on the number of species present in a reef ecosystem.
- ♦ Formulate a hypothesis on the pH conditions under which the enzyme catalase works best.
- ♦ Formulate a hypothesis on the direction in which molecules will move through plastic sandwich bag/visking tubing.
- ♦ Formulate a hypothesis about the effect of different factors on the rate of breathing.

## **Recognize and control variables.**

- ♦ Identify and control variables in an experiment to determine the pH conditions under which the enzyme catalase works best.
- ♦ Identify and control variables in an experiment to determine the effect of temperature on enzyme action.
- ♦ Identify and control variables in an experiment to demonstrate aerobic respiration in plant parts.

## **Design, conduct and evaluate scientific investigations.**

- ♦ Design, conduct and evaluate an experiment to determine the effects of temperature on the rate of diffusion.
- ♦ Conduct and evaluate an experiment to show osmosis.
- ♦ Design, conduct and evaluate an experiment to demonstrate aerobic respiration in the parts of a plant.
- ♦ Design, conduct and evaluate an experiment to demonstrate anaerobic respiration in yeast.

## **Formulate models.**

- ♦ Construct a 3D model of a plant cell with its organelles.
- ♦ Design, make and use models to demonstrate reproduction by sporulation.
- ♦ Make model dentitions.
- ♦ Create a model of a hydroponics system and explain how it works.

## **Apply principles and concepts (scientific & technological) to make products.**

- ♦ Prepare a brochure to show the advantages and disadvantages of mariculture and supporting its use in The Bahamas as a means of increasing the food needed.
- ♦ Identify one challenge to large-scale production of a named potential staple crop and suggest a solution to the challenge.
- ♦ Apply the principle of surface area and rate of transpiration to suggest one technological application.

# STANDARDS AND BENCHMARKS

## **Make informed, responsible and wise decisions.**

- ◆ Write a personal pledge to help conserve the local forest.
- ◆ Engage in practices that promote conservation of wetlands.
- ◆ Engage in practices that promote “clean air” for breathing.
- ◆ Resolve to buy Bahamian food products keeping a record of products bought.
- ◆ Begin and maintain a backyard/container garden.

## **Pursue new knowledge.**

- ◆ Research the importance of mangrove ecosystems.
- ◆ Research trends in fishing industry over the last three decades.
- ◆ Research the economic importance of yeast.
- ◆ Research lung diseases caused by smoking.

## **Demonstrate critical thinking.**

- ◆ Suggest methods of reducing threats to ecosystems.
- ◆ Propose a plan for The Bahamas to become more self-sufficient in food production.
- ◆ Advocate for sustainable harvesting of popular marine seafood.
- ◆ Justify modifications of dicotyledonous leaves as adaptations to aquatic/halophytic/xerophytic environment.

## **GRADE: 11**

## **Use materials and scientific equipment correctly and safely.**

- ◆ Use apparatus and materials safely in performing food tests.
- ◆ Use apparatus and materials correctly and safely in an experiment to investigate whether light is needed in the production of starch by photosynthesis.
- ◆ Use a stethoscope to investigate heartbeat.
- ◆ Use a microscope to view prepared slides of blood.
- ◆ Use a scalpel or other cutting utensil to dissect a kidney.

## **Make observations.**

- ◆ Make observations of plant tissue in solutions of different concentrations.
- ◆ Observe inherited monohybrid traits of students in the classroom.
- ◆ Observe results of food tests on various food samples.
- ◆ Observe and record colour of both leaves (different conditions) tested for starch.
- ◆ Observe the external and internal appearance of the human heart.

## **Utilize classification process.**

- ◆ Classify waste as bio-degradable and non-biodegradable.
- ◆ Classify proteins in the cell.
- ◆ Compare and contrast mitosis and meiosis.
- ◆ Compare and contrast the structure of the three types of blood vessels.

## **Make inferences and draw conclusions.**

- ◆ Draw conclusions, based on comparisons of seedlings, plants and fruits with deficiencies and “normal” ones, on the function of named minerals in plant nutrition and physiology.
- ◆ Formulate a conclusion on which surface allows a faster rate of transpiration.
- ◆ Make inferences/conclusions as to the affect of exercise of pulse rate.
- ◆ Make inferences about the functions of the kidney based on the composition of blood in the renal artery and renal vein.

# STANDARDS AND BENCHMARKS

## **Communicate information.**

- ◆ Explain the effects of oil spills.
- ◆ Explain the process of eutrophication.
- ◆ Explain the importance of water to cells.
- ◆ Write an experimental report on an experiment to investigate the effect of a given environmental factor on the rate of transpiration.
- ◆ Explain how the gender of a baby is determined.

## **Recognize relationships.**

- ◆ Demonstrate the relationship between amino acids and proteins.
- ◆ Relate the composition and state of blood to its functions.
- ◆ Describe the relationship between the Lymphatic and Circulatory Systems.
- ◆ Make a correlation between ADH concentration and urine production.

## **Measure accurately.**

- ◆ Measure length and width of potato/carrot strips.
- ◆ Measure the water level or weight loss in an experiment.
- ◆ Measure accurately the pulse rate of students.
- ◆ Use a thermometer to accurately measure temperature of water in insulated and non-insulated flasks.

## **Make predictions.**

- ◆ Predict the decade in which The Bahamas would notice climate changes using scientific models.
- ◆ Predict what would happen to a sample of red blood cells when placed in solutions of varying concentrations.
- ◆ Predict which nutrient(s) can be found in given foods.
- ◆ Predict how conditions of the body affect average pulse rate.
- ◆ Make predictions about the effect of insufficient/excess ADH on urine production.

## **Collect, process and interpret data/information.**

- ◆ Analyse data collected from an investigation to ascertain the knowledge and response level of persons to “climate change”.
- ◆ Draw bar graphs showing the change in length of plant strips.
- ◆ Solve problems based on information given for monohybrid inheritance, complete dominance.
- ◆ Analyse data from a survey of an inherited phenotypic trait in humans.

## **Formulate hypotheses.**

- ◆ Formulate a hypothesis as to the most common pollutant in the sea/beach.
- ◆ Formulate a hypothesis as to why certain traits are more common in males.
- ◆ Formulate a hypothesis on the effect of named factors on the volume and composition of urine.
- ◆ Formulate a hypothesis on whether insulation affects the rate at which organisms lose heat.

## **Recognize and control variables.**

- ◆ Identify and control variables in an experiment to investigate whether light is needed in the production of starch by photosynthesis.
- ◆ Identify and control variables in an experiment to prove that transpiration mainly occurs through the leaves of a plant.
- ◆ Identify and control variables in an experiment that investigates how the rate of transpiration is affected by a given environmental factor.

# STANDARDS AND BENCHMARKS

## **Design, conduct and evaluate scientific investigations.**

- ◆ Conduct an investigation to determine the types of pollutants found on beaches.
- ◆ Perform an investigation to determine the effects of varying concentration of sugar solutions on plant tissue.
- ◆ Conduct food tests on food samples to determine the presence of the nutrients in each food sample using food tests.
- ◆ Perform an investigation to determine the form in which food is stored in leaves of a plant.
- ◆ Design, conduct and evaluate an experiment to investigate the effect of a given environmental factor on the rate of transpiration.

## **Formulate models.**

- ◆ Make a model to explain the process of eutrophication.
- ◆ Make a model to represent a molecule of glucose.
- ◆ Produce a model of a blood vessel (using PVC piping) to show fat deposited.
- ◆ Construct a model representing a nephron to demonstrate ultrafiltration.

## **Apply principles and concepts (scientific & technological) to make products.**

- ◆ Design and construct a model that may be used by householders or a small business to reuse one of the named land pollutants.
- ◆ Design a product to contain an oil spill.
- ◆ Design a product that would allow consumers to test the validity of nutrient information on food packages.

## **Make informed, responsible and wise decisions.**

- ◆ Formulate a personal commitment to become a good steward of the environment in utilizing “green” practices.
- ◆ Research and practice wise dietary choices necessary for maintaining healthy kidneys.

## **Pursue new knowledge.**

- ◆ Research data on the rate of ozone depletion.
- ◆ Find out the principle of greenhouses.
- ◆ Investigate the use of alternative energy sources that would reduce greenhouse gas emissions.
- ◆ Research the importance of fats in cells.
- ◆ Research the significance of blood groups in transfusions.

## **Demonstrate critical thinking.**

- ◆ Critically analyse the information read on what may happen to small islands/ bays as a result of climate change/global warming.
- ◆ Suggest methods of controlling common water pollutants.
- ◆ Suggest how variation in a species might occur.
- ◆ Justify: “body size affects the rate at which an organism loses heat.”

## **GRADE: 12**

## **Use materials and scientific equipment correctly and safely.**

- ◆ Use equipment for an investigation to extract DNA.
- ◆ Use a ruler to investigate reaction time of classmates to stimuli.
- ◆ Use a scalpel, razorblade or scissors to dissect various types of flowers.

# STANDARDS AND BENCHMARKS

## **Make observations.**

- ◆ Observe photographs of different organisms in different habitats and their adaptations which help them to survive there.
- ◆ Observe food labels to determine food additives in commonly used foods.
- ◆ Observe various types of tropisms.
- ◆ Observe responses in an experiment to investigate reaction time of classmates to various stimuli.
- ◆ Observe local fruits and seeds to determine method of dispersal.

## **Utilize classification process.**

- ◆ Classify molecules which are components of DNA and RNA.
- ◆ Classify examples of variation as continuous or discontinuous.
- ◆ Classify common food additives.
- ◆ Classify plant growth responses.
- ◆ Classify STIs by the agents causing them.

## **Make inferences and draw conclusions.**

- ◆ Use data to form a conclusion on the harvesting of groupers.
- ◆ Form an inference as to the meaning of the term “genetically modified crops”.
- ◆ Based on a survey conducted, draw conclusions on the extent to which best food safety practices are carried out.

## **Communicate information.**

- ◆ Explain the functions of national parks.
- ◆ Explain the role of microbes in the manufacture of foods.
- ◆ Explain the process of hearing.
- ◆ Explain how nerves cause muscles to contract.
- ◆ Describe the sequence of events from pollination to fruit and seed formation.

## **Recognize relationships.**

- ◆ Make a model to show the relationship between the Central Nervous System and Peripheral Nervous System.
- ◆ Relate the structure of the semi-circular canals to their function in orientation.
- ◆ Relate the structure of the placenta to its role in absorption, gas exchange, and excretion.

## **Measure accurately.**

- ◆ Measure materials for the investigation to extract DNA.
- ◆ Measure time in an experiment to investigate reaction time of classmates to various temperatures.
- ◆ Measure accurately the length of a seedling.

## **Make predictions.**

- ◆ Predict the effects of decreasing biodiversity in local ecosystems.
- ◆ Predict what a “fruit stand” will look like in 2050.
- ◆ Predict what happens to the pupil of the eye when in dim light.

## **Collect, process and interpret data/information.**

- ◆ Estimate the size of a bead (representing fish) population.
- ◆ Calculate the rate of growth for a seedling.
- ◆ Interpret percentile graphs showing height or weight of humans at different ages.

## **Formulate hypotheses.**

- ◆ Formulate a hypothesis as to the number of flora and fauna species found in The Bahamas.
- ◆ Formulate a hypothesis on a plant’s growth response to one stimulus.
- ◆ Formulate a hypothesis as to the rate of population growth on the island.

# STANDARDS AND BENCHMARKS

## **Recognize and control variables.**

- ◆ Identify and state how variables will be controlled in an experiment to investigate the response(s) of a plant to sunlight.
- ◆ Identify and state how variables will be controlled in an experiment to investigate a seedling's response to gravity.
- ◆ Identify and state how variables will be controlled in an experiment to verify a (named) condition is necessary for germination.

## **Design, conduct and evaluate scientific investigations.**

- ◆ Conduct and evaluate an investigation to extract DNA.
- ◆ Conduct a survey to determine the extent to which food, plants and animals in the community are products of biotechnology.
- ◆ Design, conduct and evaluate an experiment to investigate reaction time of classmates to various stimuli.
- ◆ Conduct investigations to show reproduction in plant tubers and the Bryophyllum plant.

## **Formulate models.**

- ◆ Create a model of the double helix structure of DNA.
- ◆ Make a model that functions as the semi-circular canals.
- ◆ Make a model of the knee joint to show movement of the leg.

## **Apply principles and concepts (scientific & technological) to make products.**

- ◆ Prepare a brochure to show the advantages and disadvantages of mariculture and support its use in The Bahamas as a means of increasing the food needed.
- ◆ Identify one challenge to large-scale production of a named potential staple crop and suggest a solution to the challenge.
- ◆ Apply the principle of surface area and transpiration to suggest one technological application.

## **Make informed, responsible and wise decisions.**

- ◆ Make a personal position statement on the use of GM foods.
- ◆ Make a personal commitment to read food labels/avoid certain food additives.
- ◆ Adopt practices to maintain healthy eyes.

## **Pursue new knowledge.**

- ◆ Interview local fishermen to identify the major challenges faced by the local lobster fishermen and vendors.
- ◆ Research methods of cloning.
- ◆ Find out the advantages and disadvantages of genetically modified foods.
- ◆ Conduct research on the use of human embryos for stem cell research.

## **Demonstrate critical thinking.**

- ◆ Critically assess the value of national parks and protected areas in The Bahamas.
- ◆ Analyze the trends of catches of a commercially important marine animal (fish/conch/lobster) in The Bahamas over the last 3 decades and suggest implications of these trends.
- ◆ Suggest benefits that have been derived from knowledge of the structure of DNA.
- ◆ Evaluate methods of artificial vegetative propagation.

## COMPARISON OF BENCHMARKS FOR GRADE LEVELS

<b>Grade</b>	<b>Use materials and scientific equipment correctly and safely.</b>	<b>Make observations.</b>	<b>Utilize classification process.</b>	<b>Make inferences and draw conclusions.</b>	<b>Communicate information.</b>	<b>Recognize relationships.</b>	<b>Measure accurately.</b>	<b>Make predictions.</b>
<b>10</b>	Use apparatus and materials (glass tubing, Visking tubing, different concentration solutions) to demonstrate osmosis.	Observe the external appearance of microscopic organisms.	Classify organisms in an ecosystem according to phyla.	Form a conclusion based on observations and results of an experiment involving Variation of one factor (temperature, concentration, pH).	Describe the arrangement of tissues in vascular bundles (in leaves, stems or roots).	Explain the relationship between the dentitions of an omnivore, carnivore and herbivore and their diet.	Measure to 0.001g , liquids to 0.5 ml or cm <sup>3</sup> , Read temperature to 1°C.	Predict outcome of an experimental investigation.
<b>11</b>	Use apparatus and materials (hot water bath, test tubes, test tube holders, porcelain tile, dropping pipette, alcohol, iodine solution) correctly and safely in an experiment to investigate whether light is needed in the production of starch by photosynthesis.	Make observations of plant tissue in solutions of different concentrations.	Classify T. S. blood vessels (diagrams/ prepared slides).	Make inferences or draw a valid conclusion based on sequential observations with one step missing.	Write an experimental report on an experiment to investigate the effect of a given environmental factor on the rate of transpiration.	Describe the relationship between the amount of a chemical/fluid produced on the operation of a process (ADH concentration and urine production).	Measure to 0.001g , liquids to 0.5 ml or cm <sup>3</sup> , Read temperature to 1°C.	Predict the outcome if one variable is taken into account.
<b>12</b>	Use a scalpel, razorblade or scissors to dissect various types of flowers.	Observe slow changes in organisms over a period of time (various types of tropisms).	Classify molecules which are components of macro-molecules (DNA and RNA).	Use data from several sources to form a valid conclusion.	Use annotated diagrams to describe a sequence of events that occurs over a period of time (from pollination to fruit and seed formation).	Relate the structure of an organ to its functions (placenta).	Measure to 0.001g , liquids to 0.5 ml or cm <sup>3</sup> , Read temperature to 1°C.	Based on data predict a long-term outcome if there are no interferences.

## COMPARISON OF BENCHMARKS FOR GRADE LEVELS

Grade	Collect, process and interpret data/information.	Formulate hypotheses.	Recognize and control variables.	Design, conduct and evaluate scientific investigations.	Formulate models.	Apply principles and concepts (scientific & technological) to make products.	Make informed, responsible and wise decisions.	Pursue new knowledge.
10	Collect population data during field studies.	Formulate hypothesis.	Recognize variables.	Plan and conduct simple investigations.	Make models of cells.	Create an item from materials obtained locally.	Make decisions based on the information given.	Conduct research of literature to find information on a given topic.
11	Convert population numbers to ratios.	Formulate a hypothesis that may be easily tested.	Recognize variables and attempt to control one.	Select an appropriate method for an investigation to solve a problem.	Construct a model to show a process.	Design a gadget based on a scientific principle studied.	Adopt practices for a healthy lifestyle and good environmental stewardship.	Identify a topic or question of interest and related to the information studied to conduct independent research.
12	Construct and interpret graphs.	Formulate a hypothesis that may not be easily tested.	Recognize and control more than one variable.	Plan, conduct and evaluate an investigation to verify a hypothesis.	Make a model that functions.	Suggest the use of technology based on a scientific principle studied.	Make a position statement on a contemporary biological issue.	Interview people to acquire data/information.

Grade	Demonstrate critical thinking.
10	Pose a question on content studied that would extend their knowledge.
11	Compare benefits and disadvantages on an issue, formulate an opinion and defend it.
12	Suggest possible resolutions to the dilemma between the need for biotechnology and the apparent lapses in bioethics.

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: MANGROVE ECOSYSTEMS**

**DURATION: 2 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Locate on a map of the island likely areas for mangrove ecosystems to be located.	<sup>1</sup> Mangroves are flowering plants (angiosperms) adapted to the interface between land and sea, lakes/ponds, areas that are sheltered from high wave action, endure a highly dynamic, low oxygen environment, cope with high salinity; grow most extensively in muddy sediments. Often distinctly zoned, but may include large stands of only one or two species.	<ul style="list-style-type: none"> <li>Identify leeward side of island.</li> <li>Locate sheltered side of island on a map.</li> </ul>	Map of the island	Valid sites on the sheltered side of island at the interphase of land and sea identified on a map
Make an annotated outline drawing of the profile of a mangrove ecosystem showing zonation and the features of each zone.	Open water, high tide, inter-tidal, low tide, dry land zones. Substrate, flora, fauna.	<ul style="list-style-type: none"> <li>Read information on zones of a mangrove ecosystem.</li> <li>Make an annotated outline drawing of the profile of a mangrove ecosystem showing zonation and the features of each zone.</li> </ul>	<i>Marine Biology for the Caribbean</i>	Rubric for assessing visual aids/presentations
Construct and use field equipment in an ecosystem.	Field sampling techniques and equipment: quadrats – a square frame (metal, plastic or wooden) usually 0.5m <sup>2</sup> or 1 m <sup>2</sup> , line transects, belt transects; capture techniques for mobile animals – sweep nets; simple fish traps (small fish); pitfall traps.	<ul style="list-style-type: none"> <li>Make a quadrat to survey organisms in an aquatic, coastal or terrestrial ecosystem on or near school grounds.</li> <li>Make a fish trap (bottle) to capture fish in a rocky shore, sandy beach or sea grass.</li> <li>Make nets or traps to sample small invertebrates in a terrestrial ecosystem.</li> <li>Make a line transect.</li> </ul>	Meter rules; string; quadrats (pvc pipe; wooded slats); fish trap - 12 oz or bigger plastic bottles, scissors, duct tape; poles; clip boards; jam jars; <a href="http://www.breef.org">www.breef.org</a> Compiled Documents – BREEF Marine Conservation Workshop GCSE Biology	Rubric used to evaluate construction of field equipment  Correct use of field equipment

<sup>1</sup> <http://www.mesa.edu.au/cams/module1/readings02.htm> - tidal



**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: MANGROVE ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Explain the adaptations of the three types of mangroves and Buttonwood to the conditions in which they live.	Red – stilt roots, germinating seeds while attached, leaf covering: in water Black – pneumatophores: high tide and intertidal, low oxygen conditions White – leaf coverings, salt secreting gland, no specialized roots: shoreline Buttonwood – size leaves: land	Create a visual aid showing the structural features along with an explanation of each feature as an adaptation.	BNT fact sheets	Rubric for assessing visual aids
Illustrate the flow of energy through a mangrove food web.	Bacteria and fungi breakdown litter to form a food source for small invertebrates which, in turn, are fed on by higher carnivores. Mangroves – basis of complex detrital food web supporting fish, crustaceans, molluscs and birds.	Construct a mangrove food web using data collected from field survey and other resources.	<a href="http://www.reef.org/resources/galleries/caribbean">http://www.reef.org/resources/galleries/caribbean</a> Wondrous West Indian Wetlands Teacher’s Resource Book; <i>Treasures in the sea</i> BREEF Marine Conservation Workshop other Internet sources	Plausible food web correctly drawn
Predict how energy distribution and energy use will be altered through changes in the food web.		Predict how energy distribution and energy use will be altered through changes in the food web.	GCSE Biology	Plausible predictions with reasons given
Explain the role of mangroves in land-building.	Succession of mangroves.	<ul style="list-style-type: none"> <li>• Relate the type of mangrove found to the abiotic conditions in an imaginary transect from the sea to inland.</li> <li>• Make a sketch showing the profile of mangrove types from the sea to inland.</li> <li>• Make an oral presentation explaining the role of mangroves in land-building.</li> </ul>	<i>General Science</i> – Silver Burdett	<p style="text-align: center;">Accuracy of sketch</p> <p style="text-align: center;">Rubric for assessing oral presentations</p>

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: MANGROVE ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Research the importance of mangrove ecosystems.	Mangroves act as barrier to erosion waves, help protect against tides and storm surge; prevent salt intrusion onto land; stabilize sediment deposits; provide habitat for commercial and recreational fisheries resources; serve as nursery or breeding habitat for important commercial and recreational offshore fisheries resources (e.g. spiny lobster); trap silt; filter land based pollutants; in Bahamas mangroves relatively easily accessible and therefore of high environmental education value.	<ul style="list-style-type: none"> <li>• Participate in a debate on mangroves wetlands versus wastelands.</li> <li>• Prepare a brochure or multimedia presentation highlighting the importance of mangrove ecosystems.</li> </ul>	<i>Treasures in the Sea; Wondrous West Indian Wetlands</i> ; BREEF Marine Conservation Workshop Internet sources Craft materials, media equipment	Rubric for assessing debate/oral presentations  Rubric for assessing visual aids/presentations
Research the natural and man-made threats to mangrove ecosystems.	Urban development, pollution, storms, climate change, invasive species	<ul style="list-style-type: none"> <li>• Create a song, poem, rap or infomercial that promotes the awareness of the threats of mangrove ecosystems.</li> <li>• Class field trip to a mangrove ecosystem (previous). Identify and record (using a table) threats observed.</li> </ul>	<i>Treasures in the Sea; Wondrous West Indian Wetlands</i> ; BREEF Marine Conservation website; Bahamas Environmental Protection Manual; Pamphlets Fact Sheets from Ministry of Environment; Bahamas National Trust and other Environmental Groups operating in The Bahamas Internet sources	<ul style="list-style-type: none"> <li>• Rubric for assessing oral presentations</li> <li>• Correct identification of threats recorded in suitable table</li> </ul>
Suggest methods of conservation		Prepare a speech to be given at a town meeting to persuade members of the community to implement measures to preserve one identified mangrove ecosystem on the island.		Rubric for assessing oral presentations

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: CORAL REEF ECOSYSTEMS**

**DURATION: 2 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Identify the locations of coral reefs on a map of the world and a map of The Bahamas.		<ul style="list-style-type: none"> <li>• Indicate the locations of major coral reefs on a map of the world.</li> <li>• Indicate the locations of major coral reefs on a map of The Bahamas.</li> </ul>	Blank world maps and maps of the Bahamas, crayon pencils, maps with locations of coral reefs (Bahamas National Trust – Coral Reef Handbook)	Correct labeling of maps and identification of abiotic factors
Show the relationship between locations of coral reefs and abiotic factors which are needed for coral reefs to thrive.	Found in tropical waters that are: shallow (do not exceed depths of 50-70m); warm (23-25°C OR 70-85°F); clear; clean; sunlit	<ul style="list-style-type: none"> <li>• Note temperature and depth of water next to coral reefs.</li> <li>• Use the maps to explain the relationship between locations of coral reefs and abiotic factors which are needed for coral reefs to thrive.</li> </ul>	<i>Marine Life of the Caribbean</i>  Maps showing depth of sea and islands.	<ul style="list-style-type: none"> <li>• Correct identification of abiotic factors</li> <li>• Rubric for assessing oral presentation with relationship clearly shown</li> </ul>
Describe a coral polyp.	Coral polyps are coelenterates, hollow bodied, tentacles, mouth, stinging cells, prey; coral polyps have symbiotic microscopic algae called zooxanthellae.	Make an annotated drawing/chart of a coral polyp showing its structures and the functions of those structures.	<i>Marine Life of the Caribbean</i>	Rubric for assessing visual aids
Explain the role of coral polyps and other organisms in coral reef formation.	Colonies of coral polyps form coral reefs. Coral polyps secrete a calcium carbonate (limestone) skeleton; coralline algae, trap and stick sand together and stabilize the reef. Hard corals build reefs, soft corals do not.	Creatively display reef building organisms using photos, drawings etc	Reef identification cards; booklets	Rubric for assessing visual aids

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: CORAL REEF ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Identify hard and soft coral found locally.	Hard corals: staghorn coral, elkhorn coral; brain coral; soft corals: sea fans, sea whips.	Make a key identifying and locating hard and soft coral on pictures or diagrams of a Bahamian reef.	Diagrams or photographs showing flora and fauna of a Bahamian reef.	Correct identification and distinctions made between soft and hard corals using an appropriate key
Create a news article explaining the benefits of coral reefs.	Coral reefs important for: providing spawning, nursery, shelter and feeding areas for a large variety of organisms (biodiversity); storm protection – minimize wave impact; fisheries; sand production; tourism – way to earn foreign currency and provide jobs; medical advances/pharmaceuticals (video, audio or print)	Prepare a news article explaining the importance of coral reefs. The article could be prepared for print or electronic media.	Pamphlets from governmental and non-governmental environmental agencies Bahamas Reef Environment Education Foundation (BREEF) <a href="http://www.breef.org">www.breef.org</a> ; Abaco Friends of the Environment, <a href="http://www.friendsoftheenvironment.org">www.friendsoftheenvironment.org</a> ; The Nature Conservancy <a href="http://www.nature.org/wherewework/caribbean/bahamas/">http://www.nature.org/wherewework/caribbean/bahamas/</a> Bahamas National Trust <a href="http://www.bnt.bs">www.bnt.bs</a> The Bahamas Environment Science and Technology Commission (BEST) <a href="http://www.best.bs">www.best.bs</a> <a href="http://www.reefmonitor.org">www.reefmonitor.org</a>	Rubric for assessing (oral) presentation

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: CORAL REEF ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Explain the role of zooxanthellae.	Zooxanthellae are algae living inside coral for protection and access to light. Coral polyps make use of carbohydrates and oxygen the algae make as a result of photosynthesis. Zooxanthellae also help with the corals ability to make their limestone skeleton. Pigments in algae give coral its colour.	<ul style="list-style-type: none"> <li>• Compare photographs of bleached coral and healthy coral.</li> <li>• Describe what would happen if the zooxanthellae did not return to the polyp tissues.</li> <li>• Design a concept map to show the role of zooxanthellae in coral reefs.</li> </ul>	Internet, magazines, photographs  <i>Marine Life of the Caribbean</i>	<ul style="list-style-type: none"> <li>• Comparison of bleached and healthy coral</li> <li>• Rubric for assessing visual aids</li> </ul>
Observe the diversity of organisms in the coral reef ecosystem.		<ul style="list-style-type: none"> <li>• Observe the diversity of organisms in the coral reef ecosystem in a virtual field trip.</li> <li>• Identify three reef organisms not previously known (to student)</li> <li>• Formulate a hypothesis on the number of species present in a reef ecosystem.</li> </ul>	Internet  <i>Marine Life of the Caribbean Guide to Corals &amp; Fishes</i>	<ul style="list-style-type: none"> <li>• Number and diversity of organisms described</li> <li>• Identification of three organisms</li> </ul>
Construct a coral food web showing producers, primary, secondary and tertiary consumers.	Producers - phytoplankton; zooxanthellae; coralline algae; calcareous algae e.g. Halimeda produces 50% Caribbean beach sand; sea weeds (macroalgae); sea grasses. Primary consumers – zooplankton; tube worms; conch; sea urchins; herbivorous reef fish – damselfish, parrot fish. Secondary and tertiary consumers - coral polyps; sponges; sea anemone; carnivorous reef fish – butterfly fish, puffer fish, grouper, eels, sharks, barracudas	Construct a coral food web showing producers, primary, secondary and tertiary consumers.	<i>Treasures in the Sea – An Educator’s guide to Teaching Marine Biodiversity</i> ; Bahamas National Trust & American Museum of Natural History <i>Wondrous West Indian Wetlands - A resource Book on Caribbean Wetlands for teachers and other Educators</i> Compiled Documents – BREEF Marine Conservation Workshop Internet sources	<ul style="list-style-type: none"> <li>• Rubric for assessing visual aids</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: CORAL REEF ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Identify the adaptations of reef fish to their environment.	Body plan/shape adaptations: fusiform; laterally compressed; ribbon/snake-like; sphere, color patterns: camouflage; disruptive coloration; counter-shading; advertising; deceiving	<ul style="list-style-type: none"> <li>• Match various reef fish to given shapes and state the advantage of each shape.</li> <li>• Make a poster or 3-D model of a reef highlighting 3 or more adaptations.</li> <li>• Record in a creative manner the adaptations of reef fish to the environment.</li> </ul>	Reef identification cards; reef guides; Internet video clips, paper; paints/coloring pencils; worksheets; photographs; glue etc. Treasures in the Sea – An Educator’s guide to Teaching Marine Biodiversity Pisces Guide to Caribbean Reef Ecology - William S. Alevizon BREEF website	<ul style="list-style-type: none"> <li>• Correct identification and description of fish shapes.</li> <li>• Rubric for assessing poster/model</li> <li>• Rubric for assessing adaptations to the environment.</li> </ul>
Research natural and man-made threats to coral reefs.	Over-fishing – including the use of damaging fishing practices e.g. dynamite, chlorine bleach; rising levels of CO <sub>2</sub> ; ship groundings; sewage; marine debris; sediments - from poor land use, deforestation, and dredging; coastal development; global climate change; coral bleaching - caused by elevated sea surface temperatures due to global climate change; diseases, plagues and invasive species; indirect human impact - rising poverty, increasing populations, poor capacity for management and lack of resources, lack of political will, and oceans governance.	<ul style="list-style-type: none"> <li>• Conduct research to identify natural and man-made threats to coral reefs.</li> <li>• Create a fact sheet by collating information on threats to coral reefs published by environmental agencies based in The Bahamas.</li> </ul>	<a href="http://www.reefrelief.org/reef.shtml">http://www.reefrelief.org/reef.shtml</a> Reef protection pamphlets (Bahamas National Trust, Ministry of Agriculture and Fisheries, BREEF etc.) <i>Treasures in the Sea</i> – An Educator’s guide to Teaching Marine Biodiversity, Wondrous West Indian Wetlands; BREEF Marine Conservation Workshop Internet sources	Rubric for assessing research

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: ROCKY SHORES ECOSYSTEMS**

**DURATION: 3 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Locate on a map of the island likely areas for rocky shoreline ecosystems to be located.	Windward side of island, cope with strong breezes, strong wave action, high salinity, strong sunlight, little soil, exposed bare rock, tide pools	<ul style="list-style-type: none"> <li>Identify windward side of island.</li> <li>Locate exposed side of island on a map.</li> </ul>	Map of the island	Valid sites on the exposed side (to main winds) of island identified on a map
Conduct field studies (or virtual) of a rocky shoreline.	Environmental conditions include – exposure to strong light; heat; wind action; wave action; tides; rain; hard substrate; exposure to predators. Colour and wave height of sea. Divided into distinct zones: Splash, High Tide, Mid Tide/Inter-tidal, Low Tide Zone. Tide Pools. Surface of substrate, cliffs, blowholes, rock pools	<ul style="list-style-type: none"> <li>Observe the abiotic features of the rocky shore.</li> <li>Identify four zones.</li> <li>Observe special features of the substrate.</li> </ul>	Paper, pencils, camera, field guide, quadrat, tape measure, rope, string, meter rules, poles <i>Caribbean Biology - An Integrated Approach; Marine Life of the Caribbean; Making a Quadrat – BREEF Marine Conservation Workshop</i>	Number and quality of detailed observations
Measure temperature and wind speed.		Measure temperature (air, rock surface, water), wind direction and wind speed (at 3 points along the transect).	Thermometers, string, rope, anemometer, wind vane.	Accuracy of measurements, clarity of recording measurements
Use tools and equipment to gather data.	Quadrats, line transects, measuring tape	<ul style="list-style-type: none"> <li>Use quadrats to survey sessile organisms.</li> <li>Use quadrats, line or belt transects to observe and record the distribution of plants.</li> </ul>	Quadrat, tape measure, rope, string, meter rules, poles <i>GCSE Biology</i>	Rubric for assessing use of materials and equipment correctly and safely
Collect and record data.		<ul style="list-style-type: none"> <li>Identify (names or key) the organisms found in quadrat and transect studies.</li> <li>Count and record the number of each type of organism found in quadrat and transect studies.</li> </ul>	Tally counter, clipboard <i>GCSE Biology</i>	Clarity in recording of data

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: ROCKY SHORE ECOSYSTEMS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Make an annotated outline drawing of the profile of a typical rocky shoreline ecosystem showing zonation and the features of each zone.	Low tide, inter-tidal, high tide, splash, exposed rock, pioneer zones	<ul style="list-style-type: none"> <li>• Make an outline drawing of the profile of a rocky shoreline showing the main zones.</li> <li>• For each zone note the substrate, exposure to sunlight, covering by water.</li> </ul>		Clarity of diagram, validity of notes (based on observations)
Identify key organisms found in each zone.	Nerites, Periwinkles, Limpets, chitons, sea urchins, Caribbean topshell; green, brown and red seaweeds.	<ul style="list-style-type: none"> <li>• Draw and describe the external features of organisms from each of three zones.</li> <li>• Using pictures or drawings make waterproof file cards identifying organisms.</li> </ul>	Index; cards, digital camera (optional), contact paper, pictures <i>Caribbean Biology - An Integrated Approach; Marine Life of the Caribbean</i> Fact sheets Bahamas National Trust or Bahamas Environmental Protection Manual	Descriptions of identified organisms
Describe the adaptations of the organisms to their habitat/zone.	Crustaceans and mollusks including those above. Adaptations of organisms to: drying out; overheating; change in salinity, wave action, predation	Use the descriptions of organisms (above) to the rocky shore environment and zone in particular to describe the adaptations of the organisms to their habitat/zone.	As above	Number of adaptations identified, clear relationships shown between adaptations and habitat.
Conduct a survey of <i>Citation pica</i> (whelks, walks, West Indian Topshell) or other named mollusc on a rocky shore.	Size and distribution	Observe a named mollusc in its habitat and measure its distribution in the various zones of a rocky shore.	Quadrats, poles, string, meter rule Field guide, paper; adaptation <i>Caribbean Biology - An Integrated Approach; Marine Life of the Caribbean</i>	Rubric for assessing surveys
Show the relationship between the features of the mollusc surveyed and its adaptations to the environment.		Complete table that compares organism, adaptation and value of adaptation.	<i>Marine Life of the Caribbean</i> BNT publications	Relationship clearly shown between the adaptations of mollusc to its habitat.

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: ROCKY SHORE ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Suggest benefits derived from the rocky shoreline.	Protection against erosion of landmass by waves, pioneer zones break wind action protecting inland plants, source of edible mollusks.	<ul style="list-style-type: none"> <li>• Brainstorm benefits derived from the rocky shoreline.</li> <li>• Prepare a cartoon showing benefits derived from the rocky shoreline</li> </ul>	<i>Marine Life of the Caribbean</i>	Valid benefits with plausible reasons/explanations
Conduct research to determine threats to the rocky shoreline ecosystems.	Industrial plants nearby, oil tankers berthing at docks, container ships traffic, nearby ocean pathways with vessels discharging waste.	<ul style="list-style-type: none"> <li>• Conduct research to determine threats to the Rocky shoreline ecosystems.</li> <li>• Include the threats in the cartoon.</li> <li>• Make a position statement on the need to monitor identified threats to local rocky shorelines.</li> </ul>	Internet, websites: BNT. BREEF, news articles	Rubric for conducting research  Rubric for assessing visual aids  Clarity in stating a position statement with relevant reasons

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: SANDY BEACH ECOSYSTEMS**

**DURATION: 3 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Locate on a map of the island likely areas for sandy shoreline ecosystems.	Located on the sheltered side of island, often with reefs offshore. Gentle breezes, gentle wave action, deposition of sand, shifting sandy substrate.	<ul style="list-style-type: none"> <li>Identify leeward side of island.</li> <li>Locate sheltered side of island on a map.</li> </ul>	Map showing island of residence	Valid sites on the sheltered side of island (protected by reefs)
Conduct field (or virtual) studies of a sandy beach.	<p>Colour and wave height of sea, wind, temperature.</p> <p>Identify zones on sandy beach: Low Tide, Intertidal, High Tide, Pioneer, Fixed Dune, Scrub Woodland Zone. Variations in soil particle size/texture along a profile from the sea inland, variation in colour, holes (animals)</p>	<ul style="list-style-type: none"> <li>Observe the abiotic features of the rocky shore.</li> <li>Identify six zones.</li> <li>Observe special features of the substrate.</li> </ul>	<p>Quadrats, poles, string, meter rule digital camera (optional) , index cards; pencil;</p> <p><i>Caribbean Biology - An Integrated Approach;</i></p> <p><i>Marine Life of the Caribbean GCSE Biology</i></p>	Number and level of details of observations
Make an annotated outline drawing of the profile of a sandy shoreline ecosystem showing zonation.		<ul style="list-style-type: none"> <li>Sketch the slope (profile) of the beach</li> <li>Identify the main zones</li> <li>Indicate the features of each zone.</li> </ul>	Pencil, paper, transect line, clipboard,	Clarity of diagram and accuracy of zones and features indicated
Measure temperature and wind speed.		<ul style="list-style-type: none"> <li>Use equipment to measure abiotic factors.</li> <li>Measure temperature (air, sand surface, 10 cm below surface, water), wind direction and wind speed (at 3 points along the transect).</li> </ul>	Thermometers, string, rope, anemometer, wind vane.	<p>Rubric for assessing correct use of equipment</p> <p>Accuracy of measurements, clarity of recording measurements</p>
Use tools and equipment to gather data.	Quadrats, line transects, measuring tape	<ul style="list-style-type: none"> <li>Use quadrats to survey sessile organisms.</li> <li>Use quadrats, line or belt transects to observe and record the distribution of plants.</li> </ul>	Quadrat, tape measure, rope, string, meter rules, poles	Rubric for assessing use of equipment

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: SANDY BEACH ECOSYSTEMS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Collect and record data.		<ul style="list-style-type: none"> <li>• Identify (names or key) the organisms found in quadrat and transect studies.</li> <li>• Count and record the number of each type of organism found in quadrat and transect studies.</li> </ul>	Tally counter, clipboard <i>GCSE Biology</i>	Clarity in recording of data
Identify key organisms found in each zone.		<ul style="list-style-type: none"> <li>• Draw and describe the external features of organisms from each of three zones.</li> <li>• Using pictures or drawings make waterproof file cards identifying organisms.</li> </ul>	Index; cards, digital camera (optional), contact paper, pictures <i>Caribbean Biology - An Integrated Approach; Marine Life of the Caribbean</i> Fact sheets Bahamas National Trust or Bahamas Environmental Protection Manual	Descriptions of identified organisms
Conduct a survey of invertebrates on a sandy shore.		<ul style="list-style-type: none"> <li>• Observe invertebrates in their habitat.</li> <li>• Record invertebrates found.</li> <li>• Note their distribution in the various zones of a sandy shore.</li> <li>• Make a graphic organizer to show the distribution of invertebrates in the zones.</li> <li>• Classify the invertebrates found on sandy shores.</li> <li>• Construct a bar graph showing the number each phylum represented.</li> </ul>	Quadrats, poles, string, meter rule Field guide, paper; adaptation <i>Caribbean Biology - An Integrated Approach; Marine Life of the Caribbean</i>	<p>Accuracy of information and distribution clearly shown</p> <p>Identified invertebrates correctly classified in phyla</p> <p>Rubric for assessing collecting and processing data</p>

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: SANDY BEACH ECOSYSTEMS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Show the relationship between the features of the invertebrates surveyed and their adaptations to the environment/zone.	Flat invertebrates – least resistance to waves, burrowing – escape exposure to direct sunlight.	Complete table that compares organism, adaptation and value of adaptation.	<i>Marine Life of the Caribbean</i> BNT	Relationship clearly shown between the adaptations of invertebrates to their habitat
Show the relationship between the features of plants observed and their adaptations to the environment/zone.	Plants with long, branching roots – hold substrate, absorb maximum fresh water; plants green, flexible stems – withstand breezes; xerophytic adaptations – salt conditions.	Complete table that compares organism, adaptation and value of adaptation.	<i>Marine Life of the Caribbean</i> BNT	Relationship clearly shown between the adaptations of plants to their habitat
Research the importance of the sandy shoreline.	Recreation, economy, protection against inland erosion.	<ul style="list-style-type: none"> <li>Brainstorm benefits derived from the sandy shoreline.</li> <li>Prepare a cartoon/song/rap highlighting benefits derived from the sandy shoreline.</li> </ul>	Articles on tourism/national income	<ul style="list-style-type: none"> <li>Valid benefits with plausible reasons/explanations</li> <li>Rubric for assessing visual/oral presentations</li> </ul>
Research the threats to the sandy shoreline.	Dredging, shipping corridor (release waste), human pollution, construction, mining, damaging reefs, bleaching reefs, hurricanes, climate change.	<ul style="list-style-type: none"> <li>Conduct research to determine threats to sandy shoreline ecosystems.</li> </ul>	Internet, websites: BNT, BREEF	Rubric for assessing conducting research
Suggest ways to reduce threats to the sandy shoreline.		Make a presentation (in a forum – school/community) to advocate implementation of measures to reduce the threats to sandy shorelines in The Bahamas.	Internet, BREEF website	Rubric for assessing oral/visual presentations

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: FOREST ECOSYSTEMS**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare the abiotic conditions in the three geographical zones of The Bahamas.	Abiotic factors (substrate, wind, water); adaptations: <b>Northern Bahamas Pine forest</b> – found in Grand Bahama, Andros, Abaco and New Providence. <b>Central Bahamas Broadleaf Hardwood Forest</b> Coppice – Whiteland coppice run along coasts <b>Southern Bahamas Drought Resistant Woodland</b> – islands south of Crooked Island Passage – islands mainly dry.	<ul style="list-style-type: none"> <li>• Locate the three zones on a map of The Bahamas.</li> <li>• Compare the rainfall and substrate in each of the zones.</li> </ul>	Maps, annual rainfall records.	Accuracy of information
Describe the main flora and fauna found in each forest and their adaptations.	Main flora and fauna; adaptations: <b>Northern Bahamas Pine forest</b> – Caribbean pine ( <i>Pinus caribea</i> var. <i>bahamensis</i> ); southern bracken fern ( <i>Pteridium aquilinum</i> ); silver thatch palm ( <i>Coccothrinax argentata</i> ), poisonwood ( <i>Metopium toxiferum</i> ), five fingers ( <i>Tabebuia bahamensis</i> ). Identify some of the animals. Abaco Bahama Parrot; Bahama Woodstar Hummingbird; Cuban Emerald Hummingbird, pine warbler, Bahamian boa constrictor, lizards, Andros Rock Iguana (Andros) <b>Central Bahamas Broadleaf Hardwood Forest</b> Coppice – Brasileto, Acasia, Seagrape Balsam and Cacti (Dildo Cactus, Prickly Pear Cactus) land crabs Giant White Land Crab and the Black Crab; Blackland Coppice interior of islands. <b>Southern Bahamas Drought Resistant Woodland</b> – cactus and stunted versions of some species further north.	<ul style="list-style-type: none"> <li>• Identify the main flora found in the ecosystem.</li> <li>• Describe any features that are adaptations to the habitat.</li> <li>• Identify the main fauna found in the ecosystem.</li> <li>• Describe any features that are adaptations to the habitat.</li> </ul>	BNT publications Nature Conservancy posters	<ul style="list-style-type: none"> <li>• Number of flora and fauna identified</li> <li>• Correct identification of features as adaptations</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: FOREST ECOSYSTEMS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Conduct field studies of a forest.	Main flora and fauna; abiotic factors; adaptations: <b>Northern Bahamas Pine forest</b> (found in Grand Bahama, Andros, Abaco and New Providence) <b>Central Bahamas Broadleaf Hardwood Forest</b> Coppice (Cat Island, Eleuthera, Exuma, Rum Cay, San Salvador ) Whiteland coppice run along coasts & Blackland Coppice interior of islands <b>Southern Bahamas Drought Resistant Woodland</b> – islands south of Crooked Island Passage –cactus and stunted versions of some species further north.  <b>ONE FOREST TYPE WILL BE STUDIED FOR THIS UNIT.</b>	Conduct a field survey of a named terrestrial ecosystem	Bahamas National Trust Whiteland Coppice; Blackland Coppice; Pine Forest Exploring the Bahamian Pine Forest – A Teacher’s Resource Bahamas National Trust Bahamas Environmental Handbook	Rubric for assessing field reports
Use a line transect or other appropriate method to survey organisms in the area.	As above	<ul style="list-style-type: none"> <li>Identify the more abundant organisms in the forest studied</li> <li>Use a key on a diagram to represent types of plants in the line transect.</li> </ul>	As above	<ul style="list-style-type: none"> <li>Number of organisms present correctly identified</li> <li>Realistic representation of line transect</li> </ul>
Construct a possible food web for the ecosystem	As above	Construct a possible food web for the ecosystem	<i>GCSE Biology</i>	Plausibility of food web constructed
Research the importance of the terrestrial ecosystem to man and wildlife.		Prepare a cartoon, poem, skit, song or rap to demonstrate the importance of the ecosystem.	Bush Medicine resource book BNT fact sheets Exploring the Bahamian Pine Forest – A Teacher’s Resource	Rubric for assessing oral/visual presentations

**SCOPE OF WORK  
GRADE 10  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: FOREST ECOSYSTEMS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Suggest possible threats to the ecosystem.	Threats to terrestrial ecosystems include: fire, urban development and climate change.	<ul style="list-style-type: none"> <li>• Identify threats to the dominant local terrestrial ecosystem</li> <li>• Describe the impact of these threats to the ecosystem.</li> <li>• Suggest methods of reducing threats.</li> </ul>	Exploring the Bahamian Pine Forest – A Teacher’s Resource	Number and validity of suggested threats
Persuade peers to value the terrestrial ecosystem.	Forest regeneration.	<ul style="list-style-type: none"> <li>• Create a pamphlet to persuade peers to value the terrestrial ecosystem.</li> </ul>		Rubric for assessing visual aids
Show personal valuing of the local forest.		Write a personal pledge to help conserve the local forest.	BNT fact sheets	Correct (forest) content, personal focus, enthusiasm and commitment conveyed

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: CELLS**

**DURATION: ½ week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use a light microscope to observe structures in plant and animal cells.	Structures in plant cells only: cell wall, chloroplasts, starch grains; animal cell only: glycogen granules; both cells: cell membrane, nucleus, chromatin, vacuoles.	<ul style="list-style-type: none"> <li>Examine prepared slides of plant and animal cells with microscope.</li> <li>Prepare slides of plant and animal cells.</li> <li>Draw and label cells as seen under low and high power.</li> </ul>	Prepared slides of animal or plant cells; Onion, knife/scalpel, toothpick, iodine, methyl blue, microscope slides, cover slips, microscopes <i>CXC Human and Social Biology</i> <i>Longman Biology for CSEC</i>	Correct handling of apparatus and materials
Observe detailed structures of plant and animal cells.	Structures seen under electron microscopes are: smooth and rough endoplasmic reticulum, ribosome, golgi apparatus, lysosome, centriole (animal cell) mitochondria	<ul style="list-style-type: none"> <li>Observe cell structures on photographs, transparencies etc.</li> <li>Label blank diagrams of cells showing organelles.</li> </ul>	Detailed diagrams of cells showing organelles. <i>CXC Human and Social Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct labeling of diagram of cell
Make a 3D model of a plant and animal cell.	Model should include: cell wall, cell membrane, chloroplasts, nucleus, nucleolus, chromatin, mitochondria, smooth and rough endoplasmic reticulum, ribosome, golgi apparatus, lysosome	<ul style="list-style-type: none"> <li>Construct a 3D model of a plant cell with its organelles.</li> <li>Make a cell mobile.</li> </ul>	Variety of craft materials such as: Scissors, construction paper, glue	Rubric for assessing models
Explain the relationship of the cell parts to their function.	In addition to parts of the cell seen under the microscope, include the following: <u>endoplasmic reticulum</u> – components of cell membrane assembled here and some proteins are changed; <u>ribosome</u> – proteins are assembled here; <u>golgi apparatus</u> – modify proteins and repack for distribution; <u>lysosome</u> – digests excess or worn out cell parts, food particles and invading microbes; <u>centriole</u> – involved in cell reproduction	<ul style="list-style-type: none"> <li>Role play- students representing different organelles describe their structure and function;</li> <li>“Sell a cell” – students must sell parts (market their importance) of a cell</li> </ul>	Diagrams of detailed structures  <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Rubric for assessing oral presentations (role-play)</li> <li>Rubric for assessing oral/visual presentations</li> </ul>

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: SIMPLE ORGANISMS**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Observe diagram of bacterial cell. and conclude that it is a prokaryote cell.	A prokaryote cell has a simpler structure than a eukaryote cell. It does not have a proper nucleus and only a single DNA strand.	<ul style="list-style-type: none"> <li>Observe a diagram of a bacterial cell and identify cell parts.</li> <li>Compare the bacterial cell with a plant and animal cell.</li> <li>Form a conclusion that it is a prokaryote cell.</li> </ul>	Transparency/chart/diagram of bacterial cell <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Correct identification and/classification of cells as prokaryotes or eukaryotes
Describe binary fission in simple organisms.	Amoeba and bacteria reproduce by binary fission; offspring identical to parent; chromosomes replicate first; then nucleus/nuclear material splits into two; then cytoplasm – then 2 identical organisms, rapid once every 20 minutes.	<ul style="list-style-type: none"> <li>Make annotated diagrams to show binary fission.</li> <li>Identify examples of simple organisms that reproduce by binary fission.</li> <li>Use plasticene to demonstrate binary fission.</li> <li>Draw conclusions about the speed of reproduction, number of offspring produced and resemblance of offspring to parents.</li> </ul>	Plasticene <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids
Observe yeast budding.	Yeast is an unusual plant. Each organism consists of a single cell. The main method of reproduction is asexual, by budding: this generally results in the daughter cells remaining attached together, forming characteristic colonies.	<ul style="list-style-type: none"> <li>Make a yeast suspension.</li> <li>Use methylene blue to stain suspension on microscope slide.</li> <li>Observe cells reproducing under a microscope.</li> <li>Make a sketch of observations.</li> </ul>	Yeast, water, glucose, methylene blue, glass slide, cover slip, microscope <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>Correct use of the microscope</li> <li>Accuracy of sketch/drawing</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: SIMPLE ORGANISMS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Describe budding in simple organisms.	Yeast nucleus divide by budding, nucleus divides, cytoplasm outgrowth, bud forms, colonies of buds; buds separate to form new colonies, offspring identical to parent. Budding found in Coelenterates, yeast cells.	<ul style="list-style-type: none"> <li>• Make annotated diagrams to show budding.</li> <li>• Identify examples of simple organisms that reproduce by budding.</li> <li>• Use plasticene to demonstrate budding.</li> </ul>	Plasticene <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual presentation
Observe growth and development of Mucor.	Pin mould grows on substances like stale bread and cheese. The surface shows a superficial mat of grey cylindrical branching threads called hyphae which penetrate the substrate. The hyphae secrete enzymes which digest the food and make it soluble to be absorbed.	<ul style="list-style-type: none"> <li>• Set investigation - a slice of bread or a piece of cheese in a sandwich bag left on the table for a week.</li> <li>• Observe the mould using a magnifying glass or a sample on a slide using the microscope.</li> </ul>	Bread , cheese, sandwich bag, Magnifying glass, glass slide, microscope  <i>Caribbean Biology</i> <i>CXC Human and Social Biology</i>	Correct use of the microscope
Describe spore formation in simple organisms.	Pin mould have spores – single reproductive cell produced by sporangium, cytoplasm collects around the nuclei to form spores, sporangia black swellings at tip of erect hyphae; sporangia burst release spores	<ul style="list-style-type: none"> <li>• Make annotated diagrams to show spore formation.</li> <li>• Identify examples of simple organisms that reproduce by sporulation.</li> <li>• Design, make and use models to demonstrate reproduction by sporulation.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual presentation  Rubric for assessing models

**SCOPE OF WORK  
GRADE 10  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: ACTIVITY OF ENZYMES IN CELLS**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use materials to show enzyme action.	An enzyme is a type of protein that is produced by cells. Enzymes catalyze chemical reactions in living organisms. The enzyme in liver and potato breaks down hydrogen peroxide (formed in cells) into water and oxygen	Use liver or potato and hydrogen peroxide to show the production of oxygen bubbles which indicate enzyme activity.	Hydrogen peroxide solution Liver or Irish potato; Test tubes; knife; mortar and pestle (or other grinding apparatus)  <i>GCSE Biology</i> <i>Biology for Life</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Correct use of apparatus and safe use of materials  Number and quality (details) of observations
Plan and conduct an experiment to determine the pH conditions under which the enzyme catalase works best.	Enzymes work best at a certain pH. Explain effect of change in pH on enzyme i.e. change can alter the shape of a protein; hence affect shape of active site; which could slow down or stop reaction.	<ul style="list-style-type: none"> <li>• Formulate a hypothesis on the pH conditions under which the enzyme catalase works best.</li> <li>• Plan the experiment</li> <li>• Identify and control variables</li> <li>• Conduct experiment</li> <li>• Make observations</li> <li>• Formulate a conclusion</li> </ul>	Potato or liver extracts; hydrogen peroxide; Amylase solution and starch solution; Alkali (e.g. sodium carbonate) Acid (e.g. acetic acid); Water (neutral); Iodine solution; Test tubes; beakers; water bath; Pipette; syringe <i>CXC Human and Social Biology</i> <i>GCSE Biology</i>	Rubric for assessing investigations
Plan and conduct an experiment to determine the effect of temperature on enzyme action.	Enzyme – alter shape of active site – no reaction; decrease temperature - decrease activity.	<ul style="list-style-type: none"> <li>• Formulate a hypothesis on the temperature at which the enzyme catalase works best.</li> <li>• Plan the experiment</li> <li>• Identify and control variables</li> <li>• Conduct experiment</li> <li>• Vary the temperature of liver or potato by placing them in different temperature water baths</li> </ul>	Hydrogen peroxide solution Liver or Irish potato Test tubes Hot, cold and room temperature water baths  <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing investigations

**SCOPE OF WORK  
GRADE 10  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: ACTIVITY OF ENZYMES IN CELLS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Measure temperature.	An enzyme works best at a certain temperature/ the optimum temperature; increase in temperature increases rate of reaction; high temperature may denature.	<ul style="list-style-type: none"> <li>• Use a thermometer to measure the temperature of water baths with cold, warm and hot water.</li> <li>• Observe the bubbles formed.</li> <li>• Count and/or compare the relative amounts of bubbles released.</li> <li>• Observe changes in enzyme actions – e.g. measure length of foam formed</li> <li>• Formulate a conclusion.</li> </ul>	Hydrogen peroxide solution, liver or Irish potato, test tubes, thermometers, water baths	<ul style="list-style-type: none"> <li>• Correct use of thermometer</li> <li>• Accuracy in measurement of temperature</li> </ul>

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

**DURATION: 2 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use coloured substances to demonstrate diffusion.	Diffusion is the process by which molecules tend to move from an area where they are more concentrated to an area where they are less concentrated.	<ul style="list-style-type: none"> <li>Place a drop of food colouring, ink, dye, kool aid, copper sulphate or potassium permanganate crystals in water and observe them spreading out.</li> <li>Spray perfume/air freshener and allow students to raise hands when they detect the odour.</li> </ul>	Food colouring/ ink/dye/kool aid/ copper sulphate/ potassium permanganate crystals; <i>CXC Human and Social Biology</i>  Perfume, air freshener	Correct and safe use of materials
Observe diffusion of substances in air and liquids.	As above	Describe observations in a diagram or orally.	As above	Number and quality (details) of observations (oral or diagrammatic description)
Illustrate examples of diffusion in the human body.	Examples of diffusion in the human body: absorption of digested food in the gut; gaseous exchange in the lungs; diffusion of cellular wastes into and out of the blood	Create a study aid which uses graphics/drawings/pictures/video clips to illustrate examples of diffusion in the human body.	Pencils, crayons, paper or media player.  <i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing visual aids
Design and conduct an experiment to determine the effects of temperature on the rate of diffusion.	Molecules spread out faster as temperature increases, hence rate of diffusion increases with temperature.	<ul style="list-style-type: none"> <li>Design an experiment using any coloured material and water or perfume in air</li> <li>Carry out experiment</li> </ul>	Coloured material e.g. food colouring, dyes, ink; beakers or plastic cups, perfume  <i>Longman Biology for CSEC</i>	Rubric for assessing investigations (including planning)
Observe the effects of temperature on the rate of diffusion.		<ul style="list-style-type: none"> <li>Measure and record temperatures of water.</li> <li>Observe the spreading out of a coloured material in water at different temperatures of water.</li> </ul>	Coloured material/dye, heat source, Ice, water, thermometers, timer	Accuracy of measurements of temperature of water to 0.5°C; clarity of recording measurements

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Perform an experiment to show osmosis.	Osmosis is the process by which there is an overall movement of molecules from an area where there is a higher concentration of them through a partially permeable membrane to an area where there is a lower concentration of them. Molecules differ in size. Those smaller than the pore size of membrane will move through it.	Perform an experiment to show osmosis.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Experimental report (at the end)
Use apparatus and materials to demonstrate osmosis.		<ul style="list-style-type: none"> <li>Assemble apparatus showing care not to allow dyed solution to mix with water in the beaker, water level in the beaker to cover top of plastic. Make sure bag/tube is securely fastened to prevent leaks.</li> <li>Make a labeled diagram of the experiment.</li> </ul>	Visking tubing or plastic baggie, thistle funnel/narrow glass tube, clamp and retort stand, stirrer, measuring cylinder, water, sugar/salt, dye  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>Correct and safe handling of apparatus and materials</li> <li>Correct labelling of diagram</li> </ul>
Measure materials needed for osmosis experiment.		Measure water in beaker, salt/sugar, water to make solution, dye	As above  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Accuracy of measurements; clarity of recording measurements

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Make observations of osmosis.	The level of solution in the thistle funnel/glass tube rises as a result of water molecules moving in from the surrounding water in the beaker.	<ul style="list-style-type: none"> <li>• Mark the level of the solution in the tube at the beginning of the experiment</li> <li>• Mark the level of the solution at the end of the experiment</li> <li>• Note the difference.</li> <li>• Observe colour</li> </ul>	Markers	Accuracy of levels marked and distance measured; clarity of recording measurements
Formulate a conclusion from the experiment on osmosis.	Water molecules moved through the partially permeable (semi-permeable/ selectively permeable, differentially permeable) membrane by osmosis.	Formulate a conclusion from the experiment on osmosis.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Clarity and accuracy of conclusion based on results and observations made
Plan and perform an experiment to investigate the effects of temperature on rate of osmosis.	Heat causes molecules to increase their speed. The rate of osmosis increases with increased temperatures.	<ul style="list-style-type: none"> <li>• Plan an experiment to investigate the effects of temperature on rate of osmosis.</li> <li>• Conduct the experiment.</li> <li>• Write a lab report (including variables, experimental errors, conclusions).</li> </ul>	As above with thermometers, source of heat.	Rubric for assessing investigations
Describe simply the process of active transport.	Molecules are moved across a membrane from an area of a lower concentration of them to an area of a higher concentration of them. The process utilizes a significant amount of energy.	Dramatize the process of active transport of molecules across a membrane.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing oral presentations/skits
Demonstrate the relationship between diffusion and osmosis.	Osmosis is a special case of diffusion utilizing a partially permeable membrane.	Dramatize diffusion and osmosis explaining the relationship between them.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Clarity and accuracy (content) in demonstrating the relationship

**SCOPE OF WORK  
GRADE 10  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Compare and contrast diffusion, osmosis and active transport.</p>	<p>Similarities in terms of transport / movement of substances; across cell membrane; Differences in <i>terms of types of substances</i> (liquids &amp; gases in diffusion; water in osmosis; certain selected solutes); <i>speed</i> ( rapid in diffusion &amp; active transport, slow in osmosis); <i>transport from – to</i> ( high to low concentration in diffusion &amp; osmosis, low to high in active transport); <i>necessity of living semi permeable membrane</i>( diffusion – not needed, osmosis - either living or non-living , active transport – living needed ); <i>necessity of cell energy</i> (diffusion &amp; osmosis – none, active transport – needed);</p>	<ul style="list-style-type: none"> <li>• Draw table to show similarities and differences</li> <li>• Make annotated molecular diagrams to show the similarities and differences.</li> <li>• Draw Venn diagrams to compare and contrast the processes.</li> <li>• Use online tutorials to demonstrate osmosis, diffusion and active transport.</li> </ul>	<p><i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p> <p>Internet</p>	<ul style="list-style-type: none"> <li>• Clarity of molecular diagram, accuracy of notes</li> <li>• Clarity of Venn diagrams, accuracy of information</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: OSMOSIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Formulate a hypothesis on the direction in which iodine, starch and water will move through a plastic sandwich bag/visking tubing.	The plastic bag, like a cell membrane, is semi permeable and allows only small molecules to pass through easily. Iodine molecule is small and starch is large.	Formulate a hypothesis on the direction in which each of the following will move through plastic sandwich bag/visking tubing: iodine, starch and water.	Iodine and starch solutions, small plastic baggies/visking tubing, bag ties, beakers, measuring cylinders	Plausibility of hypothesis and reasons given
Predict the outcome of an experiment using plastic sandwich bags/visking tubing, iodine and starch, to show selectivity of the cell membrane.	When iodine and starch are mixed a blue black colour is observed.	Predict if and where, a blue-black colour change will occur.	Iodine and starch solutions, small plastic baggies/visking tubing, bag ties, beakers, measuring cylinders  <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Plausibility of prediction and reasons given
Conduct an experiment to demonstrate selectivity of cell membrane using plastic sandwich bags.	The plastic bag, like the cell membrane, is semi permeable and only allows small molecules to pass through easily. Iodine molecule is small and starch is large. If starch and iodine mix, a blue-black colour will be observed.	Perform experiment - add measured quantities of starch to beaker and plastic bag, Add measured quantities of iodine to other beaker and plastic bag. Place bag with starch in beaker with iodine and vice versa. Observe for colour changes and measure new volumes after an hour.	As above	Number of steps in methodology correctly followed
Use apparatus to demonstrate selectivity of the cell membrane.		Use apparatus to demonstrate selectivity of the cell membrane.	Iodine and starch solutions, small plastic baggies, bag ties, beakers	Correct and safe use of apparatus and materials
Make inferences and draw a logical conclusion on selectivity of the cell membrane.	As above	Make inferences and draw a logical conclusion on selectivity of the cell membrane.	Textbook, lab instructions, data from experiment <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of inference/conclusion based on observations/results

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: ANIMAL NUTRITION**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe dentitions of an omnivore, carnivore and herbivore.	Carnivores – prominent canines and rigid teeth e.g. dog, lion. Herbivores – flat teeth, no canines and a gap (i.e. diastema) e.g. cows, rabbits, sheep. Omnivores – no prominent teeth, all present e.g. humans, pigs.	<ul style="list-style-type: none"> <li>• Observe the dentition of various type mammalian feeders.</li> <li>• Describe the dentition of each including the dental formula, relative size and shape of (types)</li> </ul>	Diagrams /transparencies of the skulls of known carnivores, herbivores and a mirror (to view their own teeth)  <i>GCSE Biology</i>	Clarity and accuracy of the description of each dentition
Compare the dentitions of omnivore, carnivore and herbivore.		Make an outline drawing of each type of tooth for each dentition, in a given table or graphic organizer.	Worksheet with table or graphic organizer for comparing types of teeth for three types of dentition.	Clarity and accuracy of diagrams
Explain the relationship between the dentitions of omnivore, carnivore and herbivore and their diet.	Carnivore’s teeth are sharp for slicing meat, incisors meet to remove meat from bones. Herbivore’s teeth flat for mashing plant material, teeth continue to grow as feeding is for long periods,. None of omnivore’s teeth are large for specialization.	<ul style="list-style-type: none"> <li>• Make model dentitions</li> <li>• Use models to explain the relationship between size and shape of teeth in each dentition and the type of diet.</li> </ul>	As above <i>GCSE Biology</i>	Rubric for assessing models  Clarity and accuracy (content) in demonstrating the relationship
Observe the digestive tracts of named mammalian omnivore, carnivore and herbivore.	Carnivorous and omnivorous mammals have guts similar to man’s. Herbivores have a special digestive system due to their diet consisting of cellulose, length of large intestine, appendix, behaviour – ruminant /chew cud, pouch in stomach, rabbits digest food twice.	<ul style="list-style-type: none"> <li>• Observe the alimentary canals of various type mammalian feeders.</li> <li>• Describe the alimentary canal of each type of feeder.</li> </ul>	Diagrams /transparencies of the digestive tracts of cow, rabbit, dog, human <i>GCSE Biology</i>	Clarity and accuracy in describing each alimentary canal

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: ANIMAL NUTRITION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare and contrast the digestive tracts of a named herbivore, omnivore and carnivore.	As above	<ul style="list-style-type: none"> <li>• Make an outline scale drawing of each type of alimentary (stretched out) parallel to each other.</li> <li>• Note similarities and differences.</li> </ul>	<i>Modern Biology for Secondary Schools</i>	Clarity and accuracy of diagrams  Number and accuracy of similarities and differences shown
Explain the relationship between the digestive tracts of a named omnivore, carnivore and herbivore and their diet.	As above	<ul style="list-style-type: none"> <li>• Make model alimentary canal</li> <li>• Use models to explain the relationship between size and shape of the alimentary canal and the type of diet.</li> </ul>	<i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i>	Rubric for assessing models  Clarity and accuracy (content) in demonstrating the relationship
Classify vertebrates into feeding groups based on dentition and gut.		<ul style="list-style-type: none"> <li>• Examine diagrams of dentitions given to determine the type of diet of the animal.</li> <li>• Examine diagrams of guts to identify those that belong to herbivores.</li> </ul>	Photographs and diagrams of skulls and dentitions. <i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i>	Number of dentitions and alimentary canals correctly identified

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: AGRICULTURE**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Predict the effects of deforestation on farmland.	Deforestation – soil erosion, loss of humus, drying	<ul style="list-style-type: none"> <li>• Predict the effects of deforestation on farmland.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Valid prediction with plausible reasons
Compare the positive and negative effects of the use of chemicals by subsistence farmers.	Fertilizers, herbicides, pesticides, loss of crops due to pests' destruction reduced.	<ul style="list-style-type: none"> <li>• Identify types of chemicals based on their use.</li> <li>• Research chemicals used in farming – types, the positive and negative effects.</li> <li>• Compare the positive and negative effects of the use of chemicals by subsistence farmers.</li> </ul>	Agriculture resource books.  <i>Biology for CSEC</i>	Accuracy of information, clarity in presentation
Make a presentation on the use of technology in food production in The Bahamas.	Herbicides, pesticides, drip irrigation, Hydroponics, genetically modified stock (food/seeds – insect resistance), tissue culture, greenhouse/shed house production	<ul style="list-style-type: none"> <li>• Identify types of technology used.</li> <li>• State the benefits derived from each method of technology.</li> <li>• Make a presentation on the use of technology in food production in The Bahamas.</li> </ul>	Department of Agriculture Publications	Rubric for assessing oral/visual presentations
Suggest staple crops to be grown (animals raised) in The Bahamas.	Maize, soya bean	<ul style="list-style-type: none"> <li>• Identify possible staple crops/ animals to be raised</li> <li>• Analyse the possibility of raising the crops.</li> <li>• Make a proposal suggesting staple crops to be grown (animals raised) in The Bahamas.</li> </ul>		Correct identification of: <ul style="list-style-type: none"> <li>• crops that might be staples</li> <li>• advantages and disadvantages of the crops</li> <li>• best possible crops</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: AGRICULTURE**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare the population of The Bahamas for each of the past three decades.		<ul style="list-style-type: none"> <li>• Conduct research</li> <li>• Compare the population</li> <li>• Calculate the percentage increase per decade and over the three decades.</li> </ul>	Bahamas Handbook Information from Department Statistics Government publications	Rubric for assessing oral presentations/research (description of the change in population over the past 30 years)
Conduct research to compare the number of farms over 30 years.		<ul style="list-style-type: none"> <li>• Prepare a survey instrument</li> <li>• Conduct a survey to determine the number of commercial and subsistence farms 30 years prior and the number at present in the island/district.</li> </ul>	Information from the Department of Statistics and Agriculture and Marine Resources	Rubric for assessing research (with survey)
Conduct research to find out the percentage of foods consumed that are produced locally.		<ul style="list-style-type: none"> <li>• Identify four foods produced locally that are popular in the diet.</li> <li>• Conduct research to determine the quantity of each food that is consumed annually in The Bahamas.</li> <li>• Conduct research to determine the quantity of each food that is imported annually in The Bahamas.</li> <li>• Calculate the percentage of the total consumption of each food which is satisfied by the quantity of it produced locally.</li> </ul>	Statistics and the Ministry of Agriculture and Marine Resources	Rubric for assessing collecting and processing data
Classify the main threats to agriculture in The Bahamas.	Soil type, depth, rainfall in some islands, hurricanes, animals, invasive species, humans.	<ul style="list-style-type: none"> <li>• Brainstorm the main threats to agriculture in The Bahamas.</li> <li>• Classify the threats.</li> </ul>	Information from the Department of Agriculture	<ul style="list-style-type: none"> <li>• Plausibility of threats cited</li> <li>• Validity of classification</li> </ul>

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: AGRICULTURE**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Suggest means by which the named threats might be reduced or eliminated.	As above Farming methods, seasonal crops, irrigation, hydroponics	Brainstorm Suggest means by which the named threats might be reduced or eliminated.	<i>AQA Science</i>	Plausibility of suggestions made with reasons
Propose a plan for The Bahamas to become more self-sufficient in food production.		<ul style="list-style-type: none"> <li>• Identify one or more food(s) or means of food production</li> <li>• Outline reasons for this food/ means of production selected as a means towards self-sufficiency.</li> <li>• Prepare a proposal (written/audio/visual) to be presented to the Ministry of Agriculture, round table discussion or “town meeting” in the school or local community.</li> </ul>	Information form the Department of Agriculture  <i>AQA Science</i>	Rubric for assessing (oral) presentations
Research use of hydroponics in The Bahamas or Caribbean.	Hydroponics is a system used to grow plants without the presence of soil. It utilizes water and nutrients needed by the seed/seedling to grow.	<ul style="list-style-type: none"> <li>• Research the use of hydroponics in The Bahamas or Caribbean.</li> <li>• Describe the operation of a hydroponics system.</li> </ul>	Photos/ diagrams of a hydroponics system. Internet	Clarity and accuracy in description of the operation of a hydroponics system
Create a model to show how a hydroponics system works.		Create a model of a hydroponics system and explain how it works.	Materials to construct hydroponics system model, Internet  <i>AQA Science</i>	Rubric for assessing models

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: AGRICULTURE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Resolve to buy Bahamian food products keeping a record of products bought.		<ul style="list-style-type: none"> <li>• Identify foods produced on a commercial scale in The Bahamas.</li> <li>• Make a personal resolution to purchase locally-produced foods.</li> </ul>	Information from the Department of Agriculture.	Record of long term behaviour
Begin and maintain a backyard/container garden.		<ul style="list-style-type: none"> <li>• Guest speaker</li> <li>• Identify area, grow boxes etc. and seedlings.</li> <li>• Set up a backyard garden</li> </ul>	As above	Cultivation of at least one type of vegetable/fruit cultivated

**SCOPE OF WORK  
GRADE 10**

**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FISHING**

**DURATION: 3 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify marine organisms that are commonly found in the Bahamian Diet.	Jack, grunt, grouper, turbot, goggle-eye, yellow-tail, snapper, mutton-fish, rock fish, conch, lobster	<ul style="list-style-type: none"> <li>Brainstorm</li> <li>Identify fish and other marine organisms.</li> </ul>	Reef fish poster Photographs of marine animals	Number of marine organisms (seafood) identified
Locate major fishing grounds in The Bahamas.	Reefs, shoals/banks / sounds	<ul style="list-style-type: none"> <li>Classify types of fishing grounds.</li> <li>Locate major fishing areas on map of The Bahamas.</li> </ul>	Map of The Bahamas showing depth of water and reefs.	Number and accuracy of locations of major fishing areas
Research the annual catch for these organisms in Bahamian waters.		<ul style="list-style-type: none"> <li>Identify six marine organisms that are commonly used as seafood.</li> <li>Research the annual catch for each in Bahamian waters.</li> <li>Record the data in order according to quantity.</li> </ul>	Ministry of the Environment and Marine Resources – Department of Fisheries	Rubric for assessing conducting research; collecting and recording data
Calculate the percentage catch of the marine organisms that is exported from The Bahamas.		<ul style="list-style-type: none"> <li>For each organism (above) record the quantity of the total annual catch that is exported.</li> <li>Calculate the percentage catch of each of the marine organisms (above), that is exported.</li> </ul>	As above	Rubric for assessing collecting and processing data
Show the percentage composition of nutrients in three marine foods.	Varies depending on marine foods chosen.	<ul style="list-style-type: none"> <li>Select three of the organisms (above).</li> <li>Find out the percentage composition of nutrients for each of the organisms.</li> <li>Construct a pie-graph to show the proportion of nutrients for each seafood.</li> </ul>	Nutrition tables	Rubric for assessing processing data (pie-graphs)

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FISHING**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Account for the trends observed in graphs of the catches of commercially important fisheries resource in The Bahamas over the last three decades.	The fishing industry is very important to the Bahamian economy. Over the years the income generated from these industries have changed significantly for numerous reasons. The public must be made aware of the importance of this industry as a source of income nationally, so as to encourage others to enter these fields and also support them when possible.	<ul style="list-style-type: none"> <li>• Research trends in fishing industry over last three decades.</li> <li>• Construct/observe graphs of the catches of commercially important fisheries resource in The Bahamas over the last three decades.</li> <li>• Suggest explanations for the trends shown.</li> </ul>	The Bahamas Handbook	Plausibility of explanations given
Identify the main threats to the organisms.	Pollution, dredging, temperature change, poisoning corals, overfishing (including poaching), catching juveniles, invasive species.	<ul style="list-style-type: none"> <li>• Brainstorm</li> <li>• Compile a list of threats to populations of organisms found in the waters of The Bahamas and consumed in The Bahamas.</li> </ul>	Information from the Ministry of Agriculture and Marine Resources	Number and plausibility of possible threats cited
Create a five minute infomercial on the short term economic gain of overfishing vs. the long-term adverse effects.	Overfishing is a problem that is detrimental to the sustainability of the marine ecosystem and subsequently the fishing industry. If not addressed adequately, this may lead to the extinction of certain marine organisms such as the Nassau grouper, and local turtles.	In assigned groups, create a five-minute infomercial on the short term economic gain of overfishing vs. the long-term adverse effects.	News articles, Information from the Ministry of Agriculture and Marine Resources, interviews with fishermen	Rubric for assessing oral/visual presentations (infomercial)

**SCOPE OF WORK  
GRADE 10  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FISHING**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Advocate for sustainable harvesting of popular marine seafood.		<ul style="list-style-type: none"> <li>• List and describe methods that would reduce overfishing, pollution and poisoning organisms.</li> <li>• Prepare an argument/ presentation to convince persons to implement the methods (above) to ensure sustainable harvesting of the marine organisms.</li> <li>• Identify and utilize a medium to promote the advocacy.</li> </ul>		Rubric for assessing oral/visual presentations (convincing argument)
Research use of aquaculture/mariculture in The Bahamas or the Caribbean.		<ul style="list-style-type: none"> <li>• Identify species raised by mariculture.</li> <li>• Describe the conditions necessary for mariculture.</li> <li>• Prepare a brochure to show the advantages and disadvantages of mariculture and supporting its use in The Bahamas as a means of increasing the food needed.</li> </ul>	Ministry of the Environment and Marine Resources – Department of Fisheries	Rubric for assessing visual aids
Propose a plan for The Bahamas to have sustainable fisheries for one seafood.		<ul style="list-style-type: none"> <li>• Identify one seafood.</li> <li>• Describe the conditions necessary for the species not to be threatened.</li> <li>• Prepare a brochure to show a proposed plan for sustainable harvesting of the species in The Bahamas.</li> </ul>	Information from the Ministry of Agriculture and Marine Resources	Rubric for assessing visual aids

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: STRUCTURE AND FUNCTION OF LEAVES, STEMS AND ROOTS**

**DURATION: 2 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe the external features of a maize and hibiscus or sea grape leaf.	The external structures of a leaf include the margin, apex, midrib, side-veins, leaf stalk/petiole, and lamina.	Draw a maize and hibiscus/ sea grape leaf, labeling their structures.	Maize, hibiscus/sea grape leaf, pencils,	Clarity and accuracy of diagrams and labels
Use the microscope correctly and safely to view a prepared slide of a cross-section of a monocotyledonous leaf.	<p>The cells in the leaf are arranged in distinct layers. Each layer is unique and special in its role/function in the process of photosynthesis.</p> <p>Adaptations of leaf structure:</p> <ul style="list-style-type: none"> <li>• Waxy cuticle</li> <li>• Upper epidermis</li> <li>• Palisade mesophyll layer</li> <li>• Spongy mesophyll layer</li> <li>• Xylem</li> <li>• Phloem</li> <li>• Lower epidermis</li> </ul>	<ul style="list-style-type: none"> <li>• Use a microscope to view the internal structures of a monocotyledonous leaf on a prepared slide.</li> <li>• Make a sketch diagram of the main internal structures.</li> </ul>	<p>Microscope, prepared slide of a leaf</p> <p><i>Biology for CSEC</i></p>	<p>Correct and safe handling/use of microscope</p> <p>Clarity and accuracy of diagram</p>
Observe a prepared slide of a dicotyledonous leaf under a microscope.		<ul style="list-style-type: none"> <li>• Observe the internal structures of a dicotyledonous leaf on a prepared slide using a microscope.</li> <li>• Make a sketch diagram of the main internal structures.</li> </ul>	<p><i>GCSE Biology</i> <i>Longman Biology for CSEC</i></p>	<p>Clarity and accuracy of diagram</p>

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: STRUCTURE AND FUNCTION OF LEAVES, STEMS AND ROOTS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Relate the internal features to the external features for the monocotyledonous and dicotyledonous leaves.		<ul style="list-style-type: none"> <li>• Compare the arrangement of vascular bundles/veins in the internal view of a monocotyledonous leaf and their arrangement on the maize leaf (external view).</li> <li>• Compare the arrangement of vascular bundles/veins in the internal view of a dicotyledonous leaf and their arrangement on the hibiscus/sea grape leaf (external view).</li> </ul>	Microscope, prepared slide of a leaf	Clarity and accuracy (content) in demonstrating the relationship
Relate the appearance of each internal structure of a leaf seen to its function in photosynthesis.	Epidermis, palisade mesophyll, spongy mesophyll (intercellular spaces), xylem, phloem, guard cells	Use diagrams or models of tissues in a leaf to explain how the appearance of each internal structure is adapted to its function in photosynthesis.	Microscope, cut-out diagrams or models of tissues <i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing oral presentations
Describe the arrangement of tissues in the vascular bundles in leaves.	Top – bottom: sclerenchyma, xylem, phloem	<ul style="list-style-type: none"> <li>• Make an outline diagram of tissues in the vascular bundles.</li> <li>• Label the diagram.</li> </ul>	Microscope, prepared slides of leaves, textbook  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of diagram and labels

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: STRUCTURE AND FUNCTION OF LEAVES, STEMS AND ROOTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare the external appearance of the dicotyledonous leaf with modified leaves.	Leaves of: water hyacinth, pine/casuarinas, cactus, pusley/portulaca, sesuvium, white mangrove, onion (bulb)	<ul style="list-style-type: none"> <li>• Use dicotyledonous leaf as standard to compare modified leaves in: size, shape, thickness of cuticle, thickness of leaf, pubescence, frequency and positioning of stomata, salt-secreting glands.</li> <li>• Note features in table showing comparisons.</li> <li>• Classify modifications according to the type environment.</li> <li>• Justify modifications as adaptations to aquatic/halophytic/ xerophytic environment.</li> </ul>	<i>Caribbean Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Table – accuracy of information, number of comparisons</li> <li>• Correct classification of modifications</li> <li>• Clarity and accuracy (content) in demonstrating the relationship between the modified feature and the conditions of the plant’s habitat</li> </ul>
Observe the internal features of a cross-section of a monocotyledonous stem.	Scattered vascular bundles, epidermis, ground tissue	<ul style="list-style-type: none"> <li>• Observe prepared slides of T. S. monocotyledonous stem.</li> <li>• Make an outline diagram of a T. S. monocot. Stem</li> <li>• Label the diagram.</li> </ul>	Prepared slides, microscope  <i>Modern Biology for Secondary Schools</i>	Clarity and accuracy of diagram and labels
Observe the internal features of a cross-section of a dicotyledonous stem.	Vascular bundles in ring, pith, endodermis, epidermis	<ul style="list-style-type: none"> <li>• Observe prepared slides of T. S. dicotyledonous stem.</li> <li>• Make an outline diagram of a T. S. dicot. stem</li> <li>• Label the diagram.</li> </ul>	Prepared slides, microscope <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Modern Biology for Secondary schools</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of diagram and labels

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**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: STRUCTURE AND FUNCTION OF LEAVES, STEMS AND ROOTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare the internal features of monocotyledonous and dicotyledonous stems.	Arrangement of vascular bundles, pith, sclerenchyma, cambium	Use a graphic organizer to compare and contrast the internal features of monocot and dicot stems.	<i>Modern Biology for Secondary Schools</i>	Clarity and accuracy of diagram and information
Observe the internal features of a longitudinal-section of a dicotyledonous stem.	Xylem, phloem sieve tubes, companion cells,	<ul style="list-style-type: none"> <li>• Observe prepared slides of L. S. dicotyledonous stem.</li> <li>• Make an outline diagram of a L. S. dicot. stem</li> <li>• Label the diagram.</li> </ul>	Prepared slides, microscope <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Modern Biology for Secondary Schools</i>	Clarity and accuracy of diagram and labels
Explain the advantage of bark on stems.	Height, withstand winds, protection, habitat for small animals, longevity, economic importance.	Participate in a debate “stem barks are disadvantageous to plants and humans”.		Number and validity of points made in debate
Compare the external appearance of the dicotyledonous stem with modified stems.	Opuntia (prickly pear), rhizomes, stolons, runners, climbers, tubers	Complete worksheet comparing the external appearance of the dicotyledonous stem with modified stems.	<i>Modern Biology for Secondary Schools</i>	Correct completion of worksheet
Observe the internal features of a cross-section of a monocotyledonous root.	Xylem, phloem, cortex, pith	<ul style="list-style-type: none"> <li>• Observe prepared slides of T. S. monocotyledonous root.</li> <li>• Make an outline diagram of a T. S. monocot. root</li> <li>• Label the diagram.</li> </ul>	Prepared slides, microscope  <i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i>	Clarity and accuracy of diagram and labels
Observe the internal features of a cross-section of a dicotyledonous root.	Xylem, phloem, cortex, pith	<ul style="list-style-type: none"> <li>• Observe prepared slides of T. S. dicotyledonous root.</li> <li>• Make an outline diagram of a T. S. dicot. root</li> <li>• Label the diagram.</li> </ul>	Prepared slides, microscope  <i>Biology for CSEC</i> <i>Modern Biology for Secondary Schools</i>	Clarity and accuracy of diagram and labels
Compare the internal features of monocotyledonous and dicotyledonous roots.	Relative number of xylem and phloem vessels	Use a graphic organizer to compare and contrast the internal features of monocot and dicot roots.	<i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i>	Clarity and accuracy of diagram and information

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**UNIT: STRUCTURE AND FUNCTION OF LEAVES, STEMS AND ROOTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Observe the internal features of a longitudinal-section of a dicotyledonous root.	Xylem, phloem sieve tubes, companion cells	<ul style="list-style-type: none"> <li>Observe prepared slides of L. S. dicotyledonous root.</li> <li>Make a model L. S. dicot. root</li> </ul>	Prepared slides, microscope <i>GCSE Biology</i>	Rubric for assessing models
Compare the external appearance of the dicotyledonous root with modified roots.	Buttress, clasping, tuber, breathing, stilt, prop, sucking, epiphytic	Complete worksheet comparing the external appearance of the dicotyledonous root with modified root.	<i>Caribbean Biology</i> <i>Modern Biology for Secondary Schools</i>	Correct completion of worksheet
Compare the internal structure of a dicot root with a dicot stem.	Position of xylem to phloem, arrangement of vascular tissue, pith, endodermis, cortex	Use a graphic organizer to compare and contrast the internal features of dicot stem and root.	<i>Modern Biology for Secondary Schools</i> <i>Biology for CSEC</i> <i>GCSE Biology</i>	Clarity and accuracy of diagram and labels

## SCOPE OF WORK

### GRADE 10

#### STRAND: ANIMAL ANATOMY AND PHYSIOLOGY

##### UNIT: RESPIRATION

**DURATION: 4 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Trace the pathway of air into the leaf for respiration.	Air moves in through stomata and inter-cellular spaces to cells.	Trace the pathway of air into the leaf cells for respiration.	Unlabelled T. S. leaf showing outline tissues and cells. <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct pathway
Classify examples of respiration as aerobic or anaerobic.	Definitions of: respiration, aerobic respiration, anaerobic respiration.	<ul style="list-style-type: none"> <li>• Define aerobic and anaerobic respiration.</li> <li>• Classify examples of respiration as aerobic or anaerobic.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct classification of respiration
Design, and conduct an experiment to demonstrate aerobic respiration in plant parts.	Roots, stems, leaves, flowers	<ul style="list-style-type: none"> <li>• Setup similar experiments with a specific part of the plant in each conical flask, an ignition tube with colourless lime water suspended by thread/string, sealed with rubber stopper.</li> <li>• Variables kept constant.</li> <li>• Control experiment setup.</li> </ul>	Conical flasks, ignition tubes, rubber stoppers, string, Vaseline, lime water, parts of plants (roots, stem, leaves, flowers)  <i>Modern Biology for Secondary Schools</i> <i>Biology for CSEC</i>	Rubric for assessing investigations
Design, and conduct an experiment to demonstrate aerobic respiration in animals.	Woodlice	Setup similar experiments with a specific part of the plant in each conical flask, an ignition tube with colourless lime water suspended by thread/string, sealed with rubber stopper.	Conical flasks, ignition tubes, rubber stoppers, string, Vaseline, lime water, small animals  <i>Biology for CSEC</i>	Rubric for assessing investigations
Use materials and apparatus to demonstrate the production of carbon dioxide during aerobic respiration.		Use materials and apparatus to demonstrate the production of carbon dioxide during aerobic respiration.	Conical flasks, ignition tubes, rubber stoppers, string, Vaseline, lime water, small animals <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing correct and safe use of apparatus and materials

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**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Predict the products of anaerobic respiration.		Predict the products of anaerobic respiration.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Plausibility of predictions made
Use materials and apparatus to demonstrate anaerobic respiration.	Yeast respire anaerobically, changing glucose (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ) to ethanol (C <sub>2</sub> H <sub>5</sub> OH) and carbon dioxide (CO <sub>2</sub> ). The test for carbon dioxide is that it turns clear lime water cloudy or milky white. Anaerobic respiration in yeast is also called <b>alcoholic fermentation</b> . The carbon dioxide produced when yeast respire is used to make dough and batter (for bread, cakes...) rise in baking and to give alcoholic beverages their sparkle or 'fizz' in brewing.	Use apparatus and materials provided to demonstrate anaerobic respiration.	Boiling and test tubes, mango (or other fruit)/sugar, water, delivery tube, yeast, one-hole stopper, lime water, mortar, pestle, oil <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing correct and safe handling of apparatus and materials
Design and conduct an experiment to demonstrate anaerobic respiration in yeast.		<ul style="list-style-type: none"> <li>• Plan an experiment</li> <li>• Setup experiment: food substrate, yeast water in airtight boiling tube.</li> <li>• Setup experiment food substrate, yeast water with oil on surface in boiling tube, one hole stopper, delivery tube into test tube with limewater.</li> <li>• Filter contents from first experiment (after 4 weeks), distill the filtrate. Smell (do not taste) the distillate (70°C)</li> </ul>	<i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing investigations

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**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe and describe changes that take place when yeast respire anaerobically.		<ul style="list-style-type: none"> <li>• Observe changes that take place when yeast respire anaerobically.</li> <li>• Describe the changes observed as a result of anaerobic respiration.</li> </ul>	<i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Number and quality (details) of observations, clarity in description
Research the economic importance of yeast.		Produce a pamphlet to explain the use of yeast cells in baking bread and brewing alcoholic beverages.	Internet, Encyclopedia <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing research; pamphlet
Differentiate between aerobic and anaerobic respiration.	<b>Aerobic</b> means that respiration takes place in the presence of oxygen. The food molecules are combined with and oxidized by oxygen. The glucose is converted to CO <sub>2</sub> and H <sub>2</sub> O and lots of free energy is released. <b>Anaerobic</b> means that respiration takes place in the absence of oxygen. The glucose is not completely oxidized to CO <sub>2</sub> and H <sub>2</sub> O, but is converted to CO <sub>2</sub> and C <sub>2</sub> H <sub>5</sub> OH (alcohol) or to C <sub>3</sub> H <sub>6</sub> O <sub>3</sub> (lactic acid). Only little energy is released.	Indicate the differences between aerobic and anaerobic respiration in a table.	Ruler  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Number and clarity of differences indicated
Use a diagram to explain the role of ATP in cellular respiration.	ATP dissociates into ADP and releases a phosphate with energy that is available for use in the cell.	Use a diagram to explain the role of ATP in cellular respiration.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing oral presentations

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**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Summarize the processes of aerobic and anaerobic respiration in word equations.		<ul style="list-style-type: none"> <li>• Create a graphic organizer to summarize aerobic respiration in both yeast and muscle cells.</li> <li>• Create a graphic organizer to summarize anaerobic respiration in both yeast and muscle cells.</li> </ul>	<i>Longman Biology for CSEC</i>	Clarity and accuracy of diagram and information
Summarize the processes of aerobic and anaerobic respiration in chemical equations.		Use the word equations for aerobic and anaerobic respiration (and prior knowledge) to construct balanced chemical equations.	<i>AQA Science GCSE Biology Biology for CSEC Longman Biology for CSEC</i>	Correct chemical equations
Describe what makes the internal features of a mitochondrion suitable for respiration.	The mitochondrion is a tiny rod-like, spherical, or elongated organelle where aerobic respiration occurs. It is referred to as the ‘ <b>powerhouse</b> ’ of the cell because it generates all of the cell’s energy. The inner membrane of the mitochondria is greatly folded ( <b>cris</b> tae), increasing its surface area.	<ul style="list-style-type: none"> <li>• Examine a diagram showing the internal features of a mitochondrion</li> <li>• Describe what makes the internal features of a mitochondrion suitable for respiration</li> </ul>	Diagram/photomicrograph of the mitochondria  <i>AQA Science Biology for CSEC Longman Biology for CSEC CXC Human and Social Biology</i>	Clarity and accuracy of the explanation of the adaptations of the mitochondria for respiration
Make a model showing the internal structure of the mitochondrion.	Many chemical reactions take place on this inner membrane. The fluid area inside the mitochondria is called the <b>matrix</b> . It is filled with water and proteins (enzymes). The proteins combine food molecules with oxygen and the material is digested. This keeps the cell full of energy.	<ul style="list-style-type: none"> <li>• Observe the internal feature of a mitochondrion and explain how it is adapted for respiration.</li> <li>• Construct a model of a mitochondrion showing cristae on the internal surface.</li> </ul>	A variety of craft materials, scissors, glue  <i>AQA Science Biology for CSEC Longman Biology for CSEC</i>	Rubric for assessing models

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**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Infer why it is better to breathe through the nose than through the mouth.</p>	<p>The trachea and larger air passages are lined with mucus secreting cells. The mucus traps dirt and bacteria in inhaled air. Tiny hair-like structures called <b>cilia</b> cover some cells and beat back and forth very quickly, sweeping the mucus and trapped particles back towards the mouth, preventing them from entering the lungs. A network of capillaries underlies the ciliated mucus membrane and blood in the capillaries warm the incoming air. Hence, air entering the nose is warmed, moistened, and filtered. These protective functions are not performed when air is breathed in through the mouth, increasing the risk of infection.</p>	<ul style="list-style-type: none"> <li>• Examine the features of the nose and mouth as portals for breathing.</li> <li>• Compare the efficiency of the nose and mouth as entrances for breathing.</li> <li>• Make an annotated diagram of the nose/nasal passages and pharynx.</li>   <li>• Referring to the differences in the linings of the respiratory passage and the alimentary canal, explain why it is better to breathe through the nose than through the mouth.</li> </ul>	<p>Photomicrographs</p> <p><i>AQA Science</i>  <i>Biology for CSEC</i>  <i>CXC Human and Social Biology</i></p>	<ul style="list-style-type: none"> <li>• Clarity and accuracy of diagram and information</li>   <li>• Plausibility of suggested consequences of breathing through the mouth as opposed to breathing through the nose; clarity of suggestions</li> <li>• Correct advantages of breathing through the nose</li> </ul>
<p>Create a model of a human lung.</p>		<p>Create a model of a human lung.</p>	<p>Internet</p> <p><i>Longman Biology for CSEC</i></p>	<p>Rubric for assessing models</p>

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**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Construct a model of the human respiratory system to demonstrate breathing.	Breathing involves <b>inhaling</b> and <b>exhaling</b> . When we inhale, the diaphragm and intercostal muscles contract, pushing the ribs up and out. This increases the volume in the thorax, but decreases the pressure. Air rushes in through the nose and mouth, forcing the lungs to expand or inflate. When we exhale, the diaphragm and intercostals muscles relax, pulling the ribs down and in. This decreases the space in the thorax and increases the pressure. Air rushes out of the lungs, causing them to deflate.	<ul style="list-style-type: none"> <li>Construct a working model of the respiratory system</li> <li>Utilize the model of the respiratory system to orally explain how breathing occurs in humans.</li> </ul>	Plastic bottle/cup, scissors, balloons (large and small), tape, straw, elastic bands.  <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing models  Rubric for assessing oral presentations
Draw pie graphs comparing the composition of inspired and expired air.	As air is breathed in and crosses the respiratory membranes, it is moistened. The oxygen in the air is used for respiration and carbon dioxide is released. Nitrogen cannot be used in its gaseous state by human beings hence, the percentage is the same in exhaled and inhaled air. Exhaled/expired air has a lower oxygen but a higher carbon dioxide and water vapour content than inhaled/inspired air	Draw pie graphs comparing the composition of inspired and expired air.	Ruler, compass, pencil, protractor, calculator <i>AQA Science</i> <i>GCSE Biology</i>	Accuracy of pie charts/graphs
Compare the colour of blood before and after passing alveoli.		Dramatize the changes in gaseous composition of blood as it approaches and leaves the alveoli.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing oral presentations
Compare relative amounts of carbon dioxide in inhaled and exhaled air.		Observe changes in the color of lime water when air is breathed out.	Test tubes, delivery tubes, rubber bungs, rubber tubing, lime water, drinking straws <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Quality (details) of observations; clarity of description

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**UNIT: RESPIRATION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Describe the passage of an oxygen molecule from the air to a capillary in the lungs.	When air is inhaled, it passes along the nasal passages, down the trachea and into the bronchial tubes until it reaches the lungs. Oxygen molecules then diffuse from the air into the blood in the capillaries.	<ul style="list-style-type: none"> <li>Trace the passage of an oxygen molecule from the air to a capillary in the lungs.</li> <li>Create a visual presentation to show the passage.</li> </ul>	Diagram of respiratory system, markers  <i>AQA Science</i> <i>Biology for CSEC</i>	Rubric for assessing visual presentations
Use a stopwatch to measure the number of breaths taken per minute.	Breathing rate is the number of breaths a human takes per minute. At rest, we normally inhale and exhale about 16 to 25 times per minute. The rate is faster in males and slower in athletes.	With a partner, measure and record the number of breaths per minute for each other.	Stopwatch/watch	Correct and safe use of stopwatch; Rubric for assessing collecting and recording data
Calculate the average breathing rate for the class.		<ul style="list-style-type: none"> <li>Measure number of breaths for partners for 30 seconds</li> <li>Record class data.</li> <li>Use measurements obtained for each classmate to calculate the average breathing rate per minute for the class.</li> </ul>		Rubric for assessing collecting and processing data
Predict the effect specific factors/different types of exercise have on breathing rate.	Breathing rate increases with exercise, age, weight, and less physical fitness.	Suggest and explain how factors, such as exercise, gender, age, weight... affect the rate of breathing.	Stopwatch/watch and any equipment needed for exercise (e.g. stairs, hoola-hoop, skipping rope)	Clarity and plausibility/logical predictions
Explain how the process of breathing is controlled.	High concentrations of carbon dioxide in the blood stimulates the brain to send messages to initiate inhaling.	<ul style="list-style-type: none"> <li>Describe the relationship between the carbon dioxide concentration and breathing rate and depth.</li> <li>Draw a diagram summarizing the cycle that controls breathing.</li> </ul>	<i>Human Form &amp; Function</i> <i>CXC Human and Social Biology</i>	Clarity and accuracy (content) in demonstrating the relationship  Rubric for assessing visual aids

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**UNIT: RESPIRATION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Construct a bar graph comparing average breathing rates before and after exercise.	When the muscles work harder, they require more oxygen and the extra carbon dioxide produced must be removed as quickly as possible before it builds up and poisons the tissues. To accomplish this, we must breathe deeper and faster. Faster breathing rate supplies the increased oxygen demand.  Heat, altitude, carbon dioxide	Draw a bar graph to show the average breathing rates of three boys and three girls before and after performing the same exercise for the same length of time.	Graph paper, pencil, ruler  <i>CXC Human and Social Biology</i>	Clarity and accuracy of bar graph
Recognize and control variables when measuring breathing rates.		Recognize and control variables when measuring breathing rates after numerous activities.	Stopwatch <i>CXC Human and Social Biology</i>	Correct variables identified; attempts to control them
Design and conduct an experiment to determine the effect of different types of exercise on the rate of breathing.		Plan, perform, and record an experiment to explain the effect different types of exercise (jogging, jumping jacks, climbing stairs, bicycling...) have on breathing rate.	Stopwatch, exercise equipment <i>CXC Human and Social Biology</i>	Rubric for assessing investigations
Formulate a hypothesis about the effect of factors on the rate of breathing.	Temperature, carbon dioxide level, sudden noise	Formulate a hypothesis about the effect of different factors on the rate of breathing.	Stopwatch <i>CXC Human and Social Biology</i>	Clarity and plausibility of hypothesis and reasons

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**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Plan and perform an experiment to determine lung capacity.		<ul style="list-style-type: none"> <li>Plan an experiment to determine lung capacity</li> <li>Perform an experiment to determine the effect of exercise on lung capacity.</li> </ul>	Balloons, measuring tape, string, ruler, pencil, stairs, exercise machine <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing investigations
Use a balloon and measuring tape to investigate the capacity of the lungs.	The total amount of air which a person can breathe in is called the <b>vital capacity</b> . It represents the total volume of the lungs when fully inflated. The maximum amount for an adult male is usually between 4-5 L. It increases in trained athletes and decreases in females. Lung capacity is also affected by age, height, and weight.	Select a partner and use balloons and a measuring tape to measure each other's lung capacity.	Balloons, measuring tape, string, ruler, pencil	Rubric for assessing correct and safe handling of apparatus and materials
Measure the circumference of inflated balloons to compare the lung capacity of students.		Measure the lung capacities of a select group of students (boys and girls, athletes and non-athletes).		Accuracy of measurements, clarity of recording measurements of lung capacity
Recognize and explain the relationship between the structure of the alveolus and gas exchange.	There are millions of alveoli in each lung, producing a large surface area for gas exchange. Each alveolus is surrounded by a network of capillaries in which oxygen and carbon dioxide are transported. The membrane separating the alveolus and capillaries is extremely thin so the gases only have a short distance to diffuse across. A thin layer of fluid in which the oxygen dissolves covers each alveolus.	<ul style="list-style-type: none"> <li>Identify the special features of the alveolus</li> <li>Explain how the features of an alveolus relate to its function in gaseous exchange.</li> </ul>	Internet, Diagrams/Photographs of an alveolus  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Clarity and logical explanation of how the structure and features of alveoli make them suited for gaseous exchange

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**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Predict the direction in which oxygen and carbon dioxide molecules move across gas exchange surfaces based on the principles of diffusion.</p>	<p>Diffusion is the movement of molecules from an area of high concentration to an area of low concentration until they are evenly spread. Since the air in the alveolus has a higher concentration of oxygen than blood entering the capillary, oxygen diffuses from the air into the blood. There is more carbon dioxide in the blood in the capillary than in the air in the alveolus. Therefore, carbon dioxide diffuses from the blood into the air.</p>	<ul style="list-style-type: none"> <li>• Create a concept map showing the directions in which oxygen and carbon dioxide molecules will diffuse across a gas exchange surface.</li> <li>• Draw a diagram of the alveolus and use colored arrows (red and blue) to show the movement of oxygen and carbon dioxide across the alveolar wall.</li> </ul>	<p>Poster paper, markers/colored pencils/crayons</p> <p><i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i></p>	<ul style="list-style-type: none"> <li>• Clarity and accuracy of concept map</li> <li>• Rubric for assessing visual presentations</li> </ul>
<p>Predict the effects of smoking on gas exchange.</p>		<p>Suggest how smoking affects gas exchange.</p>	<p>Human Form and Function <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i></p>	<p>Clarity and plausibility of suggestions on the effect of smoking on gas exchange</p>
<p>Observe photographs of the lungs of smokers and non-smokers.</p>	<p>Cigarette smoke contains <b>carcinogens</b> or cancer-causing agents. Therefore, persons who smoke are more likely to get <b>lung cancer</b> than non-smokers. Smoking also causes destruction of cilia so the air is not filtered and this causes bronchial infections or <b>bronchitis</b>. The production of excess mucus leads to the characteristic “<b>smoker’s cough</b>”.</p>	<ul style="list-style-type: none"> <li>• Observe photographs of the lungs of smokers and non-smokers.</li> <li>• Compare the lung tissue of both.</li> <li>• Identify effects of smoking on lung tissue.</li> <li>• Make inferences or draw conclusions on effect of smoking on the respiratory system.</li> </ul>	<p>Photographs of lung tissue from smokers and non-smokers; Internet,</p> <p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i></p>	<ul style="list-style-type: none"> <li>• Number and validity of similarities and differences cited in the comparison of the lungs of smokers and non-smokers</li> <li>• Clarity and logic of inferences made on effect of smoking on the respiratory system</li> </ul>

**SCOPE OF WORK**  
**GRADE 10**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: RESPIRATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Explain the relationship between cigarette smoking and lung disease.</p>	<p>Repeated coughing may rupture the delicate walls of the alveoli, decreasing the surface area for gas exchange. This results in a condition called <b>emphysema</b>, where persons become short of breath very easily.</p>	<ul style="list-style-type: none"> <li>• Research lung diseases caused by smoking</li> <li>• Identify the frequency of these diseases in smokers versus non-smokers.</li> <li>• Orally explain the relationship between smoking and these diseases.</li> </ul>	<p><i>Human Form &amp; Function</i>  <i>GCSE Biology</i>  <i>Biology for CSEC</i>  <i>Longman Biology for CSEC</i>  <i>CXC Human and Social Biology</i></p>	<p>Rubric for assessing oral presentations</p>

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: AIR POLLUTION**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Explain the terms pollution and pollutant.	Definitions and examples	Make a “jingle” or rhyme to explain the concept of pollution and pollutant	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing oral presentations
Research main air pollutants.	Carbon dioxide, exhaust emissions, CFCs, smoke, dust, sulphur dioxide producing acid rain, CFCs, carbon monoxide, oxides of nitrogen; smog formation, photochemical smog	<ul style="list-style-type: none"> <li>• Conduct research to identify the main air pollutants.</li> <li>• Use a table to record the effects and source of each pollutant.</li> <li>• Write a short story to highlight the negative effects of smog.</li> </ul>	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Clarity and accuracy of diagram and information Rubric for assessing (“script”) oral presentations
Conduct a sample survey to ascertain the extent to which CFCs are used in the community.	Chlorofluorocarbonates	<ul style="list-style-type: none"> <li>• Compile a list of products that contain CFCs</li> <li>• Design and produce a simple questionnaire.</li> <li>• Conduct the survey</li> <li>• Analyse the data.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> Internet	Rubric for collecting and processing data
Relate the use of CFCs to the depletion of the ozone layer.		<ul style="list-style-type: none"> <li>• Research data on the rate of ozone depletion.</li> <li>• Identify places where ozone depletion is greatest.</li> <li>• Identify sources releasing CFCs to the atmosphere.</li> <li>• Note the effects of CFCs on the ozone layer.</li> <li>• Make a visual presentation for use at a town meeting to persuade persons to become good stewards of the environment with regards to CFCs.</li> </ul>	<i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing visual presentations

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: AIR POLLUTION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Conduct an investigation to compare dust pollution in different areas.	(see content on Air pollution above)	Investigate how much dust is collected on different walls (such as wall exposed to a busy road vs. wall inside the building).	Vaseline; microscope slides, scotch tape magnifying glass Biology for Life <i>CXC Human and Social Biology</i>	Rubric for assessing experimental reports
Read a news article on “climate change”	Biodiversity	Complete a worksheet: <ul style="list-style-type: none"> <li>• Indicators of climate change</li> <li>• The rate of change for each indicator</li> </ul>	Local daily newspapers Magazines, Internet	Correct completion of the worksheet
Explain the greenhouse effect.	Carbon dioxide layer is easily penetrated by high energy rays from sun. Reflected rays have less energy cannot pass through layer to leave atmosphere. Rays are trapped in the atmosphere. Temperature rise – “global warming”	<ul style="list-style-type: none"> <li>• Find out the principle of greenhouses</li> <li>• Review articles on the greenhouse effect</li> <li>• Explain using a visual aid why the term “greenhouse effect” is applied to the climate.</li> </ul>	Magazines, Internet, Science resource books  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing oral and visual presentations
Formulate a hypothesis as to the aspects of climate change that will affect The Bahamas.	Extreme temperatures, death of corals/reef, rise in sea levels, higher category hurricanes.	Formulate a hypothesis as to the aspects of climate change that will affect The Bahamas.	As above	Clarity and plausibility of the hypotheses and reasons given
Predict the decade in which The Bahamas would notice the change in climatic factors using scientific models.		<ul style="list-style-type: none"> <li>• Research the rate of increase in average temperature/sea level.</li> <li>• Calculate the rate of increase per decade.</li> <li>• Predict the decade in which The Bahamas would notice the change in climatic factors using scientific models.</li> </ul>	Internet	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data</li> <li>• Clarity and plausibility of prediction and reasons</li> </ul>
Identify the climatic factors in The Bahamas that would be most affected by climate change.	As above	Identify the climatic factors in The Bahamas that would be most affected by climate change.		Number and validity of factors identified; plausibility of reasons

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: AIR POLLUTION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Design and conduct an investigation to ascertain the knowledge and response level of persons to “climate change”.		<ul style="list-style-type: none"> <li>• Design a questionnaire to ascertain the knowledge and response level of persons to “climate change”</li> <li>• Conduct a sample survey</li> <li>• Analyse data collected</li> <li>• Formulate conclusions</li> </ul>	<i>Biology for CSEC</i>	Rubric for assessing investigations
Analyze the efforts of government to reduce carbon dioxide emissions in the country.	Greenhouse gases including: carbon dioxide, methane and nitrous oxide	Conduct research to determine laws that regulate: <ul style="list-style-type: none"> <li>• Exhaust fumes</li> <li>• Burning trash</li> <li>• Industrial emissions</li> <li>• Green spaces</li> <li>• Fuels</li> </ul> Based on the research findings, write a position statement rating the government’s efforts to reduce carbon dioxide emissions.	Internet (government publications, NGO environmental agencies)	Rubric for assessing research
Investigate the use of alternative energy sources that would reduce greenhouse gas emissions.		<ul style="list-style-type: none"> <li>• Investigate the use of alternative energy sources that would reduce greenhouse gas emissions; include local efforts as far as possible.</li> <li>• Debate the validity of the statement that greenhouse gases emissions have direct negative affects on humans and other organisms.</li> </ul>	Physics resource/textbooks	Rubric for assessing investigations  Rubric for assessing oral presentations

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: AIR POLLUTION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Analyze the efforts of schools to educate students towards reversing global warming factors.		Conduct research to determine the extent to which schools educate students towards reversing global warming factors: <ul style="list-style-type: none"> <li>• Taught curriculum</li> <li>• Hidden curriculum</li> <li>• Eco-school programmes implemented.</li> </ul> Based on the research findings, write a position statement rating the extent to which schools educate students towards reversing global warming factors.	Curricula for various subjects at different grade levels (primary, junior & senior high schools).	Rubric for assessing research
Research what may happen to small islands/ bays as a result of climate change/global warming.	Define climate change; “a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is observed over long time-periods (many decades)” <sup>2</sup> likely impacts of climate change on biodiversity.	<ul style="list-style-type: none"> <li>• Research what may happen to small islands/ bays as a result of climate change/global warming.</li> <li>• Critically analyse the information read.</li> <li>• Make an oral presentation (speech, dramatic monologue, debate).</li> </ul>	Internet sources e.g. <a href="http://www.sandwatch.org">www.sandwatch.org</a> <a href="http://www.unfccc.org">www.unfccc.org</a> <a href="http://www.ipcc.ch">www.ipcc.ch</a> ; Bahamian governmental and non governmental environmental protection agencies. Bahamas Environmental Handbook (BEST Commission)  <i>AQA Science</i>	Rubric for assessing research  Rubric for assessing oral presentations

<sup>2</sup> Sandwatch manual Gillian Cambers and Paul Diamond  
Biology Curriculum 2010, Grades: 10 – 12

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: LAND POLLUTION**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Create a poster representing the causes, process and effects of ozone depletion.	Chlorofluorocarbons (CFCs) used in the making of aerosol sprays, refrigerants and plastic foam causing thinning of ozone layer which helps to block harmful UV rays from the sun, may lead to increased risk of skin cancer; holes in ozone layer first appeared in 1985.	<ul style="list-style-type: none"> <li>Find out the causes of ozone depletion</li> <li>Note points in the process of ozone depletion.</li> <li>Collect and display items that cause (aerosol cans, etc) ozone depletion</li> <li>Create a poster representing the causes, process and effects of ozone depletion.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing visual aids/presentations
Formulate a personal commitment to become a good steward of the environment in utilizing “green” practices.		Formulate a personal commitment to become a good steward of the environment in utilizing “green” practices.	BNT Publications Ministry of Environmental Publications	Long-term behaviour
Suggest “green” practices that every person could use.	Conserve electricity, maintain green spaces, regularly service vehicles	Prepare a brochure or cartoon encouraging everyone to do their part by committing to environmentally good practices.	As above	Rubric for assessing visual presentations
Classify main land pollutants.	Chemicals – batteries, agricultural (fertilizers, pesticides) oil, paints, gasoline, solid wastes: cars, stoves, refrigerators, tools, appliances Containers – (rubber, plastic, glass, Styrofoam) biomedical waste.	<ul style="list-style-type: none"> <li>Brainstorm land pollutants</li> <li>Classify land pollutants according to their source</li> <li>State the effects of each pollutant on the environment.</li> </ul>	<i>AQA Science</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Plausibility of classification method and criteria
Suggest methods of controlling the main land pollutants.		Suggest methods of controlling the major land pollutants.	Publications DEHS	Clarity and validity of methods and plausibility of explanations

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: LAND POLLUTION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Promote the theme “Reduce, Reuse, Recycle”.	Biodegradable vs. nonbiodegradable waste; recycling	<ul style="list-style-type: none"> <li>Classify waste as biodegradable and non-biodegradable.</li> <li>Prepare a brochure or video presentation entitled “A practical guide to Reduce, Reuse, Recycle your Waste”.</li> </ul>	<i>Biology for CSEC</i> <i>DEHS publications</i> <i>CXC Human and Social Biology</i>	Plausibility of classification method and criteria  Rubric for assessing visual presentations
Recognize the relationship between types of solid waste produced and the lifestyle of residents.		Match pollutants with persons who would discard them e.g. oil, gasoline, rubber tyres	Publications DEHS	Clarity and accuracy (content) in demonstrating the relationship
Construct a model that may be used by householders or a small business to reuse one of the named land pollutants.		Design and construct a model that may be used by householders or a small business to reuse one of the named land pollutants.		Rubric for assessing models
Produce an anti-litter brochure.		Prepare a brochure that: <ul style="list-style-type: none"> <li>Identifies the main land pollutants on the island.</li> <li>Identify the source(s) for each pollutant.</li> <li>State the effects of each pollutant.</li> <li>Suggest methods of controlling pollution caused by each pollutant.</li> </ul>	Department of Environmental Health Services Observations Survey data	Rubric for assessing visual presentations

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: WATER POLLUTION**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Formulate a hypothesis as to the most common pollutant in the sea/beach.		Formulate a hypothesis as to the most common pollutant in the sea/beach.		Clarity and plausibility of hypothesis and reasons
Conduct an investigation to determine the types of pollutants found on beaches.	Bottles, plastic bags, disposable cups, plates, forks, plastic containers, beverage cans, clothing, wood	Participate in a beach/coastal clean-up.	Data sheets	
Classify pollutants.	Glass, wood, styrofoam, plastic, cans, metal objects	<ul style="list-style-type: none"> <li>• Sort/classify items collected</li> <li>• Count the items in each group</li> </ul>		Validity of classification method and criteria Rubric for assessing collecting data
Calculate the percentage of pollutant items collected which comprise the major pollutant.		Calculate the percentage of pollutant items collected which comprise the major pollutant.	Data from investigation(s)	Rubric for assessing processing data
Make an inference/draw a conclusion as to the major pollutant in the sea.		Make an inference/draw a conclusion as to the major pollutant in the sea.	Completed data sheets	Clarity and accuracy of inference/conclusion based on data collected
Investigate water pollutants from a suspected polluted source.	(see content on Water pollution)	Investigate water pollutants from a suspected polluted source (e.g. bay, harbor, pond).	String, metal disc coloured black and white, glass containers, litmus or universal indicator, filter paper, filter funnel, evaporating dish heat source, measuring cylinders <i>CXC Human &amp; Social Biology</i>	Rubric for assessing investigations: clarity of written report
Compare the pollutants found in inland water with those found in the sea.	Inland - Household garbage, sewage,	<ul style="list-style-type: none"> <li>• Brainstorm as a class</li> <li>• Compare and contrast pollutants found in two water environments on a Venn Diagram</li> </ul>	<i>CXC Human and Social Biology</i>	Clarity and accuracy of diagram and information

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: WATER POLLUTION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Classify water pollutants.	Chemicals (pesticides, fertilizers), plastic, glass, metals, sewage, organic matter, detergents, bioaccumulation, oil , industrial wastes (lead, mercury); radioactive chemicals; thermal pollution	Classify water pollutants.	Photographs and artifacts  <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Plausibility of classification method and criteria
Compare the sources and effects of common water pollutants.	As above	<ul style="list-style-type: none"> <li>• Identify the source of each of the main water pollutants.</li> <li>• Identify the effects of each of the water pollutants.</li> <li>• Use a graphic organizer to compare the sources and effects of common water pollutants</li> </ul>	<i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids
Suggest methods of controlling common water pollutants.		Suggest methods of controlling common water pollutants.		Valid suggested methods with plausible reasons/explanations
Describe the effects of “heavy” metals on marine food chains.		<ul style="list-style-type: none"> <li>• Identify “heavy” metals</li> <li>• Make a diagram to show the concentration of “poisons” as they are moved through the food chain.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids
Explain the effects of pesticides on the marine food chains.		Make a diagram to show the concentration of “poisons” as they are moved through the food chain.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids
Design a product to contain an oil spill.	Oil poisons fish when eaten, makes feathers reduce insulation, can lead to hypothermia, and makes it difficult for birds to fly,	<ul style="list-style-type: none"> <li>• Identify the source(s) of oil pollution</li> <li>• Explain the effects of oil spills</li> <li>• Demonstrate cleaning oil from a feather</li> <li>• Suggest methods of containing and cleaning oil spills.</li> </ul>	Medicine dropper (acting as skimmer which vacuum), cotton balls or pad tissue (acts a booms which contain spill); detergent; cooking oil/motor oil; shallow pond (pollution solution) <i>CXC Human and Social Biology</i>	Rubric for assessing models

**SCOPE OF WORK  
GRADE 11  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: WATER POLLUTION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Describe the threats to the marine environment caused by marine debris.		Make a poster showing marine debris with notes indicating the threat each poses.	Publications BNT <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids
Explain the process of eutrophication.	Phosphates in detergents and fertilizers cause a rapid growth in the algae, bacteria use up oxygen to decay algae as they die which, in turn, reduces oxygen. Water ecosystems with reduced oxygen will support fewer individuals and less variety of organisms (reduce biodiversity, define eutrophication, identify the causes of eutrophication).	Make a model to explain the process of eutrophication.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing models
Explain the relationship between clean water and a healthy lifestyle.		Make a visual presentation to demonstrate the relationship between clean water and a healthy lifestyle.	<i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual presentations - clarity and accuracy (content) in demonstrating the relationship

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

**DURATION: 1 ½ weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use materials to illustrate turgidity and plasmolysis in plant cells.	Define the terms hypertonic, isotonic and hypotonic and relate them to the concentration of water molecules in solutions. Define the terms turgidity and plasmolysis.	Make temporary slides plant tissue in water, plant tissue in concentrated salt/sugar solution	Microscope, sugar or salt, red area of rhubarb stalk or red onion, Rheo leaf epidermis, blotting paper/tissue, pipette/dropper  <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing correct and safe handling of apparatus and materials
Make observations of plant tissue in solutions of different concentrations.	Cell loses water in hypertonic solutions, cell contents move away from cell walls as vacuole shrinks. Cell becomes flaccid (limp). Cell gains water in hypotonic solutions, vacuole increases in size, pressing cytoplasm against cell walls. Cell becomes firm.	<ul style="list-style-type: none"> <li>Observe cells of Rheo, rhubarb stalk or red onion under a microscope in a drop of water and in a concentrated salt or sugar solution.</li> <li>Make diagrams to show observations</li> </ul>	As above  <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Number and quality (details) of observations  Rubric for assessing diagrams
Perform an investigation to determine the effects of varying concentration of sugar solutions on plant tissue.	As above	Place strips/cylinders of potato or carrots in hyper-, iso- and hypotonic solutions for 24 hours.	Potato or carrots; Sugar/salt; water; knife/scalpel/cork borer; beakers/plastic cups; ruler <i>Caribbean Biology</i>	Rubric for assessing correct and safe handling of apparatus and materials  Rubric for assessing experimental reports
Observe the effects of varying the concentration of solutions on plant tissues.	Changes in size, colour, turgidity	Observe what happens when potato or carrot strips/pieces are placed in different concentration of sugar or salt solutions.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Number and quality (details) of observations
Measure length and width of potato/carrot strips.		<ul style="list-style-type: none"> <li>Measure length and width of potato/ carrot strips at the beginning of experiment and at the end of 24 hours.</li> <li>Record measurements</li> </ul>	<i>Longman Biology for CSEC</i>	Accuracy of measurements, clarity of recording measurements

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: TRANSPORT IN CELLS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Show the change in length of plant strips.		Draw bar graphs showing the lengths at the beginning and end of 24-hour period.		Rubric for processing data
Explain the effects of solutions of different concentrations on plant tissue.	As above	<ul style="list-style-type: none"> <li>• Draw a conclusion</li> <li>• Write an explanation for the observations and results recorded.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of conclusion based on results and observations made
Predict what would happen to a sample of red blood cells when placed in solutions of varying concentrations.	A red blood cell is an example of an animal cell; cell wall is absent; cell wall is rigid and cannot be stretched.	<ul style="list-style-type: none"> <li>• Read information on the effects of varying concentration of solutions on animal cells.</li> <li>• Create a graphic organizer illustrating what may occur when a red blood cell is placed in solution of varying concentrations (hyper-, iso-, hypotonic) with justification.</li> </ul>	<i>Biology for CSEC</i>	Plausibility of predictions and reasons given

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: STRUCTURE OF CELLS**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Explain the importance of water to cells.	Cells comprise about 75% water. Less leads to death. Water is needed for: turgor, solvent, chemical reactions.	<ul style="list-style-type: none"> <li>Brainstorm uses of water to cells.</li> <li>Create a cartoon showing the importance of water to cells.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids (cartoon)
Relate the properties of water to its functions in cells.	Water absorbs much heat with little rise in temperature, “universal” solvent, water pressure, osmosis	<ul style="list-style-type: none"> <li>Class discussion</li> <li>Worksheet</li> </ul>	Worksheet	Worksheet - clarity and accuracy (content) in demonstrating the relationship
Classify proteins in the cell.	All proteins contain carbon, hydrogen, oxygen and nitrogen along with sulphur and some also have phosphorus. <b>Structural</b> proteins are found in the mitochondria, ribosomes, chromosomes and cell membranes. <b>Enzymes</b> are proteins and control chemical activities in the cell.	<ul style="list-style-type: none"> <li>List elements in proteins</li> <li>Name the two functional classes of protein</li> <li>State the functions of proteins in each group.</li> <li>Classify cellular proteins into the two classes.</li> </ul>	Worksheet  <i>AQA Science</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct classification of proteins
Demonstrate the relationship between amino acids and proteins.	Number of amino acids, units that build protein like letters build words. Proteins long chain molecules. Sequence of amino acids and linkages between chains determines the protein. <i>Terms: di-, tri-, polypeptides</i>	<ul style="list-style-type: none"> <li>Use materials to build long chain molecules (proteins) form unit amino acids.</li> <li>Make labeled diagrams to represent synthesis of proteins from amino acids</li> </ul>	Molecular model kit, or plasticene and toothpicks, or beads. <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models  Rubric for assessing oral/visual presentations
Relate the properties of protein to its function in cells.	Macromolecules – structure, specificity of shape – enzyme reaction, links break at 50°C – denatured.	<ul style="list-style-type: none"> <li>Class discussion</li> <li>Match property of protein to function or feature of cells with a brief explanation.</li> </ul>	Worksheet  <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Clarity and accuracy (content) in demonstrating the relationship

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: STRUCTURE OF CELLS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Identify fats as essential chemicals in cells.	Fats used in structure of cell and nuclear membranes. Droplets in cytoplasm produce energy.	<ul style="list-style-type: none"> <li>Research the importance of fats in cells.</li> <li>Explain the importance of fats in cells.</li> </ul>	<i>AQA Science</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Valid reasons
Make a diagram to show the chemical arrangement of a portion of a fat molecule.	H <sub>2</sub> – C O – organic acid H – C O – organic acid      fatty acid H <sub>2</sub> – C O – organic acid	Make a diagram to show the chemical arrangement of a portion of a fat molecule.	<i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids
Make a model to represent a molecule of glucose.	A ring showing the arrangement of C <sub>6</sub> H <sub>12</sub> O <sub>6</sub>	Make a model to represent a molecule of glucose.	<i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing models
Relate the properties of carbohydrates to their function in cells.	Macromolecules – structure, insoluble for storage, sugars – soluble transport, simple – respiration, building	<ul style="list-style-type: none"> <li>Class discussion</li> <li>Match property of carbohydrates to functions and feature of cells with a brief explanation.</li> </ul>	Worksheet <i>GCSE Biology</i>	Clarity and accuracy (content) in demonstrating the relationship
Compare and contrast the chemical composition of proteins, fats and carbohydrates.	Elements, molecular length, functions, molecular structure of basic units	Draw a Venn Diagram to Compare and contrast proteins, fats and carbohydrates	<i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Venn Diagram (number and accuracy of similarities and differences)
Describe inter-conversions of substances in cells.	Glucose to glycogen, amino acids to protein, fatty acids and glycerol to fats. Animal cells carbohydrates to lipids, lipids to protein. Plant cells make amino acids and glucose from simple substances.	Make a visual display (graphic organizer, annotated diagrams, PowerPoint Presentation) to show inter-conversions of substances in cells.	<i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: CELL DIVISION - MITOSIS**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare the appearance of a cell that is reproducing with the appearance of one that is not.		<ul style="list-style-type: none"> <li>Observe a photograph of cell in the process of reproducing and one that is not.</li> <li>Note differences.</li> </ul>	<i>GCSE Biology</i>	Number and quality (details) of observations
Identify the cell structures that are involved in reproduction.	Nucleus, chromosomes, centrioles, nuclear membrane	<ul style="list-style-type: none"> <li>Identify the cell structures that are involved in reproduction.</li> </ul>	Worksheet <i>AQA Science</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Structures identified
Observe diagrams showing stages in mitosis.	<p>Interphase – resting/non-reproductive stage.</p> <p>Stages in mitosis are:</p> <ul style="list-style-type: none"> <li>Prophase</li> <li>Metaphase</li> <li>Anaphase</li> <li>Telophase.</li> </ul>	<ul style="list-style-type: none"> <li>Examine a prepared onion root tip using lower power of the microscope.(A simple drawing beside each microscope helps students to focus on relevant part of slide)</li> <li>Produce a drawing of a cell cycle.</li> <li>Observe stages of mitosis under microscope</li> </ul>	<p>Prepared slides of L.S. root tips.</p> <p>Wall charts, large models (plasticine models of chromosomes), chalkboards diagrams, microscope</p> <p><i>GCSE Biology</i> <i>Biology for CSEC</i></p>	<p>Correct use of the microscope to observe stages in mitosis</p> <p>Number and quality (details) of observations in diagrams</p>
Summarize what happens in each stage of mitosis.	<p>Interphase- cell preparation for division.</p> <p>Prophase-chromosomes make a copy of themselves with centromere- nuclear membrane disappears</p> <p>Metaphase-chromosomes line up along equator of the spindle with each chromatid attached to a separate spindle fibre by its centromere</p> <p>Anaphase-chromatids separate, move to poles- becomes a separate chromosome</p> <p>Telophase-two identical nuclei are formed with cytoplasm, nucleolus, and reappearance of nuclear envelope</p>	<ul style="list-style-type: none"> <li>Make annotated drawing (diagram) of each phase of mitosis.</li> <li>Develop a mnemonic device for each stage.</li> </ul>	<p>Mitosis Flip Books, models, transparencies, CXC Biology</p> <p>Internet</p> <p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	Clarity of diagram, accuracy/validity of notes

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: CELL DIVISION - MEIOSIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Observe prepared slides of the cross-section of an ovary/testis.	Follicles can be seen in the ovary in cross section. The follicles produce ova (eggs).  A section across a mammal's testis shows the inside of a seminiferous tubule which produces sperms.	Make outline drawings of the cross-section of ovary/testis as seen under the microscope/ magnifying glass	Prepared slides of cross section of gametes, microscope <i>Balanced Science Book 2</i> <i>GCSE Biology</i> <i>Biology for Life</i>	Rubric for assessing correct and safe use of the microscope Clarity and accuracy of diagram
Observe diagrams showing stages in meiosis.	Two different divisions in meiosis :- Interphase Prophase 1      Prophase 11 Metaphase 1    Metaphase 11 Anaphase 1     Anaphase 11 Telophase 1    Telophase 11	<ul style="list-style-type: none"> <li>Observe diagrams showing stages in meiosis.</li> <li>Make explanatory notes next to the diagram for each stage.</li> <li>Compare and contrast the same stages in both cycles (e.g. Prophase I and II).</li> <li>Demonstrate cross over using clay structures</li> </ul>	Posters/charts, models, Biology The dynamics of Life Unlabelled diagrams showing the stages in meiosis.  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>  Clay, plasticine, play dough	Clarity and accuracy of notes  Number and accuracy of similarities and differences  Rubric for assessing models
Suggest how variation in a species might occur.	Crossing over which occurs during the first cell division increases variation within a species by creating new combinations of genes on chromosomes.  As chromosomes cross over, they are no longer homologous.	Create a graphic organizer to suggest how meiosis leads to variation in a species.	Poster paper, markers, text books, Internet	Plausibility of suggestion and reasons/logical explanation given
Justify the importance of meiosis being a "reduction division".	In meiosis, one diploid cell (2N) produces 4 haploid (N) cells providing a way for off springs to have the same number of chromosomes as their parents when fertilization occurs .	Use annotated diagram to show why the chromosome number must be halved to maintain the diploid number of chromosomes in body cells.	<i>Balanced Science Bk. 2</i> <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Clarity and accuracy of logical explanation

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: CELL DIVISION - MEIOSIS**

LEARNER OUTCOMES	CONTENT		ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare and contrast mitosis and meiosis.	Mitosis	Meiosis	<ul style="list-style-type: none"> <li>• Review information on mitosis and meiosis</li> <li>• Construct a table to show similarities and differences</li> <li>• Develop a mnemonic device for the stages of cell division.</li> </ul>	<i>CXC Biology</i> <i>Biology Skills for Excellence</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>  Internet	Appropriate diagram (number and accuracy of similarities and differences)
	1. Genetically identical offspring  2. One division  3. Diploid offspring  4. Process occurring in somatic cells	1. Offspring with variation  2. Two divisions  3. Haploid offspring/cells  4. Production of gametes			

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: MONOHYBRID INHERITANCE**

**DURATION: 3 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Formulate a hypothesis as to traits that are inherited.	A trait is a visible feature.	Formulate a hypothesis as to traits that are inherited.		Plausibility of hypothesis and reasons given
Formulate a hypothesis as to how traits are inherited.	The gene is the unit of inheritance. Genes are found on the chromosomes.	Formulate a hypothesis as to how traits are inherited.		Plausibility of hypothesis and reasons given
Observe inherited monohybrid traits of students in the classroom.	Characteristics which are passed on from one generation to the next such as tongue rolling, ear lobes, hitchhikers thumb.	<ul style="list-style-type: none"> <li>Identify inherited traits in students.</li> <li>Observe and note the variations of these traits among students in the class.</li> <li>Construct a table or graph e.g. bar graph/pie graph showing the variations.</li> </ul>	<i>CXC Human and Social Biology</i>  <i>AQA Science GCSE Biology</i> <i>Biology for CSEC</i>	Number and quality (details) of observations  Clarity in recording of data  Clarity and accuracy of data in a suitable table/ bar or pie graph
Observe inherited traits of plants and animals in the schoolyard.	EXAMPLES: Plants:- leaf shape, color of parts, life cycle Animals:- number of legs, wings, type of skeleton,	<ul style="list-style-type: none"> <li>Observe plants and animals in the schoolyard.</li> <li>Identify the traits.</li> <li>Record traits observed.</li> </ul>	Photographs, live specimen  Biology – Dynamics of Life.	Number and quality (details) of observations and clarity in recording
Use correct terminology in solving genetics problems.	Phenotype, genotype, homozygous, heterozygous, dominant, recessive, complete, incomplete, co-dominance, allelomorphic (alleles), P, F1, F2, Punnett Square, ratio, probability, monohybrid	<ul style="list-style-type: none"> <li>Define common vocabulary in monohybrid inheritance.</li> <li>Use correct terminology in drill exercises.</li> <li>Use correct terminology in solving genetics problems.</li> </ul>	<i>AQA Science GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct use of terminology in solving genetics problems.
Solve problems based on information given for monohybrid inheritance, complete dominance.	If two parents are homozygous for a genetically inherited recessive trait, what is the probability that they will have a child who does not have this trait in his or her phenotype? If two parents are heterozygous for a genetically inherited dominant trait, what is the probability that they will have a child together who has this trait in his or her phenotype?	<ul style="list-style-type: none"> <li>Solve a variety of genetics problems using the Punnett square or crosses to solve problems to F2.</li> <li>Formulate a “what if... question.</li> </ul>	<i>Biology for Life</i> <i>CXC Biology</i> <i>AQA Science GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing problem-solving.

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: MONOHYBRID INHERITANCE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Solve problems based on information given for monohybrid inheritance, incomplete dominance.	In the heterozygous condition, there is a “blending” of the genes so that the phenotype is in between the two homozygous phenotypic expressions. The phenotypic and genotypic ratios are the same.	<ul style="list-style-type: none"> <li>• Solve a variety of genetics problems using the Punnett square or crosses to solve problems to F2.</li> <li>• Formulate a “what if... question.</li> </ul>	<i>GCSE Biology</i> <i>Biology for Life</i> <i>Biology for CSEC</i> <i>CXC Biology</i>	Rubric for assessing problem-solving
Solve problems based on information given for monohybrid inheritance, co-dominance.	In the heterozygous condition, both phenotypes are shown e.g. red hairs and white hairs. The phenotypic and genotypic ratios are the same.	<ul style="list-style-type: none"> <li>• Solve a variety of genetics problems using the Punnett square or crosses to solve problems to F2.</li> <li>• Formulate a “what if... question.</li> </ul>	<i>GCSE Biology</i> <i>Biology for Life</i> <i>Biology for CSEC</i> <i>CXC Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing problem-solving
Design, conduct, and evaluate a survey of an inherited phenotypic trait in humans.	Examples: tongue rolling, left-handedness, patent-baldness, red-green colour blindness, clockwise pattern of hair, free ear lobes, PTC taster	<ul style="list-style-type: none"> <li>• Choose trait</li> <li>• Take a survey of persons e.g. left handed or right handed</li> <li>• Record the data.</li> <li>• Analyze the data</li> <li>• State a conclusion as to which feature appears to be dominant.</li> </ul>	<i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> Internet	Rubric for assessing an investigation (using a survey)

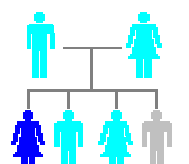
**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: MONOHYBRID INHERITANCE**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Distinguish between the sex and other homologous chromosomes in humans.	There are 22 pairs of autosome somatic chromosomes and one pair of sex chromosomes in humans. Sex chromosomes are not identical. The Y is shorter than the X.	<ul style="list-style-type: none"> <li>Observe photographs of human homologous chromosomes.</li> <li>Describe the sex chromosomes.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Accuracy of observations and clarity of description
Explain how the gender of a baby is determined.	An X chromosome from each parent would produce a girl (female XX) a X chromosome from the mother and a Y chromosome from the father would produce a boy (male XY).	<ul style="list-style-type: none"> <li>Flip two coins (same type) with heads representing X and tails Y for 50 times. Record the combinations.</li> <li>Determine the probability of either gender.</li> <li>Draw a Punnett Square or crosses assist in explaining how the gender of a baby is determined.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing processing data Accuracy and clarity of diagram and explanation of cross results
Identify examples of sex-linked traits.	Traits that seem in a higher proportion in males are termed sex-linked They are coded by recessive genes as they only need to be present on the one X chromosome to be observed. In females the gene would have to be present on both X chromosomes. E.g. hemophilia, red-green colour-blindness, pattern baldness, sickle cell anaemia.	<ul style="list-style-type: none"> <li>Formulate a hypothesis as to why certain traits are more common in males.</li> <li>Identify examples of sex-linked traits.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Plausibility of hypothesis and reasons given  Correct identification of examples

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: MONOHYBRID INHERITANCE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT									
<p>Solve monohybrid inheritance problems for sex-linked traits.</p>	<p>If both parents are carriers of the recessive allele for a disorder, all of their children will face the following odds of inheriting the trait:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>A</td> <td>a</td> </tr> <tr> <td>A</td> <td>AA</td> <td>Aa</td> </tr> <tr> <td>a</td> <td>Aa</td> <td>aa</td> </tr> </table>  <p>25% chance of having the recessive disorder 50% chance of being a healthy carrier 25% chance of being healthy and not have the recessive allele at all</p>		A	a	A	AA	Aa	a	Aa	aa	<ul style="list-style-type: none"> <li>Solve monohybrid inheritance problems for sex-linked traits.</li> <li>Formulate a “what if... question.</li> </ul>	<p><i>GCSE Biology</i> <i>Biology for CSEC</i></p>	<p>Rubric for assessing problem-solving</p>
	A	a											
A	AA	Aa											
a	Aa	aa											

**SCOPE OF WORK  
GRADE 11  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: MONOHYBRID INHERITANCE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Apply the principles of monohybrid inheritance to the inheritance of A, B Blood Grouping.</p>	<p>The human X-chromosome carries some alleles for which there are no partners on the Y-chromosome (which doesn't carry any alleles except those that decide gender). The result of inheriting an allele like this is different for males and females, and so the characters they code for are called <b>sex-linked</b> characters. A sex-linked allele inherited by a male is expressed even if it is recessive because it is not hidden by another, dominant, allele. So almost all who suffer from this disease are males.</p> <p>Content for previous objective</p>	<ul style="list-style-type: none"> <li>• Apply the principles of monohybrid inheritance to the inheritance of A, B Blood Grouping.</li> <li>• Make an oral and visual presentation describing monohybrid inheritance.</li> </ul>	<p><i>Life Science Glencoe Science</i></p> <p><i>Life Science Merrill</i></p> <p><i>Second Edition Biology Exploring Life</i></p> <p><i>GCSE Biology</i></p> <p><i>Biology for CSEC</i></p> <p><i>Longman Biology for CSEC</i></p> <p><i>CXC Human and Social Biology</i></p>	<p>Rubric for assessing oral/visual presentations</p>

**SCOPE OF WORK  
GRADE 11  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: NUTRIENTS IN FOOD**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Predict which nutrient(s) can be found in given foods.	The presence of protein using Biuret reagent and the presence of reducing sugars using Benedict's solution or mixed Fehlings Solution, non-reducing sugar using hydrochloric acid and mixed Fehlings soln.	<ul style="list-style-type: none"> <li>• Predict which food nutrient(s) can be found in given food samples</li> <li>• Construct a suitable table to record predictions.</li> </ul>	Food samples  <i>Biology for CSEC</i>	Plausibility of predictions and reasons given; appropriate table constructed
Use apparatus and materials safely in performing food tests.		<ul style="list-style-type: none"> <li>• Handle apparatus correctly in performing investigations.</li> <li>• Handle materials correctly in performing investigations.</li> <li>• Handle apparatus and materials safely in performing investigations.</li> </ul>	Food samples, test tubes, test tube racks, Benedict's solution, mixed Fehlings Solution (A & B/I & II) Biuret reagent, dropper/pipette, hot water bath, test tube holders  <i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing correct and safe use of apparatus and materials
Conduct food tests on the food samples to verify the predictions		Perform tests to determine the presence of the nutrients (reducing sugars, non-reducing sugars and proteins) in each food sample using food tests.		Rubric for assessing correct and safe use of apparatus reagents
Observe results of food tests on various food samples.	Positive tests are: protein - purple with Biuret, reducing sugar - dark yellow – red with Benedict's Solution heated; non-reducing – no reaction with Benedict's but dark yellow – red with hydrochloric acid and mixed Fehlings Solution.	Record all observations of the food tests results in an appropriate table.	As above	Number and quality (details) of observations; clarity in recording observations

**SCOPE OF WORK  
GRADE 11  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: NUTRIENTS IN FOOD**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Draw conclusions to verify predictions on nutrients present in food samples.		<ul style="list-style-type: none"> <li>• Based on the observed results of the food tests performed, formulate inferences/conclusions about the nutrients present in each food sample.</li> <li>• Compare and note inferences/conclusions with predictions.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	<p>Clarity and accuracy of inferences/conclusion based on results and observations made</p> <p>Accuracy of similarities and differences cited</p>
Conduct an experiment to compare the amount of Vitamin C in juices.	The reagent DCPIP (alternatively, potassium permanganate and hydrochloric acid) can be used to test for the presence of Vitamin C. vit. C decolourizes potassium permanganate	<ul style="list-style-type: none"> <li>• Conduct an experiment to compare the amount of Vitamin C in different juices.</li> <li>• Record observations in table.</li> </ul>	Various fruit juices, water (control), pipette/dropper, DCPIP/potassium permanganate	<p>Rubric for assessing investigations</p> <p>Clarity in recording observations</p>

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: PLANT NUTRITION**

**DURATION: 2 ½ weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Form a hypothesis on materials needed for photosynthesis.	Carbon dioxide, water, light energy, chlorophyll	<ul style="list-style-type: none"> <li>Brainstorm</li> <li>List materials needed</li> </ul>	<i>AQA Science</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Plausibility of hypothesis and reasons given
Identify sources of raw materials for photosynthesis.	Soil, air, sun	<ul style="list-style-type: none"> <li>Brainstorm</li> <li>Make an annotated diagram of a plant showing sources, and the route to the leaves.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing visual aids
Justify leaves as the parts of plants best suited for photosynthesis.	Chlorophyll mainly in leaves, carbon dioxide in air through stomata, water through xylem, sunlight to leaves	Write a short essay or a picture story justifying leaves as the parts of plants best suited for photosynthesis.	<i>Biology for CSEC</i>	Number and accuracy of points; logical argument
Summarize the process of photosynthesis.	Photosynthesis is the process by which plants make their own food. It requires the raw materials carbon dioxide and water under conditions of light and chlorophyll presence. The products made are glucose and oxygen. (students must know word and chemical equations).The rate of photosynthesis can be affected by many factors such as availability of water, carbon dioxide and light, and the temperature.	Design a graphic organizer/poster to summarize the process of photosynthesis.	Craft materials <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids
Suggest limiting factors of photosynthesis.		<ul style="list-style-type: none"> <li>Discuss word equation of photosynthesis.</li> <li>Suggest factors that limit rate of photosynthesis</li> <li>Arrange them in an organized concept map.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids (concept map or graphic organizer)
Compose an equation to represent the process of photosynthesis.	Carbon dioxide + water → glucose + oxygen	Compose an equation to represent the process of photosynthesis.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Correct word equation
Perform an investigation to determine the form in which food is stored in leaves of a plant.	Leaves make food for the plant through photosynthesis. They produce sugar/glucose which is stored as starch. The presence of starch is tested with iodine. Sugar may also be converted to proteins, fats, etc. The importance of destarching leaves.	<ul style="list-style-type: none"> <li>Destarched (leaves) plant</li> <li>Plant photosynthesizes</li> <li>Boil leaves</li> <li>Decolourize leaves</li> <li>Perform food tests</li> </ul>	Test tubes, test tube racks, iodine, Benedict's solution, Biuret reagent, dropper/ pipette, ethanol, Bunsen burner, porcelain tile, beaker, water <i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing investigations

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: PLANT NUTRITION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Control variables in an investigation.	Leaves of similar size from one plant used.	<ul style="list-style-type: none"> <li>Identify variables</li> <li>Control variables</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Correct identification of variables and variable(s) kept constant
Use apparatus and materials correctly and safely in an investigation to determine the form in which food is stored in leaves of a plant.	As above	Use apparatus and materials correctly and safely in an investigation to determine the form in which food is stored in leaves of a plant.	<i>Biology for CSEC</i>	Rubric for assessing correct and safe handling of apparatus and materials
Observe change in the colour of reagents.		Observe and record colour of each reagent before and after reaction with leaf.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Number and quality (details) of observations and clarity in recording
Form a conclusion on the form in which food is stored in leaves of a plant.		Form a conclusion on the form in which food is stored in leaves of a plant.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Clarity and accuracy of conclusion based on observations made
Design an investigation to determine whether light is necessary for photosynthesis.		Design an investigation to determine whether light is necessary for photosynthesis.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Clarity, details and logic of plan
Conduct an experiment to investigate whether light is needed in the production of starch by photosynthesis.	Light provides the energy needed to split water molecules during the light phase of photosynthesis.	<ul style="list-style-type: none"> <li>Conduct an experiment to investigate the importance of light in photosynthesis.</li> <li>Write an experimental report</li> </ul>	Light source, two identical destarched plants, light and dark areas, iodine, ethanol, test tube, Bunsen burner, forceps, beaker, water, porcelain tile  <i>Biology for CSEC</i>	Rubric to assess experimental investigation  Rubric to assess experimental reports
Control variables in an investigation.	As above	<ul style="list-style-type: none"> <li>Identify variables</li> <li>Control variables</li> </ul>	Leaves of identical size from same type plant under same prior conditions used.  <i>Biology for CSEC</i> <i>GCSE Biology</i>	Correct identification and control of valid variables

**SCOPE OF WORK  
GRADE 11  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: PLANT NUTRITION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use apparatus and materials correctly and safely to investigate whether light is needed in the production of starch by photosynthesis.	As above	Use apparatus and materials correctly and safely in an investigation to investigate whether light is needed in the production of starch by photosynthesis.	As above <i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing correct and safe use of apparatus and materials
Observe the colour in both leaves tested.		Observe and record colour of both leaves tested for starch.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Accuracy of observations and clarity in recording
Form a conclusion on whether light is needed in the production of starch by photosynthesis.		Form a conclusion on whether light is needed in the production of starch by photosynthesis.	<i>GCSE Biology</i>	Clarity and accuracy of conclusion based on results and observations made
Formulate a hypothesis on whether chlorophyll is necessary for photosynthesis.		Formulate a hypothesis on whether chlorophyll is necessary for photosynthesis	<i>GCSE Biology</i>	Plausibility of hypothesis and reasons given
Conduct an experiment to show that chlorophyll is essential for the production of starch.	Chlorophyll in the leaves absorb light energy.	Conduct an experiment to investigate the importance of chlorophyll in photosynthesis.  Write an experimental report on the investigation.	Light source, two plants, dark area, iodine, ethanol, test tube, Bunsen burner, forceps, beaker, foil/dark paper or a variegated leaf (two colours – green and yellow).  <i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing experimental investigations
Control variables in an investigation.		<ul style="list-style-type: none"> <li>• Identify variables</li> <li>• Control variables</li> </ul>	Leaves of identical size from same type plant under same prior conditions used OR variegated leaf.	Correct identification and control of valid variables
Use apparatus and materials correctly and safely to determine whether chlorophyll is needed in the production of starch by photosynthesis.	As above	Use apparatus and materials correctly and safely in an investigation to determine whether chlorophyll is needed in the production of starch by photosynthesis.	As above	Rubric for assessing correct and safe use of apparatus and materials

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: PLANT NUTRITION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Form a conclusion on whether chlorophyll is needed for the production of starch by photosynthesis.		Form a conclusion on whether chlorophyll is needed in the production of starch by photosynthesis.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Clarity and accuracy of conclusion based on results and observations made
Observe the colour in leaves tested.		Observe and record colour of leaves tested for starch.	<i>GCSE Biology</i>	Plausible observations made and clearly recorded
Compare the processes of photosynthesis and respiration.	Summary equations are reverse of each other.	Compare raw materials, products, energy.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Valid similarities and differences
Compare and contrast seedlings, plants and fruits with named mineral deficiencies.	<sup>1</sup> Deficiencies: Sulphur – yellow leaves, slim stems; Phosphorus – poor, weedy growth, reddish stem and leaves, mottling of leaves; Nitrogen – stunted growth, very small leaves; Calcium – weak, stunted growth, poor root development; Iron – poor growth, yellow leaves; Magnesium - poor growth, yellow leaves; Potassium – very poor growth, orange or brown leaves.	<ul style="list-style-type: none"> <li>• Observe photographs or specimens showing mineral deficiencies.</li> <li>• Compare photographs or specimens with “normal” plants.</li> <li>• Match the observations with named deficiency signs (in textbook).</li> <li>• Construct a suitable table to record what is observed in each seedling, plant and fruit for each mineral deficiency.</li> </ul>	Photos/ actual specimens of seedlings, plants, and fruits that are deficient in named minerals. Photographs of named deficiency diseases.  <i>Modern Biology for Secondary Schools.</i> <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Number and quality (details) of observations          Suitable table and accuracy of information
Draw conclusions on the function of named minerals in plant nutrition and physiology.		Draw conclusions, based on comparisons of seedlings, plants and fruits with deficiencies and “normal” ones, on the function of named minerals in plants.	Photos/ actual specimens of seedlings, plants, and fruits that are deficient in named minerals   <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of conclusion based on observations made

<sup>1</sup>Modern Biology for Secondary Schools.

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: TRANSPORT IN PLANTS**

**DURATION: 2 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Design, conduct and evaluate an experiment to prove that transpiration mainly occurs through the leaves of a plant.	Transpiration is the loss of water vapour through the shoot (mainly leaves) of plants. The rate of transpiration can be affected by various environmental factors such as humidity, wind, and temperature. Increase in the wind speed and temperature, increases the rate of transpiration in plants. An increase in the humidity will decrease the rate of transpiration in plants.	Design, conduct and evaluate an experiment to prove that transpiration mainly occurs through the leaves of a plant ensuring that all variables are controlled.	Two potted plants / young herbaceous plants of same type, two plastic bags, bread ties/string, water, two flasks/ bottles  <i>Longman Biology for CSEC</i>	Rubric for assessing experimental investigations
Use a potometer or the weighing method to determine the transpiration rate of a plant.	Potometer is used to measure the rate at which a plant takes up water. Water lost from the leaves is measured as the change in water level in the capillary tube. The difference in weight of a plant/shoot in water over a period of time is a measure of the water uptake to replace that lost by transpiration.	<ul style="list-style-type: none"> <li>• Assemble apparatus.</li> <li>• Ensure the experiment is air-tight.</li> </ul>	Water, beaker, capillary tube, clamp stand, rubber tubing, balance, shoot/plant, photometer.  <i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing experimental investigations
Measure the water level or weight of experiment.		<ul style="list-style-type: none"> <li>• Take measurements before and after a time period. Measure the amount of water taken up in a cut plant using a potometer.</li> <li>• Record measurements.</li> </ul>	Balance (triple beam or digital)  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Accuracy of measurements, clarity of recording measurements

**SCOPE OF WORK  
GRADE 11  
STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: TRANSPORT IN PLANTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Calculate the rate of transpiration.		<ul style="list-style-type: none"> <li>Calculate the rate of transpiration.</li> </ul>	<i>Biology for CSEC</i>	Rubric for assessing processing data (ml /hour or g/hour)
Control variables in an investigation to show transpiration mainly occurs through the leaves of a plant.		<ul style="list-style-type: none"> <li>Identify variables</li> <li>Control variables</li> </ul>	Identical plants (size from same type plant under same prior conditions used).  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Correct identification and control of valid variables
Conduct an investigation to determine from which surface of the leaf more water vapour lost.	Transpiration is the loss of water vapour through the leaves of plants. The number of stomata on the lower epidermis is higher than those found on the upper epidermis. Water vapour is released from stomata during the process of transpiration. Hence, transpiration occurs faster in the lower epidermis.	<ul style="list-style-type: none"> <li>Investigate from which surface of the leaf more water vapour lost.</li> <li>Use potometer or weighing method.</li> </ul>	Potted plants, Vaseline, plastic bags	Rubric for assessing experimental investigations
Control variables in an investigation to determine from which surface of the leaf is more water vapour lost.		<ul style="list-style-type: none"> <li>Identify variables</li> <li>Control variables</li> </ul>	Identical leaves (size on same plant under same prior conditions used). <i>GCSE Biology</i>	Correct identification and control of valid variables
Use materials correctly and safely to determine from which surface of the leaf transpiration occurs faster.	White anhydrous cobalt chloride turns blue in the presence of water. Vaseline blocks the pores and, therefore, the release of water vapour.	<ul style="list-style-type: none"> <li>Place anhydrous cobalt chloride paper on both surfaces of 4 leaves and observes which surface of each leaf transpires faster.</li> <li>Investigate how putting Vaseline on either or both leaf surfaces affects transpiration.</li> </ul>	Anhydrous cobalt chloride, forceps, potted plants, Vaseline	Rubric for assessing correct and safe use of apparatus and materials
Formulate a conclusion on which surface allows a faster rate of transpiration.		Draw a conclusion on which surface allows a faster rate of transpiration.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Clarity and accuracy of conclusion based on results and observations made

**SCOPE OF WORK  
GRADE 11  
STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: TRANSPORT IN PLANTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Suggest factors that would affect the rate of transpiration.	Temperature, light intensity, humidity, wind speed.	<ul style="list-style-type: none"> <li>Brainstorming</li> <li>Suggest factors that would affect the rate of transpiration.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Correct (valid) factors identified
Design an experiment to investigate the effect of a given environmental factor on the rate of transpiration.	Logical plan (including materials, apparatus and method).	<ul style="list-style-type: none"> <li>Design an experiment to investigate the effect light intensity has on the rate of transpiration.</li> <li>Design an experiment to investigate the effect wind speed has on the rate of transpiration.</li> <li>Design an experiment to investigate the effect temperature has on the rate of transpiration.</li> <li>Design an experiment to investigate the effect humidity has on the rate of transpiration.</li> </ul>	Identical plants, potometers or balances and conical flasks etc., vaseline	Clarity, details and logic of plan
Conduct and evaluate an experiment that investigates how the rate of transpiration is affected by a given environmental factor.		<ul style="list-style-type: none"> <li>Conduct an experiment that investigates how the rate of transpiration is affected by a given environmental factor</li> <li>Identify and control variables</li> <li>Record measurements.</li> <li>Write an experimental report</li> <li>Evaluate the investigation.</li> </ul>	As above	Rubric for assessing an experimental investigation
Predict the effect should a plant lose too much water.	When plants lose more water than they take in, the cells in the leaves will lose water and become flaccid. Thus, the plant will wilt.	Predict the effect should a plant lose too much water.	<i>Longman Biology for CSEC</i>	Plausibility of predictions and reasons given

**SCOPE OF WORK  
GRADE 11  
STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: TRANSPORT IN PLANTS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Suggest how leaves of certain plants are adapted to prevent excessive water loss by transpiration.	Leaves may also be adapted to ensure that sufficient water is in the plant. In dry regions leaves appear differently to reduce water loss through transpiration. For example less stomata, rolled up leaves, storage of water in leaves/stems or dropping of leaves during dry season etc...	Create flashcards pasting photos of special (named) plants on one side and on the other explain how the plants' leaves are adapted to prevent excessive water loss through transpiration.	Aloe plant, cacti, photos/ diagrams/ transparencies of plants that live in arid/dry conditions, index cards  <i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing visual aids
Observe the part of the vascular bundle which is responsible for the movement of water through a celery stalk.	The xylem tissue transmits water. If dye is placed in water and celery stalk is in the water with the dye, the dye will travel up the stem in the vascular bundles (more specifically xylem vessels).	<ul style="list-style-type: none"> <li>• Cut the base of a celery stalk</li> <li>• Allow celery stalk to sit in a beaker of colored water.</li> <li>• Cut a thin slice (T. S.) of the stalk.</li> <li>• Observe the base of the stalk as well as the slice.</li> <li>• Identify the part of the vascular bundle which is responsible for water transport.</li> <li>• Make labelled diagrams showing the coloured areas of the T. S. and L. S. celery stalk.</li> </ul>	Colored dye/food colouring, celery stalk, beaker, water, scalpel/razor blade  <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids (diagrams)

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: TRANSPORT IN PLANTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Observe what occurs when the bark is ringed / removed from the stem region of a tree trunk.	If a ring of bark is cut from around a tree trunk, food substances cannot get down the trunk. A bulge will result above the ring due to the accumulation of food. In a tree trunk, the phloem is located in the soft inner part of the bark that was removed. This phloem transports food substances.	Observe what occurs, over a period of 3-5 days, when the bark is ringed / removed from the stem region of a tree trunk	Tree trunk, tool for cutting  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Quality (details) of observations made
Suggest the part of the vascular bundle that is responsible for food transport.		<ul style="list-style-type: none"> <li>• Orally suggest an explanation for the observations.</li> <li>• Identify the part of the vascular bundle that is responsible for this occurrence.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Plausibility of suggestions and reasons given
Suggest the destination and use of food manufactured in leaves.	After food is made by the leaves, some of it is transported (translocation) to growing points of the plant, to the roots and storage organs. It is transported for use in respiration and/or converted to other substance (such as proteins, oils and cellulose).	Brainstorm in pairs to: <ul style="list-style-type: none"> <li>• Suggest where food (made by photosynthesis) is transported to during translocation</li> <li>• Why this movement is important.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Plausibility of suggestions and reasons given

**SCOPE OF WORK  
GRADE 11**

**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HUMAN HEART**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe the external and internal appearance of the human heart.	Heart is made up of cardiac muscle which does not fatigue. Human heart divided into right and left side by the septum; upper chambers the atria receive blood from veins; lower chambers are ventricles which pump blood to arteries; compare relative thickness of walls of chambers; direction of flow controlled by atrioventricular valves (bicuspid/ mitral and tricuspid valves) and semi-lunar valves, valve tendons support valves; vena cava returns deoxygenated blood to right atrium; pulmonary artery transports deoxygenated blood to lungs; pulmonary veins, transport oxygenate blood from lungs to left atrium; aorta transports oxygenated blood from left ventricle to body; coronary arteries supply heart muscle with oxygen and nutrients.	<ul style="list-style-type: none"> <li>Observe posters/charts, models, overhead transparencies or photographs of the external and internal appearance of the human heart.</li> <li>Describe the external and internal appearance of the human heart.</li> </ul>	Posters/charts, models, overhead transparencies, textbook  <i>AQA Science</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Number and quality (details) of observations; clarity of description
Draw and label the external features of a mammalian heart.		Draw and label the heart before dissection	Pig, sheep, or goat's heart.	Rubric for assessing visual aids diagrams
Use a scalpel or other cutting utensil to dissect the heart of a mammal.		Use a scalpel or other cutting utensil to dissect the heart of a mammal	Scalpel, dissecting tray, dissecting pins,	Correct and safe use of apparatus and materials
Use a magnifying lens to observe the structure of the heart		Use a magnifying lens to observe the structure of the heart	Magnifying glass;	
Observe the internal structure of a mammalian heart.		<ul style="list-style-type: none"> <li>Observe the structure of a mammalian heart.</li> <li>Identify the internal structures of the heart</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct identification of Structures
Relate the structures of the heart to their function.		<ul style="list-style-type: none"> <li>Make annotated drawing to show the structure and function of the heart and its associated blood vessels.</li> <li>Explain how the structures are suited to their functions.</li> </ul>	Diagram L. S. heart on worksheet  <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct labeling of diagrams and accuracy of notes  Clarity and accuracy (content) in demonstrating the relationship
Construct a model of the human heart.		Construct a model of the human heart	Plastic or paper cups, straws, glue, scissors, hard card, red and blue markers or modeling clay/paper mâché, tubing, red and blue; model of human heart; <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing models

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HUMAN HEART**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Show the direction through which blood flows through the heart		Use the model of the heart or a PowerPoint Presentation to demonstrate the direction of blood flow through the heart.	Red and blue markers/crayons/pencils  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual presentations
Use a stethoscope to investigate heartbeat	Complete contraction and relaxation of heart produces two-tone (lub-dub) sound. The first tone heard is due to the closing of the tricuspid and bicuspid valves as the ventricles contract. The closing of the semi-lunar valves is the second sound followed by a pause. On average the heartbeat is 72 beats per minute. Heartbeat increases with exercise as contraction of muscles need more of oxygen and nutrients carried by blood. Adrenalin increases the heart rate. Differences in sound allow doctor to diagnose disorders	<ul style="list-style-type: none"> <li>• Examine a stethoscope</li> <li>• Use the stethoscope to measure heartbeat per minute.</li> <li>• Describe (orally) the noises heard</li> <li>• Relate the operation of structures of the heart to the sound produced during beats.</li> </ul>	Rubber tubing, glass T-shaped tube, filter funnel at end, or stethoscope. <i>CXC Human and Social Biology</i>	Correct and safe use of stethoscope
Design investigations to determine the effects of external factors on heartbeat.	Sudden noises, increased exercise cause an increase in heartbeat.	<ul style="list-style-type: none"> <li>• Brainstorm factors that might cause a change in heartbeat rate.</li> <li>• Design the investigations.</li> <li>• Include comparison of the base heartbeat rate with each rate caused by an external factor.</li> <li>• Draw bar graphs to compare the heartbeat rates.</li> </ul>	<i>CXC Human and Social Biology</i>	Clarity, details and logic of plan

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HUMAN HEART**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Predict the effects of exercise on pulse rate.	<p>The pumping of the heart causes surges of blood in arteries. This is detected as the pulse where an artery lies above a bone near the surface of the body. The rate of beats per minute is about 72 but varies with age, activity and diseases.</p> <p>With each beat, the heart moves blood through the body.</p> <p>During exercise more carbon dioxide produced due to increased respiration for energy. Increase in CO<sub>2</sub> signals energy is obtained from</p>	Predict the effects of exercise on pulse rate	<p>Clock/stopwatch</p> <p><i>CXC Human and Social Biology</i></p>	Plausibility of predictions and reasons given
Measure accurately the pulse rate of students to determine average pulse rate		<ul style="list-style-type: none"> <li>• Measure accurately the pulse rate of students</li> <li>• Calculate the average pulse rate at rest</li> <li>• Calculate the average pulse rate after exercise</li> </ul>	<p><i>Longman Biology for CSEC</i></p> <p><i>CXC Human and Social Biology</i></p>	<p>Accuracy of measurements, clarity of recording measurements</p> <p>Rubric for assessing processing data</p>
Make inferences/conclusions as to the effect of exercise on pulse rate.		Make inferences/conclusions as to the affect of exercise on pulse rate	<p><i>Longman Biology for CSEC</i></p> <p><i>CXC Human and Social Biology</i></p>	Clarity and accuracy of conclusion based on results/data
Predict how conditions of the body affect average pulse rate	Age, weight, lifestyle (regular exercise, drug abuse)	Predict the effects of age, weight, regular exercise and drug abuse on pulse rate.	Clock/stop watch; graph paper; or software to generate graphs	Plausibility of predictions and reasons given

**SCOPE OF WORK  
GRADE 11  
STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HUMAN HEART**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Research the common causes and effects of heart disease.		<ul style="list-style-type: none"> <li>• Research the common causes and effects of heart disease</li> <li>• Create an infomercial to show common causes and effects of heart disease and any preventative measures.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> Internet	Rubric for assessing research  Rubric for assessing visual presentations
Describe the relationship between intake of dietary cholesterol and fatty deposits on artery walls		Describe the relationship between intake of dietary cholesterol and fatty deposits on artery walls	<i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Clarity and accuracy (content) in demonstrating the relationship
Use sphygmomanometer to measure blood pressure	Blood pressure is measured in large arteries and expressed by 2 numbers. The first number is a measure of the pressure caused when the ventricles contract and blood is pushed out the heart – systolic pressure. Then blood pressure drops as the ventricles relax. The second number is a measure of the diastolic pressure that occurs as the ventricles becomes filled with blood before they contract again such as systolic 120, diastolic 80. Techniques in using Sphygmomanometer	Students take turns measuring arterial blood pressure on a partner and rotate roles. Using digital blood pressure reader. (AQA Science GCSE Biology)	Sphygmomanometer, stethoscope, table, chairs, alcohol, cotton balls  <i>CXC Human and Social Biology</i>	Accuracy of measurements
Record results of class/group blood pressure in a suitable manner		Record results of class/group blood pressure in a suitable manner	<i>CXC Human and Social Biology</i>	Clarity of recording measurements
Construct a histogram to show the class' blood pressure data.		<ul style="list-style-type: none"> <li>• Construct a histogram to show the class' blood pressure data.</li> <li>• From the graph determine the average range of pressure</li> </ul>	<i>CXC Human and Social Biology</i>	Rubric for assessing processing data

**SCOPE OF WORK  
GRADE 11  
STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HUMAN HEART**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Draw a conclusion on the blood pressure range for the class.		<ul style="list-style-type: none"> <li>• Interpret results of the data</li> <li>• Draw a suitable conclusion</li> </ul>	CXC Human and Social Biology	Clarity and accuracy of conclusion based on results and observations made
Research cardiovascular diseases.	<p>A heart attack is caused by the build-up of fatty substances, cholesterol, calcium and other substances that make up plaque. Plaque can begin to build up within the inner linings of the larger arteries of the body in childhood, but it takes much longer, usually thirty years or more, for the build-up to escalate to dangerous levels. This process of plaque build-up is called atherosclerosis, a process which is quickened by having high blood pressure or cholesterol, diabetes or especially by smoking. Because less blood is getting through to the heart, oxygen, which is carried within the blood cells, also becomes limited. If one or more artery (arteries) becomes completely blocked, a heart attack follows.</p> <p>If immediate treatment, usually surgery to clear up the arteries, is not administered, the muscles of the heart become permanently injured, causing the patient to die or become disabled.</p> <p>A heart attack can, less frequently than by the complete blocking of the arteries, also be caused by a severe spasm or tightening of the coronary artery, which temporarily cuts off blood flow from the heart</p>	<p>Research symptoms, effects, causes, prevention and treatment for:</p> <p>Hypertension Atherosclerosis Coronary heart attack Cerebral hemorrhage Arteriosclerosis</p> <p>Produce a model of a blood vessel using PVC piping (rubber or hard plastic tubing) and adding layers of plasticine/clay to show fat deposits</p>	<p><i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i> Internet</p> <p>PVC pipes, clay/ plasticines</p>	<p>Rubric for assessing (investigations) research</p> <p>Rubric for assessing models</p>

**SCOPE OF WORK  
GRADE 11  
STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE HEART**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Research how artificial pacemakers stimulate heart contractions</p>	<p>Pacemaker- special group of muscle cells in the right atrium that controls heartbeat. Sends electrical messages that stimulate heart muscle to contract. Pacemaker may also receive signals from brain to speed up nor slow down heart bear A number of conditions can cause the heart to develop an abnormal heartbeat. An artificial pacemaker can be surgically implanted. Artificial pacemakers deliver an electronic shock at intervals that approximate the natural cardiac rhythm. Implanted in patients skin or on the chest wall. Consist of pulse generator and two electrodes. Electrodes connected to the right atrium and right ventricle through a vein</p>	<ul style="list-style-type: none"> <li>• Research how artificial pacemakers stimulate heart contractions.</li> <li>• Make an oral presentation to describe how pacemakers operate.</li> </ul>	<p><i>GCSE Biology</i></p> <p>Internet</p>	<p>Rubric for assessing oral presentations</p>

**SCOPE OF WORK  
GRADE 11**

**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: THE CIRCULATORY SYSTEM**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Create a life-size model or display illustrating the circulation of blood through the human body.</p>	<p>Pulmonary circulation – the flow of blood from heart to lungs and back to heart. Systemic – circulation flow of blood from the heart to body and back to heart            Show flow of blood through the heart and body: superior and inferior vena cava-right atrium-right ventricle-pulmonary arteries-lungs-pulmonary vein-left atrium-left ventricle-aorta-body. Carotid artery to head, subclavian artery to arms; hepatic artery to liver; mesenteric artery to alimentary canal; renal artery to kidney; iliac artery to trunk and legs; femoral artery to legs. Femoral vein legs to posterior/inferior vena cava; renal vein kidneys to posterior vena cava, hepatic portal vein from small intestine to liver; hepatic vein from liver to inferior vena cava; subclavian vein to superior/anterior vena cava, jugular vein from head to vena cava</p>	<ul style="list-style-type: none"> <li>• Create a life-size model or display to illustrate the pathway of blood through the body. Include major vessels to and from the head, arms, lungs, alimentary canal/small intestines, liver, kidneys and legs.</li> <li>• Draw arrows to show blood travels from heart to the lungs, back to the heart, to all other parts of the body and back to the heart.</li> </ul>	<p>Chart paper/ folding display boards markers/paint/crayons</p> <p><i>GCSE Biology</i>  <i>Longman Biology for CSEC</i>  <i>CXC Human and Social Biology</i></p>	<p>Rubric for assessing visual aids/models</p>
<p>Identify major blood vessels.</p>	<p>As above</p>	<p>Label the major blood vessels on the model or display.</p>	<p><i>Biology for CSEC</i>  <i>GCSE Biology</i>  <i>Longman Biology for CSEC</i>  <i>CXC Human and Social Biology</i></p>	<p>Correct labeling</p>

## SCOPE OF WORK

### GRADE 11

#### STRAND: ANIMAL ANATOMY AND PHYSIOLOGY

##### UNIT: THE CIRCULATORY SYSTEM

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe cross sections of blood vessels.	Cross sections of arteries, arterioles, capillaries, venules and veins show differences in size, thickness of walls and presence of valves.	<ul style="list-style-type: none"> <li>Observe cross-sections of arteries, veins and capillaries.</li> <li>Label diagrams of C. S. blood vessels.</li> <li>Compare and contrast the structure of the three types of blood vessels.</li> </ul>	Microscope slides T. S. capillary, vein, artery, microscopes, diagrams of T. S. capillary, vein, artery  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Number and accuracy of similarities and differences
Explain the difference in the composition of blood in the pulmonary artery compared with blood in other arteries.	The pulmonary arteries transport deoxygenated blood other arteries transport oxygenated blood.	Use a simple model to explain the difference in the composition of blood in the pulmonary artery compared with blood in other arteries.		Rubric for assessing oral presentations
Differentiate between veins and arteries.	Arteries - thick muscle and elastin layer, walls thick to withstand high pressure; small lumen; transport blood to heart (except pulmonary artery); blood pressure high, blood flows rapidly in pulses; carry oxygenated blood (except pulmonary artery); no valves present Veins – thin elastic walls; carry blood towards heart (except pulmonary vein) blood at low pressure and flows smoothly, carry deoxygenated blood (except pulmonary vein); lie close to body surface, valves prevent backflow of blood, Capillaries – wall one cell thick for ease of diffusion, small lumen; carry blood to the cells of tissues and organs, substances pass through walls, low pressure and slow flow, no valves, carry blood from arterioles to venules	Construct a table showing the structural and functional differences between arteries and veins.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Number of valid differences

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: BLOOD**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use a microscope to view prepared slides of blood.	Plasma – pale yellow liquid containing food (glucose, amino acids, vitamins, minerals), excretory substances (e.g. urea, carbon dioxide), blood proteins (e.g. albumen, globulin, fibrinogen) , hormones and water Red blood cells (erythrocytes) – biconcave discs, no nucleus, lives 3 months, made in bone marrow, destroyed in liver & spleen, red pigment haemoglobin combines with oxygen to form oxyhaemoglobin, 1mm <sup>3</sup> has 5	<ul style="list-style-type: none"> <li>Place a prepared slide of human blood smear on the stage of a microscope. Focus the slide using low and high power objectives</li> </ul>	Microscope, prepared slide of human blood.  <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing the use of materials and equipment correctly and safely  Correct and safe use of apparatus and materials
Observe prepared slide of blood smear to identify the components of blood.	As above	<ul style="list-style-type: none"> <li>Observe prepared slide of blood smear to identify the components of blood</li> <li>Use photographs of blood cells to identify the components of blood on the slide.</li> </ul>	<i>Longman Biology for CSEC</i>	Correct identification of cells

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: BLOOD**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare blood cells.	million rbc's; transport oxygen from lungs to tissues White blood cells – 2 types, defend against disease; larger than rbc's, 1 mm <sup>3</sup> has 8000 - 10000 Phagocytes – irregular shape; lobed nucleus; pseudopodia can move through capillary walls to infection site; can surround and engulf bacteria, formed in bone marrow ; Lymphocytes – produce antibodies that destroy pathogens by causing them to clump or neutralizing their toxins, formed in lymph nodes and spleen	Compare leucocytes, lymphocytes, erythrocytes <ul style="list-style-type: none"> <li>• Number per ml</li> <li>• Size</li> <li>• Place of origin</li> <li>• Life span</li> <li>• Destruction</li> <li>• Shape</li> <li>• Colour</li> <li>• Nucleus</li> <li>• Cytoplasm</li> </ul> Construct a table or graphic organizer to show comparisons.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids.
Describe how the features of each type of blood cell are adapted for their functions.		Write a short story describing how the features of each type of blood cell are adapted for their functions.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Clarity and accuracy (content) in demonstrating the relationship; storyline
Relate the composition and state of blood to its functions.	Plasma – liquid for transportation (heat, food, hormones), RBCs – transportation of oxygen, WBCs – fight disease causing organisms, platelets – blood clotting.	Use visual aids to explain how the composition of blood is suited to its functions.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing oral/visual presentations

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: BLOOD**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Research the significance of blood groups in transfusions.</p>	<p>There are 4 groups known as A, B, AB, and O. These groups are based on proteins (A and B) called antigens, that are present on the surface of red blood cells and two antibodies in plasma Anti-A and Anti B. Transfusion - the injection of blood or blood components to replace blood lost through surgery or injury. Blood must be cross matched for compatibility            Type A can receive A, O; can donate to A, AB            Type B can receive B, O; can donate to B and AB            Rhesus factor present (Rh pos) or absent (Rh neg). Rh neg can be given to Rh neg or Rh pos people. Rh pos can only be given to Rh pos people            Blood banks collect and store blood; blood tested for diseases e.g. hepatitis, HIV</p>	<ul style="list-style-type: none"> <li>• Research the significance of blood groups in transfusions.</li> <li>• Prepare a brochure to inform teenagers of the importance of blood groupings (ABO, Rh) in transfusions and pregnancies.</li> </ul>	<p>Internet, pamphlets</p> <p><i>GCSE Biology</i>  <i>Biology for CSEC</i>  <i>CXC Human and Social Biology</i>  <i>Human Form &amp; Function</i></p>	<p>Rubric for assessing research</p> <p>Rubric for assessing visual aids</p>

## SCOPE OF WORK

### GRADE 11

#### STRAND: ANIMAL ANATOMY AND PHYSIOLOGY

##### UNIT: LYMPHATIC SYSTEM

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Identify the parts of the Lymphatic System.	The lymphatic system consists of lymphoid organs, which are spread throughout the body. These include the bone marrow, thymus, lymphatic vessels, lymph nodes, spleen, adenoids, and tonsils.	After studying a diagram of the lymphatic system, use a blank diagram of the human body to show the location of the various lymph nodes, ducts, and vessels.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct labeling
Compare blood plasma, lymph, and tissue fluid.	Blood is a mixture of cells, proteins and plasma solutes. Tissue fluid is liquid which has leaked out of the capillaries into the spaces between the cells. Lymph is the clear, watery fluid passing through lymph vessels.	On a table/ Venn diagram indicate the similarities and differences between blood, lymph, and tissue fluid.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Number and accuracy of similarities and differences
Describe the functions of the lymphatic system.	The lymphatic system has three main functions: Removal of interstitial fluid from tissues Absorption and transportation of fats and fatty acids Production of immune cells such as lymphocytes.	Create concept map or graphic organizer to summarize the functions of the lymphatic system.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Clarity and accuracy of diagram and description
Describe the relationship between the Lymphatic and Circulatory Systems.		Create a song/rap to describe the relationship between the Lymphatic and Circulatory Systems.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing oral presentations

**SCOPE OF WORK  
GRADE 11  
STRAND: PLANT ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION IN PLANTS**

**DURATION: ½ week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Formulate a hypothesis as to how plants excrete waste.		Formulate a hypothesis as to how plants excrete waste.		Plausibility and clarity of hypothesis and reasons
Research how plants excrete waste.	Plants do not have an excretory system but remove their waste in various ways including: Oxygen is a waste product removed by the stomata during daytime and during the night time only carbon dioxide is excreted. Calcium oxalate and tannin from metabolic processes are stored in leaves, bark, flowers, fruits and seeds excreted when these parts are shed. Other waste may be stored permanently in certain parts of the plant such as the xylem of hard wood.	<ul style="list-style-type: none"> <li>• Research how plants excrete waste</li> <li>• Make a visual presentation.</li> </ul>	<i>Modern Biology for Secondary Schools</i> <i>AQA Science</i> <i>Biology for CSEC</i>	Rubric for assessing visual presentations

**SCOPE OF WORK  
GRADE 11**

**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION**

**DURATION: 3 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Match the excretory organs of the human body to their metabolic waste.	Excretion is the removal of metabolic waste from the body. The main excretory organs and their metabolic waste include the following: Lungs (carbon dioxide and water vapour); Skin (salts, urea and water in sweat); liver (breakdown products from haemoglobin in bile); Kidney (urea, salt and water in urine)	Use graphic organizer or cue cards to match excretory organs and their waste.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids (graphic organizer)
Make an annotated diagram of the urinary system of Man	The main excretory organs in Man are a pair of reddish-brown, bean-shaped organs called the kidneys. The kidneys are a part of the urinary system, which also includes the ureters (transports urine to the bladder), urethra (expels urine outside of the body), urinary bladder (stores urine before expulsion)	<ul style="list-style-type: none"> <li>• Observe a poster or model of the urinary system.</li> <li>• Make a diagram of the urinary system.</li> <li>• Label the parts of the system.</li> <li>• State (beside the label) the function of each.</li> </ul>	Model, poster or transparency showing labelled parts of the urinary system.  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids
Make inferences about the functions of the kidney based on the composition of blood in the renal artery and renal vein.	Artery (brings oxygenated blood concentrated with metabolic waste to the kidney), and renal vein (transports deoxygenated blood that is less concentrated with metabolic waste from the kidneys to the heart).	<ul style="list-style-type: none"> <li>• Observe a comparative table showing composition of blood in the renal artery and vein.</li> <li>• Make inferences about the functions of the kidneys.</li> </ul>	Comparative table <i>Human Form &amp; Function</i>	Clarity and accuracy of inferences based on observations made

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use a scalpel or other cutting utensil to dissect a kidney.	Each kidney is a red-brown oval structure with an indentation on its innermost surface.	Dissect a kidney using the apparatus provided.	Sheep, chicken or pig's kidney, dissecting board, scalpel or other cutting utensil	Rubric for assessing correct and safe handling of apparatus and materials
Use a hand lens and/or microscope to observe the internal structure of a dissected kidney.	The kidney tissue is made up of many capillaries and tiny tubules held together by connective tissue. There is a darker outer region called the <b>cortex</b> and a lighter inner region called the <b>medulla</b> . The <b>pelvis</b> is the space where the ureter leaves the kidney. Cones or <b>pyramids</b> of kidney tissue project into this space.	Observe/examine the internal structure of a dissected kidney.	Hand lens, microscope, prepared slides	Rubric for assessing correct and safe handling of apparatus and materials
Create an annotated line drawing showing the internal features of a dissected kidney.		<ul style="list-style-type: none"> <li>• Draw the internal structure of a dissected kidney</li> <li>• Make annotated labels.</li> </ul>	Microscope, prepared slides, paper, pencil, colored pencils <i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids
Construct a model representing a nephron to demonstrate ultrafiltration.	The <b>nephrons</b> are the filtering units of the kidney. Their main function is to regulate the concentration of water, glucose, urea and solutes in the body by filtering the blood, reabsorbing what is needed, and excreting the rest as urine.	Construct a model to represent a nephron and illustrate ultrafiltration.	Visking tube/plastic bags, beakers, measuring cylinder, dropper, stirring rod, string, stopwatch, water, potassium permanganate, yellow food coloring Longman Biology for CSEC <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Use model of a nephron to explain its role in osmoregulation.	The renal artery brings oxygenated blood containing excretory products to the kidney. This blood is high in oxygen, water, urea and other nitrogenous compounds, mineral salts, sugar and plasma solutes, but low in carbon dioxide. The renal vein drains filtered, deoxygenated blood from the kidney. It contains less oxygen, glucose, nitrogenous wastes, salts and water, but more carbon dioxide.	Use the model of the nephron to make an oral presentation on the role of the nephrons in osmoregulation.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing oral presentations

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GRADE 11  
STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Make an annotated diagram of the nephron.</p>	<p>The nephron begins in the cortex as the <b>Bowman’s capsule</b> (encloses a knot of the capillaries called the <b>glomerulus</b> and receives filtrate). One end of the capsule is drawn out as a long, tubular structure called the <b>renal tubule</b>. The <b>first part is called proximal convoluted tubule</b> (reabsorbs valuable material). The tube descends into the medulla. It loops back on itself and is called the <b>loop of Henle</b> ( alters salt concentration in the medulla to aid in reabsorption of water from the collecting duct) then ascends back into the cortex. The tubule twists and turns again this is called the <b>second or distal convoluted tubule</b> (further reabsorption may occur). Tubules joins other tubules in a common <b>collecting duct</b>.</p>	<ul style="list-style-type: none"> <li>• Observe a diagram of a nephron.</li> <li>• Make an annotated diagram of the nephron.</li> <li>• Develop a mnemonic device to include the parts and their functions.</li> </ul>	<p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i></p>	<p>Rubric for assessing visual aids</p> <p>Correct information and format of a mnemonic device</p>
<p>Describe how the principle of the nephron is used in dialysis.</p>	<p>Similarities in structure and function</p>	<ul style="list-style-type: none"> <li>• Observe diagrams of a nephron and dialysis machine/outfit</li> <li>• Describe how the principle of the nephron is used in dialysis.</li> </ul>	<p><i>Human Form and Function</i></p> <p><i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i></p>	<p>Number of similarities correctly identified; clarity in organization of points</p>

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare and contrast excretion in plants and humans.	Plants are able to reuse excretory products oxygen (photosynthesis) and carbon dioxide (respiration) and store some waste. The waste products in humans are harmful and are therefore eliminated.	Construct a Venn diagram to Compare and contrast excretion in plants and humans.	<i>AQA Science</i>	Number and accuracy of similarities and differences
Formulate a hypothesis on the effect of named factors on the volume and composition of urine.	When it is very hot, there is an increase in perspiration, have chronic diarrhea or vomiting, or eat salty foods, the body loses lots of water and salts. As a result, your blood becomes too concentrated. The pituitary secretes ADH which causes lots of water to be reabsorbed and the bladder produces a small volume of concentrated urine. When it is cold, you perspire little, or drink lots of water, the blood becomes dilute. The pituitary secretes less ADH. Little water is reabsorbed and the bladder produces a large volume of dilute urine.	Formulate a hypothesis on the effect of diarrhea, eating salty foods, and drinking large volumes of water on urine output.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Plausibility of hypothesis and reasons given

**SCOPE OF WORK  
GRADE 11  
STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: EXCRETION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Design an investigation to determine whether a sample of urine is from a diabetic or non-diabetic.	When the pancreas fails to produce sufficient insulin or does not use the insulin produced efficiently or properly, a condition known as diabetes mellitus develops. In persons suffering from diabetes mellitus, the amount of glucose in the blood rises so high that the kidneys begin to excrete glucose into the urine. The presence of this glucose can be tested for by using Benedict's reagent. A yellow, green, or brick-red, orange color indicates a positive result.	<ul style="list-style-type: none"> <li>• Identify the apparatus and materials including the reagent to be used (Benedict's).</li> <li>• Outline the method to be used.</li> <li>• Describe the expected observations for the sample if it were from a diabetic or non-diabetic.</li> <li>• Explain the expected color changes.</li> </ul> <p><b>Not to be conducted</b></p>	<p>“Urine” samples/different concentrations of sugar solutions (with yellow food colouring), Benedict's reagent, beakers, test tubes, stirring rods, Bunsen burner, lighter, dropper, tripod, wire gauze, heat- proof mat</p> <p><i>CXC Human and Social Biology Human Form &amp; Function</i></p>	Rubric for assessing investigations
Research dietary practices necessary for maintaining healthy kidneys.	Diet choices affect health. Persons at risk for kidney disease should consume complex carbohydrates, less proteins, limit the intake of salts, and monitor fluid intake. When kidney fails due to lack of diet or other reasons they would need to undergo dialysis and or a transplant performed.	<ul style="list-style-type: none"> <li>• Research dietary practices necessary for maintaining healthy kidneys.</li> <li>• Practice wise dietary choices necessary for maintaining healthy kidneys.</li> <li>• Identify the consequences which result from not following those choices.</li> <li>• Make an oral presentation.</li> </ul>	<p>Internet, multimedia equipment (optional)</p> <p><i>CXC Human and Social Biology Human Form &amp; Function</i></p>	Rubric to assessing oral presentations

**SCOPE OF WORK  
GRADE 11**

**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

**DURATION: 3 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Predict the meaning of homeostasis.	Homeostasis is the maintenance of a constant internal environment, despite changes in the external environment. It allows cells to work efficiently.	Based on the suffix and prefix of the word, predict the meaning of homeostasis.	Internet <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Plausibility of predictions and reasons given
Explain how the kidneys and hypothalamus control the water content of the blood.	If the blood passing through the brain is too concentrated, the hypothalamus stimulates the pituitary gland to secrete anti-diuretic hormone (ADH) into the blood. When the pituitary secretes a large amount of ADH, the tubules reabsorb more water from the glomerular filtrate, giving a small volume of concentrated urine. If the blood passing through the blood is too dilute, the pituitary suppresses the secretion of ADH. When the production of ADH is suppressed, the tubules become less permeable and less water is reabsorbed from the glomerular filtrate, resulting in a large volume of dilute urine. Feedback.	Draw a flow chart or concept map to explain how the kidneys and hypothalamus control the concentration of water in the blood.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids

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**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Make a diagram or model of a nephron to show its role in osmoregulation.		<ul style="list-style-type: none"> <li>• Make a diagram or model of a nephron</li> <li>• Use the model/diagram of a nephron to describe/demonstrate its role in osmoregulation.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Make predictions about the effect of insufficient/excess ADH on urine production.		<p>Predict how the secretion of too much and too little ADH affects the volume and concentration of urine produced by the kidneys.</p> <p>Make a correlation between ADH concentration and urine production.</p>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	<p>Plausibility of predictions and reasons given</p> <p>Correct explanation of the correlation between ADH concentration and urine production</p>
Create a flow diagram to explain how the liver and pancreas control the sugar content of the blood.	When the glucose concentration in the blood is too high, the pancreas secretes the hormone insulin. This causes the liver to convert glucose into glycogen, lowering blood glucose. When the glucose concentration in the blood is too low, the pancreas secretes the hormone glucagon. This causes the liver to convert glycogen back into glucose, raising blood glucose.	Draw a flow chart or concept map to explain how the liver and the pancreas control the amount of glucose in the blood.	Pencil, ruler  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids
Recognize and describe the relationship between diet and blood glucose levels.	Foods rich in starch and sugar cause an elevation in blood glucose levels.	<ul style="list-style-type: none"> <li>• List foods eaten for breakfast, lunch, and dinner for one week.</li> <li>• Record the calories per serving of the foods.</li> </ul>	<i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Clarity and accuracy (content) in demonstrating the relationship

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Make predictions about the effect of insufficient or excess insulin secretion on blood-glucose concentration.		Predict how the secretion of too much and too little insulin will affect blood glucose levels.	<i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Plausibility of predictions and reasons given
Describe the role of the skin in homeostasis.	Shivering, vaso-constriction, “goose pimples” and reduction in sweating aid in conserving heat. Vaso-dilation, sweating aids in release of heat and cooling the body. X-ref Surface: volume ration. (X-ref. Homeostasis – temperature control)	<ul style="list-style-type: none"> <li>• Describe the mechanisms to reduce heat loss from the skin.</li> <li>• Describe the mechanisms to increase heat loss from the skin.</li> <li>• Explain the role of vasopressin in temperature control.</li> <li>• Use visual aids/demonstrations to show why the surface area of the skin makes it important in temperature regulation.</li> </ul>	Containers with a large surface: volume ratio, containers with a small surface: volume ratio <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing visual aids/models

**SCOPE OF WORK  
GRADE 11**

**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
<p>Create a flow diagram to explain the role of the skin in controlling body temperature.</p>	<p>When it is too cold, erector muscles contract, pulling the hairs up to trap an insulating layer of air. This causes the characteristic “goose-pimples”. Arterioles just below the surface of the skin constrict and constrict so that less blood containing heat flows near the surface of the skin (Vasoconstriction). Sweat glands become less active, decreasing the production of sweat. The muscles contract more (shivering), producing heat which helps to raise the body temperature. When it is too hot, the erector muscle relaxes, causing the hairs to lie flat. Arterioles below the epidermis dilate or widen, causing more blood and heat to flow near the surface (Vasodilation). Increases in sweat production. Sweat evaporates using latent heat which cools the body.</p>	<p>Develop a cartoon or another visual to explain the role of the skin in controlling body temperature.</p>	<p>Pencil, ruler, <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	<p>Rubric for assessing visual aids</p>

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Formulate a hypothesis on whether insulation affects the rate at which organisms lose heat.	<p><b>Endotherms</b> are animals (birds and mammals) that keep their body temperature constant despite changes in the external temperature. They make heat inside their body and keep it there. Animals with lots of hair or fur contract their erector muscles so the hairs stand up and trap a layer of air between them, insulating the body and preventing heat loss. The erector muscles in animals with a sparse covering of hair still contract in cold weather, but give rise to goose pimples.</p> <p><b>Ectotherms</b> are animals (fish, amphibians and reptiles) whose body temperature changes with the temperature of the surroundings. They gain heat from outside their body. These animals lack hair and fur so they bask in the sun to keep warm or retreat to holes in the ground to cool down. They always stay in a place where the temperature is suitable.</p>	<ul style="list-style-type: none"> <li>• Review methods of heat loss</li> <li>• Brainstorm the forms of insulation in common animals.</li> <li>• Formulate a hypothesis on whether insulation affects the rate at which an organism loses heat.</li> </ul>	<p><i>AQA Science</i>  <i>Biology for CSEC</i></p>	Plausibility of predictions and reasons given
Design an experiment to determine the effect of insulation on heat loss.	Content	Design an experiment to determine the effect of insulation on heat loss.	Thermometer, cotton wool, conical flasks, beaker, water, kettle/Bunsen burner, tripod, lighter, wire gauze, elastic bands	Clarity, details and logic of plan

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**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Conduct, and evaluate an experiment to determine the effect of insulation on heat loss.		Conduct, and evaluate an experiment to determine the effect of insulation on heat loss.	<i>Longman Biology for CSEC</i>	Rubric for assessing experimental investigations
Use a thermometer to accurately measure temperature of water in insulated and non-insulated flasks to 0.5° C.		<ul style="list-style-type: none"> <li>Identify variables</li> <li>Control variables</li> <li>Measure the temperature of water in a flask covered with cotton wool and one left exposed or uncovered.</li> </ul>	Thermometer, cotton wool, flasks, beaker, water, kettle/Bunsen burner, tripod, lighter, wire gauze, elastic bands	Accuracy of measurements, clarity of recording measurements
To investigate the effect of insulators on heat loss.	Materials, such as cotton wool, trap air. Since air is a poor conductor of heat, this acts as insulation and helps to retain heat. The less insulation, the more and faster heat is lost.	Collect two conical flasks of the same size. Secure cotton wool around one of the flasks. Measure and record the temperature of the water in both flasks every minute for 20 minutes. Calculate the total drop in each flask. Make valid conclusions. Write an experimental report.		<ul style="list-style-type: none"> <li>Correct and safe use of apparatus and materials</li> <li>Accuracy of measurements, clarity of recording measurements</li> <li>Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Compare temperature change of an insulated and a non-insulated flask.		<ul style="list-style-type: none"> <li>Draw a table to compare decrease in temperature in both flasks.</li> <li>Draw line graphs to compare change in temperature from an insulated and non-insulated flask</li> </ul>	Graph paper, ruler	<ul style="list-style-type: none"> <li>Clarity of recording measurements recording data.</li> <li>Rubric for assessing processing data (graphs)</li> </ul>

**SCOPE OF WORK**  
**GRADE 11**  
**STRAND: ANIMAL ANATOMY AND PHYSIOLOGY**

**UNIT: HOMEOSTASIS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Relate the results from the investigation on the effects of insulation on heat loss to the ability of one's skin to maintain body temperature.	See aforementioned content	Relate the results of the experiment to mammals with varying amounts of hair or fur (humans, cats) and animals with no insulation (lizards) maintain body temperature.	Thermometer, cotton wool, conical flasks, beaker, water, kettle/Bunsen burner, tripod, lighter, wire gauze, elastic bands  <i>AQA Science</i> <i>Biology for CSEC</i> <i>Human Form &amp; Function</i>	Clarity and accuracy (content) in demonstrating the relationship
Design an experiment to investigate the effect of body size on heat loss.		<ul style="list-style-type: none"> <li>• Include apparatus, materials</li> <li>• Record the methodology.</li> </ul>		Rubric for assessing experimental investigations (plan)
Design, conduct and evaluate an experiment to investigate the effect of body size on heat loss.		Conduct and evaluate an experiment to investigate the effect of body size on heat loss.	Conical flasks/beakers/cans of different sizes, measuring cylinder, Bunsen burner, lighter, heat proof mat, tripod, wire gauze, stop clock, water	Rubric to assessing experimental investigations (plan)
Relate the results from the investigation on the effects of body size on heat loss to the ability of large and small animals to conserve heat.	See aforementioned content	Relate the results of the experiment to large and small animals and their ability to conserve heat.	Conical flasks/beakers/cans of different sizes, measuring cylinder, Bunsen burner, lighter, heat proof mat, tripod, wire gauze, stop clock, water	Clarity and accuracy (content) in demonstrating the relationship
Suggest reasons to support "body size affects the rate at which an organism loses heat."	Very small animals have a large surface area to volume ratio and thus they have a greater rate of heat loss. A larger animal have a small surface area to volume ratio and thus have a slower rate of heat loss.	Orally suggest reasons to support body size affects the rate at which an organism loses heat.		Plausibility of suggestions and reasons given

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE ENVIRONMENT**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Justify the importance of biodiversity.	Resilience of ecosystem to natural hardships, variation, economic benefits – medicinal, ornamental, industrial products	<ul style="list-style-type: none"> <li>• Research benefits of broad biodiversity.</li> <li>• Make an oral presentation justifying the need to maintain biodiversity.</li> </ul>		Rubric for assessing oral presentations
Investigate how human activities can influence and modify the biodiversity in natural systems.	Impact of human activities due population growth increased demand for food and consumer goods; ability to use technology to change natural systems. Human activities have led to: consumption of resources (water, fossil fuels); production of a waste (landfills, greenhouse gases, pollution); modification of environment through agriculture, industrialization, and housing – deforestation, erosion, eutrophication, over-fishing, increased fires; introduction of new species; to decrease in biodiversity; destruction of habitat; climate change, over-harvesting	<ul style="list-style-type: none"> <li>• Investigate how human activities can influence and modify systems - impact of over-fishing; impact of coastal development including resorts, marinas and golf courses; impact of urbanization; impact of solid waste/sewage disposal; impact of oil and gas exploration; impact of deforestation; impact of modern agricultural practices; impact of invasive species.</li> <li>• Write a case study outlining how humans have altered a specific ecosystem and/or create an action plan or propose a course of action to maintain or increase the sustainability of local ecosystems.</li> </ul>	Bahamas Reef Environment Education Foundation (BREEF) <a href="http://www.breef.org">www.breef.org</a> ; Abaco Friends of the Environment, <a href="http://www.friendsoftheenvironment.org">www.friendsoftheenvironment.org</a> ; The Nature Conservancy <a href="http://www.nature.org/wherewework/caribbean/bahamas/">http://www.nature.org/wherewework/caribbean/bahamas/</a> Bahamas National Trust <a href="http://www.bnt.bs">www.bnt.bs</a> The Bahamas Environment Science and Technology Commission (BEST) <a href="http://www.best.bs">www.best.bs</a> Sandwatch <a href="http://www.sandwatch.org">www.sandwatch.org</a>	Rubric for assessing investigations  Number, accuracy, relevancy and sequencing of points

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE ENVIRONMENT**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Predict the effects of decreasing biodiversity in local ecosystems, after researching its importance to the stability and resiliency of ecosystems.</p>	<p>Define biodiversity as the variety of life: the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part; benefits of biodiversity include biological resources, ecosystem services and social benefits. Biological resources include : <a href="#">food for humans and for cultivated animals</a> <a href="#">medicinal and pharmaceutical resources</a>; <a href="#">breeding stocks, population reservoirs</a>; <a href="#">resources not yet identified (future resources)</a>; <a href="#">wood products</a> <a href="#">ornamental plants and animals</a>; Potential agents for crop improvement or biological control. Ecosystem services -protection of water resources ; <a href="#">soils formation and protection</a>; nutrient storage and cycling; <a href="#">pollution breakdown and absorption</a>; contribution to climate stability <a href="#">maintenance of ecosystems</a>; <a href="#">recovery from unpredictable events</a>. Social benefits include: research, education and monitoring; recreation &amp; tourism; <a href="#">cultural values</a><sup>3</sup></p>	<ul style="list-style-type: none"> <li>• Research the importance of biodiversity to the stability and resiliency of local ecosystems.</li> <li>• Make predictions on the effects of decreasing biodiversity in ecosystems.</li> </ul>	<p><a href="http://www.best.bs/Documents/Bahamas_NBSAP.pdf">http://www.best.bs/Documents/Bahamas_NBSAP.pdf</a> The Bahamas Environment Science and Technology Commission (BEST) <a href="http://www.best.bs">www.best.bs</a></p>	<p>Rubric for assessing research</p> <p>Plausibility of predictions and reasons given</p>

<sup>3</sup> <http://www.biodiversity.ru/coastlearn/bio-eng/benefits.html>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE ENVIRONMENT**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Suggest ways to minimize the impact of human activities on the environment.	Measures for preventing or reducing the effects of impact of human activities on Bahamian and Terrestrial ecosystems: Physical restructuring of the shoreline - dredge and fill development; Destructive use and vegetation loss - sand mining, dump sites; Land cover change and vegetation replacement - houses and resorts; Introduction of exotic species - <i>Casuarina</i> and <i>Scaevola</i> .	<ul style="list-style-type: none"> <li>• Identify local areas that are negatively impacted by human activities.</li> <li>• Brainstorm means of minimizing these impacts.</li> <li>• Use drama, music, art and/or technology tools to demonstrate ways to minimize the impact of human activities on the environment.</li> </ul>	<i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for assessing oral presentations
Read a published report on the state of marine ecosystems in the Bahamas and write an article summarizing its findings.	Biodiversity; threats to ecosystems; endangered species; laws; conservation management;	<ul style="list-style-type: none"> <li>• Read a published report on the state of marine ecosystems in the Bahamas</li> <li>• Write an article summarizing the findings of the article.</li> </ul>	Bahamas Reef Environment Education Foundation (BREEF) <a href="http://www.breef.org">www.breef.org</a> ; Abaco Friends of the Environment, <a href="http://www.friendsoftheenvironment.org">www.friendsoftheenvironment.org</a> ; The Nature Conservancy <a href="http://www.nature.org/wherewework/caribbean/bahamas/">http://www.nature.org/wherewework/caribbean/bahamas/</a> Bahamas National Trust <a href="http://www.bnt.bs">www.bnt.bs</a> The Bahamas Environment Science and Technology Commission (BEST) <a href="http://www.best.bs">www.best.bs</a>	Accuracy of main points, paraphrasing, cohesiveness, summarizing

**SCOPE OF WORK  
GRADE 12**

**STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: NATIONAL PARKS AND PROTECTED AREAS**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Estimate the size of a bead (representing fish) population.	Methods used to estimate fish populations e.g. tagging.	<ul style="list-style-type: none"> <li>Perform activity to simulate the technique and process of mark and release to estimate a fish population</li> <li>Estimate the population size of one type of “fish”.</li> </ul>	Internet; beads of varying colours or marbles, large jars or beakers or paper bags	<p>Rubric for assessing investigations</p> <p>Rubric for assessing processing data</p>
Explain the role and importance of methods of measuring populations of organisms.	Methods are used to track changes in population, migration, effects of environmental factors, effects of man	<ul style="list-style-type: none"> <li>Find out common methods of measuring populations.</li> <li>Identify which methods are used locally.</li> <li>Use drama or a visual presentation to explain the role and importance of methods of measuring populations of organisms.</li> </ul>		Rubric for assessing oral/visual presentations
Distinguish between a national park and a protected area.		Distinguish between a national park and a protected area.	<p>Bahamas National Trust website <a href="http://www.bnt.bs">www.bnt.bs</a></p> <p>Copies of map of The Bahamas.</p>	Difference clearly stated
Explain the functions of National Parks.	Provides a sanctuary for endangered species to survive, provides safety for reproduction, preserves bio-diversity.	<ul style="list-style-type: none"> <li>List the functions of national parks.</li> <li>Explain how the national parks perform their functions.</li> </ul>	<p>Bahamas National Trust website <a href="http://www.bnt.bs">www.bnt.bs</a></p> <p>Copies of map of The Bahamas.</p>	<ul style="list-style-type: none"> <li>Number of parks correctly identified</li> <li>Number, accuracy, relevancy and sequencing of points</li> </ul>
Identify terrestrial national parks and marine reserves in The Bahamas.	There are 25 National Parks both marine and terrestrial. New ones are being added. Abaco, Andros, Conception Island, Exuma, Inagua, Grand Bahama, New Providence, Walkers Cay	On a map of The Bahamas, identify terrestrial national parks and marine reserves	<p>Bahamas National Trust website <a href="http://www.bnt.bs">www.bnt.bs</a></p> <p>Copies of map of The Bahamas.</p>	Number of national parks correctly located and named

**SCOPE OF WORK  
GRADE 12**

**STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: NATIONAL PARKS AND PROTECTED AREAS**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
<p>Critically assess the value of national parks and protected areas in The Bahamas.</p>	<p>Replenishment, value of marine protected areas to fishery resources, 25 National Parks; role of Bahamas National Trust</p> <p>More than 700,000 Acres protected; marine and terrestrial sites; New areas being developed</p> <p>Marine protected areas (MPA) may be established for several reasons including protecting species, ecosystems, biodiversity, vulnerable &amp; rare habitats, breeding &amp; nursery grounds, historical &amp; cultural sites; In The Bahamas the MPAs are the marine reserves or marine parks; maintain and restore biodiversity and protect marine habitats; 4 established marine parks; benefit fisheries through spillover - movement of adult fish outside MPA into adjacent fisheries areas; larval export, target species, protected within a reserve serve as breeding stocks, are dispersed outside of the reserve and mature in other fisheries areas. First MPA in 1958, the Exuma Land and Sea Park; marine area became a no-take marine reserve in 1986; evidence has shown that invertebrates and fish are larger and more abundant, increasing the population available for the local fishing industry. MPAs provide place for education about marine ecosystems and conservation; serve as an ecotourism and recreational dive site.</p>	<ul style="list-style-type: none"> <li>• Read newspaper articles and/or internet articles or attend town meetings called by non-governmental and governmental environmental protection agencies.</li> <li>• Compare the benefits of MPAs with the perceived threats to local fishing.</li> <li>• Prepare a letter to your representative (parliament or local government) supporting or opposing the nearest proposed park in your area, justify your position</li> <li>• List the objectives of the national parks.</li> <li>• Conduct research (Internet or interviews) to determine the effectiveness of three parks in meeting their objectives.</li> <li>• Identify the threats to the national parks achieving their objectives.</li> <li>• Participate in a debate on whether national parks and protected areas are effectively achieving the set objectives.</li> </ul>	<p>GEO Bahamas 2005 – Global Environmental Outlook <a href="http://www.best.bs">www.best.bs</a></p> <p>Bahamas National Trust <a href="http://www.bnt.bs">www.bnt.bs</a></p>	<ul style="list-style-type: none"> <li>• Number and accuracy of points classified as benefits or threats</li> <li>• Number, accuracy, relevancy and sequencing of points</li> <li>• Rubric for assessing oral presentations</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE GROUPER**

**DURATION: 2 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use data to form a conclusion on the capture of juvenile, berried and adult groupers.		<ul style="list-style-type: none"> <li>• Collect data on juvenile and adult grouper in habitat and nurseries;</li> <li>• Display information in an interesting manner.</li> <li>• Review collected data and compare recent data with older records.</li> <li>• Use data to form a conclusion on the harvesting of groupers.</li> </ul>	Treasures of the Sea; BREEF  Department of Marine Resources	<p>Number and accuracy of similarities and differences</p> <p>Clarity and accuracy of conclusion based on results and observations</p>
Analyze the trends of catches of commercially important grouper in The Bahamas over the last 3 decades.	Fisheries management necessary in order to maintain yields (catches) from that particular fishing ground Review the range of regulations that exist for commercially important species in the Bahamas including licenses, closed season, closed areas, gear restriction, catch restriction, effort restriction and size limits. Define sustainability of fisheries resources as harvesting in such a way that ensures long term access to these resources by local communities.	<ul style="list-style-type: none"> <li>• Construct graphs to show the catches of commercially important fisheries resources in The Bahamas over the last 3 decades.</li> <li>• Analyze the trends.</li> <li>• Suggest the implications of these trends for fisheries management.</li> </ul>	Statistics - Department of Fisheries	<p>Rubric for assessing processing data (graphs)</p> <p>Plausibility of suggestions and validity of reasons given</p>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE GROUPE**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify the major challenges faced by the local grouper fishermen and vendors.	<p>“That sustainability of fisheries resources is harvesting in such a way that ensures long term access to these resources by local communities.</p> <p>The methods used to ensure sustainable utilization of fisheries resources such as licensing, gear restrictions, closed areas and seasons aim at controlling use without damaging the resource.</p> <p>Those fishers should abide by the regulations set by the authorities.”<sup>4</sup></p> <p>That there are many challenges, including natural and human influenced, facing fishermen and fishing communities including poaching, overfishing, habitat degradation, marketing, global economy</p>	<ul style="list-style-type: none"> <li>• Interview local fishermen and/or hold panel discussion with local fishermen and fisheries officer.</li> <li>• Prepare a “did you know?” infomercial or flyer to make the public aware of the challenges faced by local fishermen in catching groupers.</li> </ul>	<p>www. for a living planet www. david suzukisuzuki.org/oceans/fishing Department of Fisheries Personnel Local Fishermen</p>	<p>Rubric for conducting survey/investigations</p> <p>Rubric for assessing visual aids</p>
Identify threats to the local grouper population.	Over-fishing by local fishermen, poachers, catching grouper during breeding season and as juveniles.	<ul style="list-style-type: none"> <li>• Class discussion</li> <li>• Identify threats to the local grouper population.</li> </ul>	<p>BREEF BNT Ministry of Environment</p>	Valid threats identified
Suggests measures for conservation of the local grouper populations.		Suggests measures for conservation of the local grouper populations.	<p>BREEF BNT Ministry of Environment</p>	Plausibility of suggestions and reasons given

<sup>4</sup> Introduction to Small Scale Fisheries Manual – Commonwealth of Learning  
Biology Curriculum 2010, Grades: 10 – 12

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE LOBSTER**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use data to form a conclusion on the capture of juvenile and adult lobster.		<ul style="list-style-type: none"> <li>• Collect data on juvenile and adult lobsters in their habitat;</li> <li>• Display information in an interesting manner.</li> <li>• Review collected data and compare recent data with older records.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult lobsters.</li> </ul>	Treasures of the Sea; BREEF Department of Marine Resources.	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data</li> <li>• Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Analyze the trends of catches of commercially important lobster in The Bahamas over the last three decades.	Fisheries management may be necessary in order to maintain yields (catches) from that particular fishing ground. Review the range of regulations that exist for commercially important species in the Bahamas including licenses, closed season, closed areas, gear restriction, catch restriction, effort restriction and size limits. Define sustainability of fisheries resources as harvesting in such a way that ensures long term access to these resources by local communities.	<ul style="list-style-type: none"> <li>• Construct graphs to show the catches of commercially important fisheries resources in The Bahamas over the last three decades.</li> <li>• Analyze the trends.</li> <li>• Suggest the implications of these trends for fisheries management.</li> </ul>	Statistics - Department of Fisheries	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data (graphs)</li> <li>• Plausibility of suggestions and reasons given</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE LOBSTER**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify the major challenges faced by the local lobster fishermen and vendors.	<p>“That sustainability of fisheries resources is harvesting in such a way that ensures long term access to these resources by local communities.</p> <p>The methods used to ensure sustainable utilization of fisheries resources such as licensing, gear restrictions, closed areas and seasons aim at controlling use without damaging the resource.</p> <p>Those fishers should abide by the regulations set by the authorities.”<sup>5</sup></p> <p>That there are many challenges, including natural and human influenced, facing fishermen and fishing communities including poaching, overfishing, habitat degradation, marketing, global economy</p>	<ul style="list-style-type: none"> <li>• Interview local fishermen and/or hold panel discussion with local fishermen and fisheries officer.</li> <li>• Prepare a “did you know?” infomercial or flyer to make the public aware of the challenges faced by local fishermen in catching lobsters.</li> </ul>	<p>wwf. for a living planet www. david suzukisuzuki.org/oceans/fishing Department of Fisheries Personnel Local Fishermen</p>	<ul style="list-style-type: none"> <li>• Rubric for assessing conducting investigations (survey)</li> <li>• Rubric for assessing visual aids</li> </ul>
Identify threats to the local lobster population.	Over-fishing by local fishermen, poachers, catching lobster during breeding season and as juveniles.	<ul style="list-style-type: none"> <li>• Class discussion</li> <li>• Identify threats to the local lobster population.</li> </ul>	BREEF BNT Ministry of Environment	Number of valid threats identified
Suggest measures for conservation of the local lobster populations.		Suggest measures for conservation of the local lobster populations.	BREEF BNT Ministry of Environment	Plausibility of suggestions and reasons given

<sup>5</sup> Introduction to Small Scale Fisheries Manual – Commonwealth of Learning  
Biology Curriculum 2010, Grades: 10 – 12

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE CONCH**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use data to form a conclusion on the capture of juvenile and adult conchs.	Conch middens give an indication of the state of the conch fisheries over the years and the extent to which juvenile conch are being fished in a particular area at a particular time.	<ul style="list-style-type: none"> <li>• Collect data on juvenile and adult conchs in old and new middens.</li> <li>• Display information in an interesting manner.</li> <li>• Review collected data and compare recent data with older records.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult conchs.</li> </ul>	Treasures of the Sea; BREEF publications Dept. of Marine Resources	<ul style="list-style-type: none"> <li>• Rubric for processing data</li> <li>• Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Analyze the trends of catches of commercially important Conch in The Bahamas over the last three decades.	Fisheries management necessary in order to maintain yields (catches) from that particular fishing ground. Review the range of regulations that exist for commercially important species in the Bahamas including licenses, closed season, closed areas, gear restriction, catch restriction, effort restriction and size limits. Define sustainability of fisheries resources as harvesting in such a way that ensures long term access to these resources by local communities.	<ul style="list-style-type: none"> <li>• Construct graphs to show the catches of commercially important fisheries resources in The Bahamas over the last three decades.</li> <li>• Analyze the trends.</li> <li>• Suggest the implications of these trends for fisheries management.</li> </ul>	Statistics - Department of Fisheries	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data (graphs)</li> <li>• Plausibility of suggestions and reasons given</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE CONCH**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify the major challenges faced by the local conch fishermen and vendors.	<p>“That sustainability of fisheries resources is harvesting in such a way that ensures long term access to these resources by local communities.</p> <p>The methods used to ensure sustainable utilization of fisheries resources such as licensing, gear restrictions, closed areas and seasons aim at controlling use without damaging the resource.</p> <p>Those fishers should abide by the regulations set by the authorities.”<sup>6</sup></p> <p>That there are many challenges, including natural and human influenced, facing fishermen and fishing communities including poaching, overfishing, habitat degradation, marketing, global economy</p>	<ul style="list-style-type: none"> <li>• Interview local fishermen and/or hold panel discussion with local fishermen and fisheries officer.</li> <li>• Prepare a “did you know?” infomercial or flyer to make the public aware of the challenges faced by local fishermen.</li> </ul>	<p>www. for a living planet www. david suzukisuzuki.org/oceans/fishing Department of Fisheries Personnel Local Fishermen</p>	<ul style="list-style-type: none"> <li>• Rubric for conducting investigations (survey)</li> <li>• Rubric for assessing visual aids</li> </ul>
Identify threats to the local conch population.	Over-fishing by local fishermen, poachers, catching conch during breeding season and as juveniles.	<ul style="list-style-type: none"> <li>• Class discussion</li> <li>• Identify threats to the local conch population.</li> </ul>	BNT – Publications Ministry of Environment	Number and validity of threats identified
Suggests measures for conservation of the local conch populations.		Suggests measures for conservation of the local conch populations.		Plausibility of suggestions and reasons given

<sup>6</sup> Introduction to Small Scale Fisheries Manual – Commonwealth of Learning  
Biology Curriculum 2010, Grades: 10 – 12

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON BONEFISH**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use data to form a conclusion on the capture of juvenile and adult bonefish.		<ul style="list-style-type: none"> <li>• Collect data on juvenile and adult bonefish in their habitat;</li> <li>• Display information in an interesting manner.</li> <li>• Review collected data and compare recent data with older records.</li> <li>• Use data to form a conclusion on the capture of juvenile and adult bonefish.</li> </ul>	<i>Treasures of the Sea</i> ; BREEF	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data</li> <li>• Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Analyze the trends of catches of commercially important bonefish in The Bahamas over the last three decades.	Fisheries management may be necessary in order to maintain yields (catches) from that particular fishing grounds. Review the range of regulations that exist for commercially important species in the Bahamas including licenses, closed season, closed areas, gear restriction, catch restriction, effort restriction and size limits. Define sustainability of fisheries resources as harvesting in such a way that ensures long term access to these resources by local communities.	<ul style="list-style-type: none"> <li>• Construct graphs to show the catches of commercially important fisheries resources in The Bahamas over the last three decades.</li> <li>• Analyze the trends.</li> <li>• Suggest the implications of these trends for fisheries management.</li> </ul>	Statistics - Department of Fisheries	<ul style="list-style-type: none"> <li>• Rubric for assessing processing data (graphs)</li> <li>• Plausibility of suggestions and reasons given</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON BONEFISH**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify the major challenges faced by the local bonefishermen and vendors.	<p>“That sustainability of fisheries resources is harvesting in such a way that ensures long term access to these resources by local communities.</p> <p>The methods used to ensure sustainable utilization of fisheries resources such as licensing, gear restrictions, closed areas and seasons aim at controlling use without damaging the resource.</p> <p>Those fishers should abide by the regulations set by the authorities.”<sup>7</sup></p> <p>That there are many challenges, including natural and human influenced, facing fishermen and fishing communities including poaching, overfishing, habitat degradation, marketing, global economy</p>	<ul style="list-style-type: none"> <li>• Interview local fishermen and/or hold panel discussion with local fishermen and fisheries officer.</li> <li>• Prepare a “did you know?” infomercial or flyer to make the public aware of the challenges faced by local fishermen.</li> </ul>	<p>www. for a living planet www. david suzukisuzuki.org/oceans/fishing Department of Fisheries Personnel Local Fishermen</p>	<ul style="list-style-type: none"> <li>• Rubric for assessing conducting survey/investigations</li> <li>• Rubric for assessing visual aids</li> </ul>
Identify threats to the local bonefish population.	Over-fishing by local fishermen, poachers, catching bonefish during breeding season and as juveniles.	<ul style="list-style-type: none"> <li>• Class discussion</li> <li>• Identify threats to the local bonefish population.</li> </ul>	Ministry of Environment publications	Number and validity of threats identified
Suggests measures for conservation of the local bonefish populations.		Suggests measures for conservation of the local bonefish populations.	Ministry of Environment publications	Plausibility of suggestions and reasons given

<sup>7</sup> Introduction to Small Scale Fisheries Manual – Commonwealth of Learning  
Biology Curriculum 2010, Grades: 10 – 12

**SCOPE OF WORK  
GRADE 12  
STRAND: ENVIRONMENTAL BIOLOGY**

**UNIT: HUMAN IMPACT ON THE LAND CRAB**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify threats to the local crab population.	Over-fishing by local fishermen, poachers, catching land crab during breeding season and as juveniles.	<ul style="list-style-type: none"> <li>• Class discussion</li> <li>• Identify threats to the local crab population.</li> </ul>		Number and validity of threats identified
Suggests measures for conservation of the local crab populations.		Suggests measures for conservation of the local crab populations.		Plausibility of suggestions and reasons given

**SCOPE OF WORK  
GRADE 12  
STRAND: CELL BIOLOGY**

**UNIT: NUCLEIC ACIDS**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Formulate a hypothesis about what makes a person unique.	The structure of DNA – the sequence of bases.	Formulate a hypothesis about what makes a person unique.		Plausibility of hypothesis and reasons given
Classify molecules which are components of DNA and RNA.	Sugars (deoxyribonucleic and ribonucleic), phosphates, nitrogenous bases (adenine, cytosine, guanine, thymine, uracil)	Identify and mark components to be used in building a DNA molecule	Styrofoam pieces, plasticine, toothpicks, pipe cleaners, markers, molecular models  <i>AQA Science</i> <i>GCSE Biology</i>	Correct labeling
Create a model of the double helix structure of DNA.	DNA is found in every living organism and is present in every cell of the body. The DNA in each cell contains all the same information as the original fertilized egg. The chromosomes present in the nucleus are made of DNA (deoxyribonucleic acid). DNA is made of a double chain formed by repeating small chemical units called nucleotides. Each nucleotide (arranged as in a ladder- like structure) is made up of a sugar called deoxyribose, a phosphate group and a nitrogenous compound.	Create a model of DNA	Poster paper, yarn Styrofoam pieces, plasticine, toothpicks, pipe cleaners, markers, molecular models  <i>AQA Science</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Make an oral presentation describing the structure of DNA.	As above	In groups, make an oral (song, skit, story) presentation describing the structure of DNA and RNA	Information sheet <i>GCSE Biology</i> <i>AQA Science</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing oral presentations

**SCOPE OF WORK  
GRADE 12  
STRAND: CELL REPRODUCTION**

**UNIT: NUCLEIC ACIDS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Relate the DNA molecule to chromosome structure.	Chromosomes are thread-like structures within a cell's nucleus which contain the genetic information that is passed from one generation to the next. Chromosomes are composed of a very long strand of DNA, coiled many times. Sections of DNA form genes. Analogy- DNA = letters, genes = words, chromosomes = books.	Draw a diagram, illustrating the relationship between DNA, genes and chromosomes.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Clarity and accuracy (content) in demonstrating the relationship
Conduct an investigation to extract DNA.		Perform an investigation: DNA Extraction with Kitchen Chemistry by Donna M. Bronson website: <a href="http://www.iit.edu/">www.iit.edu/</a>	Split peas, dish detergent, salt, toothpicks, meat tenderizer, small beakers, alcohol, onions, yeast, broccoli, raw chicken liver, strainer	Rubric for assessing conducting investigations
Measure materials for the investigation to extract DNA.		Measure water, peas, salt	Materials listed, measuring cups, measuring spoons or balance	Accuracy of measurements
Use equipment for the investigation to extract DNA.		As above	As above	Rubric for assessing correct and safe use of apparatus and materials
Conduct research to find out the relationship between the structure of DNA and mutations.	Any occurrence which changes the sequence of triads or bases on DNA causes a mutation (change in features)	Conduct research to find out the relationship between the structure of DNA and mutations.	Internet <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Rubric for assessing research
Suggest benefits that have been derived from knowledge of the structure of DNA.	Genetic engineering: enhance positive traits in plants (crops) and animals; identification of disease causing genes; medical treatments etc.	Brainstorming in small groups. Class discussion.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Plausibility of benefits identified

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: BIO-TECHNOLOGY**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
List the advantages and disadvantages of using tissue culture as a means of producing plants.	A small amount of plant tissue when treated with hormones, a culture is formed from which, each cell could develop into a new plant. Productivity is greatly enhanced by this technology.	<ul style="list-style-type: none"> <li>Define the term clone.</li> <li>Describe simply the process of producing plants from cloning tissue.</li> <li>List the advantages and disadvantages of using tissue culture as a means of producing plants.</li> </ul>	Magazines, Internet <i>Biology for CSEC</i> <i>GCSE Biology</i>	<ul style="list-style-type: none"> <li>Number, accuracy, relevancy and sequencing of points</li> <li>Number of advantages and disadvantages correctly identified</li> </ul>
Critically assess the advantages and disadvantages of cloning animal embryos.	Hormones cause release of many ova, fertilized in vivo or in vitro. Each fertilized ovum is divided into several cells each developing into an embryo. Identically cloned offspring are born.	<ul style="list-style-type: none"> <li>List advantages and disadvantages of cloning animal embryos.</li> <li>Participate in a debate on this topic.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	<ul style="list-style-type: none"> <li>Number of advantages and disadvantages correctly identified</li> <li>Rubric for assessing oral presentations</li> </ul>
Describe simply fusion (adult) cell cloning.	Nucleus is removed from an adult cell and placed in an ovum which has had its nucleus removed. An electric shock causes the new cell to develop as an embryo genetically the same as the adult cell.	Make a visual presentation to describe the process of cloning an adult cell.	<i>AQA Science</i>	Rubric for assessing visual presentations
Compare and contrast methods of cloning.		<ul style="list-style-type: none"> <li>Research methods of cloning</li> <li>Compare and contrast methods of cloning.</li> </ul>	<i>Biology for CSEC</i>	Number and accuracy of similarities and differences
Suggest ways in which cloning might benefit humans.	Producing tissues to alter damaged tissues, replace tissues, produce animals for research, stem cell research.	Suggest ways in which cloning might benefit humans.	<i>GCSE Biology</i>	Plausibility of suggestions and reasons given

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: BIO-TECHNOLOGY**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Describe simply the process of genetic engineering.	Any change in the genetic material of an organism. This may be done by transferring or reconfiguring the genes.	<ul style="list-style-type: none"> <li>Define genetic engineering</li> <li>Describe simply the process of genetic engineering.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Clarity, accuracy, relevancy and sequencing of main points
Compare the advantages and disadvantages of genetically modified crops/food.		<ul style="list-style-type: none"> <li>Conduct research on genetically modified foods in The Bahamas.</li> <li>Identify examples of genetically modified crops.</li> <li>Find out the features that have been modified in each case.</li> <li>Make a visual presentation showing the benefits, possible harm, and an opinion with reasons on whether all GM foods should be labeled.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>Rubric for assessing research</li> <li>Rubric for assessing visual presentations</li> </ul>
Identify examples of gene transfer between animal and plant tissue.		Identify examples of gene transfer between animal and plant tissue (literature).	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct identification of examples
Compare the advantages and disadvantages of genetic engineering.	Bacteria can make human protein (insulin) in quantities needed, increased growth rates of plants and animals used as food, improved quality of food (genetically modified foods) Disadvantages include Infertile crops economic implications for developing countries, super bugs, long-term effects on humans unknown.	Compare the advantages and disadvantages of genetic engineering.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Number of advantages and disadvantages correctly identified

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: BIO-TECHNOLOGY**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Conduct a survey to determine the extent to which food, plants and animals in the community are products of biotechnology.	Seeds, seedlings, crops, animals, potatoes, corn, tomatoes, cereals	<ul style="list-style-type: none"> <li>Identify products of biotechnology.</li> <li>Design a questionnaire</li> <li>Conduct a survey</li> </ul>	<i>GCSE Biology</i>	Rubric for assessing investigations(survey)
Prepare a proposal for the education of adults in the community on the basis of biotechnology and bioethics.		<ul style="list-style-type: none"> <li>Determine the level of knowledge and interest in biotechnology among teenagers and adults.</li> <li>Organize a medium or forum through which to provide information on biotechnology.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Clarity, details, logic and feasibility of plan
Form an inference as to the meaning of the term “genetically modified crops”.		<ul style="list-style-type: none"> <li>Brainstorm terms “genes” and “modify”.</li> <li>Form an inference as to the meaning of the term “genetically modified crops”.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	Clarity and accuracy of inference based on the term
Observe pictures or samples of genetically modified foods.	It involves the isolation, manipulation and reintroduction of DNA into cells or model organism usually to express a protein to reach desired effects.	<ul style="list-style-type: none"> <li>Cut out pictures of plants /fruits and vegetables as well as livestock and fish which have been genetically modified.</li> <li>Make observations and comment on their appearance</li> </ul>	Magazines ,film strips, videos <a href="http://www.monsanto.com/">http://www.monsanto.com/</a> <a href="http://www.jic.bbsrc.ac.uk/welcome.htm">http://www.jic.bbsrc.ac.uk/welcome.htm</a> Nuffield Council for Bioethics report	Clarity and accuracy of description based on observations
Produce a poster or pamphlet which promotes genetically modified foods.	GMFs are:- <ul style="list-style-type: none"> <li>Resistant to:-a) pathogenic fungi in maize and potato</li> <li>b) Insect pests in many crop plants</li> <li>Increased growth rates in fish and chicken</li> <li>Increase in size/yield</li> <li>Longer shelf life of fruits</li> <li>Tastier and more nutritious</li> </ul>	Make a poster or pamphlet promoting the benefits of GM foods	Paper, colouring pencils/pens, Magazine clippings <i>CXC Biology</i>  <i>Biology for CSEC</i> <i>GCSE Biology</i>	Rubric for assessing visual aids

**SCOPE OF WORK  
GRADE 12  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: BIO-TECHNOLOGY**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare the advantages and disadvantages of genetically modified foods.	Genetically modified crops offer many benefits, such as increased yields, reduced maturation times and improved resistance to diseases and pests. Disadvantages:-unknown effects of GM crops, - tampering with nature.	<ul style="list-style-type: none"> <li>Find out the advantages and disadvantages of genetically modified foods.</li> <li>Prepare a position on GMFs</li> <li>Make an oral presentation on the position.</li> </ul>	<a href="http://www.foe.org/campaigns/food-and-biotechnology">http://www.foe.org/campaigns/food and biotechnology</a> <a href="http://www.parliament.uk/post/pn138.pdf">http://www.parliament.uk/post/pn138.pdf</a> <a href="http://www.monsanto.com/">http://www.monsanto.com/</a>  <i>CXC Biology</i> <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>Number of advantages and disadvantages correctly identified</li> <li>Rubric for assessing oral presentations</li> </ul>
Predict what a “fruit stand” will look like in 2050.		Make a diagram or a model fruit/vegetable stand with fruits “of the future”.	Card board, paint, play dough, colouring <i>GCSE Biology</i>	Rubric for assessing visual aids
Debate the use of human embryos for stem cell research.	Stem cells are capable of turning into any type of cell in the body, hold the best hope of curing a range of diseases including Parkinson’s and juvenile diabetes. The problem is that some of the most versatile and useful stem cells are those extracted from embryos. Many opponents of such research believe a newly fertilised human egg has the same moral status as a person, so using a ball of embryonic cells in research is tantamount to murder.	<ul style="list-style-type: none"> <li>Conduct research on the use of human embryos for stem cell research.</li> <li>Small group discussion on the use of human embryos for stem cell research.</li> </ul>	Magazines, videos, topical articles  <i>AQA Science</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	<ul style="list-style-type: none"> <li>Rubric for assessing research</li> <li>Rubric for assessing oral presentations</li> </ul>
Predict the likely outcome of stem cell research on some illnesses.	The goal is for surgeons to create organs to order, re-grow crippled spine and hearts and reverse the damage of Parkinson’s disease or diabetes with ease. Stem cells may have the potential to accomplish the goal. Immune rejection and waiting list for replacement organs are consigned to history. Potential for abuse. Ethical issues.	<ul style="list-style-type: none"> <li>Predict the likely outcome of stem cell research on some illnesses such as Parkinson’s disease, Alzheimer’s disease and diabetes</li> <li>Conduct research on the topic.</li> <li>Debate the ethics of stem cell research.</li> </ul>	Internet, magazines  <i>AQA Science</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	<ul style="list-style-type: none"> <li>Plausibility of predictions and reasons given</li> <li>Rubric for assessing oral presentations</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: VARIATION**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Research how changes in chromosomes cause variations.	Crossing over, additions, deletions, mutation	<ul style="list-style-type: none"> <li>Define variation</li> <li>Read articles on causes of mutations.</li> <li>Predict how changes in chromosomes might lead to variations.</li> </ul>	Magazines <i>GCSE Biology</i>	Plausibility of predictions and reasons given
Describe how random assortment of chromosomes contributes to variations of features in species.		<ul style="list-style-type: none"> <li>Observe photographs or diagrams showing random assortment of chromosomes</li> <li>Describe how this leads to variation.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i>	Number, accuracy, relevancy and sequencing of points
Explain how sexual reproduction leads to variation in a population.	Sexual reproduction combines non-identical partners and therefore, genes.	Use annotated diagrams to explain how sexual reproduction leads to variation in a population.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Number, accuracy, relevancy and sequencing of points
Identify examples of continuous variation.	Variation is the <a href="#">phenotypic differences</a> among <a href="#">individuals</a> in a <a href="#">population</a> . There are two types of variation continuous and discontinuous variation. Examples of continuous – height, weight, complexion.	Identify examples of continuous variation.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Number of examples correctly identified
Identify examples of discontinuous variation.	Example of discontinuous variation is Blood Groups,	Identify examples of discontinuous variation.	<i>GCSE Biology</i>	Number of examples correctly identified
Suggest how natural selection changes the phenotypic ratio of a population.	Changes in physical environment and predation would reduce the numbers of organisms with certain features (not adapted to the changes).	<ul style="list-style-type: none"> <li>Suggest how natural selection changes the phenotypic ratio of a population.</li> <li>Identify possible examples.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Plausibility of suggestion(s) and reasons given

**SCOPE OF WORK  
GRADE 12  
STRAND: CELL BIOLOGY AND GENETICS**

**UNIT: VARIATION**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Suggest how artificial selection changes the phenotypic ratio of a population.	Humans select for (positively) and against (negatively) features in pets, garden plants etc. The process showing artificial selection changing the ratio of a phenotype in the population.	<ul style="list-style-type: none"> <li>• List plants that people in the community favour.</li> <li>• List plants that people in the community dislike and get rid of.</li> <li>• List animals that people in the community favour.</li> <li>• List animals that people in the community dislike and get rid of.</li> <li>• Suggest how artificial selection changes the phenotypic ratio of a population.</li> </ul>	<p><i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	Plausibility of suggestion(s) and reasons given
Suggest how natural selection causes resistance to certain chemicals.	For some insects, DDT is a poison. Others developed DDT resistance - when DDT was introduced into the ecosystem, insects with a variation showing resistance to DDT were favoured as were not harmed by DDT. They then were able to survive and reproduced while others without this variation died. Where antibiotics are used many bacteria died. But antibiotics-resistant bacteria survived and reproduced and produced bacteria with that variation.	<ul style="list-style-type: none"> <li>• Observe photographs of different organisms in different habitats and their adaptations which help them to survive there.</li> <li>• Suggest how natural selection causes resistance to certain chemicals such as insecticides by insects or antibiotics by bacteria. Examples : Large teeth and claws, camouflaging and mimicry</li> </ul>	<p>Glencoe Biology- An everyday Experience , Science.glencoe.com</p> <p>Biology- Dynamics of Life</p> <p>Photographs showing adaptations</p> <p><i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i></p>	Plausibility of suggestion(s) and reasons given

**SCOPE OF WORK  
GRADE 12**

**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FOOD AND FOOD NUTRIENTS**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify food contaminants.	Viruses, bacteria, protists	<ul style="list-style-type: none"> <li>Brainstorm food contaminants</li> <li>Identify sources of food contaminants.</li> </ul>	<i>Human Biology for The Tropics</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Correct identification of major classes of contaminants</li> <li>Correct matching of identified contaminants with sources of contamination</li> </ul>
Suggest ways to prevent food contamination.	The storage, handling and serving of food must be done very carefully to prevent food contamination. The presence of microbes on food can result in illness due to the toxins they release as they decay the food and/or transmit diseases.	<ul style="list-style-type: none"> <li>Using critical thinking or prior knowledge, suggest ways to prevent food contamination.</li> <li>Create a graphic organizer to summarize the ways by which food can become contaminated.</li> </ul>	<i>GCSE Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Plausibility of suggestions and reasons given</li> <li>Rubric for assessing visual aids</li> </ul>
Create a poster to educate the public of the importance of food safety.		<ul style="list-style-type: none"> <li>Create a poster to highlight the importance of food safety.</li> </ul>	poster paper, markers, magazines	Rubric for assessing visual aids
Design and conduct a small survey to determine the extent to which best food safety practices are used.	Best safety practices are the correct methods of storing, handling and serving food. Includes cooking and storing food at the correct temperature, washing of hands before handling foods, separating raw animal food and /or animal waste from ready to eat food.	<ul style="list-style-type: none"> <li>Design a survey questionnaire</li> <li>Conduct survey, attempting to control variables.</li> <li>Record data</li> <li>Analyse data</li> </ul>	<i>GCSE Biology</i>	Rubrics for assessing investigations (surveys)
Draw conclusions on the extent to which best food safety practices are carried out.		Draw conclusions based on survey conducted.		Clarity and accuracy of conclusion based on results and observations made

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FOOD AND FOOD NUTRIENTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
State the guidelines that govern food imports to The Bahamas.		<ul style="list-style-type: none"> <li>• Discuss the importance of checking foodstuff brought into the country.</li> <li>• Find out the role of the government Food Technology Laboratory</li> <li>• State the guidelines that govern food imports to The Bahamas.</li> </ul>	Ministry of Environment publications	Number, accuracy and clarity of guidelines
Observe food labels to determine food additives in commonly used foods.		<ul style="list-style-type: none"> <li>• Observe food labels to determine food additives in commonly used foods.</li> <li>• List food additives.</li> </ul>	Labels on common food items. <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Number of labels observed and additives correctly identified
Classify common food additives.	Colourings, preservatives, aromas, flavourings	<ul style="list-style-type: none"> <li>• Find out the reason for the use of each additive above.</li> <li>• Classify additives based on their function.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Plausibility of classification method and criteria
Evaluate the use of common food additives.	Yellow, red, purple dyes.	<ul style="list-style-type: none"> <li>• Compare (graphic organizer) the benefits of use of dyes with disadvantages</li> <li>• Compare the benefits of use of flavourings with disadvantages.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Number and accuracy of advantages and disadvantages

**SCOPE OF WORK  
GRADE 12  
STRAND: NUTRITION AND FOOD SUPPLY**

**UNIT: FOOD AND FOOD NUTRIENTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Research common food additives found on the labels of certain foods.	Natural and artificial chemicals are added to foods for numerous purposes. These chemicals are known as food additives. Additives may be used to add sweetness, flavor, and/or color to foods. Sometimes they assist in preserving the foods to increase shelf life, or to give the food the right consistency.	<ul style="list-style-type: none"> <li>• Research common food additives found on the labels of certain foods.</li> <li>• Identify the possible health effects of each additive.</li> <li>• Construct a table summarizing: additive, common food sources, health effects.</li> </ul>	Internet <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Rubric for assessing research</li> <li>• Number, accuracy and clarity in recording</li> </ul>
Explain the role of microbes in the manufacture of foods.	Microbes play a very important role in our everyday lives. They are used to make foods such as butter, yoghurt, cheese and vinegar, in brewing and baking	<ul style="list-style-type: none"> <li>• Research the commercial uses of microbes in the production of food products</li> <li>• Identify the microbes and foods made.</li> <li>• Describe the process for the production of each food.</li> <li>• Prepare a journal or portfolio showing the role of microbes in the manufacture of foods.</li> </ul>	Internet Photos/ illustrations/ transparencies showing use of modern technology in agriculture.  <i>AQA Science</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Rubric for assessing research</li> <li>• Clarity and accuracy (content) in demonstrating the relationship</li> </ul>
Compare the benefits of microbes with the harm caused.	Making of linen and antibiotics, getting rid of sewage and in genetic engineering.	<ul style="list-style-type: none"> <li>• Research beneficial roles played by microbes.</li> <li>• Find out negative effects of microbes.</li> <li>• Participate in a debate/discussion that the benefits of microbes outweigh the harm caused by them.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Rubric for assessing research</li> <li>• Rubric for assessing oral presentations</li> </ul>

**SCOPE OF WORK  
GRADE 12**

**STRAND: RESPONSE IN PLANTS AND SIMPLE ANIMALS**

**UNIT: TROPISM**

**DURATION: 1 ½ weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Classify plant growth responses.	Tropism – growth, positive – towards, negative – away from, chemo- - chemicals, geo- - gravity, hydro- - water, photo- - light.	<ul style="list-style-type: none"> <li>• Brainstorm how plants would respond.</li> <li>• Formulate a hypothesis on the growth response to one stimulus.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Plausibility of hypothesis and reasons given
Observe various types of tropisms.	A Tropism is the growth and movement of a plant in response to a stimulus. There are many types of tropism and they are: Thigma-tropism (stimulus is temperature) touch, hydrotropism (stimulus is water), phototropism (stimulus is sunlight), geotropism (stimulus is gravity). Tropism can be positive (growth occurs in the direction of the stimulus) or negative (growth occurs in the direction opposite the stimulus).	<ul style="list-style-type: none"> <li>• Observe photographs showing tropisms.</li> <li>• Use concept map to identify the different types of tropisms.</li> </ul>	Photographs showing tropisms.  <i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Correct identification of tropic responses
Design an experiment to investigate the response(s) of a plant to sunlight.	(see previous content)	<ul style="list-style-type: none"> <li>• Formulate a hypothesis</li> <li>• Identify and state how variables will be controlled.</li> <li>• Plan an experiment to investigate the response(s) of a plant to sunlight.</li> <li>• State the length of experiment.</li> </ul>	Seedlings, water, box with a window/ opening to one side, box without window.  <i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Plausibility of hypothesis and reasons given</li> <li>• Correct identification and control of valid variables</li> <li>• Clarity, details and logic of plan</li> </ul>

**SCOPE OF WORK  
GRADE 12**

**STRAND: RESPONSE IN PLANTS AND SIMPLE ANIMALS**

**UNIT: TROPISM**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Conduct an experiment to investigate the response(s) of a plant to sunlight.		<ul style="list-style-type: none"> <li>• Conduct an experiment to investigate the response(s) of a plant to sunlight.</li> <li>• Record observations</li> <li>• Draw conclusions about the response of shoots to light stimuli.</li> </ul>	<p><i>Biology For Life</i> Seedlings, lamps, cardboard box ruler</p> <p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	Rubric for assessing (experimental) investigations
Design an experiment to investigate a seedling's response to gravity.	Geotropism is the type of tropism that responds to gravity. Gravity always acts downward on objects. Hence growth in response to gravity shall always occur in the downward motion; growth occurring opposite to gravity would be considered negative geo-tropism.	<ul style="list-style-type: none"> <li>• Formulate a hypothesis</li> <li>• Identify and state how variables will be controlled.</li> <li>• Plan an experiment to investigate the response(s) of a plant to gravity.</li> </ul>	<p>Seedlings, klinostat (cylindrical chamber that can rotate) Cork, pins, ruler, beaker, cotton wool and cardboard box</p> <p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	<ul style="list-style-type: none"> <li>• Plausibility of hypothesis and reasons given</li> <li>• Correct identification and control of valid variables</li> <li>• Clarity, details and logic of plan</li> </ul>
Explain the role of auxins in tropic responses.	Auxin is a hormone found in the tip of the shoot of a plant and it aids in growth and movement of a plant in response to a stimulus. In phototropism, there is one side of a shoot that may receive more sunlight than the other. Auxin diffuses down the shoot causing the cells in the dark to grow faster and becoming more elongated. This actually causes the bending of the shoot towards sunlight. When the shoot bends in direction of the stimulus it is said to be a positive response.	Make an oral presentation explaining the role of auxins in tropic responses.	<p><i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i></p>	Rubric for assessing oral presentations

**SCOPE OF WORK  
GRADE 12**

**STRAND: RESPONSE IN PLANTS AND SIMPLE ANIMALS**

**UNIT: TROPISM**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Design an experiment to verify the role of root and shoot tips in tropisms.	Inside the tip of the shoot is where auxin (the hormone that controls growth and movement within plants) is found. Removal of the tip of the shoot would result in stagnant or a halt in growth and movement of a plant upwards, however, lateral buds will give rise to side branches.	<ul style="list-style-type: none"> <li>• Formulate a hypothesis</li> <li>• Identify and state how variables will be controlled.</li> <li>• Design an experiment to investigate the effect of cutting off the shoot and root tips of seedlings on their growth.</li> </ul>	Petri Dish 12 seedlings of maize, scissors, ruler <i>Biology for Life</i>  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Plausibility of hypothesis and reasons given</li> <li>• Correct identification and control of valid variables</li> <li>• Clarity, details and logic of plan</li> </ul>
Observe what happens when the tip of the shoot is cut off.		<ul style="list-style-type: none"> <li>• Observe the growth of the shoot</li> <li>• Observe the growth of the root</li> <li>• Formulate an inference from the observations.</li> </ul>	Seedlings, razor, scalpel <i>Biology for Life</i>  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Number and quality (details) of observations</li> <li>• Clarity and accuracy of inference based on results and observations made</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

UNIT: THE ENDOCRINE SYSTEM

DURATION: 1 ½ weeks

LEARNER OUTCOMES	CONTENT			ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Distinguish between exocrine and endocrine glands.	Exocrine glands have ducts that lead to the target organ or exterior. Endocrine glands are ductless releasing hormones (product) into the blood stream.			Draw concept map to distinguish between exocrine and endocrine glands.	Internet <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual presentations/aids
Identify the major endocrine glands	Endocrine Glands: pituitary, thyroid, adrenal, ovary, testis and pancreas.			<ul style="list-style-type: none"> <li>• Observe posters, transparencies or a human torso model showing endocrine glands.</li> <li>• Describe the relative sizes and location of the glands.</li> <li>• Label an unlabeled diagram identifying endocrine glands.</li> </ul>	Unlabeled diagram of endocrine glands.  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Correct labeling of diagram
Match hormones to the glands that secrete them.	<b>Gland</b>	<b>Hormone Produced</b>	<b>Where gland is found</b>	Use puzzles and games to match glands to hormones, and their location.	Word search, crossword puzzles, concentration game  <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Number of correct matches
Thyroid	Thyroxin	In the lower throat				
Pancreas	Insulin	Beneath the stomach				
Adrenal	Adrenaline	Above the kidneys				
Ovary	Estrogen	Lower abdominal				
Testis	Testosterone	Scrotum				
Pituitary	Gonad Stimulating Hormone					

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: RESPONSE IN HUMANS**

**UNIT: THE ENDOCRINE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Describe the role of Thyroid Stimulating Hormone and Follicle Stimulating Hormone.	TSH stimulates the thyroid gland to produce thyroxine. FSH stimulates the development of ova. Feedback mechanisms.	Make an outline diagram to show the working of TSH and FSH.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Accuracy of information and clarity of diagram
Make a visual presentation to describe the importance of maintaining a specific amount of a hormone in the body.	Endocrine Glands: pituitary, thyroid, adrenal, ovary, testis and pancreas.	<ul style="list-style-type: none"> <li>• Identify the effects in the body of too much of each hormone.</li> <li>• Identify the effects in the body of too little of each hormone.</li> <li>• Explain using visual aids (picture/ PowerPoint / videos posters) the effects of too much or too little hormone produced by endocrine glands.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual presentations
Rate the importance of the pancreas and adrenal glands compared with two other organs.	Most organs are a part of one body system. The pancreas is a part of the digestive (produces pancreatic juice) and endocrine (produces insulin). The adrenal glands are a part of the endocrine system (producing adrenaline) as well as a part of the autonomic nervous system being responsible for rapid responses in times of crisis.	<ul style="list-style-type: none"> <li>• Find out about the operation of the autonomic nervous system.</li> <li>• Ref. Digestion in the duodenum.</li> <li>• Select two additional organs</li> <li>• Rate the importance of the pancreas and adrenal glands compared with two other organs. State reasons.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Number, accuracy, relevancy and sequencing of points
Compare the nervous and endocrine systems.	Both used in coordination. Differ in structure, type of stimuli, response time.	Construct a Venn diagram or other graphic organizer to compare the nervous and endocrine systems.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Venn Diagram (number and accuracy of similarities and differences)

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE CENTRAL NERVOUS SYSTEM**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Observe the appearance of the brain.	Cerebral cortex, cerebellum, medulla oblongata, pons	<ul style="list-style-type: none"> <li>Observe posters, transparencies and a model of the human brain.</li> <li>Describe the appearance of the brain.</li> <li>Label a diagram of the brain.</li> </ul>	Posters, model and transparencies of the human brain.  <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Accuracy of information and clarity of description</li> <li>Correct labeling of diagram</li> </ul>
Relate the external parts of the brain to their function(s).	As above.	<ul style="list-style-type: none"> <li>Using different diagrams of the brain, identify three parts.</li> <li>Construct a table identifying each part of the brain, the features of that part and the adaptations/specialization of the features to suit the function of the part.</li> </ul>	Different diagrams of the brain from different sources; Internet  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Correct identification of parts of the brain</li> <li>Clarity and accuracy (content) in demonstrating the relationship</li> </ul>
Identify the functions of the main internal parts of the brain.	Meninges, hypothalamus, pituitary gland, midbrain, pons, medulla oblongata, cerebral cortex, cerebellum.	<ul style="list-style-type: none"> <li>Observe posters, transparencies and a model of the human brain.</li> <li>Make an annotated (functions) diagram of the brain on a poster.</li> </ul>	<i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Accuracy of information and clarity of diagram
Compare the structure of the brain and spinal cord.	Location of grey and white matter, cross sectional plan, cerebro-spinal fluid	<ul style="list-style-type: none"> <li>Construct line drawings of T. S. brain and spinal cord.</li> <li>Construct Venn diagram or other graphic organizer to compare the structures.</li> </ul>	Prepared microscope slides, diagrams and posters showing cross sections of brain and spinal cord.  <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Human Form &amp; Function</i>	Correct labeling of diagrams  Venn Diagram (number and accuracy of similarities and differences)

**SCOPE OF WORK**  
**GRADE 12**  
**STRAND: RESPONSE IN HUMANS**

UNIT: THE NERVOUS SYSTEM

DURATION: 2 weeks

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare the appearance and functions of three types of neurons.	Sensory, motor, relay/intermediate neurons: external appearance, location and function.	<ul style="list-style-type: none"> <li>Observe diagrams or prepared microscope slides of neurons.</li> <li>Make a table or graphic organizer to compare the appearance and functions of three types of neurons.</li> </ul>	Diagrams or prepared slides of neurons.  <i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Number and accuracy of similarities and differences, clarity in presentation
Make a model to show the relationship between the Central Nervous System and Peripheral Nervous System.	CNS processes and stores the information received from the sensory organs and nerves of the PNS. Signals to make appropriate responses are sent from the CNS via the motor nerves to effector organs. Spinal and cranial nerves.	Make a model to show the relationship between the Central Nervous System and Peripheral Nervous System.	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Use a ruler to measure reaction time of classmates to stimuli.		<ul style="list-style-type: none"> <li>Plan an experiment to measure reaction times by finding out how far a ruler drops before being caught.</li> <li>May compare left and right hands</li> <li>May compare quiet conditions to those with loud distractions.</li> </ul>	Ruler	Clarity, details and logic of plan
Observe responses in an experiment to investigate reaction of classmates to stimuli.		<ul style="list-style-type: none"> <li>Conduct experiment and record observations.</li> </ul>	Ruler	Rubric for assessing (experimental) investigations

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE NERVOUS SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify simple reflex actions	Sneezing, knee jerk, runny nose/eyes, blinking etc. characteristics of simple reflex actions. Spinal and cranial reflexes.	<ul style="list-style-type: none"> <li>Brainstorm examples of automatic responses.</li> <li>Identify the characteristics of simple reflex actions.</li> <li>Define a reflex action.</li> <li>Classify simple reflex actions as spinal or cranial reflexes.</li> </ul>	Worksheet (examples of reflex actions given, students add examples to be classified). <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Number of examples of reflex actions identified  Number of examples correctly classified
Describe the operation of a reflex arc.	Stimulus, dendrons, axons, Schwann cells, dendrites, synapse, electrical impulses, chemical messengers. The sequential flow of an impulse through system parts i.e. Sense organ → up Spinal Cord → CNS → Spinal Cord → muscle or gland by means of various nerve cells.	<ul style="list-style-type: none"> <li>Use a diagram of a reflex arc to describe its operation.</li> <li>Dramatize the sequence of events involved in a reflex action</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Rubric for assessing visual presentations</li> <li>Rubric for assessing oral presentations</li> </ul>
Compare simple and conditioned reflex actions.	Simple reflexes are inborn and involuntary, conditioned are learnt and voluntary responses.	<ul style="list-style-type: none"> <li>Read the story of Pavlov's experiments with dogs.</li> <li>Identify examples of conditioned reflexes.</li> <li>Compare simple reflexes with conditioned reflexes.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Number and accuracy of similarities and differences

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE SKIN**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Use a table to summarize the parts of the skin and their functions.		Use a table to summarize the parts of the skin and their functions.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correctly summarize the parts of the skin and their function
Use equipment to investigate reaction time of classmates to various temperatures.	Ice bath, water at 15, 28, 35, 70 °C.	<ul style="list-style-type: none"> <li>• Design and conduct an experiment to investigate reaction time of classmates to various temperatures.</li> <li>• Identify variables.</li> <li>• Use a ruler and watch</li> <li>• Measure time</li> <li>• Observe responses.</li> <li>• Construct a table comparing response rates to temperatures.</li> <li>• Formulate conclusions based on data.</li> </ul>	Stop watch, water baths at different temperatures	Rubric for assessing <ul style="list-style-type: none"> <li>• (experimental) investigations</li> <li>• Valid variables identified</li> <li>• Correct use of equipment</li> <li>• Accuracy of measurements</li> <li>• Accuracy of observations</li> <li>• Clarity in recording data</li> <li>• Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Identify the parts of the skin.	Label the skin and know its parts (sweat pores, epidermis, dermis, layer of fat (hypodermis), hair follicle, hair shaft, sebaceous gland, sense organ, sweat gland, blood vessel arteries/ veins/capillaries, epidermis, dermis, subcutaneous fat, nervous receptors (pain, touch, heat, cold, pressure	<ul style="list-style-type: none"> <li>• Observe a poster, model and microscopic prepared slide of human skin.</li> <li>• Identify the parts of the skin (L. S.).</li> <li>• Label parts of the skin on an unlabeled diagram</li> </ul>	Poster, model and microscopic prepared slide of human skin, unlabeled diagram of the human skin <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct labeling of diagram
Compare the skin's sensitivity to touch in various locations on the bodies.	In the skin receptors are free nerve endings which respond to pain touch and temperature. Some areas are more sensitive than others, because they do not all have the same number/density of receptors. The greatest density of touch receptors are found on your fingers, toes and face.	<ul style="list-style-type: none"> <li>• Investigate which parts of the skin are sensitive to touch. (e.g. back of hand, arm and leg)</li> </ul>	<i>Biology for Life</i> . Bristle mounted on a wooden holder (pencil, dowel) marker. <i>Longman Biology for CSEC</i>	Accuracy of observations and clarity in making comparisons

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: HUMAN THE EYE**

**DURATION: 1 ½ weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use a ruler and stop watch to investigate reaction time of classmates to various stimuli.	Define irritability, stimuli, response. Identify various stimuli (sound, temperature, falling object etc) that can cause different responses based on sensitivity from the eye, ear, and skin.	<ul style="list-style-type: none"> <li>Design and conduct an experiment to investigate reaction time of classmates to various stimuli.</li> <li>Identify variables.</li> <li>Use a ruler and watch</li> <li>Measure time</li> <li>Observe responses.</li> <li>Construct a table comparing response rates to stimuli.</li> <li>Formulate conclusions based on data.</li> </ul>	Ruler Watch Horn/ ice/ pins Biology for life	Rubric for assessing <ul style="list-style-type: none"> <li>(experimental) investigations</li> <li>Valid variables identified</li> <li>Correct use of equipment</li> <li>Accuracy of measurements</li> <li>Accuracy of observations</li> <li>Clarity in recording data</li> <li>Clarity and accuracy of conclusion based on results and observations made</li> </ul>
Identify the parts of the eye.	The parts of the eye (Retina, cornea, aqueous humor, vitreous humor, lens, ciliary muscle, ligaments, sclera, choroid, optic nerve, blind spot, yellow fovea, iris, pupil, tear gland, eye lashes, conjunctiva)	<ul style="list-style-type: none"> <li>Observe a poster and model of human eye and specimen of a mammalian eye.</li> <li>Identify the parts of the eye.</li> <li>Label parts of the eye on a diagram</li> </ul>	Poster of the human eye, model of the human eye, specimen of a mammalian eye, unlabeled diagram of the human eye <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct labeling of diagram
Relate the parts of the eye to their function(s).	As above.	<ul style="list-style-type: none"> <li>Using three different diagrams of the eye, identify common structures.</li> <li>Construct a table identifying each part of the eye, the features of that part and the adaptations/specialization of the features to suit the function of the part.</li> <li>Make an annotated (functions) diagram of the eye on a poster.</li> </ul>	Three different diagrams of the eye from three different sources; Internet, <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>Correct identification of common structures of the eye</li> <li>Clarity and accuracy (content) in demonstrating the relationship</li> <li>Rubric for assessing visual aids</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE EYE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Observe what happens to the pupil of the eye when in bright light.	Action of circular and radial muscles, size of pupil.	<ul style="list-style-type: none"> <li>• Use a flash light (or other light source) to shine on the eye.</li> <li>• Observe what happens to the pupil.</li> <li>• Predict the observations in dim light.</li> <li>• Suggest an explanation and reasons for the observations in dim light or darkness.</li> </ul>	Flashlight Paper Diagram of the eye Mirror <i>Biology for Life</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Clarity of description of observations</li> <li>• Plausibility of predictions and reasons given</li> <li>• Plausibility of suggestions and reasons given</li> </ul>
Explain the process of seeing.	Light rays pass through the lens and into the eye and are focused onto the retina. The image on the retina is upside down due to the actual bending of light. The brain, once the messages reach the brain then inverts the image and we see things right side up. Normally when a person is looking at an object from afar, the ciliary muscles relaxes and pulls the lens into a flat shape. When an object is being observed in close view, the ciliary muscles contract and the lens takes on its normal short round shape. The movement of the lens in this manner is called accommodation.	<ul style="list-style-type: none"> <li>• Follow the pathway of light from an object to the cornea, through to the fovea and optic nerve to the brain.</li> <li>• Create a concept map to explain the sequence of how we see.</li> </ul>	Paper  <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE EYE**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Justify the statement that the structure of the eye concentrates light on the fovea.		<ul style="list-style-type: none"> <li>• Read related information in a textbook.</li> <li>• Organize points to prove the statement.</li> <li>• Make an oral presentation.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing oral presentations
Describe common visual disorders.	Myopia, hypermetropia, astigmatism, presbyopia	<ul style="list-style-type: none"> <li>• Read related information in a textbook</li> <li>• Complete a worksheet describing the defects, symptoms, corrective measures</li> </ul>	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Simple, accurate, clear descriptions (own words)

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE EAR**

**DURATION: 1 week**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Design and conduct an experiment to test the sensitivity of the ears to sounds.	Threshold of hearing; stereoscopic sounds (from both ears).	<ul style="list-style-type: none"> <li>• Identify a variety of sounds to be used.</li> <li>• Identify variables</li> <li>• Conduct and evaluate experiment to test the sensitivity of ears based on location, types of sounds and involvement of both ears and or one.</li> </ul>	Sources of a variety (4 – 6) sounds.  <i>Human Form &amp; Function</i>	Variables correctly identified  Rubric for assessing investigations
Identify the parts of the ear.	Pinna, auditory canal, tympanic membrane, ossicles (malleus, incus, stapes), round and oval windows, Eustachian tube, cochlea, auditory nerves, semi circular canals, sacculus and utriculus, outer, middle and inner ear.	<ul style="list-style-type: none"> <li>• Observe a poster and model of human ear.</li> <li>• Identify the parts of the ear.</li> <li>• Label parts of the ear on a diagram</li> </ul>	Poster of the human ear, model of the human ear, unlabeled diagram of the human ear <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct labeling of diagram of the ear
Relate the parts of the ear to their function(s).	As above.	<ul style="list-style-type: none"> <li>• Using three different diagrams of the ear, identify common structures.</li> <li>• Construct a table identifying each part of the ear, the features of that part and the adaptations/specialization of the features to suit the function of the part.</li> <li>• Make an annotated (functions) diagram of the ear on a poster.</li> </ul>	Three different diagrams of the ear from three different sources; Internet <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Correctly identify common structures of the ear on various diagrams.</li> <li>• Description of relationship (part and function)</li> <li>• Rubric for assessing visual aids</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE EAR**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Explain the process of hearing.	Sound waves hit against the pinna and are directed into the ear through the auditory canal. The sound waves beat against the ear drum. In the middle ear the hammer begins to vibrate causing the anvil and stirrup to do the same causing sound waves to be created in the middle ear and amplified. The sound waves then travel through the round window into the inner ear into the cochlea of which chemical messages are created and are sent to the brain through the auditory nerves and they are interpreted and then we hear.	<ul style="list-style-type: none"> <li>Follow the pathway of sound from an object to the tympanum, through to the oval window and auditory nerve to the brain.</li> <li>Create a concept map to explain the sequence of how we hear.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing visual aids
Justify the statement that the structure of the ear concentrates sound on the oval window.	Relative sizes of tympanum and oval window, density of ossicles, relative density of air and endolymph, amplification of sound.	<ul style="list-style-type: none"> <li>Read related information in a textbook.</li> <li>Organize points to prove the statement.</li> <li>Make an oral presentation.</li> </ul>	<i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing oral presentations
Relate the structure of the semi-circular canals to their function in orientation.		<ul style="list-style-type: none"> <li>Make a model that functions as the semi-circular canals.</li> <li>Relate the relative positions of the canals to their role in providing orientation as shown in demonstrations.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Describe the role of the ear in maintaining balance.	Sacculus, utriculus, Eustachian tube, pressure (altitudes)	Write a short story, poem or song describing the role of the ear in maintaining balance.	<i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Accuracy of information, creativity, audience appeal

**SCOPE OF WORK  
GRADE 12  
STRAND: RESPONSE IN HUMANS**

**UNIT: THE EFFECTOR ORGANS**

**DURATION: 1 week**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Explain the functions of skeletal muscles.	Muscles function by contracting. Skeletal muscles are attached to the skeleton. They are able to move bones as a result of contracting.	<ul style="list-style-type: none"> <li>• Explain the functions of skeletal muscles.</li> <li>• Classify given muscles as extensor or flexor.</li> </ul>	Diagrams showing muscles with notes as to their actions. Worksheet. <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Human Form &amp; Function</i>	Muscles correctly classified.
Make an annotated diagram of the elbow joint.	Humerus, radius, ulna, tendons, ligaments, cartilage, synovial fluid, capsule, (flexors) biceps, (extensors) triceps, antagonistic muscles.	<ul style="list-style-type: none"> <li>• Observe diagrams and a model of the elbow joint.</li> <li>• Make an annotated diagram of the elbow joint noting the function of each named part.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Accuracy of diagram, labels and notes
Make a model of the knee joint to show movement of the leg.	Femur, tibia, fibula, ligaments, tendons, quadriceps(flexors), hamstring (extensors) muscles	Make a model of the knee joint to show movement of the leg.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Rubric for assessing models
Explain how nerves cause muscles to contract.	Nerve impulses change from electrical to chemical	Explain how nerves cause muscles to contract.	<i>Human Form &amp; Function</i>	Clearly stated explanation (in own words)

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: ASEXUAL REPRODUCTION**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Define the term asexual reproduction.	X-reference Reproduction in simple organisms e.g. binary or multiple fission, conjugation, budding	Define the term asexual reproduction.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Correct definition
Classify reproductive structures in plants as sexual or vegetative.	Sexual reproductive structures contain organs that produce gametes examples: cones, flowers. Vegetative structures i.e. roots, stems and leaves do not produce gametes. Vegetative reproductive structures: tubers (root, stem), stolons, runners, bulbs, corms, rhizomes, suckers, adventitious bulbs	<ul style="list-style-type: none"> <li>Brainstorming sexual structures, meaning of term “vegetative”.</li> <li>Find out which part of the plant is modified as tubers, stolons, runners, bulbs, corms, rhizomes, suckers, adventitious bulbs.</li> <li>Classify reproductive structures in plants as sexual or vegetative.</li> </ul>	<i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>Modern Biology for Secondary Schools</i>	Number of reproductive structures correctly classified as sexual or vegetative structures
Compare the processes of natural vegetative reproduction.		<ul style="list-style-type: none"> <li>Find out how reproduction occurs in tubers (root, stem), stolons, runners, bulbs, corms, rhizomes, suckers, adventitious bulbs.</li> <li>Construct models or visual aids to describe two methods of natural vegetative reproduction.</li> <li>Identify examples of tubers (root, stem), stolons, runners, bulbs, corms, rhizomes, suckers, adventitious bulbs.</li> <li>Conduct investigations to show reproduction in tubers and Bryophyllum.</li> <li>Compare the processes of vegetative reproduction.</li> </ul>	<i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>  Beaker/jar, tuber, water	Rubric for assessing visual aids  Number of vegetative reproductive structures correctly classified  Rubric for assessing investigations  Similarities and differences of the vegetative reproductive processes identified

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: ASEXUAL REPRODUCTION**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Evaluate methods of artificial vegetative propagation.	Marcotting, layering, cuttings (root, stem), grafting bud, stem). X-reference: bio-technology.	<ul style="list-style-type: none"> <li>Find out how reproduction occurs in marcotting, layering, cuttings (root, stem), grafting bud, stem).</li> <li>Identify examples of marcotting, layering, cuttings (root, stem), grafting bud, stem).</li> <li>Design and conduct an investigation to show reproduction by stem cuttings.</li> <li>Make a presentation comparing the processes of artificial vegetative reproduction using visual aids.</li> </ul>	<i>Caribbean Biology</i> <i>Modern Biology for Secondary Schools</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>  Petri dish, sand, water, <i>Bryophyllum</i>	Rubric for assessing investigations  Rubric for assessing visual presentations
Prepare a brochure to encourage persons to use vegetative propagation for home-gardening.		Prepare a brochure to encourage persons to use vegetative propagation for home-gardening.		Rubric for assessing visual aids
Compare and contrast methods of natural vegetative propagation with methods of artificial propagation.		Use a graphic organizer to compare and contrast methods of natural vegetative propagation with methods of artificial propagation.	<i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual aids
Evaluate the advantages and disadvantages of vegetative reproduction.		Evaluate the advantages and disadvantages of vegetative reproduction.	<i>Longman Biology for CSEC</i>	Valid advantages and disadvantages; relative value of advantages and disadvantages

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: SEXUAL REPRODUCTION IN PLANTS**

**DURATION: 2 weeks**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Identify flowers as reproductive structures.	Flowers are reproductive structures of plants. Some flowers have only male or female structures (dioecious); some have both (monoecious).	<ul style="list-style-type: none"> <li>Observe reproductive organs (stigma, anthers), petals, sepals of flowers in diagrams and posters or models.</li> <li>Identify these parts on various flowers.</li> </ul>	Posters, diagrams, photographs or models of flowers. Variety of flowers e.g. bougainvillea, Bauhinia, Yellow Elder, Poinciana, croton <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Named parts correctly identified in all flowers
Use a scalpel, razorblade or scissors to dissect various types of flowers.	Poinciana, Yellow Elder, Bauhinia,	<ul style="list-style-type: none"> <li>Use scalpel, razorblade or scissors to dissect various types of flowers.</li> <li>Use hand lenses to observe parts of the flower.</li> </ul>	Scalpel/scissors/razorblade, diagram of flower, a named flower	Rubric for assessing use of safe and correct techniques in handling apparatus
Observe the dissected parts of flowers.	Pedicel, receptacle, whorls (calyx, corolla, androecium, gynaecium), stamens (filament, anther, pollen grains), carpels (ovary, ovules, stigma, style)	<ul style="list-style-type: none"> <li>Observe the individual parts.</li> <li>Identify the parts.</li> <li>Use floral parts to prepare a collage.</li> </ul>	Dissected parts of flower, poster paper, glue/tape. <i>GCSE Biology</i>	Accurate and neat collage
Use a microscope to observe pollen and ovules of a dissected flower.		<ul style="list-style-type: none"> <li>Make a temporary/wet slide preparation of ovules and pollen.</li> <li>Use microscope to observe pollen and ovules mounted on slides or prepared slides.</li> </ul>	Slides, microscope, flower samples, scalpel/knife, prepared slides	Rubric for assessing use of safe and correct techniques in handling apparatus
Relate the structure of the floral parts of a named flower to their function.		<ul style="list-style-type: none"> <li>Label and add notes to an unlabelled diagram of L. S. named flower.</li> <li>Relate the structure of the floral parts to their function, highlighting any adaptations.</li> </ul>	Flower samples <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Accuracy of annotated diagram  Relationships of floral parts to functions described
Create a mnemonic device for the parts of flowers and their functions.		Create a mnemonic device for the parts of flowers and their functions.	<i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Number of parts and their function included, creativity and appeal

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: SEXUAL REPRODUCTION IN PLANTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Use materials to investigate what makes pollen grains produce a tube.	Formation of pollen tube after pollen grain lands on stigma is stimulated by sugar in the stigma.	Place pollen grain on microscope slides with sugar solution and observe growth of tube.	<i>Biology for Life</i> Slides, microscope, sugar, water, paint brush <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Rubric for assessing investigations
Observe a variety of flowers to determine the agent responsible for pollination.	Pollen grains are transferred from anther to stigma by agents such as wind and insect. Flower parts are adapted according to the pollinating agent. Size and surface of pollen grains, size and position of stigma.	<ul style="list-style-type: none"> <li>• Observe the features of the flower parts of a variety of flowers.</li> <li>• Brainstorm whether or not the flowers are pollinated by wind or insect.</li> </ul>	A variety of flowers (both wind and insect pollinated), ruler, Worksheet <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	
Classify a variety of flowers according to the type of pollination.	Maize, grass, croton, oats, shepherd's needle,	Construct a suitable table classifying the flowers observed by agent of pollination.	Worksheet <i>GCSE Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Correct identification of agent and logical justification of answer</li> <li>• Number of flowers correctly classified</li> </ul>
Describe the sequence of events from pollination to fruit and seed formation.	Growth of pollen tube, fusion of nuclei in ovules, hardening of testa, development of embryo and cotyledon(s), development of ovary into fruit.	Make a visual simulation of the development of a local fruit from the pollination of a flower.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Rubric for assessing visual presentations
Observe local fruits and seeds to determine method of dispersal.	Seeds and fruits are dispersed (scattered) by several methods which include water, animals, explosive mechanisms and wind. The seeds and fruits are specially adapted for the dispersal methods.	<ul style="list-style-type: none"> <li>• Describe common methods of dispersal (seeds and fruits)</li> <li>• Observe some local fruits and seeds</li> <li>• Make inferences as to the method of dispersal for each flower.</li> </ul>	A variety of local fruits and seeds that represent different methods of dispersal. Worksheets <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Correct identification of methods of dispersal

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: SEXUAL REPRODUCTION IN PLANTS**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Classify local fruits and seeds according to dispersal methods.	As above.	<ul style="list-style-type: none"> <li>• Construct a suitable table classifying fruits and seeds according to method of dispersal.</li> <li>• Use photos or diagrams to show features of fruits/seeds which adapt them for their method of dispersal.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i>	Correct classification of fruits and seeds
Describe dispersal methods and adaptations of local fruits and seeds.		Use observations made to produce a chart/pamphlet/handbook/power point presentation skit etc. to show the dispersal methods and adaptations of the local fruits and seeds.	Photos/actual specimen/drawings of various fruits and seeds, Construction/poster paper, crayons, pencil, glue/tape, computer <i>GCSE Biology</i> <i>Biology for CSEC</i>	Rubric for visual aids/presentations
Plan an experiment to identify the conditions necessary for germination.	These conditions include moisture, suitable temperature and oxygen. X-ref. Primary Science germination experiment.	<ul style="list-style-type: none"> <li>• Design an experiment to identify conditions needed for germination to occur.</li> <li>• Identify variables</li> <li>• Include controls</li> </ul>	Seeds, tissue/cotton, containers e.g. plastic cups, beakers, jars	<ul style="list-style-type: none"> <li>• Rubric for assessing experimental investigations.</li> <li>• Valid variables identified</li> </ul>
Conduct an experiment to determine the rate of growth for a seedling.		<ul style="list-style-type: none"> <li>• Conduct an experiment to determine the rate of growth for a seedling.</li> <li>• Measure accurately the length of the seedling.</li> <li>• Record the measurements.</li> <li>• Calculate the rate of growth per day.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i>	<ul style="list-style-type: none"> <li>• Rubric for assessing experimental investigations</li> <li>• Accuracy of measurements</li> <li>• Correct calculations</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION**

**UNIT: ASEXUAL REPRODUCTION**

**DURATION: 2 weeks**

LEARNER OUTCOMES	CONTENT		ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Tabulate the differences between sexual and asexual reproduction, highlighting the advantages and disadvantages.	<b>Asexual Reproduction</b> <b>Advantages</b> 1. Large numbers of offspring produced. 2. Offspring can be produced continuously. 3. Offspring can make good use of favorable environmental conditions. 4. If parent is of superior quality the offspring will be the same.	<b>Disadvantages</b> 1. Overcrowding and competition may occur as offspring colonise the same area as parent. 2. If the environment is changing, the offspring may find it difficult to survive. 3. If the parent is of inferior quality the offspring will also be inferior.	Use a table to show the advantages and disadvantages of asexual reproduction and sexual reproduction.	<i>CXC Biology</i>  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	<ul style="list-style-type: none"> <li>• Accuracy of differences between sexual and asexual reproduction</li> <li>• Number of advantages and disadvantages included</li> </ul>
	<b>Sexual Reproduction</b> <b>Advantages</b> 1. Genetic variability of the species is increased. 2. The species is more likely to be able to adapt to a changing environment. 3. The species may be able to colonize new areas. 4. If the parents are both of poor quality, the offspring may be of better quality.	<b>Disadvantages</b> 1. Time and energy spent on seeking mate. 2. Offspring are not produced continuously. 3. Few offspring may be produced. 4. Even if the parents are of good quality, the offspring can be of poor quality.			

**SCOPE OF WORK  
GRADE 12**

**STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

**DURATION: 3 weeks**

LEARNER OUTCOMES	CONTENT	ACTIVITIES	RESOURCES	METHOD OF ASSESSMENT
Compare and contrast the structure of an ovum and a spermatozoon.	The sperm is a very small single cell consisting of head, neck and tail. Head consists mainly of the nucleus and the neck of mitochondria. The tail gives mobility. The tip of the head has a vacuole that contains enzymes. The ovum is also a single cell, but is much larger than a sperm. Ovum also has a nucleus containing chromosomes. Its cytoplasm contains yolk. Ova move very little, if at all.	<ul style="list-style-type: none"> <li>• Use a microscope to observe prepared slides of ova and spermatozoa.</li> <li>• Draw and label structures of ova and spermatozoa after observing prepared slides of them under a microscope.</li> <li>• List similarities and differences between ova and spermatozoa in a table format.</li> </ul>	Microscope, prepared slides Internet  <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Correct handling and use of a microscope</li> <li>• Diagrams</li> <li>• Correct comparison of spermatozoa and ova in a suitable table</li> </ul>
Compare the processes by which sperm and ova are produced.	Spermatogenesis ongoing, ova maturation for period (puberty to menopause); many sperms produced at a time, one ovum develops (a Graafian Follicle); sperms moved to epididymis for storage, ova released to oviduct.	<ul style="list-style-type: none"> <li>• Read information on sperm and ova production in textbook.</li> <li>• Compare the processes for producing them.</li> </ul>	Worksheet  <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Number of valid points made; similarities and differences</li> </ul>

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Relate the events in the ovary during a menstrual cycle to the differences in hormone levels during a cycle.	The <b>menstrual phase</b> – if ovum not fertilized, it breaks down. Low levels of oestrogen and progesterone. During the <b>follicular phase</b> , the pituitary produces increasing amounts of <b>follicle stimulating hormone (FSH)</b> which acts on the ovary, causing several follicles, each containing an ovum, to develop. Only one follicle matures. The ovaries secrete lots of oestrogen. During the <b>ovulatory phase</b> , the hypothalamus and pituitary secrete release a surge of <b>luteinizing hormone (LH)</b> which causes the mature follicle to burst and release the ovum. In the <b>luteal phase</b> , the ruptured follicle develops into the <b>corpus luteum</b> which secretes increasing amounts of progesterone.	<ul style="list-style-type: none"> <li>• Make a diagram showing the dates of the month (1 – 28) as the X- axis of a graph, then draw (on the Y- axis) the relative amounts of oestrogen and progesterone present during the days of the month. Label the graphs.</li> <li>• Relate the events in the ovary during a menstrual cycle to the differences in hormone levels during a cycle.</li> </ul>	<i>AQA Science</i> <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	<ul style="list-style-type: none"> <li>• Accuracy of diagram</li> <li>• Relationships described</li> </ul>
Outline the route taken by a spermatozoon from its site of production to its release from the male's body.	Sperm made in the seminiferous tubules of the testes travel into epididymis then the sperm ducts (vasa deferentia) to the urethra to the outside of the body, and are deposited into the top of the vagina.	Use arrows and a diagram of the male reproductive system to trace the path of a sperm from the testes out of the urethra	Black/Whiteboard, chalk, markers, colored pencils, diagrams of male reproductive system (front and side views)  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>Human Form &amp; Function</i>	Pathway correctly indicated
Outline the route taken by a spermatozoon after it is ejaculated into the vagina until it fertilizes an ovum.	The sperms swim through the cervix, uterus, into the oviduct. If an ovum is in the oviduct, sperms become attached to it, one penetrates the ovum's surface membrane. The nuclei of the sperm and ovum fuse.	Use arrows and a diagram of the female reproductive system to trace the path of a sperm from the vagina to the fallopian tube/oviduct.	Black/Whiteboard, chalk, markers, colored pencils, diagrams of female reproductive system (front and side views)  <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i>	Pathway correctly indicated

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Make an annotated diagram of the pathway taken by an ovum after it is released from the ovary until it is implanted into the uterine lining.	Graafian follicle releases ovum (ovulation), effect of cilia and muscular contractions in oviduct/fallopian tube causes movement of ovum. A fertilized ovum, zygote, divides repeatedly, blastocyst (ball of cells) then an <b>embryo</b> . Implantation in the uterus.	Use arrows and a diagram of the female reproductive system to trace the path of an ovum from the ovary to the uterus.	Black/Whiteboard, chalk, markers, colored pencils <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Correct pathway of ovum from the ovary to the uterus
Summarize the events of fertilization.	<b>Fertilization</b> is the fusion of the male nucleus with the female nucleus. It occurs in the oviduct. Once sperm reach the ovum, each attaches itself to the ovum, but only one penetrates its membrane. Enzymes in the head ( <b>acrosome</b> ) of the sperm break down the wall of the ovum, preventing other sperm from entering. The nucleus of the sperm then fuses with the nucleus of the ovum.	Summarize the events of fertilization.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Concise and precise description (in own words)
Observe a diagram of the placenta and umbilical cord, examining their special features.	The placenta is the life support system of the embryo. The placenta is a flattened, circular disc that contains blood spaces and thousands of tiny folds called villi. The large surface area of the villi in the placenta facilitates the passage of materials between the mother and embryo. X-ref exchange surfaces.	Identify the special features of the placenta and umbilical cord and relate these to their function.	Internet, Diagrams of the placenta and umbilical cord <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Relationships of the special features of the placenta and umbilical cord to their functions clearly described
Relate the structure of the placenta to its role in absorption, gas exchange, and excretion.		Explain how the placenta is adapted for its role after observing a diagram of the placenta and umbilical cord.	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>Longman Biology for CSEC</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Relationships between the structure of the placenta and its roles

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare the features of a foetus in the three trimesters.	Development of limbs, proportion of head and trunk, definition of digits, development of eyes, ears, heart.	Observe photographs or posters Complete a table comparing features at 3, 6 and 9 months or 1, 3, 6 months or 2, 5 and 8 months.	Diagrams showing major developments in the foetus each month during pregnancy. <i>CXC Human and Social Biology</i> <i>GCSE Biology</i> <i>Human Form &amp; Function</i>	Number of valid points; accuracy of comparisons
Suggest factors that influence the growth rate in humans.	Heredity, nutrition, hormones, biotechnology	Suggest factors that influence the growth rate in humans.	News articles  <i>Longman Biology for CSEC</i>	Plausible suggestions
Interpret percentile graphs showing height or weight.	Age, gender	Interpret percentile graphs showing height or weight to determine average height/weight for a given age and gender. <ul style="list-style-type: none"> <li>Compare given heights and weights for an age and gender to form an inference whether the person is overweight/underweight, tall or short.</li> </ul>	Data and graphs showing height and weight for children  <i>GCSE Biology</i>	<ul style="list-style-type: none"> <li>Correct interpretations made</li> <li>Valid inferences made</li> </ul>
Compare the features of the main developmental stages in humans.	Age groups: 0 – 18 months, 2 – 5 years, 6 – 12 years, 13 – 18 years, 55 – 70 years.	<ul style="list-style-type: none"> <li>Observe diagrams showing humans at different ages</li> <li>Compare the main features of development in humans.</li> <li>Construct a table to compare features.</li> </ul>	Diagrams (unisex) of humans at five stages of development (age groups)  <i>Human Form &amp; Function</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Number of features observed Comparison of features at the five stages
Formulate a hypothesis as to the rate of population growth on the island.	Number of persons in the reproductive age group, number of offspring per family, number of persons not having children.	Formulate a hypothesis as to the rate of population growth (locally) on the island.	<i>Biology for CSEC</i> <i>GCSE Biology</i>	Plausible hypothesis with valid reasons

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Compare population growth rates in three countries and any measures taken by government to control the growth rate.	China, Japan, a European, African, Latin American, Caribbean	<ul style="list-style-type: none"> <li>Select three countries from different regions (include China).</li> <li>Conduct/research to find the growth rates and measures take by the government relative to growth rate.</li> <li>Make an oral presentation to compare the growth rates and related government initiatives / programmes.</li> </ul>	Internet  <i>Human Form &amp; Function</i>	Rubric for assessing research  Rubric for assessing oral presentations
Suggest economic implications of rapidly growing populations.	Cost for providing food, education, health care, jobs, utilities	<ul style="list-style-type: none"> <li>Class discussion</li> <li>Suggest economic implications of rapidly growing populations.</li> </ul>	<i>Biology for CSEC</i> <i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Plausible suggestions made
Suggest social implications of rapidly growing populations.	High unemployment – inadequate housing, dysfunctional families, violence, crime, illiteracy, depression, suicides, drug abuse, physical, mental & emotional illness.	Suggest social implications of rapidly growing populations.	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i> <i>Human Form &amp; Function</i>	Plausible suggestions made
Research the scientific and economic impact of bio-technology on human reproduction.	In vitro fertilization; fertility drugs; determination of congenital disorders during pregnancy; genetic map allows determination of features. More people are able to have children; extended reproductive year; multiple births; selectivity in children's appearance, more babies survive.	<ul style="list-style-type: none"> <li>Research the use of biotechnology in human reproduction.</li> <li>Write a statement outlining personal views on its scientific and economic impact.</li> </ul>	<i>GCSE Biology</i> <i>CXC Human and Social Biology</i>	Rubric for assessing research  Number of points included; scientific and economic impacts; personal view articulated clearly

**SCOPE OF WORK  
GRADE 12  
STRAND: REPRODUCTION IN HUMANS**

**UNIT: THE HUMAN REPRODUCTIVE SYSTEM**

<b>LEARNER OUTCOMES</b>	<b>CONTENT</b>	<b>ACTIVITIES</b>	<b>RESOURCES</b>	<b>METHOD OF ASSESSMENT</b>
Classify sexually transmitted diseases in a tabular format by the causative agents.	Chlamydia, monilia, trichomonas, herpes, HIV/AIDS <b>fungus diseases</b> (thrush/ Candidiasis)	Draw a table, classifying STIs by the agent causing them. Include symptoms of each disease, and method of treatment.	Internet <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	Accuracy of classification
Research the scientific and economic impact of cloning and summarize the findings in a news bulletin.	A <b>clone</b> is a member of a population of genetically identical cells produced from a single cell. After years of research, many scientists concluded that it was impossible to clone a mammal. However, in 1997, the Scottish scientist Ian Wilmut cloned a sheep, Dolly. Similar techniques were then used to clone cows, pigs, mice, and other mammals. It is now scientifically possible to clone humans. However, the use of cloning technology on humans raises serious ethical and moral issues and many persons oppose it.	<ul style="list-style-type: none"> <li>Survey at least ten persons soliciting their viewpoints on cloning animals and humans then</li> <li>Prepare a news bulletin summarizing the scientific and economic impact of cloning.</li> </ul>	Scientific articles <i>GCSE Biology</i> <i>Biology for CSEC</i>	<ul style="list-style-type: none"> <li>Rubric for assessing investigations</li> <li>Rubric for assessing visual aids</li> </ul>
Defend the legality and morality of cloning.		<ul style="list-style-type: none"> <li>Debate the pros and cons of cloning humans and other animals.</li> <li>Write a persuasive essay for or against the cloning of humans.</li> </ul>	Internet, Scientific journals <i>GCSE Biology</i> <i>Biology for CSEC</i> <i>CXC Human and Social Biology</i>	<ul style="list-style-type: none"> <li>Rubric for assessing oral presentations</li> <li>Accuracy and persuasiveness of content of essay</li> </ul>



**GENERAL RUBRIC FOR VISUAL AIDS**  
(posters, pamphlets/brochures, fliers, PowerPoint presentations)

Criteria	Exemplary <b>4</b>	Proficient <b>3</b>	Satisfactory <b>2</b>	Incomplete/ Below standard <b>1</b>	Unsatisfactory <b>U</b>
Visual appeal	Very attractive colour scheme, bold, easily-read writing, very attractive and appropriate graphics.	Attractive colour scheme, legible writing, attractive and appropriate graphics.	More than one colour font, legible writing, a graphic used.	One colour font, legible writing.	One colour font, font is not easily read.
Use of space	Visual display effectively covers at least 90% of the space available.	Visual display effectively covers approximately 75% of the space available.	Visual display covers approximately 67% of the space available.	Visual display covers 50 – 66% of the space available.	Visual display covers less than 50% of the space available.
Comprehension of assignment	Display shows an excellent understanding of the intent and focus of the assignment.	Display shows a good understanding of the intent and focus of the assignment.	Display shows some understanding of the assignment.	Display is related to the topic but does not satisfy the focus of the assignment.	Apparent misunderstanding of the assignment.
Content – information	Includes the necessary information, avoids unnecessary information, information is correct and current.	Includes the necessary information, information is correct, also includes unnecessary information.	Information included is correct. However, only some of that needed is included along with some unnecessary information.	Less than 50% of the required information is included.	Insufficient information, some information included is incorrect.
English	Vocabulary ideally suited for target group, correct grammar and spelling.	Vocabulary appropriate for target group, correct grammar and spelling.	Correct grammar and spelling.	Grammatical or spelling errors.	Grammatical and spelling errors.
Effectiveness in making a point	Display is very effective in marketing its message.	Display makes a point strongly.	Display makes a point (covers its theme).	Information does not show connection.	No evidence of structure or sequence.
Creativity	A very high level of creativity shown in visual appearance as well as in the message.	A good standard of creativity shown in visual appearance as well as in the message.	Some creativity shown in visual appearance as well as in the message.	Creativity shown in visual appearance or in the message.	Little or no evidence of creativity.
Grade	A 86 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

## GENERAL RUBRIC FOR ORAL PRESENTATIONS

(rap, song, poem, speech)

Criteria	Exemplary <b>4</b>	Proficient <b>3</b>	Satisfactory <b>2</b>	Incomplete/ Below standard <b>1</b>	Unsatisfactory <b>U</b>
Preparedness	Completely prepared and had obviously rehearsed.	Seemed well-prepared but could have spent more time rehearsing.	Somewhat prepared, but seems not to have rehearsed.	Did not seem prepared to present.	Appeared to have made no effort to prepare.
Sound appeal	Very attractive beat or rhythm used with outstanding variations of voice intonation and volume.	Attractive beat or rhythm used with good variations of voice intonation and volume.	Consistent beat or rhythm used with variations of voice intonation or volume.	Consistent beat or rhythm used with no variations in voice intonation and volume.	Lyrics were presented with no accompanying sounds.
Time/length	Duration was for the required time.	Duration was longer or shorter than the time allotted by 0 – 20% of duration	Duration was longer or shorter than the time allotted by 21 – 30% of duration.	Duration was longer or shorter than the time allotted by 31 – 40% of duration.	Duration was longer or shorter than the time allotted by 41 – 67% of duration.
Enthusiasm	Facial expressions and body language evoked a strong interest in and enthusiasm from the audience.	Facial expressions and body language sometimes evoked a strong interest in and enthusiasm from the audience.	Facial expressions and body language were used to spark interest and enthusiasm from the audience but the expressions seemed faked.	Very little use of facial expressions and body language. Did not evoke interest or enthusiasm from the audience.	Little enthusiasm was shown by the presenter(s).
Content – information	Included the necessary information which was correct and current. Unnecessary information was not included.	Included the necessary information which was correct. Unnecessary information was not included.	Information included was correct. However, it included unnecessary as well as some unnecessary information.	Less than 50% of the required information was included.	Insufficient information was given, some of which was incorrect.
English	Speaks clearly and distinctly throughout the presentation, does not mispronounce words.	Speaks clearly and distinctly throughout the presentation, mispronounced one and two words.	Speaks clearly and distinctly for most of the presentation, mispronounces key vocabulary or makes one or two grammatical errors.	Mumbles at one or two points, more than two grammatical errors.	Mumbles most of the presentation, mispronunciation and grammatical errors.
Effectiveness in making a point	Song etc. was very effective in marketing its message.	Song etc. made a point strongly.	Song etc. made a point related to the topic.	Information in the song etc. was disjointed.	Lyrics did not portray a theme.
Creativity	A very high level of creativity shown in sound appeal as well as in the message.	A good standard of creativity shown in sound appeal as well as in the message.	Some creativity shown in sound appeal as well as in the message.	Creativity shown in sound appeal or in the message.	Little or no evidence of creativity shown.
Grade	A 86 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

**GENERAL RUBRIC FOR RESEARCH PROJECTS**  
(surveys, research information)

Criteria	Exemplary <b>4</b>	Proficient <b>3</b>	Satisfactory <b>2</b>	Incomplete/ Below standard <b>1</b>	Unsatisfactory <b>U</b>
Information sources	Used a variety of relevant sources (three or more different types and several of each type of source). Cited all sources.	Used many sources of two types. Cited all sources.	Used many sources of one type (e.g. textbooks, Internet, journals, magazines, questionnaires). Sources were referenced.	Two or three sources were used.	One source used and referenced.
Sources had data to support claims	All sources (but one) had data to support claims.	Most sources had data to support claims.	Some sources had data to support claims.	One source had data to support claims.	No source had data to support claims.
Extracted relevant information	All information extracted was relevant to the topic.	All information extracted was relevant to the topic. However, no information was given for one aspect.	Some relevant and some irrelevant information was extracted.	Little relevant information was extracted.	Little information was extracted; it was mainly irrelevant.
Paraphrased information	All information extracted was paraphrased and well-written.	Most information was paraphrased and well-written.	Some information was paraphrased. However, copied portions were not indicated.	Most information was copied from sources.	All information was copied from sources.
Organized information	Information was very clearly and sequentially organized. The position was logically stated with supporting data. Alternative points of view were included.	Information is clearly and sequentially organized. Logically stated position with supporting data.	Information was clearly and sequentially organized.	Information was sequentially organized.	Information was written haphazardly.
Synthesized	Project clearly and articulately showed: problem, hypothesis, method of research, literature reviewed, findings, analysis of findings, position.	Project showed: problem, hypothesis, method of research, literature reviewed, findings, analysis of findings, position.	Project showed problem, hypothesis, method of research, literature reviewed, findings, analysis of findings, position (one missing).	Project showed problem, hypothesis, method of research, findings.	Notes shown on aspects of the project.
Grade	A 86 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

**GENERAL RUBRIC FOR INVESTIGATIONS**  
(experiments, experimental report)

Criteria	Exemplary 4	Proficient 3	Satisfactory 2	Incomplete/ Below Standard 1	Unsatisfactory U
Hypothesis	Correct purpose and explanation of purpose were clearly stated.	Correct purpose was clearly stated.	Stated a purpose that was correct.	States a purpose that is incorrect.	States a purpose that is incorrect and irrelevant.
Sequence	Aim, Apparatus, Materials, Procedure, Observations, Results, Conclusion (given in sequence).	One (sub-heading) missing or out of sequence.	Two (sub-headings) missing or out of sequence.	One missing and two out of sequence.	More than two missing or out of sequence.
Procedure/Method	Clear step-by-step description of experimental procedures; labeled diagrams used.	Step-by-step description written description with one step missing, labeled diagrams included.	Two steps missing or diagrams not labeled.	An account written which includes most steps but not clearly and sequentially recorded.	A few steps are recorded.
Observations	All observations made and recorded in a clear format.	All obvious observations made and recorded in a clear format.	One obvious observation missing, clear format for recording.	Two observations missing or format for recording is not clear.	More than two observations missing.
Results	All data clearly recorded with units to the highest level of accuracy.	One reading missing; data clearly recorded with units to the highest level of accuracy.	Readings not to highest level of accuracy but all recorded with units in a clear format.	Readings not to highest level of accuracy and not recorded clearly.	A few readings recorded with no units.
Conclusion	Conclusion is logically drawn from data and stated as a relationship—in general terms.	Logical conclusion drawn, general reference to data, stated as a summary conclusion.	Logical conclusion but not connected to data. Written as a series of statements.	Obvious conclusion drawn, not connected to data, hypothesis or aim.	Results stated as a conclusion.
Handles apparatus and materials	Handles apparatus correctly, handles materials appropriately and safely, no help needed.	Handles apparatus correctly, handles materials appropriately and safely, one or two reminders given.	Handles apparatus correctly, handles materials appropriately, one or two reminders given.	Handles apparatus or materials correctly, two or three reminders given.	Uses apparatus and materials with much assistance given.
Error	Identifies all main sources of error and explains effect on results.	Identifies all but one main sources of error and explains effect on results.	Identifies sources of error.	Suggests possibility of error but identifies no sources.	Does not address Possibility of error.
Grade	A 86 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

Reference: [www.accessexcellence.org](http://www.accessexcellence.org)

**GENERAL RUBRIC FOR FIELD WORK**  
(field trips)

Criteria	Exemplary <b>4</b>	Proficient <b>3</b>	Satisfactory <b>2</b>	Incomplete/ Below standard <b>1</b>	Unsatisfactory <b>U</b>
Organization/ systematic investigation	Read and comprehended instructions first. Gathered the necessary equipment. Organized functions/tasks for group members. Worked systematically.	Read and comprehended instructions first. Gathered the necessary equipment. Organize functions/tasks for group members.	Read instructions first. Gathered the necessary equipment. Group worked together.	Read instructions, gathered equipment. Members of the group performed tasks but not in sequence.	Did not participate or individuals in the group performed tasks randomly/haphazardly.
Following instructions	Followed all instructions. Made adaptations when necessary.	Followed all instructions except one.	Followed most instructions.	Followed some instructions.	Failed to follow most instructions.
Use of equipment	Used equipment safely and correctly without additional assistance.	Used equipment safely and correctly with some assistance (reminders).	Used equipment safely but with much assistance needed.	Used equipment correctly but unsafely.	Did not use all equipment correctly and no evidence of safety techniques used.
Collection of data	Required number of readings taken – additional done to verify anomalies. Readings all taken at required time/place etc.	Required number of readings taken. Readings all taken at required time/place etc.	Most of the required number of readings taken. Readings all taken at required time/place etc.	Some of the number of readings taken. Readings for some intervals missing.	Few readings were taken. Readings were not at regular intervals.
Observations	All possible observations made and described in detail.	Most observations made in detail and the others as obvious observations.	Some observations made in detail.	Most observations made as general or obvious observations.	Few, obvious observations made.
Teamwork	Performed all assigned duties efficiently. Supported other group members. Readily provided additional assistance as was needed.	Performed all assigned duties efficiently. Supported other group members.	Performed all assigned duties.	Performed most assigned duties. Worked independently.	Performed few duties. Did not support other group members. Refused to perform additional tasks.
Safety	Adhered to all rules of conduct. Reminded others to keep the rules.	Adhered to all rules of conduct.	Adhered to most rules of conduct.	Caused another student to break a rule.	Action(s) responsible for jeopardizing the safety of another participant.
Sensitivity to the environment	Demonstrated sensitivity to the environment at all times and reminded others to do so.	Demonstrated sensitivity to the environment at all times.	Demonstrated sensitivity to the environment most times.	Required frequent reminders to avoid negatively impacting the environment.	Actions caused a negative reaction or damage to the environment.
Grade	A 86 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

### GENERAL RUBRIC FOR MODELS

Criteria	Exemplary <b>4</b>	Proficient <b>3</b>	Satisfactory <b>2</b>	Incomplete/ Below standard <b>1</b>	Unsatisfactory <b>U</b>
Representation of Components	Included all the necessary components, no unnecessary or unrelated parts were included. Components accurately represented (appearance) object.	Included all the necessary components, no unnecessary or unrelated parts were included. Components did not accurately represent the object.	Included some of the necessary components, no unnecessary or unrelated parts were included. Components accurately represented the object.	Included few of the necessary components, or unnecessary or unrelated parts were included. Components did not accurately represent the object.	Incomplete model or model did not accurately represent the object.
Proportions of Components	All components made in correct (proportional) dimensions. All components made in correct proportion to each other and the overall model.	All components made in correct (proportional) dimensions. Some components made in correct proportion to each other and the overall model.	Some components made in correct (proportional) dimensions. Some components made in correct proportion to each other and the overall model.	Few components made in correct (proportional) dimensions. Components were not in correct proportion to each other or to the overall model.	Components did not made in correct proportions.
Materials Used.	All materials used were appropriate, non-hazardous, inexpensive and easily available.	All materials used were appropriate, non-hazardous and inexpensive.	Some materials used were appropriate.	Few materials used were appropriate	Some materials used were inappropriate and at least one was unsafe.
Construction	Much care taken in the construction process. The model was neat, durable and well-fitted.	Much care taken in the construction process. The model was neat and well-fitted but not durable.	The structure was fairly well-fitted and neat.	The structure was fairly well-fitted.	The structure was falling apart and untidy.
Overall Appearance	Very attractive colour scheme used. Bold, easily-read writing used. Structure was appropriate size.	Attractive colour scheme used. Structure was appropriate size.	More than one colour used. Font used was legible. Structure was appropriate size.	One colour used. Structure was very small or too large.	No attempt to make the structure attractive.
Creativity	A very high level of creativity shown in visual appearance as well as in the message.	A good standard of creativity shown in visual appearance as well as in the message.	Some creativity shown in visual appearance as well as in the message.	Creativity shown in visual appearance or in the message.	Little or no evidence of creativity.
Information Displayed	Includes the necessary information, avoids unnecessary information, information is correct and current.	Includes the necessary information, information is correct, also includes unnecessary information.	Information included is correct. However, only some of that needed is included along with some unnecessary information.	Less than 50% of the required information is included.	Insufficient information, some information included is incorrect.
Grade	A 84 – 100	B 71 – 85	C 56 – 70	D 41 – 55	F 40 and lower

## APPENDIX II

# BIBLIOGRAPHY

- A Guide for Curriculum Writers, Delbert Mueller; University Press of America  
A Handbook of Content Literacy Strategies: 75 Practical Reading and Writing Ideas; Elaine C. Stephens and Jean E. Brown, Christopher Gordon Publishers  
Bahamas Environmental Handbook  
Bahamas Environmental Protection Manual  
Bahamas National Trust – Coral Reef Handbook  
Bahamas National Trust Whiteland Coppice; Blackland Coppice; Pine Forest  
Biology Exploring Life, Second Edition Gil Bruni, Larry Mc Kane Gerry Karp  
Bush Medicine – Martha Smith  
Caribbean Biology – An Integrated Approach  
Compiled Documents – BREEF Marine Conservation Workshop  
Exploring the Bahamian Pine Forest – A Teacher’s Resource Bahamas National Trust  
Fact Sheets from Bahamas National Trust  
Fact Sheets from Ministry of Environment  
From Plato to Piaget, William Cooney, Charles Cross, Barry Trunk; University Press of America  
Guide to Corals & Fishes of Florida, The Bahamas and The Caribbean; Idaz & Jerry Greenberg  
Human and Social Biology of the Tropics, Phil Gadd  
Integrated Science Activity Book Prentice Hall  
Marine Life of the Caribbean 2<sup>nd</sup> Ed – Alick Jones & Nancy Sefton; Macmillan Education Limited  
Modern Biology for Secondary Schools, Sarojini T. Ramalingam, Sheila Pereira, Africana FEP Publishers Limited in association with FEP International Private Limited  
Senior Biology 2 Student Resource and Activity Manual 2002 Published by: Biozone International Ltd  
Treasures in the sea – An Educator’s guide to Teaching Marine Biodiversity; Bahamas National Trust & American Museum of Natural History  
Understanding by Design Grant Wiggins and Jay McTighe; ASCD  
Wondrous West Indian Wetlands – Mangroves of the Caribbean- An identification Guide  
Wondrous West Indian Wetlands Teacher’s Resource Book

### TEXTBOOKS

- Atwaroo-Ali, Linda, Series Editor: Dr. Mike Taylor (2009). *Biology for CSEC*. Macmillan Caribbean ISBN 978-0-230-03482-2.
- Bradfield Phil, Potter Steve (2004). *Longman Biology for CXC*. Pearson Longman. ISBN 0-582-82765-5.
- Fullick, Ann, Series Editor: Lawrie Ryan (2006). *AQA Science, GCSE Biology*. Nelson Thornes, ISBN 978-0-7487-9641-0.
- Gadd, Phil, Series Editor: Dr. Mike Taylor (2007). *CXC Human and Social Biology* (5<sup>th</sup> Edition). Macmillan Caribbean ISBN 978-1-4050-8367-6.
- Mackean, D. G. (2008). *GCSE Biology* (third edition. Hodder Murray, ISBN 978-0-7195-8615-6.
- Minett, Pamela; Wayne, David; Rubenstein, David (1989). *Human Form & Function*. UNWIN HYMAN ISBN 0-7135-2714-5.

**APPENDIX III**  
**SUPPLIES FOR SENIOR HIGH SCHOOL BIOLOGY**

Item No.	Quantity	Description
1	18	Beakers, Pyrex, squat form with rim, markings and spout, 1 litre
2	48	Beakers, Pyrex, squat form with rim, markings and spout, 600 ml
3	36	Beakers, Pyrex, squat form with rim, markings and spout, 400 ml
4	48	Beakers, Pyrex, squat form with rim, markings and spout, 250 ml
5	36	Beakers, Pyrex, squat form with rim, markings and spout, 100 ml
6	24	Measuring Cylinders, glass, graduated with spout, 250 ml
7	30	Measuring Cylinders, glass, graduated with spout, 100 ml
8	12	Measuring Cylinders, glass, graduated with spout, 50 ml
9	6	Measuring Cylinders, glass, graduated with spout, 500 ml
10	36	Conical Flasks, narrow mouth, Pyrex, 250 ml
11	30	Test tube Holders, all metal
12	36	Tongs, crucible, mild steel, bowed 150 mm
13	24	Racks, wooden, with drying pegs for both test tubes and boiling tubes, 6 holes
14	36	Bunsen burners, propane
15	30	Wire gauze, stainless steel with ceramic centre
16	36	Evaporating Basins, flat-bottom, porcelain with spout, 100 ml
17	72	Thermometers, red spirit filled, range -10/110°C x 1.0 divs, 305 mm length
18	36	Tripod stands, enameled cast iron, 125 mm sides, 200 mm height
19	24 prs	Petri Dishes (with covers), borosilicate 100 x 20 mm
20	300	Petri Dishes (with covers)
21	60	Spotting tiles, 12-cavities, white plastic
22	48	Teats and pipettes, complete assembly, 30 ml
23	24	Reagent Bottles with stoppers, 250 ml
24	48	Bottles, wide mouth, clear glass, powder type with black plastic screw cap, 250 ml
25	4	Flasks, 500 ml flat-bottom
26	24	Thistle funnels, glass 200 mm
27	2	Balance, Ohaus portable electronic, 200g capacity, readability 0.01 g
28	6	Balance, single pan, 4 beam hanging, capacity 311g, readability 0.01 g
29	12	Counters, tally, hand held
30	1 pk.	Cork Stoppers, assorted sizes (no holes)
31	2 sets	Cork borers size 1 – 6
32	12 pks.	Litmus paper, red
33	12 pks.	Litmus paper, blue
34	1 reel	Universal Indicator Paper
35	12 pks.	Cobalt Chloride paper
36	12 pks.	Potassium Iodide paper
37	100	Test tubes, pyrex
38	48	Boiling tubes, pyrex
39	48	Stirring rods
40		Microscope slides
41		Microscope cover slips
42	18	Microscopes, compound monocular BMS 3 AF x 5, x 10, x 40
43	6	Sphygmometer
44	12	Safety Goggles, wrap around frame, contoured nose piece, polycarbonate lens, vented side shield
45	100	Safety Gloves, natural latex, large
46	20	Aprons, splash & chemical resistant
47	1	Goggle storage bag, 15 pockets, holes for wall attachment
48	1	Laboratory Safety poster
49	1	Laboratory Safety Techniques poster
50	50	Brushes test tube, nylon with cotton end, (12 – 16 mm test tube)
51	30	Spatulas, spoon end, nickel 150mm
52	1	Potometer, Gangongs
53	30	Rules, wooden, horizontal reading, 1 m,
54	50	Bottles, wash, polythene, general purpose, 250 ml
55	20	Bottles, dropping, “Polystop” clear glass 30 ml

## SUPPLIES FOR SENIOR HIGH SCHOOL BIOLOGY

Item No.	Quantity	Description
56	1	Mini torso with detachable head, half size, 12 parts
57	1	Eye model, 6 part – 5 x life size
58	1	Ear model, 5 x life size
59	1	Kidney, nephron and Malpighian corpuscle mounted on one baseboard
60	1	Heart model, basic model
61	1	Dicotyledonous flower model
62	1	Cell with details of organelles model
63	1	T. S. Dicotyledonous Leaf (tissues)
64	12	Dissecting Kits, student in canvas roll
65	12	Dissecting (pans with wax) boards
66	24	Magnifiers, folding pocket, 25 mm, double x 5, x 10
67	1	Biology slide set (50 slides)
68	2 sets	Basic histology prepared slide set
69	2 sets	Cell division prepared slide set
70	1	Skin section model, 70 x full size
71	1	Male pelvis model
72	1	Female pelvis model
73	1	Kidney with adrenal gland
74	2	GCSE Biology CD-ROM set of three CDs
75		Pipe cleaners
76	1 pk.	Cotton/wool
77	6 boxes	Molecule models
78	12	Thistle funnels
79		Visking tubing
80		Craft materials e.g. scissors, construction paper, glue
81		Plasticine
82		Rope
83		PVC pipe
		Buckets
		Binoculars

Item No.	Quantity	Description
84	1	Ethanol, Absolute, 250 ml size
85	1	Hydrochloric Acid, reagent grade 1.5 litre size
86	1	Sodium Hydroxide pellets, size 500g
87	1	Sulphuric Acid
88	1	Benedict's solution, qualitative, 500 ml
89	1	Biuret solution, 500 ml
90		Amylase solution
91		Food colouring
92		Potassium permanganate
93		Iodine solution, 500 ml

Item No.	Quantity	Description
94	24	AQA Science, GCSE Biology, Ann Fullick; Nelson Thornes
95	12	Marine Life of the Caribbean
96	12	Caribbean Biology

## APPENDIX IV

### PREREQUISITES FOR TENTH GRADE BIOLOGY

#### KNOWLEDGE

Students should be able to:

- Use Linnaeus' System of Classification.
- State the characteristics of seven phyla of invertebrates and be able to classify invertebrates into the phyla and arthropods into classes.
- State the characteristics of organisms in the Monera and Protist Kingdoms.
- Classify organisms into three groups of feeders (herbivores, carnivores, omnivores).
- Correctly use the terms: herbivore, carnivore, omnivore, producer, consumer, population and community.
- Construct a simple food chain.
- Explain a simple food web.
- Understand feeding relationships i.e. can interpret food chains and webs.
- Identify local endangered organisms and common invasive organisms.
- Describe the external appearance, life history and economic importance of: spiny lobster, Nassau grouper, queen conch and white crab.
- Identify main land pollutants and describe the negative effects of these pollutants.
- Explain the Carbon Cycle.
- Identify the organelles of a cell as seen under a light microscope and state their function.
- Identify specialized plant and animal cells.
- Describe the organization of cells.
- Identify and state the functions of the parts (including teeth) of the Human Digestive System.
- Describe the process of digestion of food throughout the alimentary canal.
- Name the food nutrients, state their use in the body, identify foods that are rich in them and state deficiency disorders.
- Demonstrate an understanding of a balanced diet.
- Identify positive results for food tests on starch and fats.
- Describe methods of food preservation.
- Describe the competition between demand for marine food (conch, grouper, lobster) and the need for conservation measures for sustainable supply.
- Explain the relationship between: atoms and ions, elements and compounds, mixtures and solutions.
- Identify parts of word equations and explain basic equations.
- Label the main external parts of: dicotyleonous herbaceous plant; dicot root system and leaf; monocot root system and leaf.
- Label parts of the Human Reproductive Systems.
- State the function of the parts of the male and female reproductive systems.
- Identify the signs of puberty and menopause.
- Explain the menstrual cycle.
- State the sequence of events in fertilization.
- Explain how fraternal and identical twins are formed.
- Label the structures shown in a diagram of a foetus in the uterus.
- Describe the stages in birth.
- Classify common contraceptives and rate their effectiveness.
- State the signs, symptoms and causative agent of gonorrhoea, syphilis, herpes, AIDS.
- Simply explain the principle of reflection and refraction of light.
- Simply explain the principle of reflection of sound.
- Explain the difference in speed of sound through different materials.
- Describe the principle of simple levers and how they work.

## SKILLS

Students should be able to:

- Count organisms.
- Follow instructions to make a piece of equipment.
- Measure accurately using a metre ruler, measuring /graduated cylinder, thermometer, triple-beam balance.
- Use a stirring rod, beaker, measuring /graduated cylinder, thermometer, triple-beam balance and compound light microscope correctly.
- Prepare a wet slide.
- Observe features of specimens viewed with a microscope.
- Observe changes in reactants during an experiment.
- Observe differences between given organisms.
- Use features of organisms to classify them into kingdoms/phyla.
- Use feeding habits to classify organisms.
- Classify foods into food groups.
- Perform food tests for starch and fats.
- Use external features of an organism to make inferences about its habitat or mode of life.
- Draw valid conclusions based on observations and/or results obtained from investigations.
- Create posters, poem/song/rap, skit to describe or explain information.
- Demonstrate the relationships between cells, tissues, organs and systems
- Recognize the relationship between a food web and food chain.
- Predict the effect of the increase of a plant population on the population of its herbivorous consumers.
- Calculate averages and percentages.
- Construct and interpret pie and bar graphs.
- Follow instructions (verbal and pictorial) to conduct an experiment.
- Write an experimental report in the accepted format.
- Identify parts of the scientific method.
- Read information from several sources to synthesize a response to a question or formulate a statement on a topic.
- Compare and contrast features or identify and compile advantages and disadvantages.

# Perspectives That Enrich Instruction

Scientific Literacy is an essential support for sustainable development in the global economy. It therefore stands to reason that one of the main goals of the Science Instructional Programme would be the promotion of Scientific Literacy.

The benefits that accrue from the promotion of Scientific Literacy in the curriculum are numerous. For, as Scientific Literacy increases, so does the students' appreciation of the **application of scientific principles to problem solving**. In addition, students are encouraged to focus their creative energies, spawned by alert inquiring minds, to produce positive end results that can be of economic, social and emotional value to themselves and society.

As educators zealously attempt to prepare students for coping with the challenges of life in a technology driven world, care should be taken to incorporate current and innovative practices in the Science Instructional Programme. These and other instructional strategies will:

- ❖ Motivate students to increase their understanding of the subject through practical immersion and discovery encounter experiences.
- ❖ Increase the effectiveness of Science instruction
- ❖ Build students' confidence and competence
- ❖ Heighten students' expectations
- ❖ Promote higher overall achievement

This section is intended to provide teachers at the primary level with a wide range of perspectives and innovative practices for implementing an effective Science Instructional Programme. These strategies comprise:

- ❖ Inquiry-based Learning
- ❖ Constructivism
- ❖ Bloom's Taxonomy
- ❖ Process Skills Development
- ❖ Use of the Scientific Method
- ❖ Cooperative Learning Technique
- ❖ Student-centred vs Teacher-centred Learning
- ❖ Multiple Intelligences and Learning Styles
- ❖ Assessment Strategies
- ❖ Information Technology Linkages
- ❖ Science Safety

# Inquiry-based Learning

**Inquiry-based Learning** places emphasis on experiential learning; where practical “hands-on” activities are used to motivate students to focus their innate curiosities and inquiring minds on problem solving through the application of scientific principles.

Proponents of the traditional “lecture method” of instruction (i.e. imparting information directly from text books with limited or no opportunity for students to engage exploration, questioning and discovery skills) are rapidly being convinced that this strategy (with respect to the teaching of Science) is very ineffective, and when compared with other modern approaches is now obsolete.

Research has shown that frequent use of the lecture method especially with regards to the teaching of Science results in diminished student expectation and achievement. Research “shows that people don’t learn science by absorbing stuff that has been poured unto them (via lectures) but rather by constructing meaning out of experiences that the teacher provides.”  
*Wendy Saul, Science Education Analyst; University of Maryland, Baltimore County, U.S.A.*

In **Inquiry-based Learning**, opportunities are provided that create an environment that enable students to gain experience as a result of Science exploration. Practical experiences are provided and open-ended questions asked to encourage experimentation that does not necessarily have a known outcome and that will lead to testable questions. During this experimentation, students are encouraged to take risks and are therefore, not afraid to make

mistakes. Some of the greatest scientific discoveries come after many failures and disappointments.

Inquiry-based learning goes beyond providing students with opportunities for practical, “hands-on” experiences to illustrate established scientific principles e.g. giving them batteries, bulbs, and wires to show the concept of current electricity. This strategy takes the learning process to a different level e.g. It may challenge students to use the batteries, bulb, wire and additional materials to develop something useful for a deaf person or something that can assist with a specific chore, homework assignment, etc.

The inquiry-based approach to the teaching of Science is key to effective and meaningful instruction as it encourages students to:

- ◆ Critically evaluate situations
- ◆ Frame their own questions
- ◆ Develop diverse strategies for coping with problems in their environment
- ◆ Cultivate organizational and creative skills
- ◆ Assume leadership roles and be self motivated
- ◆ Be accountable for their learning
- ◆ Collaborate and communicate with one another
- ◆ Develop team interaction skills

# Constructivism

Constructivism is closely related to **Inquiry-based Learning** therefore, effective application of **Inquiry-based Learning** is enhanced by **Constructivism**. **Constructivism** means generating meaning by connecting what is to be learned with personal knowledge that has been constructed from past experiences. “A Constructivist is one who believes that the learner is responsible for constructing knowledge and, therefore, the responsibility for learning must be returned to the child.” *Ebenezer & Conner 1998, Learning to Teach Science, A Model for the 21ST Century.*

Students’ understanding of the world is moulded by their experiences. As they think about these experiences, their views and beliefs, they construct personal meaning and acquire knowledge. Constructivists advocate that students should not be expected to just accept knowledge and skills developed over the years and imparted by the teacher. Instead they become “active seekers” of knowledge as inquiry is encouraged and they discover and decipher things for themselves.

In using Constructivism, teachers become facilitators that create stimulating environments with a variety of “hands-on” experiences that empower students to explore. The teacher’s main role is to provide experiences that help students make connections between what is learned and what they already know or believe. More learning takes place when students become active participants in the learning process and are “allowed to make their own sense out of the world.”

Providing students with “hands-on” experiences that reinforce ideas or perceptions that they already have results in them assimilating or absorbing new concepts easily. The knowledge that the students construct from the information that they receive as a result of these “hands-on” activities makes sense and is easier for them to relate to and apply to their everyday life and their environment.

Constructivists probe students’ knowledge base, examine and classify their concepts then provide them with opportunities to share and debate common knowledge. They then convert and expand students’ knowledge by asking open-ended questions and presenting problems which cause them to gain new understanding of the concepts being taught. By doing this they challenge and promote conceptual change.

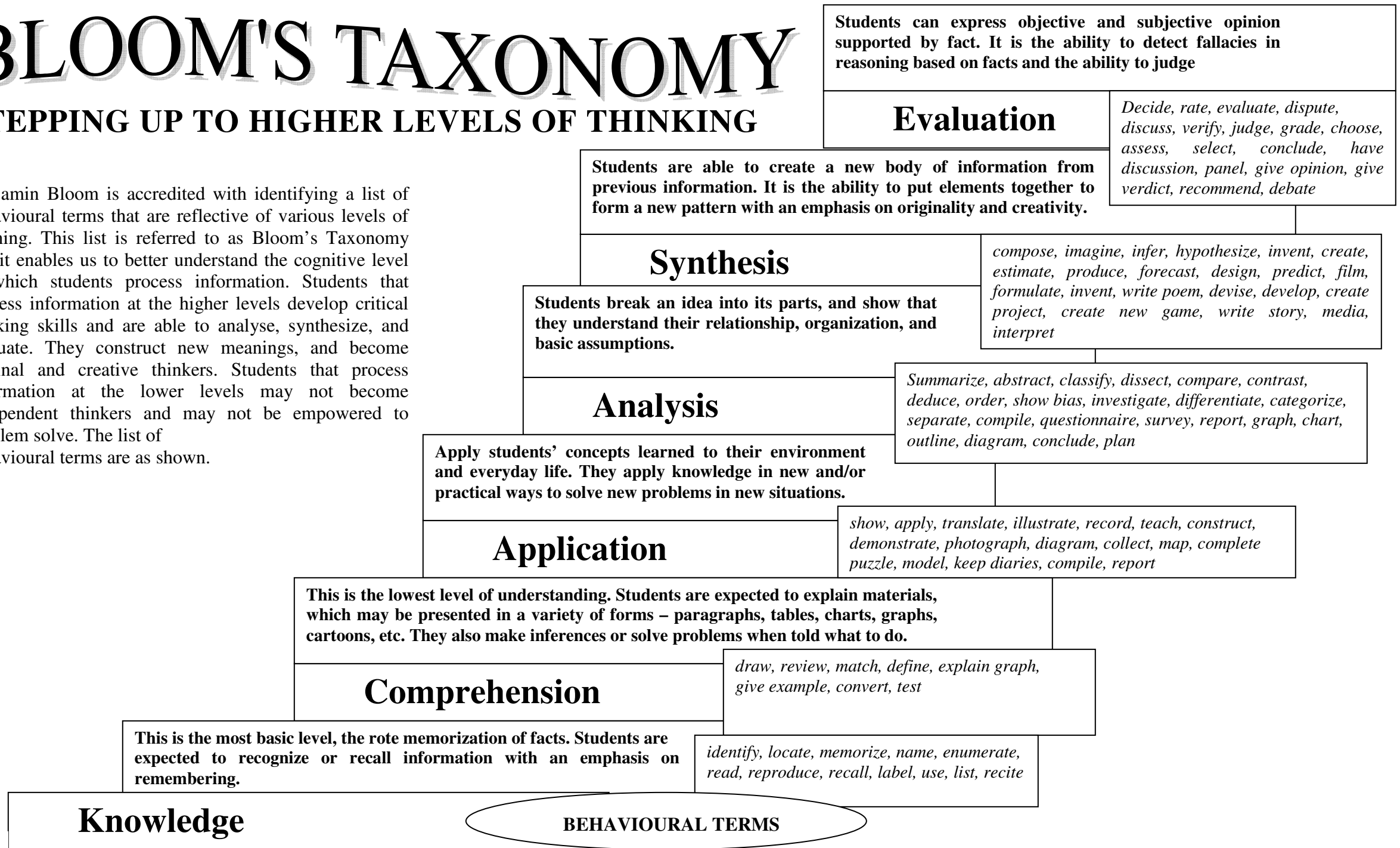
When using the Constructivism Theory, it should be noted that there are times when knowledge has to be imparted directly by the teacher in a detailed and explicit way. Although many benefits can be accrued from utilizing the Constructivism Theory if it is not used properly, learning may become sporadic and disorganized. Although students should not be stifled in their exploration to acquire knowledge, when using this theory it is important to:

- ◆ Set clear precise goals for the knowledge and skills that the students are expected to acquire
- ◆ Communicate these goals to the students and ensure that they are understood
- ◆ Organize assignments in a clearly planned sequence
- ◆ Provide guidance for the students

# BLOOM'S TAXONOMY

## STEPPING UP TO HIGHER LEVELS OF THINKING

Benjamin Bloom is accredited with identifying a list of behavioural terms that are reflective of various levels of learning. This list is referred to as Bloom's Taxonomy and it enables us to better understand the cognitive level at which students process information. Students that process information at the higher levels develop critical thinking skills and are able to analyse, synthesize, and evaluate. They construct new meanings, and become original and creative thinkers. Students that process information at the lower levels may not become independent thinkers and may not be empowered to problem solve. The list of behavioural terms are as shown.



# Process Skills Development

Process skills are practical skills that allow students to use previous experiences, build upon them and link knowledge and skills learned at school to their environment and every day life.

Process skills help students to develop and apply critical thinking. Once given the opportunity to use and apply process skills, students develop the ability to reflect on and to evaluate their approaches to problem solving. As a result, students will come to the realization that there may be several solutions to any given problem. In this way, students can formulate hypotheses as testable ideas in their minds and can demonstrate deductive patterns of thought. Through integration of the basic and complex process skills listed, students should develop the ability to think logically and abstractly.

## Basic Process Skills

### Observing

Using one or more of the five senses (seeing, hearing, tasting, smelling, feeling) to find out about the world. Observing increases students' perceptions so that they can learn more about objects and events.

### Classifying

Grouping objects or events based on similarities and/or categorizing based on existing relationships among objects or events.

### Inferring

Explaining and interpreting observed events and collected data and explaining why they might have happened.

### Communicating

Passing on information, proposing interpretations, explanations, and causes from observed events and collected data.

### Recognizing and Using Spatial Relationships

Observing where things are in relation to other things by estimating the relative positions of moving and non-moving objects to one another.

### Measuring

Finding out the size or amount of an object or substance when compared to a certain unit. Identifying and ordering length, area, volume, mass, and temperature to describe and quantify objects or events.

### Predicting

Suggesting possible results or outcomes that will happen in the future based on observations and inferences drawn from previous experiences. The suggestions have to be based on correct information.

## Using Numbers

Applying ordering, counting, adding, subtracting, multiplying, and dividing to quantify data where appropriate in investigations or experiments.

## Complex Process Skills

### Interpreting Data

Explaining the meaning or importance of information.

### Forming Hypotheses

Asking questions about a problem and making assumptions in order to draw out and test different solutions to the problem.

### Separating and Controlling Variables

Recognizing the many factors (variables) that affect the relationship of the factors to one another so that one factor (variable) can be manipulated while the others are controlled.

### Experimenting

Test hypotheses or predictions by first identifying things (variables) that are important, then deciding which variables to change or manipulate which will be held constant, and what results to expect.

### Formulating Models

Constructing mental, verbal, or physical representations or ideas, objects, or events. The models are then used to clarify explanations or to demonstrate relationships.

### Defining Operationally

Describing the properties of things and their functions. These working definitions are based on actual experiences that the student had.

# USE OF THE SCIENTIFIC METHOD

Students need to be taught valuable problem solving skills in order to react appropriately to the many situations that confront them on a daily basis. The **Scientific Method** sets out a sequence of logical steps that are employed in problem solving. It is applicable to **ALL** areas of life and is not restricted only to the teaching of Science.

The components of the **Scientific Method** and their descriptors are set out below. It is to be noted that students should utilize this format when writing up experiments or laboratory reports.

<b>1. PURPOSE</b>	The purpose is the question that is to be answered by doing the experiment. State the reason or reasons why you are doing the experiment. State the purpose as a question needing an answer.
<b>2. HYPOTHESIS</b>	A hypothesis is an educated guess on how the experiment/ activity will turn out, that is based on prior knowledge. Although a good hypothesis is testable, it may not be correct. Experimenting can find out whether or not the hypothesis is correct or not.
<b>3. MATERIALS</b>	All materials required for the activity/ experiment need to be identified. One must be as accurate as possible in describing the materials. Be sure to give exact amounts and quantities.
<b>4. PROCEDURE</b>	The procedure describes everything that will be done during the experiment. The procedure affects the result of the experiment therefore, care should be taken to explain the procedure as accurately as possible. State the procedure as numbered steps. (It would help if they are written with behavioural terms at the beginning.)
<b>5. OBSERVATION</b>	The observation describes exactly what happens during an experiment. Report the observations made and the data collected during the experiment. Data are recorded facts or measurements from an experiment. Data should be presented as tables, charts, and graphs, to be easily understood.
<b>6. CONCLUSION</b>	The conclusion is a comparison between the results and the hypothesis of an experiment. To draw a conclusion, the data needs to be analyzed to see what is meant. Explain observations and describe how the data relates to the problem. The conclusion should state whether or not the data supports the hypothesis. Part of the conclusion may be a statement or a new hypothesis based on findings and suggestions for testing the new hypothesis in a further experiment.

# COOPERATIVE LEARNING

- Builds Critical Thinking Skills
- Builds Team Interaction Skills and Social Skills
- Promotes Individual and Collective Responsibility
- Promotes Responsibility for Learning
- Develops Leadership Skills
- Shares Knowledge
- Gives All Team Members a Sense of Accomplishment
- Utilizes Peer Teaching
- Improves Student Performance
- Increases Retention
- Develops Self Esteem
- Encourages Time on Task

The **Cooperative Learning Technique** allows all students to have a sense of accomplishment. **Cooperative Learning** promotes group work and opportunities for verbal face-to-face interactions, which assist students to acquire and apply concepts.

**Cooperative Learning** builds interpersonal skills and positive interdependence characterized by specific roles, sharing of knowledge and materials and achievement of mutual goals. It encourages group processing as students analyse how well their groups are functioning and design and employ strategies to ensure that they function effectively.

When using the **Cooperative Learning Technique**, the teacher functions as a facilitator and students are more accountable for their learning and share the responsibility for the learning of others. It is important for the teacher to set and evaluate social and academic goals for the groups and the quantity and quality of students' learning.

When forming cooperative groups, it is recommended that groups work together for three to six weeks before students are assigned new roles or groups changed. During the year, each student should have an opportunity to function in each role. Once groups are formed, ensure that all members realize that they are jointly responsible for achieving group goals. They do this by:

- Contributing ideas to the group
- Listening carefully for ideas from others
- Helping the group make good decisions
- Cooperating rather than competing
- Solving problems in a calm manner

*Reference: Circle of Learning: Cooperative Learning in the Classroom by D. W. Johnson et al, 1986*

## STUDENTS' ROLES AND FUNCTIONS

### Supervisor, Leader or Investigator

Does experiments, manipulates materials

### Assistant, Helper or Organizer

Collects, organizes and distributes materials and makes sure group cleans up any mess.

### Manager or Motivator

Assists supervisor, leader or investigator, encourages the group, encourages time on task and adherence to goals and safe practices, and also times activities, if necessary.

### Writer or Recorder

Records observations, questions, answers, illustrations etc.

### Reporter

Collaborates with Writer or Recorder and shares group's data, results, and conclusion with class.

# STUDENT-CENTRED vs. TEACHER-CENTRED LEARNING

Student-centred Learning develops self-directed learners who are confident in doing Science, proactive in the learning process and willing to share and accept responsibility for their own learning. Student-centred Learning activities are adaptive and cater to the learning needs of students.

## COMPARISON OF STUDENT-CENTRED AND TEACHER-CENTRED LEARNING

### STUDENT-CENTRED

- ◆ Students' conceptions and experiences are explored.
- ◆ Teacher challenges students to question before accepting information.
- ◆ Discussion is encouraged between students and teacher.
- ◆ Students are allowed to move about in an orderly manner to discuss and problem solve.
- ◆ Students share and help each other. They use peer tutoring.
- ◆ Students actively participate in decision-making.
- ◆ Learning activities cater to multiple intelligences and different learning styles.

### TEACHER-CENTRED

- ◆ Teacher is the authority figure and has the final say.
- ◆ Students must never question the teacher.
- ◆ Students only respond when a question is asked.
- ◆ Students must remain seated at all times.
- ◆ Collaboration between students is discouraged and regarded as cheating.
- ◆ Students do not participate in decision-making.
- ◆ There is very little variation in learning activities.

# MULTIPLE INTELLIGENCES

HOWARD GARDNER

The theory of Multiple Intelligences is a way of understanding the different facets of the intellect and each person's level of intelligence. The intelligences can work individually or in collaboration with the other intelligences, so a person could be operating in more than one intelligence. As we teach children, we should ensure that appropriate provision is made for individual differences and multiple intelligences.

- ❖ **Linguistic Intelligence** is a person's ability to construct and comprehend language. It is the capacity to use language to express feelings and to understand other people. It may be in a person's native language or another language. Poets, writers, orators, speakers, lawyers specialize in linguistic intelligence.
- ❖ **Naturalist Intelligence** is the ability to identify and classify patterns in nature. It the way a person relates to his environment and the recognition of the role that the environment plays in our lives. It is the ability to discriminate among living things like plants and animals and sensitivity to changes in nature e.g. weather patterns, rock configurations.
- ❖ **Spatial Intelligence** is how persons comprehend shapes and images in three dimensions. Spatial Intelligence is utilized to perceive and interpret things that we may or may not see. It is the ability to represent the spatial world internally in your mind--the way a sailor navigates the seas with only the stars or airplane pilot navigates aerial space, or the way a chess player or sculptor represents the spatial world. Spatial intelligence can be used in the arts or in the sciences. Persons with this type of Spatial Intelligence are usually painters, sculptors, architects and scientists who deal with anatomy and topology.
- ❖ **Musical Intelligence** is the ability to perform and compose music. It is the capacity to think in music, to be able to hear patterns, recognize them, remember them, and perhaps manipulate them. Persons with strong musical intelligence are completely preoccupied with music, it is always playing in their minds. Persons with musical intelligence use music to face their challenges and to assist them in solving their problems.
- ❖ **Bodily - Kinesthetic Intelligence** is a natural sense of how the body should act and react in demanding situations. These persons have extraordinary control of their movements, balance, agility and grace. They have the capacity to use their whole body or parts of their body to solve a problem, make something, or put on some kind of a production. **Bodily - Kinesthetic Intelligence** is evident in athletes and persons in the performing arts, particularly dance or acting.
- ❖ **Logical – Mathematical Intelligence** is the ability to mentally process logical problems. Persons with a highly developed **Logical-Mathematical Intelligence** can manipulate numbers, operations and quantities, and they have the ability to process logical questions at an unusually fast rate. These persons have the ability to understand the underlying principles of some kind of a causal system, the way a scientist or a logician does.

- ❖ **Intrapersonal Intelligence is a person's cognitive ability to** sense and understand him or herself. It refers to a very strong self-concept and strength of character, which gives the person the ability to solve internal problems. These persons know who they are, what they can do, what they want to do, how they react to things, which things to avoid, and which things to gravitate toward. These persons have a strong sense of purpose and are not easily deterred from that purpose. They know their strengths and their limitations and know where to go if they need help.
- ❖ **Interpersonal Intelligence** is understanding and interacting with others and interpreting their behaviour. As social beings, it is an essential ability that we all need however, persons with Interpersonal Intelligence have a greater perception of distinctions between persons and have the ability to judge their moods, temperaments, intentions and motivations. Persons with **Interpersonal Intelligence** become teachers, clergy, leaders, clinicians, salespersons, or politicians. Anybody who deals with other people has to be skilled in the interpersonal sphere.

# Learning Styles

DAVID A. KOLB

**Persons have their unique, individual way of learning. Understanding how students learn and planning activities that cater to various learning styles will enhance their learning and ensure higher achievement.**

- ❖ **Visual Style**  
Persons who prefer the visual style convert what they hear and read to pictorial images in their brain. When recalling information they go through a process similar to reviewing pictures in a movie. These students have no problems in obeying conventional classroom rules. They will sit quietly, write neatly and use all materials well. These persons often choose careers like engineer, surgeon, designer, architect and positions of leadership that requires visionary thinking.
- ❖ **Auditory Style**  
These persons learn best by hearing and listening, they process information through their listening and repeating skills. They are good storytellers and can successfully talk through their problems. These students can easily repeat what they heard just as it was said. They are the most talkative and the most likely to participate in discussion however, they may experience difficulty in writing. These persons often become psychologists, disc jockeys, great musicians and other occupations that require a great deal of listening.
- ❖ **Kinesthetic Style**  
These persons process and remember information through their bodies and their feelings. Kinesthetic learners need to touch and feel what they are learning about. They may become restless unless they are actively involved in the learning process.

# Assessment Strategies

## WHAT IS ASSESSMENT?

- ◆ Whenever we interact with other people we obtain and interpret information about their knowledge and understanding, and may well make judgments about their ideas, abilities and attitudes.
- ◆ Assessment whether direct or indirect is a human encounter and is a central feature of social life.
- ◆ Educational assessment includes a wide range of methods for evaluating student performance that describes the nature and extent of learning and how it matches up to the objectives of teaching.

*When assessing there must be alignment between what is in the curriculum, what is actually taught and what is tested.*

## WHY DO WE ASSESS?

- ◆ The main purpose of assessment is to judge the attainment or performance level of students, with a view of evaluating or grading them for one purpose or another.
- ◆ Purpose might include:
  - ⇒ Placing students in appropriate teaching sets;
  - ⇒ Providing extra motivation for learning and an aid to remembering;
  - ⇒ Informing parents about progress;
  - ⇒ Informing other teachers who have to make decisions about students e.g. when students transfer to a new school or new courses, which may have been studied;
  - ⇒ Accumulating records of achievement;
  - ⇒ Acting as a diagnostic tool e.g. diagnosing weaknesses so that remedial action may be taken;
  - ⇒ Making decisions about examination entries involving predictions about future performance;
  - ⇒ Informing further education institutions or employers about attainment so that suitable placement may be made. In doing this, we are using measured attainment to make predications about likely future performance.

*Hence assessment has primarily been used as a means of judging the attainment and progress of students, providing a reporting system and deciding appropriate action.*

## FORMS OF ASSESSMENT

Assessment may be:

- ⇒ Informal
- ⇒ Formal

- ◆ **Informal assessment** takes place during normal learning activities. Much information can be picked up by teachers in their normal interaction with individual students, allowing problems to be overcome at an early stage and progress accelerated. Hence **informal assessment** is often used **diagnostically**.
- ◆ It is often said that **informal assessment** should be unobtrusive if the teacher is to gain reliable insights about students' abilities and the state of development, and that it should be for a specific purpose and for private use only.
- ◆ With **formative i.e. informal assessment** the results are fed back to the learner. Such feedback can be **confirmatory** (a recognition that the particular tasks have been mastered at that particular time) or can be **corrective**, allowing dialogue between teacher and learner to show where the learner went wrong.
- ◆ **Formal assessment** is only aimed at obtaining knowledge about the student. It is obtrusive and may not be able to provide direct instructional function.
- ◆ **Formal assessment** becomes **summative** when information is not available for feedback purposes because it is obtained too late in the learner's career to be used in this way.
- ◆ **Formal and summative assessment** is used largely for public purposes (e.g. BJC, BGCSE and RSA Examinations)
- ◆ Even this is changing with the advent of initiatives such as the GLAT where **formal and summative assessments** are made with students at grade 3 and 6. The results of formal assessments made at an early stage can be used for the benefit of the learner at the next stage of education.

## ASSESSMENT MAY ALSO BE TRADITIONAL OR AUTHENTIC

**Traditional Assessment** measures what the students were taught and basically assesses their ability to recall information. This type of assessment includes **homework, quizzes and tests**.

**Authentic Assessment** measures what students have actually learned and can promote further learning. This type of assessment includes **portfolios, journal keeping, anecdotal records, student conferencing, self and peer assessment, projects and reports**.

*Although there is no alternative for traditional assessment in certain situations, authentic assessment should be frequently used in the High School Science Instructional Programme.*

*Contributed by Shena Williams, Examination and Assessment Division*

# Safety in the Teaching/Learning Environment

Teachers should communicate the following safety rules to their students and ensure that they are obeyed.

## In the Classroom

- Know the location and proper use of the fire extinguisher and first aid kit.
- Never eat, drink or smell any substance in the laboratory unless you are instructed to do so by the teacher.
- Listen to your teacher for special safety directions. If you do not understand something, ask for help.
- Wear safety goggles when your teacher tells you to wear them.
- Wear safety aprons if you work with anything messy or anything that might spill.
- Read all of the directions before doing experiments or using equipment. Make sure you understand them. If you do not, ask your teacher for assistance.
- Carefully read the label on the container of a product before you use it; follow the manufacturer's instructions and pay special attention to health or safety warnings.

Biology Curriculum 2010, Grades: 10 – 12

- Be careful around a hot plate, Bunsen burner or other sources of heat. Only use these items if instructed to do so by the teacher.
- Keep your hair and clothes away from open flames. Tie back long hair and roll up long sleeves.
- When heating materials in test tubes, always slant the tubes away from yourself and others.
- Keep your hands dry around electrical equipment.
- Never run or play around in the Science Laboratory classroom.
- Never draw any material into a tube with your mouth.
- Tell your teacher if something breaks or spills. Move away from it and wait for the teacher's instructions.
- Put away tools and equipment safely the way your teacher tells you to, as soon as you finish using them; do not leave them where they may be stumbled over.

- Clean your work area, and wash your hands afterwards.

## On Field Trips

- Always be accompanied by a trusted adult approved by the principal – like your teacher, a parent/guardian or an expert about the field trip.
- Never touch animals or plants without the adult's approval. The animal might bite. The plant might be poisonwood or another harmful plant.
- Stay with your group and keep within sight of the accompanying adult. Report any scrapes, cuts, and injuries to your teacher immediately.

## Responsibility

- Treat living things, the environment, and each other with respect.

**Refer to the Safety Manual (High School Science) for further information.**

**APPENDIX VII**  
**Biology Curriculum**  
 Grade Level Evaluation Form

Kindly complete this format the end of the first year using it with Grade 10.

**Section A**

Place a tick in the box which best describes your response to items 1 – 11. Your honest responses are both valuable and appreciated.

No.	Item	Always	Often	Seldom	Never
1.	Are the content and concepts included in the <i>tenth</i> grade curriculum age-appropriate?				
2.	Is sufficient information given in the content column to provide guidance as to the depth to be covered?				
3.	Are sufficient opportunities given for students to develop the designated 17 skills?				
4.	Are the suggested methods of assessment directly related to the learner outcomes and targeted skill?				
5.	To what extent did you use the suggested methods of assessment?				
6.	Did students complete assignments?				
7.	Were the identified resource materials available?				
8.	Are the suggested activities appropriate for concept formation and reinforcement of main points?				
9.	Were you able to use the suggested activities?				
10.	Did the curriculum provide sufficient guidance in how to adapt it to meet the needs of students of higher or lower ability levels?				
11.	Were you able to introduce local examples to relate to students' interest and experiences?				

**Section B**

Indicate your responses in the space provided.

12. Which topics/concepts, if any were too difficult?

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13. Which topics/concepts if any would be better suited at *junior high* level?

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14. Which skills, if any, were over-emphasized?

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15. Which skills, if any, were under-emphasized?

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16. Which units, if any, were given too much time to be completed?

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**Biology Curriculum**  
Grade Level Evaluation Form

17. Which units, if any, were allocated insufficient time to be completed?

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18. Which skills, if any, did students show an improvement in during the year?

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19. What is the approximate percentage of students who was able to attain the standards for *Grade ten*?

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20. Which part(s), if any, of the grade level curriculum was/were successfully implemented? Why?

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21. Which part(s), if any, of the grade level curriculum was/were not successfully implemented? Why?

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22. Was there any aspect of the curriculum for *tenth* grade that placed the students at a disadvantage because of their location (island/district/type of school)? If so, state which parts and why.

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**Section C**

Please circle the appropriate category which describes the school to which you are posted and your years of teaching experience.

<b>School Type:</b>	Junior High	Secondary	All-Age	
<b>Student Population:</b>	30 – 199	200 – 450	451 +	
<b>Location:</b>	Family Islands	Grand Bahama	New Providence	
<b>Your years of experience in the Bahamian school system:</b>				
	0 – 3 years	4 – 9 years	10 – 15 years	16 + years