CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Advanced Proficiency Examination
CAPE®

BIOLOGY SYLLABUS

Effective for examinations from May/June 2008
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Please note that the syllabus was revised and amendments are indicated by italics.

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Revised 2007

Please check the website www.cxc.org for updates on CXC’s syllabuses.
Introduction

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

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

Recognised educational institutions presenting candidates for CAPE Associate Degree in one of the nine categories must, on registering these candidates at the start of the qualifying year, have them confirm in the required form, the Associate Degree they wish to be awarded. Candidates will not be awarded any possible alternatives for which they did not apply.
Science plays a major role in the evolution of knowledge. It empowers us to use creative and independent approaches to problem solving. It arouses our natural curiosity and enables us to meet diverse and ever expanding challenges. It enhances our ability to inquire, seek answers, research and interpret data. These skills lead to the construction of theories and laws that help us to explain natural phenomena and exercise control over our environment. Science is, thus, an integral component of a balanced education.

The most important natural resource in the Caribbean is its people. If the Caribbean is to play an important role in the new global village and survive economically, a sustained development of the scientific and technological resources of its people is essential.

The diverse forms of life, investigated and recorded by human society, have led to the development of a discipline known as Biology. The study of this subject leads to an understanding and appreciation of the concept of life at all levels and, hence, to a greater respect and reverence for life. The interconnected web of life and the unique role of the human species is integral to the dynamic nature of the biosphere. Students of Biology should recognise the enormous responsibility they must undertake to ensure the continuity of life in all its forms. It is incumbent on them to use this knowledge to protect, sustain, conserve and improve the variety of life in the ecosphere. Additionally, the study of Biology prepares students for careers in biological, agricultural, environmental, medical, paramedical and applied science.

This CAPE syllabus is, therefore, designed to provide a coherent course of study which addresses, in addition to a specific knowledge base, the development of related skills and attitudes. The syllabus takes into account the requirements for tertiary education at regional and international institutions. The syllabus is structured in such a way as to ensure that students become aware of their moral, social, and ethical responsibilities, as well as, the benefits intrinsic to the practical application of scientific knowledge to careers in the scientific field.

AIMS

The syllabus aims to enable students to:

1. acquire a body of knowledge and develop an understanding of biological concepts and principles;
2. understand how new information results in reformulation or rejection of earlier models and concepts;
3. recognise the scope of Biology from the molecular level to that of entire ecosystems;
4. develop an ability to communicate biological information in a variety of acceptable ways;
5. acquire an understanding of the scientific method and be able to apply it to solving problems, both in academic and non-academic settings;

6. appreciate the impact of biological knowledge on society and its relevance to ethical, economic, environmental and technological issues;

7. acquire training in the practical skills and thought processes associated with the study of science;

8. develop the ability to apply biological knowledge and skills to relevant Caribbean situations and issues.

**SKILLS AND ABILITIES TO BE ASSESSED**

The skills students are expected to develop on completion of this syllabus, have been grouped under three main headings:

(i) Knowledge and Comprehension;

(ii) Use of Knowledge;

(iii) Experimental Skills.

**Knowledge and Comprehension (KC)**

Knowledge

The ability to identify, remember and grasp the meaning of basic facts, concepts and principles.

Comprehension

The ability to:

- select appropriate ideas, match, compare and cite examples of facts, concepts and principles in familiar situations;

- explain familiar phenomena in terms of theories, models, laws and principles.

**Use of Knowledge (UK)**

Application

The ability to:

- use facts, concepts, principles and procedures in unfamiliar situations;

- transform data accurately and appropriately;

- use common characteristics as a basis for classification;

- use formulae accurately for computations.
Use of Knowledge (UK) (cont’d)

Analysis and Interpretation

The ability to:

- identify and recognise the component parts of a whole and interpret the relationships between those parts;
- identify causal factors and show how they interact with each other;
- infer, predict and draw conclusions;
- make necessary and accurate calculations and recognise the limitations and assumptions of data.

Synthesis

The ability to:

- combine component parts to form a new meaningful whole;
- make predictions and solve problems.

Evaluation

The ability to make reasoned judgements and recommendations based on the value of ideas and information and their implications.

Experimental Skills (XS)

Observation, Recording and Reporting

The ability to:

- select observations relevant to the particular activity;
- make accurate observations and minimise experimental errors;
- recognise, identify and interpret biological materials both microscopically and macroscopically;
- record observations, measurements, methods and techniques with due regard for precision, accuracy and units;
- record and report unexpected results;
- select and use appropriate models of recording data or observations, for example, graphs, tables, diagrams and drawings;
- present data in an appropriate manner, using the accepted convention of recording errors and uncertainties;
Experimental Skills (XS) (cont’d)

- organise and present information, ideas, descriptions and arguments clearly and logically in a complete report, using spelling, punctuation and grammar with an acceptable degree of accuracy;

- report accurately and concisely using scientific terminology and conventions as necessary.

Manipulation and Measurement

The ability to:

- follow a detailed set or sequence of instructions;

- make measurements with due regard for precision and accuracy;

- handle chemicals and living organisms with care;

- cut, stain and mount sections and make temporary mounts;

- set up light microscope for optimum use both under low power and high power;

- use the stage micrometer and eyepiece graticule for accurate measuring;

- assemble and use simple apparatus and measuring instruments.

Drawing

The ability to:

- make clear, accurate line representations of specimens, with no shading or unnecessary details;

- produce drawings with clean continuous lines of even thickness;

- label drawings accurately and use label lines which do not cross each other or carry arrowheads or dots;

- annotate drawings appropriately and accurately;

- make drawings which are large enough to display specific details;

- calculate the magnification of the drawings.
Experimental Skills (XS) (cont’d)

Planning and Designing

The ability to:

- identify problems, make predictions, develop hypotheses and devise means of carrying out investigations to test the hypotheses;
- plan and execute experimental procedures and operations in an appropriate sequence;
- use experimental controls where appropriate;
- modify an original plan or sequence of operations as a result of difficulties encountered in carrying out experiments or obtaining unexpected results;
- take into account possible sources of errors and danger in the design of an experiment;
- select and use appropriate equipment and techniques.

Planning and Designing skills may be assessed by use of fieldwork.

◆PRE-REQUISITES OF THE SYLLABUS

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

◆STRUCTURE OF THE SYLLABUS

This syllabus is arranged into TWO Units, each made up of three Modules. Whilst each Module in each Unit is independent, together they form a coherent course of study which should prepare candidates for the world of work and studies at the tertiary level.

Unit 1: Biomolecules, Reproduction and Development

Unit 1 is expected to be covered in approximately 150 hours, and consists of three Modules. This Unit is structured as follows:

<table>
<thead>
<tr>
<th>Module 1</th>
<th>Cell and Molecular Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 2</td>
<td>Genetics, Variation and Natural Selection</td>
</tr>
<tr>
<td>Module 3</td>
<td>Reproductive Biology</td>
</tr>
</tbody>
</table>
Unit 2: Bioenergetics, Biosystems and Applications

Unit 2 is expected to be covered in approximately 150 hours, and consists of three Modules. This Unit is structured as follows:

- Module 1 - Bioenergetics
- Module 2 - Biosystems Maintenance
- Module 3 - Applications of Biology

Each Unit forms a discrete package for certification.

The syllabus is arranged into two (2) Units, Unit 1 which will lay the foundation, and Unit 2 which expands on and applies the concepts formulated in Unit 1. It is, therefore, recommended that Unit 2 be taken after satisfactory completion of Unit 1 or a similar course. Each Unit will be certified separately.

For each Module there are general and specific objectives. The general and specific objectives indicate the scope of the content, including practical work, on which the examination will be based. However, unfamiliar situations may be presented as stimulus material in a question.

Explanatory notes are provided to the right of some specific objectives. These notes provide further guidance to teachers as to the level of detail required.

The single underlining of a specific objective and its explanatory notes, indicate those areas of the syllabus that are suitable for practical work. However, practical work should not necessarily be limited to these objectives.

It is recommended that of the approximately 50 hours suggested for each Module, a minimum of 20 hours be spent on laboratory-related activities, such as conducting experiments, making field trips and viewing audio-visual materials.
UNIT 1: BIOMOLECULES, REPRODUCTION AND DEVELOPMENT

MODULE 1: CELL AND MOLECULAR BIOLOGY

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the chemical structure of water, carbohydrates, lipids and proteins and their roles in living organisms;
2. understand that cells are the basic units of living organisms, grouped into tissues and organs;
3. understand fluid mosaic model of membrane structure and the movement of substances into and out of cells;
4. understand the mode of action of enzymes.

SPECIFIC OBJECTIVES

1. Aspects of Biochemistry

Students should be able to:

1.1 discuss how the structure and properties of water relate to the role that water plays as a medium of life;

1.2 explain the relationship between the structure and function of glucose;

1.3 explain the relationship between the structure and function of sucrose;

1.4 discuss how the molecular structure of starch, glycogen and cellulose relate to their functions in living organisms;

1.5 describe the molecular structure of a triglyceride and its role as a source of energy;

EXPLANATORY NOTES

Water as a most suitable solvent in relation to its essential roles in transport: cellular and systemic levels.

Exact molecular ring structure in full.

Exact molecular ring structure in full.

Molecular structure: types of bonds; chain and ring structure where appropriate; 3D nature; hydrolysis and condensation reactions; relate structure to properties.

Without going into detail, the student should be made aware of the relationship between triglycerides and obesity.
## SPECIFIC OBJECTIVES

**Aspects of Biochemistry (cont’d)**

1.6 describe the structure of phospholipids and their role in membrane structure and function;  
Relate structure to properties and hence to function.

1.7 describe the generalised structure of an amino acid, and the formation and breakage of a peptide bond;  
Describe the types of bonding (hydrogen, ionic, disulphide) and hydrophobic interactions that hold the molecule in shape.

1.8 explain the meaning of the terms: primary, secondary, tertiary and quaternary structures of proteins;  
Ensure that the relationships between their structures and functions are clearly established.

1.9 outline the molecular structure of haemoglobin, as an example of a globular protein, and of collagen, as an example of a fibrous protein;  
Benedict’s test, KI/I₂ test, emulsion test, Biuret test.

1.10 carry out tests for reducing and non-reducing sugars, starch, lipids and proteins;  
Clear drawings required (refer to page 4).

1.11 investigate and compare quantitatively reducing sugars and starch.  
 Differences between electron and light microscope and between resolution and magnification.

## EXPLANATORY NOTES

2. **Cell Structure**

Students should be able to:

2.1 make drawings of typical animal and plant cells as seen under the light microscope;  
Rough and smooth endoplasmic reticulum, Golgi body, mitochondria, ribosomes, lysosomes, chloroplasts, cell membrane, nuclear envelope, centrioles, nucleus and nucleolus.
# UNIT 1

## MODULE 1: CELL AND MOLECULAR BIOLOGY (cont'd)

### SPECIFIC OBJECTIVES

#### Cell Structure (cont’d)

<table>
<thead>
<tr>
<th>Specific Objective</th>
<th>Explanatory Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3 outline the functions of membrane systems and organelles;</td>
<td>As specified in the Explanatory Notes of Specific Objective 2.2.</td>
</tr>
<tr>
<td>2.4 compare the structure of typical animal and plant cells;</td>
<td>Stress similarities and differences.</td>
</tr>
<tr>
<td>2.5 describe the structure of a prokaryotic cell;</td>
<td></td>
</tr>
<tr>
<td>2.6 compare the structure of prokaryotic cells with that of eukaryotic cells;</td>
<td>Outline the basis of the endosymbiotic development of eukaryotic cells.</td>
</tr>
<tr>
<td>2.7 explain the concepts of tissue and organ using as an example the dicotyledonous root;</td>
<td></td>
</tr>
<tr>
<td>2.8 make plan drawings to show the distribution of tissues within an organ, such as the dicotyledonous root.</td>
<td>Use transverse section of a dicotyledonous root to illustrate tissues including parenchyma, xylem and phloem. The root is used as an organ.</td>
</tr>
</tbody>
</table>

### Membrane Structure and Function

Students should be able to:

<table>
<thead>
<tr>
<th>Specific Objective</th>
<th>Explanatory Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 explain the fluid mosaic model of membrane structure;</td>
<td>Outline the roles of phospholipids, cholesterol, glycolipids, protein and glycoproteins. Diagrams are required.</td>
</tr>
<tr>
<td>3.2 explain the processes of diffusion, facilitated diffusion, osmosis, active transport, endocytosis and exocytosis;</td>
<td>Emphasise the distinction between diffusion and osmosis; and active and passive processes. Diagrams are required.</td>
</tr>
</tbody>
</table>
UNIT 1
MODULE 1: CELL AND MOLECULAR BIOLOGY (cont’d)

SPECIFIC OBJECTIVES

Membrane Structure and Function (cont’d)

3.3 investigate the effects on plant cells of immersion into solutions of different water potentials.

4. Enzymes

Students should be able to:

4.1 explain that enzymes are globular proteins that catalyse metabolic reactions;

4.2 explain the mode of action of enzymes in terms of an active site, enzyme and/or substrate complex, lowering of activation energy and enzyme specificity;

4.3 explain the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme action;

4.4 explain the effects of competitive and non-competitive inhibitors on enzyme activity;

4.5 investigate the effects of temperature and substrate concentration on enzyme-catalysed reactions, and explain these effects.

EXPLANATORY NOTES

No calculations will be set on water potential.

Definition of metabolism, anabolism, catabolism required.

Properties of enzymes. Induced-fit hypothesis.

Construction and interpretation of graphs.

Use succinic dehydrogenase, nicotine and insecticides (pyrethroids) as examples of enzyme inhibitors.
Suggested Teaching and Learning Activities

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

1. Conduct laboratory exercises to reinforce subject matter rather than as a separate activity.
2. Read and use current information in this particular area, since it is constantly changing.
3. Use multimedia and 3-dimensional models to assist in conceptualising cell and/or molecular structure.

Scientific Journals, such as:
- New Scientist
- Scientific American
- Biological Sciences Review

News Magazines, such as:
- Time
- Newsweek
- Discover

RESOURCES

Bradfield, P., Dodds, J. et al  

Clegg, C. with Mackean, D.  

Jones, A., Reed, R. and Weyers, J.  
UNIT 1
MODULE 2: GENETICS, VARIATION AND NATURAL SELECTION

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the structure of nucleic acids and their roles in protein synthesis and nuclear division;
2. understand the behaviour of chromosomes, nucleus and cytoplasm in mitotic and meiotic cell division and their importance for stability and variation in a species;
3. understand the importance of mitosis and meiosis for stability and variation in a species;
4. understand the patterns of inheritance;
5. understand selected aspects of genetic engineering and its medical, agricultural, environmental, ethical and social implications;
6. understand the genetic basis of variation and its importance in natural selection.

SPECIFIC OBJECTIVES

1. Structure and Roles of Nucleic Acids

Students should be able to:

1.1 illustrate the structure of RNA and DNA using simple labelled diagrams;

1.2 explain the importance of hydrogen bonds and base pairing in DNA replication;

1.3 explain the relationship between the sequence of nucleotides and the amino acid sequence in a polypeptide;

1.4 describe the roles of DNA and RNA in protein synthesis;

1.5 explain the relationship between the structure of DNA, protein structure and the phenotype of an organism;

1.6 describe the relationship between DNA chromatin and chromosomes.

EXPLANATORY NOTES

Draw a nucleotide using shapes; recognise (not draw) the structural formulae of nucleotides, ribose, deoxyribose, pyrimidines, purines; nature of hydrogen bonds.

Recognise (include) the significance of 5' and 3'; semiconservative replication; genetic code; initiation, transcription, translation, termination.

Different types of RNA and their respective roles.
UNIT 1
MODULE 2: GENETICS, VARIATION AND NATURAL SELECTION (CONT'D)

SPECIFIC OBJECTIVES

2. Mitotic and Meiotic Cell Division

Students should be able to:

2.1 describe with the aid of diagrams, the processes involved in mitotic cell division;  

2.2 make drawings from prepared slides, and/or a freshly prepared root tip squash to show the stages of mitosis;  

2.3 explain the importance of DNA replication for maintaining genetic stability;  

2.4 discuss the role and importance of mitosis in growth, repair and asexual reproduction;  

2.5 explain what is meant by homologous pairs of chromosomes, and the terms haploid and diploid;  

2.6 describe with the aid of diagrams, the processes involved in meiotic cell division;  

2.7 construct models to demonstrate chromosome behaviour in meiosis;  

2.8 describe how meiosis contributes to heritable variation.

EXPLANATORY NOTES

Include interphase.

Include crossing over, alignment of chromosomes at metaphase, random segregation at anaphase. Names of the intermediate stages of meiosis not required.

Pipe cleaners, plastic wire, embroidery thread. Bristol board may be used for modelling chromosome behaviour in meiosis – biodegradable materials not recommended.
## UNIT 1
**MODULE 2: GENETICS, VARIATION AND NATURAL SELECTION (CON’T)**

### SPECIFIC OBJECTIVES

3. **Patterns of Inheritance**

Students should be able to:

3.1 explain the terms: gene, allele, dominant, recessive, codominant, homozygous and heterozygous;

3.2 use genetic diagrams to solve problems involving monohybrid and dihybrid crosses;

3.3 analyse the results of a genetic cross by applying the Chi-square test;

3.4 determine whether the difference between the observed and expected ratio is significant using the results of the Chi-square test.

### EXPLANATORY NOTES

- Use examples.
- Include those involving sex linkages, codominance multiple alleles and dominant epistasis. Candidates should understand the ratios.
- Formulae will be given. Set out data in tabular form.
- Include the concept of probability. Explain the use of 0.05 confidence limits and the null hypothesis.

4. **Aspects of Genetic Engineering**

Students should be able to:

4.1 outline the principles of restriction enzyme use in removing sections of the genome;

4.2 explain the steps involved in recombinant DNA technology;

4.3 discuss the possible benefits and hazards of gene therapy;

4.4 discuss the implications of the use of genetically modified organisms on humans and the environment.

- Include isolation of genes; cloning of genes; vectors. Use examples including insulin production.
- Use examples including cystic fibrosis.
- Medical, agricultural, ethical and social implications.
# UNIT 1
## MODULE 2: GENETICS, VARIATION AND NATURAL SELECTION (CONTD)

### SPECIFIC OBJECTIVES

5. Variation and Natural Selection

Students should be able to:

5.1 Explain why sexually produced organisms vary in characteristics;

5.2 describe gene and chromosome mutations;

5.3 discuss the implications of changes in DNA nucleotide sequence for cell structure and function in sickle cell anaemia;

5.4 explain how mutation brings about genetic variation;

5.5 explain why heritable variation is important to selection;

5.6 explain how environmental factors act as forces of natural selection;

5.7 explain how natural selection may be an agent of constancy or an agent of change;

5.8 discuss how natural selection brings about evolution;

5.9 discuss the biological species concept;

5.10 explain the process of speciation.

### EXPLANATORY NOTES

- Consider sickle-cell anaemia, Down Syndrome.
- Include examples, such as resistance to antibiotics, Biston betularia (peppered moth).
- Directional, disruptive and stabilising selection; knowledge of appropriate graphs is required.
- Darwin’s theory, its observations and conclusions.
- Discuss the limitations of this concept, for example, in breeding.
- Include isolating mechanisms – reproductive, geographic, behavioural and temporal, allopatric and sympatric speciation with reference to two named examples.
UNIT 1
MODULE 2: GENETICS, VARIATION AND NATURAL SELECTION (CON’TD)

Suggested Teaching and Learning Activities

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

1. Attempt several exercises in order to gain familiarity with the mathematical aspects of Biology and to appreciate levels of significance.

2. Review literature on biodiversity and conservation.

3. Discuss how humans use artificial selection to create, for example, domesticated animals, different breeds of dogs, chickens that lay a lot of eggs, Barbados Blackbelly sheep, Jamaica Hope.

RESOURCES


National Geographic Magazine

Video and/or Television materials such as those found on the Discovery Channel

Darwin_ online.org.uk

Conservation International Website (http:// www.conservation.org)

PBS Evolution website http://www.pbs.org/wgbh/evolution works on Darwin

www.merlot.com

www.nap.edu/readingriom/books/evolution98 teaching about evolution in the nature of science.
UNIT 1
MODULE 3: REPRODUCTIVE BIOLOGY

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand asexual reproduction and vegetative propagation;
2. understand sexual reproduction in the flowering plant;
3. understand sexual reproduction in humans.

SPECIFIC OBJECTIVES

1. **Asexual Reproduction and Vegetative Propagation**

   Students should be able to:

   1.1 explain the term asexual reproduction; Discuss binary fission, budding, asexual spore formation, fragmentation; one example of asexual reproduction in plants, for example, ginger, meristems, hormone stimulation, details of the processes involved in tissue culture and the production of cuttings.

   1.2 discuss the advantages and disadvantages of asexual reproduction;

   1.3 explain the principles and the importance of vegetative propagation as exemplified by the use of cuttings and tissue culture;

   1.4 discuss the genetic consequences of asexual reproduction.

2. **Sexual Reproduction in the Flowering Plant**

   Students should be able to:

   2.1 describe the structure of the anther and the formation of pollen grains; Annotated diagrams required.

   2.2 describe the structure of the ovule and the formation of the embryo sac; Annotated diagrams required.
### UNIT 1
### MODULE 3: REPRODUCTIVE BIOLOGY (cont’d)

#### SPECIFIC OBJECTIVES

**Sexual Reproduction in the Flowering Plant (cont’d)**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3</td>
<td>make drawings of the anther and embryo sac from prepared slides;</td>
</tr>
<tr>
<td>2.4</td>
<td>explain how cross-fertilisation is promoted;</td>
</tr>
<tr>
<td>2.5</td>
<td>discuss the genetic consequences of sexual reproduction;</td>
</tr>
<tr>
<td>2.6</td>
<td>explain the sequence of events from pollination to fertilization;</td>
</tr>
<tr>
<td>2.7</td>
<td>explain the significance of double fertilization in the embryo sac;</td>
</tr>
<tr>
<td>2.8</td>
<td>discuss the development of the seed and the fruit from the embryo sac and its contents, the ovule and the avari.</td>
</tr>
</tbody>
</table>

**Sexual Reproduction in Humans**

Students should be able to:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>describe the structure and function of the male and female reproductive systems;</td>
</tr>
<tr>
<td>3.2</td>
<td>make drawings from prepared slides of the mammalian ovary and testis;</td>
</tr>
<tr>
<td>3.3</td>
<td>explain gametogenesis;</td>
</tr>
<tr>
<td>3.4</td>
<td>compare the structure of the ovum and the sperm;</td>
</tr>
</tbody>
</table>

#### EXPLANATORY NOTES

- Non-synchronous maturation of stamens (Protogyny) and carpels (proteandry), separate sexes (dioecy), insect pollination, self incompatibility and sterility.
- Include self fertilization and cross fertilization.
- Annotated diagrams required.
- Types of fruits not required.
UNIT 1
MODULE 3: REPRODUCTIVE BIOLOGY (cont’d)

SPECIFIC OBJECTIVES

Sexual Reproduction in Humans (cont’d)

3.5 discuss how the structure of the ovum and the sperm suit their functions;

3.6 explain how hormones regulate gametogenesis;

3.7 discuss the importance of hormones in the control of the menstrual cycle;

3.8 describe how and where fertilization and implantation normally occur;

3.9 discuss how knowledge of human reproductive anatomy and physiology has been applied to the development of contraceptive methods;

3.10 explain the structure and functions of the placenta;

3.11 discuss the functions of the amnion;

3.12 discuss the possible effects of maternal behaviour on foetal development. Include the role of nutrition, alcohol abuse, use of legal and illicit drugs and cigarette smoking.

Suggested Teaching and Learning Activities

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

1. Examine a range of floral structures in order to clarify varying pollination methods.

2. Invite resource personnel skilled in plant biotechnology and human reproduction.

3. Visits to appropriate Family Planning Centres, Plant Propagation Stations and Tissue Culture Units.
UNIT 1
MODULE 3: REPRODUCTIVE BIOLOGY

RESOURCES


UNIT 2: BIOENERGETICS, BIOSYSTEMS AND APPLICATIONS

MODULE 1: BIOENERGETICS

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the process of photosynthesis and its role in transforming light energy into chemical energy in the form of Adenosine Triphosphate (ATP);
2. understand the process of cellular respiration and its role in producing ATP;
3. understand energy flow and nutrient cycling in ecosystems and their role in maintaining the stability of these ecosystems;
4. appreciate the ecosystem as a dynamic system involving interaction of biotic and abiotic components;
5. be aware of biodiversity and conservation.

SPECIFIC OBJECTIVES

1. Photosynthesis and ATP Synthesis

Students should be able to:

1.1 describe the structure of a dicotyledonous leaf, a palisade cell and a chloroplast relating these structures to their roles in the process of photosynthesis;

1.2 make drawings from prepared slides of a transverse section of a dicotyledonous leaf, and a palisade cell;

1.3 explain the process of photophosphorylation;

EXPLANATORY NOTES

Annotated diagrams required.

Include ATP’s functions as the universal energy “currency” in all living organisms.

Include the role of pigments, and electron carriers in the process. The conversion of light energy into chemical energy of ATP, the reduction of NADP and the evolution of oxygen as a by-product should be noted. No biochemical detail is required.
UNIT 2
MODULE 1: BIOENERGETICS (cont’d)

SPECIFIC OBJECTIVES

Photosynthesis and ATP Synthesis (cont’d)

1.4 outline the essential stages of the Calvin cycle involving the light independent fixation of carbon dioxide;

1.5 discuss the concept of limiting factors in photosynthesis;

1.6 investigate the effect of limiting factors on the rate of photosynthesis;

1.7 discuss the extent to which knowledge of limiting factors can be used to improve plant productivity.

2. Cellular Respiration and ATP Synthesis

Students should be able to:

2.1 outline the stepwise breakdown of glucose in cellular respiration;

2.2 explain the sequence of steps in glycolysis;

2.3 describe the structure of a mitochondrion, relating its structure to its function;

2.4 state the fate of pyruvate in the cytosol when oxygen is available;

EXPLANATORY NOTES

Knowledge of C₄ plants not required. Include the fixation of carbon dioxide by ribulose biphosphate to yield phosphoglyceric acid (glycerate-3-P) and the subsequent conversion to triose phosphate and other carbohydrates. Emphasise the roles of ATP and NADP.

Light intensity and carbon dioxide concentration.

Names of enzymes not required.

Include the initial phosphorylation of glucose, lysis into two 3-carbon compounds and the subsequent production of pyruvate, a small yield of ATP and reduced NAD. Recognition of simplified structural formulae intermediate.

Diagram required.

Pyruvate enters the matrix and is converted to acetyl CoA via oxidative decarboxylation.
UNIT 2
MODULE 1: BIOENERGETICS (cont’d)

SPECIFIC OBJECTIVES

Cellular Respiration and ATP Synthesis (cont’d)

2.5 outline the Krebs cycle;

2.6 explain the significance of the Krebs cycle in ATP formation;

2.7 explain the process of oxidative phosphorylation with reference to the electron transport chain;

2.8 investigate the rate of oxygen uptake during respiration using a simple respirometer;

2.9 compare the fate of pyruvate in the absence of oxygen in animals and yeast.

EXPLANATORY NOTES

Details of structures of intermediates not required.

Emphasise production of NADH and FADH₂; oxidation and decarboxylation.

Include the roles of hydrogen and electron carriers; the synthesis of ATP and the role of oxygen. No details of the carriers are required. A summary of ATP production should be known.

Germinating seeds may be used. A control is needed.

Fermentation allows for the regeneration of NAD so that glycolysis can continue in the absence of oxygen. Include the concept of oxygen debt in mammals; and note that lactate can be converted back (oxidised) to pyruvate when oxygen is again available. Include commercial uses of yeast.

3. Energy Flow and Nutrient Cycling

Students should be able to:

3.1 distinguish among the terms ecosystem, habitat, ecological niche;

3.2 discuss the way in which energy flows in an ecosystem;

3.3 discuss the efficiency of energy transfer between trophic levels;

3.4 discuss the concept of biological pyramids;

Use examples.

Food chains and food webs. Emphasise the advantages of the food web.

Include the limitations of the pyramids of numbers, biomass and energy.
UNIT 2
MODULE 1: BIOENERGETICS (cont’d)

SPECIFIC OBJECTIVES

Energy Flow and Nutrient Cycling (cont’d)

3.5 describe how nitrogen is cycled within an ecosystem;

3.6 distinguish between energy flow and nutrient cycling within an ecosystem;

3.7 explain how energy flow and nutrient cycling are important for ecosystems to remain self-sustaining units.

EXPLANATORY NOTES

Include the role of microorganisms.

4. Ecological Systems, Biodiversity and Conservation

Students should be able to:

4.1 discuss how ecosystems function as dynamic systems;

4.2 explain the concept of biodiversity;

4.3 discuss the importance of the maintenance of biodiversity;

4.4 discuss how species diversity is related to the stability of an ecosystem;

4.5 explain how in situ and ex situ conservation methods are used to maintain biodiversity.

Use a named example. Include interactions between biotic and abiotic factors.

Discuss genetic diversity, species diversity and ecosystem diversity.

Intrinsic, direct and indirect values, including medicine, natural products, tourism.

Protected areas and or reserves, seed banks, botanic gardens, zoos, sperm banks, embryo banks.
Suggested Teaching and Learning Activities

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

1. Review the general principles of oxidation, reduction and electron flow.
2. Use of charts and creation of concept maps rather than excessive biochemical details.
3. Use multimedia presentation and current information available in sources, such as Nature, National Geographic and Discovery to fully appreciate ecosystem dynamics.
4. Refer to the Eden Project in the United Kingdom.
5. Organise fieldtrips or fieldwork to include the use of sampling techniques and measurement of abiotic factors.
6. Discuss human impact on biodiversity.

RESOURCES


Websites

www.savethemanatee.org
www.ramsar.org/w.n.nariva
www.ramsar.org
www.wetlands.org
UNIT 2
MODULE 2: BIOSYSTEMS MAINTENANCE

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the mechanism by which plants absorb minerals and water through the roots and transport them through the xylem;

2. understand translocation in the phloem;

3. understand the organization, structure and transport function of the mammalian circulatory system;

4. understand the concept of homeostasis and hormonal action;

5. understand the role of the kidneys as excretory and regulatory organs;

6. understand the role of the nervous system in systems maintenance.

SPECIFIC OBJECTIVES

1. The Uptake and Transport of Water and Minerals

Students should be able to:

1.1 explain the uptake of ions by active transport in roots;

1.2 describe the entry of water into plant roots in terms of water potential;

1.3 relate the structure of xylem vessels to their function;

1.4 make drawings from prepared slides of xylem vessels;

1.5 outline the ascent of water in plants;

EXPLANATORY NOTES

Emphasise the role of the endodermis.

Include transport and support roles.

Root pressure, capillarity, cohesion, adhesion and transpiration pull. Include the role of stomata in transpiration.
UNIT 2
MODULE 2: BIOSYSTEMS MAINTENANCE (cont’d)

SPECIFIC OBJECTIVES

The Uptake and Transport of Water and Minerals (cont’d)

1.6 investigate the impact of environmental factors on the rate of transpiration.

Include light and air movements.

2. Transport in the Phloem

Students should be able to:

2.1 relate the structure of sieve tubes and companion cells to their function;

2.2 make drawings of sieve tubes and companion cells from prepared microscope slides;

2.3 label pertinent features in an electron micrograph of a sieve tube and companion cell;

2.4 explain how phloem loading in the leaves occurs against a concentration gradient;

2.5 discuss mass (pressure) flow as a possible mechanism of translocation.

Experimental evidence for and against this hypothesis.

3. The Circulatory System of Mammals

Students should be able to:

3.1 describe the structure of arteries, veins and capillaries, relating their structures to their functions;

3.2 make drawings of arteries and veins from prepared microscope slides;
UNIT 2
MODULE 2: BIOSYSTEMS MAINTENANCE (cont’d)

SPECIFIC OBJECTIVES

The Circulatory System of Mammals (cont’d)

3.3 describe the structure of the heart;

3.4 make drawings of a longitudinal section of the heart;

3.5 explain the cardiac cycle and its initiation;

3.6 discuss the internal factors that control heart action;

3.7 define the terms blood pressure and pulse;

3.8 discuss factors affecting blood pressure;

3.9 make drawings of erythrocytes and leucocytes from prepared slides;

3.10 explain the role of haemoglobin in oxygen and carbon dioxide transport;

3.11 describe oxygen dissociation curves for adult haemoglobin;

3.12 explain the significance of the effect of carbon dioxide on oxygen dissociation curves (Bohr Effect).

EXPLANATORY NOTES

Annotated diagram of the heart and associated major blood vessels.

Use fresh or preserved specimens to emphasise the 3-D structure.

Flow charts not required.

Interpret data.
UNIT 2
MODULE 2: BIOSYSTEMS MAINTENANCE (cont’d)

SPECIFIC OBJECTIVES

4. **Homeostasis and Hormonal Action**

   Students should be able to:

   4.1 discuss the concept homeostasis;

   4.2 outline the general principles of hormonal action in animals;

   4.3 explain how insulin and glucagon regulate blood glucose concentration;

   4.4 explain the effect of the plant regular molecule, ethylene (ethene), on fruit ripening;

   4.5 discuss the commercial use made of ethylene in supplying market-ready fruit.

5. **The Kidney, Excretion and Osmoregulation**

   Students should be able to:

   5.1 explain the need to remove nitrogenous and other excretory products from the body;

   5.2 describe the gross structure of the kidney and the detailed structure of the nephron and associated blood vessels;

   5.3 make drawings of sections of the kidney from prepared sides;

   5.4 explain the function of the kidney in terms of excretion and osmoregulation;

   5.5 discuss the clinical significance of the presence of glucose and protein in the urine.

EXPLANATORY NOTES

4. Receptors, effectors, set point, feedback and homeostatic equilibrium. Emphasise the dynamics of feedback mechanisms.

4.2 Include ductless glands in animals; target cells and receptors.

4.3 Mention the gaseous nature of ethylene and its effect on respiration. Types of fruits not required.

5.1 Review the formation of urea.

5.2 Annotated diagrams required.

5.4 Include the role of ADH.
UNIT 2
MODULE 2: BIOSYSTEMS MAINTENANCE (cont’d)

SPECIFIC OBJECTIVES

6. Nervous Co-ordination

Students should be able to:

6.1 describe the structure of motor and sensory neurones;

6.2 explain the role of nerve cell membranes in establishing and maintaining the resting potential;

6.3 describe the conduction of an action potential along the nerve cell membrane;

6.4 explain synaptic transmission;

6.5 outline the role of synapses.

EXPLANATORY NOTES

Annotated diagrams required.

Emphasise the value of myelinated neurons in increasing the speed of transmission.

Structure of cholinergic synapse. Annotated diagrams required.

Suggested Teaching and Learning Activities

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

1. Make slides of transverse and longitudinal sections of stems, roots and leaves from living tissue, selected by the students to investigate their microscopic structure.

2. Use binocular microscopes to examine root hairs and stomata.

3. Set up experiments on transpiration in both cut stems and potted plants to show methods and results.

4. If possible, visit the hospital’s cardiac unit to see how a pacemaker is fitted, a blood collection centre and/or a medical laboratory to observe blood testing.

5. Take blood pressure measurements, and investigate the effect of exercise, rest, excitement and temperature on blood pressure.
UNIT2

MODULE 2: BIOSYSTEMS MAINTENANCE (cont’d)

6. Use models of heart and kidneys to conceptualise 3-dimensional structure.

7. Make models of xylem, phloem, sections of Bowman’s Capsules, nephrons, alveoli, arteries, veins and blood components, to scale.

8. Use multimedia, Discovery and Discovery Health television programs, access the local Education Unit’s Audio Visual Resource Centre, and visit Websites using keywords and keep a record and or bookmarks of useful sites.

9. Allow or assist students to take photographs of microscope slides and make projector slides.

RESOURCES


(email, cs@insight-media.com)
UNIT 2
MODULE 3: APPLICATIONS OF BIOLOGY

GENERAL OBJECTIVES

On completion of this Module, students should:

1. understand the terms ‘health’ and ‘disease’;
2. understand the principles of immunology;
3. be aware of the principles underlying social and preventative medicine;
4. understand drug abuse and its implications.

SPECIFIC OBJECTIVES

1. Health and Disease

Students should be able to:

1.1 discuss the meaning of the term ‘health’;
1.2 explain the categories of disease or illness;
1.3 discuss reasons for the regional distribution of Acquired Immune Deficiency Syndrome (AIDS), diabetes and cancer;

EXPLANATORY NOTES

Focus on the physical, mental and social aspects of health.

Include physical, mental, social, chronic, infectious, degenerate, inherited, self-inflicted, deficiency, with an example of each. Diseases will fit into more than one category.

AIDS: include the biology of the virus; length of incubation period; roles of lifestyle, ease of travel, cost of drugs and lack of education on the spread of the virus.

Diabetes: include the effects of diet, obesity and prenatal malnutrition.

Cancer: include roles of environmental hazards, food additives, viruses, genetic factors; implications of symptom awareness and failure to seek treatment in management of the disease.
UNIT 2
MODULE 3: APPLICATIONS OF BIOLOGY (cont’d)

SPECIFIC OBJECTIVES

Health and Disease (cont’d)

1.4 analyze data involving incidence and mortality rates of disease.

EXEMPLARY OBJECTIVES

2. Immunology

Students should be able to:

2.1 describe the mode of action of phagocytes;

2.2 define the term, “immune response”;

2.3 compare the origin and maturation of B- and T-lymphocytes;

2.4 distinguish between the humoral and the cell-mediated immune responses;

2.5 explain the role of memory cells in long-term immunity;

2.6 relate the molecular structure of a typical antibody molecule to its function;

2.7 distinguish between active and passive immunity, natural and artificial immunity;

2.8 explain the role of vaccination in providing immunity;

33
### UNIT2
### MODULE 3: APPLICATIONS OF BIOLOGY (cont’d)

#### SPECIFIC OBJECTIVES

**Immunology (cont’d)**

<table>
<thead>
<tr>
<th>Specific Objective</th>
<th>Explanatory Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.9</td>
<td>state what is meant by a monoclonal antibody;</td>
</tr>
<tr>
<td>2.10</td>
<td>describe the use of monoclonal antibodies in diagnosis and treatment.</td>
</tr>
<tr>
<td>3. Social and Preventative Medicine</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Students should be able to:</th>
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<tbody>
<tr>
<td>3.1</td>
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<td>3.5</td>
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<td>3.6</td>
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<tr>
<td>3.7</td>
</tr>
</tbody>
</table>

#### EXPLANATORY NOTES

- The anticancer drug, MabThera; details required of the use of monoclonal antibodies in pregnancy testing.
- Review the concept of a balanced diet; Body Mass Index (BMI); Type 1 and Type 2 diabetes.
- Atherosclerosis, coronary heart disease, hypertension and stroke. Details of plaque formation.
- Include long-term and short-term consequences; relate benefits to the prevention of chronic diseases; refer to VO2 max and cardiac efficiency.
- Include processes of infection; replication of the disease-causing organisms.
- AIDS: mention lifestyle.
- Dengue fever: the vector is *Aedes aegypti*.
- Include social and economic issues.
UNIT2
MODULE 3: APPLICATIONS OF BIOLOGY (cont’d)

SPECIFIC OBJECTIVES

Social and Preventative Medicine (cont’d)

3.8 discuss the roles of social, economic and biological factors in the prevention and control of AIDS and dengue fever.

4. Substance Abuse

Students should be able to:

4.1 discuss the meaning of the term, “drug abuse”;

4.2 distinguish between psychological and physical dependence;

4.3 describe the short-term and long-term consequences of alcohol consumption on the nervous system and the liver;

4.4 discuss the social consequences of excessive alcohol use;

4.5 describe the effects of the components of cigarette smoke on the respiratory and cardiovascular systems.

EXPLANATORY NOTES

Legal and illegal drugs.

Short-term - fatty liver, hepatitis; long-term - cirrhosis, cancer, impaired nervous transmission, demyelination, dehydration of the brain cells.

Drinking and driving, aggressive behaviour, intra-family violence, family breakdown and petty crime; Include a definition of ‘a unit of alcohol’; Daily Alcohol Limits (DAL) – safe limits (that is, blood and breath limits) for driving.

Passive smoking; effects of nicotine, tar and carbon monoxide on cilia, oxygen uptake, mucus secretion; development of hyperplasia, emphysema, chronic bronchitis, cancers including lung cancer; vasoconstriction, increase in number of erythrocytes, increase in blood viscosity, formation of blood clots.
Suggested Teaching and Learning Activities

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

1. Encourage students to read and use current information in this particular area, since it is constantly changing.

2. Visit centres of excellence, such as a field station, hospital or research institute from which students can gain practical experience in these areas.

3. View documentaries which deal with these issues.

4. Invite resource personnel.

5. Group presentations.

RESOURCE

OUTLINE OF ASSESSMENT

EXTERNAL ASSESSMENT (80%)

Paper 01
(1 hour 30 minutes)
Forty-five multiple-choice items, 15 from each Module. Each item is worth 1 mark.

40%

Paper 02
(2 hours 30 minutes)
Section A - Three compulsory structured questions, one from each Module. Each question is worth 15 marks.

Section B – Three compulsory essay questions one from each Module. Each question is worth 15 marks.

40%

INTERNAL ASSESSMENT (20%)

The internal assessment will consist of selected practical laboratory exercises.

MODERATION OF INTERNAL ASSESSMENT

An Internal Assessment Record Sheet will be sent each year to schools submitting students for the examination.

All Internal Assessment Record Sheets and sample of assignments must be submitted to reach CXC by May 31 of the year of the examination. A sample of assignments will be requested by CXC for moderation purposes.

These assignments will be reassessed by CXC Examiners who moderate the Internal Assessment. Teachers’ marks may be adjusted as a result of moderation. The Examiners’ comments will be sent to schools.

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

ASSESSMENT DETAILS

Each Unit of the syllabus is assessed as outlined below.

External Assessment by Written Papers (80% of Total Assessment)

1. There will be a combined question paper and answer booklet for Paper 01, and for Section A of Paper 02. A separate answer booklet will be provided for Section B of Paper 02.

2. S.I. Units will be used on all examination papers.

3. The use of silent non-programmable calculators will be allowed in the examination. Candidates are responsible for providing their own calculators.
Paper 01  (1 hour 30 minutes – 40% of Total Assessment)

1. Composition of the Paper

This paper will consist of forty-five multiple-choice items, fifteen from each Module. All questions are compulsory and knowledge of the entire Unit is expected. The paper will assess the candidate’s knowledge across the breadth of the Unit.

The question will test KC and UK skills.

2. Mark Allocation

The paper will be worth 45 marks, with each question being allocated 1 mark.

3. Question Type

Questions may be presented using diagrams, data, graphs, prose or other stimulus material.

Paper 02 (2 hours 30 minutes - 40% of Total Assessment)

1. Composition of Paper

This paper will consist of two sections.

Questions on this paper test all three skills KC, UK and XS.

Section A will consist of three compulsory structured questions, one question from each Module.

Section B will consist of three compulsory essay questions, one from each Module. Knowledge of the entire Unit is expected.

2. Mark Allocation

The paper will be worth 90 marks.

<table>
<thead>
<tr>
<th>Section</th>
<th>Each Question/Essay</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Section B</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Total marks of Section A - 45 marks
Total marks of Section B - 45 marks

3. Question Type

Questions in Section A will be presented in a structured form. The questions will test KC and UK skills. Answers are to be written in a separate answer booklet.

Questions in Section B will be essays. The mark allocation for each section will be included. Answers for this section are to be written in a separate answer booklet. The questions will test KC, UK and XS skills.
Internal Assessment (20%)

Internal Assessment is an integral part of student assessment in the course covered by this syllabus. It is intended to assist students in acquiring certain knowledge, skills and attitudes that are associated with the subject.

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

Internal Assessment provides an opportunity to individualise a part of the curriculum to meet the needs of students. It facilitates feedback to the student at various stages of the experience. This helps to build the self-confidence of students as they proceed with their studies. Internal Assessment also facilitates the development of the critical skills and abilities emphasised by this CAPE subject and enhances the validity of the examination on which candidate performance is reported. Internal Assessment, therefore, makes a significant and unique contribution to both the development of relevant skills and the testing and rewarding of students for the development of those skills.

The Caribbean Examinations Council seeks to ensure that the Internal Assessment scores that contribute to the overall scores of candidates are valid and reliable estimates of accomplishment. The guidelines provided in this syllabus are intended to assist in doing so.

Award of Marks

The following are the skills that will be assessed:

a. Analysis and Interpretation
b. Manipulation and Measurement
c. Observation, Recording and Reporting
d. Planning and Designing
e. Drawing

In each Unit, a total of 12 marks are to be allocated for each skill as indicated in the Table below.

<table>
<thead>
<tr>
<th>Skill</th>
<th>Unit 1</th>
<th>Unit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Observation, Recording and Reporting</td>
<td>12 marks</td>
<td>12 marks</td>
</tr>
<tr>
<td>Manipulation and Measurement</td>
<td>12 marks</td>
<td>-</td>
</tr>
<tr>
<td>Analysis and Interpretation</td>
<td>12 marks</td>
<td>12 marks</td>
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<tr>
<td>Planning and Designing</td>
<td>-</td>
<td>12 marks</td>
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<tr>
<td>Drawing</td>
<td>12 marks</td>
<td>12 marks</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>48 marks</strong></td>
<td><strong>48 marks</strong></td>
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</tbody>
</table>

*Five of the 12 marks for Observation, Recording and Reporting (ORR) are to be awarded for communicating information in a logical way using correct grammar as described in the definition of the Observation, Recording and Reporting skill on pages 3 and 4. Teachers are required to provide criteria which clearly indicate how they award marks.
Each Module will carry a maximum of 16 marks.

Each candidate’s total Internal Assessment mark for any Unit should be divided in three and allocated to each Module equally.

Fractional marks should not be awarded. Wherever the Unit mark is not divisible by three, then

(a) when the remainder is 1 mark, it should be allocated to Module 1
(b) when the remainder is 2, one of the marks should be allocated to Module 2 and the other mark to Module 3.

Appropriate practical exercises for assessing any skill may be selected from any Module in the relevant Unit. Specific Objectives identified by single underlining are suitable for practical exploration.

**Specific Guidelines for Teachers**

1. Each candidate is required to keep a laboratory workbook which is to be marked by the teacher. Teachers are also expected to assess candidates as they perform practical exercises in which Manipulation and Measurement skills are required.

2. A maximum of TWO skills may be assessed by any one experiment.

3. The mark awarded for each skill assessed by practical exercises should be the average of at LEAST TWO separate assessments. The maximum mark for any skill will be 12. In each Unit, total marks awarded at the end of each Module will be 0 to 16.

4. Specific Objectives lending themselves to practical work are highlighted by single underlining. However teachers need not confine their practical exercises to these objectives.

**INTERNAL ASSESSMENT – GENERAL GUIDELINES FOR TEACHERS**

1. For each Unit marks must be submitted to CXC on the Internal Assessment forms provided. The forms should be despatched through the Local Registrar for submission to CXC by May 31 of the Year of the examination.

2. The Internal Assessment Forms for each Unit should be completed in duplicate. The original should be submitted to CXC and the copy retained by the school.

3. CXC will require a sample of the laboratory books for external moderation. Additional laboratory books may be required. These laboratory books must be retained by the school for at least 3 months after publication of examination results.

4. Candidates who do not fulfil the requirements for the Internal Assessment will be considered absent from the whole examination.
5. Teachers are asked to note the following:

(i) candidates’ laboratory books should contain all practical work undertaken during the course of study. Those exercises which are selected for use for the Internal Assessment should be clearly identified. The skill(s) tested in these selected practical exercises, the marks assigned and the scale used must be placed next to the relevant exercises;

(ii) teachers’ criteria and breakdown of marks for assessing a skill must be clearly stated and submitted with the laboratory books;

(iii) the standard of marking should be consistent;

(iv) the relationship between the marks in the laboratory books and those submitted to CXC on the Internal Assessment Form should be clearly shown.

◆REGULATIONS FOR PRIVATE CANDIDATES

1. Candidates who are registered privately will be required to sit Papers 01, 02 and 03B. Detailed information on Papers 01 and 02 is given on page 38 of this syllabus.

2. Paper 03B (Alternate to Internal Assessment) - 20%

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

   (i) a practical based question to be executed by the candidate;
   (ii) a question based on data analysis;
   (iii) a planning and design exercise.

   This paper will constitute 20% of the overall assessment of the candidates’ performance on the Unit.

◆REGULATIONS FOR RESIT CANDIDATES

Candidates, who have earned a moderated score of at least 50% of the total marks for the Internal Assessment component, may elect not to repeat this component, provided they re-write the examination no later than TWO years following their first attempt. These resit candidates must complete Papers 01 and 02 of the examination for the year in which they register.

Resit candidates must be entered through a school or other approved educational institution.

Candidates who have obtained less than 50% of the marks for the Internal Assessment component must repeat the component at any subsequent sitting or write Paper 03B.
**ASSESSMENT GRID**

The Assessment Grid for each Unit contains marks assigned to papers and to Modules and percentage contribution of each paper to total scores.

<table>
<thead>
<tr>
<th>Papers</th>
<th>Module 1</th>
<th>Module 2</th>
<th>Module 3</th>
<th>Total</th>
<th>(%)</th>
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</thead>
<tbody>
<tr>
<td><strong>External Assessment</strong></td>
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<tr>
<td><strong>Paper 01</strong>&lt;br&gt;(1 hour 30 minutes)&lt;br&gt;Multiple Choice</td>
<td>15&lt;br&gt;30 (weighted)</td>
<td>15&lt;br&gt;30 (weighted)</td>
<td>15&lt;br&gt;30 (weighted)</td>
<td>45&lt;br&gt;90 (weighted)</td>
<td>(40)</td>
</tr>
<tr>
<td><strong>Paper 02</strong>&lt;br&gt;(2 hours 30 minutes)&lt;br&gt;Section A - Structured questions</td>
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<td>45</td>
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<tr>
<td><strong>Internal Assessment</strong>&lt;br&gt;Papers 03A or 03B</td>
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<tr>
<td></td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>48</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>76</td>
<td>76</td>
<td>76</td>
<td>228</td>
<td>(100)</td>
</tr>
</tbody>
</table>
RESOURCES

The following is a list of books and other printed material that might be used for CAPE Biology. The list is by no means exhaustive. Each student should have access to at least one text.

Texts


Supplementary Texts and Teachers’ Guide

Anon Preliminary Biology Study Guide, University of the West Indies, Barbados: Distance Education Centre, 1997.


Reference Books for Field Study

Plant Identification

Barlow, V.  

Fournet, J. and Hammerton, J.  

Nellis, D.  

Whittaker, M.  

Animal Identification

Raffaele, H. et al  

Stirling, P.  

Stokes, F.  

Sultry, L.  

Sutty, L.  
# Glossary

## Key to Abbreviations

- **KC** - Knowledge and Comprehension
- **UK** - Use of Knowledge
- **XS** - Experimental Skills

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyse</td>
<td>Examine in detail</td>
<td>UK</td>
</tr>
<tr>
<td>Annotate</td>
<td>Add a brief note to a label</td>
<td>Simple phrase or a few words only</td>
</tr>
<tr>
<td>Apply</td>
<td>Use knowledge and or principles to solve problems</td>
<td>Make references/conclusions; UK</td>
</tr>
<tr>
<td>Assess</td>
<td>Present reasons for the importance of particular structures, relationships or processes</td>
<td>Compare the advantages and disadvantages or the merits and demerits of a particular structure, relationship or process; UK</td>
</tr>
<tr>
<td>Calculate</td>
<td>Arrive at the solution to a numerical problem</td>
<td>Steps should be shown; units must be included</td>
</tr>
<tr>
<td>Cite</td>
<td>Provide a quotation or a reference to the subject</td>
<td>KC</td>
</tr>
<tr>
<td>Classify</td>
<td>Divide into groups according to observable characteristics</td>
<td>UK</td>
</tr>
<tr>
<td>Comment</td>
<td>State opinion or view with supporting reasons</td>
<td>UK</td>
</tr>
<tr>
<td>Compare</td>
<td>State similarities and differences</td>
<td>An example of a significance of each similarity and the difference stated may be required for comparisons which are other than structural</td>
</tr>
<tr>
<td>WORD</td>
<td>DEFINITION</td>
<td>NOTES</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Construct</td>
<td>Use a specific format to make and or draw a graph, histogram, pie chart or other representations using data or material provided or drawn from practical investigations; build (for example, a model), draw scale diagram</td>
<td>Such representations should normally bear a title, appropriate headings and legend; UK</td>
</tr>
<tr>
<td>Deduce</td>
<td>Make a logical connection between two or more pieces of information; use data to arrive at a conclusion</td>
<td>UK</td>
</tr>
<tr>
<td>Define</td>
<td>State concisely the meaning of a word or term</td>
<td>This should include the defining equation and or formula where relevant; UK</td>
</tr>
<tr>
<td>Demonstrate</td>
<td>Show; direct attention to ...</td>
<td>KC</td>
</tr>
<tr>
<td>Describe</td>
<td>Provide detailed factual information of the appearance or arrangement of a specific structure or sequence of a specific process</td>
<td>Description may be words, drawings or diagrams or an appropriate combination. Drawings or diagrams should be annotated to show appropriate detail where necessary; KC</td>
</tr>
<tr>
<td>Design</td>
<td>Include planning and presentation with appropriate practical detail</td>
<td>UK</td>
</tr>
<tr>
<td>Determine</td>
<td>Find the value present with appropriate practical detail</td>
<td>Where hypotheses are stated or when tests are to be conducted, possible outcomes should be clearly shown and/or the way in which data will be analyzed and presented; XS</td>
</tr>
<tr>
<td>Develop</td>
<td>Expand or elaborate an idea or argument with supporting reasons</td>
<td>KC/UK</td>
</tr>
<tr>
<td>Diagram</td>
<td>Simplified representation showing the relationship between components</td>
<td>KC/UK</td>
</tr>
<tr>
<td>Differentiate or</td>
<td>State or explain briefly those differences between or among items which can be used to define the items or place them into separate categories</td>
<td>KC</td>
</tr>
<tr>
<td>Distinguish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discuss</td>
<td>Present reasoned argument; consider points both for and against; explain the relative merits of a case</td>
<td>UK</td>
</tr>
<tr>
<td>WORD</td>
<td>DEFINITION</td>
<td>NOTES</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Draw</td>
<td>Make a line representation from specimens or apparatus which shows an accurate relation between the parts</td>
<td>In case of drawings from the specimens, the magnification must always be stated; KC/UK</td>
</tr>
<tr>
<td>Estimate</td>
<td>Make an approximate quantitative judgement</td>
<td></td>
</tr>
<tr>
<td>Evaluate</td>
<td>Weigh evidence and make judgements based on given criteria</td>
<td>The use of logical supporting reasons for a particular point is more important than view held; usually both sides of an argument should be considered; UK</td>
</tr>
<tr>
<td>Explain</td>
<td>Give reasons based on recall; account for</td>
<td>KC</td>
</tr>
<tr>
<td>Find</td>
<td>Locate a feature or obtain as from a graph</td>
<td>UK</td>
</tr>
<tr>
<td>Formulate</td>
<td>Devise hypotheses</td>
<td>UK</td>
</tr>
<tr>
<td>Identify</td>
<td>Name specific components or features</td>
<td>KC</td>
</tr>
<tr>
<td>Illustrate</td>
<td>Demonstrate clearly using appropriate examples or diagrams</td>
<td>KC</td>
</tr>
<tr>
<td>Interpret</td>
<td>Explain the meaning of</td>
<td>UK</td>
</tr>
<tr>
<td>Label</td>
<td>Add names to identify structures or parts indicated by pointers</td>
<td></td>
</tr>
<tr>
<td>List</td>
<td>Itemise without detail</td>
<td>KC</td>
</tr>
<tr>
<td>Measure</td>
<td>Take accurate quantitative readings using appropriate instruments</td>
<td>XS</td>
</tr>
<tr>
<td>Name</td>
<td>Give only the name of</td>
<td>No additional information is required; KC</td>
</tr>
<tr>
<td>Note</td>
<td>Record observation</td>
<td>XS</td>
</tr>
<tr>
<td>Observe</td>
<td>Pay attention to details which characterise a specimen, reaction or change taking place; to examine and note scientifically</td>
<td>Observation may involve all the senses and/or extensions of them but would normally exclude the sense of taste; XS</td>
</tr>
<tr>
<td>Outline</td>
<td>Give basic steps only</td>
<td>XS</td>
</tr>
<tr>
<td>Plan</td>
<td>Prepare to conduct an exercise</td>
<td>XS</td>
</tr>
<tr>
<td>WORD</td>
<td>DEFINITION</td>
<td>NOTES</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Predict</td>
<td>Use information provided to arrive at a likely conclusion or suggest a possible outcome</td>
<td>UK</td>
</tr>
<tr>
<td>Record</td>
<td>Write an accurate description of the full range of observations made during a given procedure</td>
<td>This includes the values for any variable being investigated; where appropriate, record; data may be depicted in graphs, histograms or tables; XS</td>
</tr>
<tr>
<td>Relate</td>
<td>Show connections between; explain how one set of facts or data depends on others or are determined by them</td>
<td>UK</td>
</tr>
<tr>
<td>Sketch</td>
<td>Make a simple freehand diagram showing relevant proportions and any important details</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Provide factual information in concise terms outlining explanations</td>
<td>KC</td>
</tr>
<tr>
<td>Suggest</td>
<td>Offer an explanation deduced from information provided or previous knowledge. (… a hypothesis; provides a generalization which offers a likely explanation for a set of data or observations.)</td>
<td>No correct or incorrect solution is presumed but suggestions must be acceptable within the limits of scientific knowledge; UK</td>
</tr>
<tr>
<td>Test</td>
<td>To find out, following set procedures</td>
<td>XS</td>
</tr>
<tr>
<td>Use</td>
<td>Implies the need to recall and apply in order to come to a conclusion</td>
<td>UK</td>
</tr>
</tbody>
</table>

*Western Zone Office*

*2007/06/25*