# CARIBBEAN EXAMINATIONS COUNCIL

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

**MAY/JUNE 2013**

## BIOLOGY

## GENERAL COMMENTS

The CAPE Biology examination is based on three papers for each unit covered in the syllabus: Paper 01 – a multiple-choice paper consisting of 45 compulsory items, 15 from each of the three modules; Paper 02 consisting of six compulsory questions, two from each of the three modules; and Paper 032, an alternative practical paper for candidates who do not register for the School-Based Assessment. Paper 02 is divided into two sections: Section A has three structured questions, one from each module, and Section B has three essay questions, one from each module. Each question on Paper 02 is worth a total of 15 marks.

The modules in each unit are:

Unit 1
Module 1 Cell and Molecular Biology
Module 2 Genetics, Variation and Natural Selection
Module 3 Reproductive Biology

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

## DETAILED COMMENTS

### UNIT 1

### Paper 01 – Multiple Choice

There was a decline in the overall performance of candidates on this paper as a result of the decline in the percentage of candidates achieving Grades I (ten per cent for this unit). With respect to the percentage of failures, there was a minimal increase for this unit.

## Paper 02 – Structured/Essay Items

### Section A – Structured Items

### Module 1

Question 1

Syllabus Objectives: 1.2, 1.4, 1.10
Highest Mark: 15  Mean Mark: 9.78  Lowest Mark: 0

The first part of this question focused on candidates' knowledge of food tests and their ability to apply this knowledge to analyse and interpret data. The second part examined candidates' understanding of the concept that macromolecules are polymers formed from monomers, for example, glycogen.

Overall, knowledge of the topics being examined and understanding of key concepts and terms were found to be adequate; the level of difficulty of the question was appropriate. Also, candidates correctly interpreted the use of rubrics such as *explain* or *state*. Overall performance was quite good with more than 50 per cent of candidates gaining ten or more marks; of these, three per cent attained full scores.

In Part (a), candidates were given a table of data showing the qualitative results of an investigation of the nutritional composition of various food items. For Part (a) (i), candidates were required to identify the nutrient being tested for the given reagents, and in Part (a) (ii), they were asked to identify foods which contained all four major nutrient components. Both sections were generally well done, with the majority of candidates demonstrating a good knowledge of the food tests and correctly interpreting the qualitative results. However, it was evident that candidates were less knowledgeable with respect to the range of expected colour changes in relation to the quantity of any one nutrient present in food items. For example, some candidates did not recognize that a change in colour from pale blue to pink, in the Biuret test, was indicative of a small amount of protein (short-chain peptides are present). In practical sessions, some attention should be paid to guiding students as to expected colour changes and interpretation of such qualitative results.

For Part (a) (iii), some candidates seemed unclear as to the number of food items which should have been listed. These included *eggs, hamburger patty* and *pepperoni pizza* as good sources of protein and *donut* as a good source of lipids; both nutrients being important for supporting cell growth and structure. With respect to a key nutrient for providing energy, all food items with good starch (glucose) content could have been listed. Also, mention of a *strong positive colour change* as justification for selection of food items was accepted.

Part (b) (i) presented no difficulty, with most candidates being able to correctly indicate the location of the two stipulated linkages. Candidates found Parts (b) (ii) and (iii) the most challenging. Sketches were often poorly done or were incomplete and therefore did not clearly show the two expected features, that is a linear series of interconnected glucose units with side branches. In a few cases, candidates incorrectly sketched the structure of a glycoprotein or a triglyceride molecule. Teachers should ensure that students clearly understand what is required when asked to do a sketch. For Part (b) (iii), many candidates were unable to distinguish the structural and functional differences between amylose and cellulose. For example, *glucose units in amylose are bonded together by alpha linkages compared to cellulose which is composed of beta linkages* or *amylose is a compact molecule which therefore makes it a good energy store compared to the cellulose which forms microfibrils and hence is of structural importance.*

Some candidates incorrectly referred to amylopectin instead of amylose.

**Module 2**

Question 2

Syllabus Objectives: 1.3, 1.4, 3.3, 3.4
Highest Mark: 15 Mean Mark: 7.96 Lowest Mark: 0

This was a very straightforward question testing candidates' understanding of a monohybrid test cross, ability to apply a Chi-square test to given data, with emphasis on formulation of a null hypothesis, and understanding of the concept of probability. In addition, candidates' understanding of the concept that translation is an RNA-directed process using codons which translate into amino acids, and ability to decipher codons using given information were assessed.

Overall, this question was fairly well done with four per cent of candidates attaining full marks and about 35 per cent attaining more than ten marks. However, genetics continues to be challenging for some candidates as at least five per cent of them gave no responses and approximately ten per cent gave incorrect answers.

Several candidates were unable to state the correct phenotypic ratio (3:1) for Part (a) (i). Some candidates stated the genotypic ratio (1:2:1) despite the inclusion of phenotypic information in the stem. Others stated the ratio as 1:3 without specifying the phenotypic categories. Part (a) (ii) was fairly well done with approximately 65 per cent of the responses demonstrating an understanding of the null hypothesis as being one of *no difference between observed and expected ratios* and by extension an alternative hypothesis where there is a *difference between observed and expected ratios*. Parts (a) (iii) and (a) (iv) were quite well done with about 85 per cent of candidates gaining full marks. Part (a) (v) seemed to be the

most challenging as several candidates were unable to apply the calculated Chi-square value from Part (a) (iii) to interpret the null hypothesis stated in Part (a) (ii).

All sections of Part (b) were well done with only a few candidates giving incorrect responses to parts of the question. Incorrect responses for Part (b) (i) included transcription, translation codes, bases, instead of the expected answer of *codon and anticodon.* Errors in deciphering the corresponding triplet bases for both tRNA and on the DNA strand accounted for candidates not gaining full marks for Parts (b) (ii) and (iii).

**Module 3**

Question 3

Syllabus Objectives: 2.8, 3.2, 3.3, 3.6
Highest Mark: 15 Mean Mark: 5.18 Lowest Mark: 0

This question focused on a comparison of various aspects of spermatogenesis and oogenesis. In addition, the ability to make a plan drawing of a section of the ovary was tested as was knowledge of the carpel.

Overall, performance on this question was lower than expected with only 12 per cent of candidates gaining ten or more marks.

Parts (a) and (b) (particularly the plan drawing) proved to be a challenge for candidates. In Part (a) (i), many candidates were unable to score full marks as they failed to adequately compare the 'duration of the process' of spermatogenesis with that of oogenesis despite the fact that an explanatory notation was included. Expected correct responses included that

> *for spermatogenesis mitosis and gamete maturation start at puberty and continue through to the rest of the life span compared to oogenesis where mitotic division was completed before birth and gamete maturation occurs from adolescence to menopause.*

For Part (a) (ii), candidates' knowledge of the roles of follicle stimulation (FSH) and luteinizing hormones (LH) in spermatogenesis was not as good as expected and they appeared to be more knowledgeable of the roles of these hormones in oogenesis. While many stated that *FSH promoted the activity of Sertoli cells*, not as many made the link to *nourishment of developing spermatozoa* or *making the Sertoli cells more receptive to testosterone.* Similarly luteinizing hormone *binds to the Leydig cells thus stimulating production of testosterone and hence production of spermatozoa.*

For Part (b), candidates were required to do a plan drawing based on a photomicrograph showing details of a section through an ovary. Drawing skills were generally below the

expected standard. In many responses, candidates did not give a plan drawing, omitted stages, or neglected to state a title and/or magnification. Also, the instruction which directed candidates to *include the stage of the developing ovum just prior to release* appeared to have been misinterpreted as several candidates included an additional stage not seen in the given material. In a few cases, a detailed textbook drawing of only the stage of the ovum just prior was given. Others omitted some stages, especially those post-release of the ovum, or labelled the stages and other features even though this was not required. Teachers must ensure that clear guidelines are given to students as to what constitutes a plan drawing versus a detailed drawing (see comments for SBA). As a result of these errors, only a small percentage of the responses were awarded the full six marks.

Part (c) was generally well done with the majority of candidates gaining at least two of the allotted three marks for recognizing that *X (the ovary wall) develops into the fruit* and that *Y (the ovule wall) becomes the testa/the ovule becomes the seed/the fertilized egg becomes the embryo*/*polar nuclei when fused with the male nucleus forms the endosperm.*

**Module 1**

Question 4

Syllabus Objectives: 3.1, 3.2,
Highest Mark: 15 Mean Mark: 5.32 Lowest Mark: 0

This question tested candidates' understanding of the concept of diffusion as a mechanism for movement of substances, and candidates' ability to use this understanding to define diffusion and to distinguish between facilitated diffusion and active transport. Also, knowledge of the concept that cellular membranes are fluid mosaics of lipids and proteins, and understanding of the role of proteins in the movement of substances in relation to the model were examined.

Overall, performance was less than satisfactory as only nine per cent of candidates gained ten or more marks.

Part (a) (i) proved to be challenging for a large number of candidates. While the majority were able to score at least one mark for stating that diffusion involved the movement of molecules from *an area of high concentration to an area of low concentration*, few were able to access the full two marks because they neglected to mention *net movement* or that movement took place *until an equilibrium was reached*. Of note was a common misconception that diffusion was limited to movement of water molecules and that this required the presence of a selectively permeable membrane. Several candidates were unable to give a clear distinction between active transport and facilitated diffusion, and opted to focus on descriptions of the processes rather than highlighting the differences. For example, *active transport requires energy while facilitated diffusion does not.*

Part (b) (i) was fairly well done with the majority of candidates being able to describe several aspects of the fluid mosaic model of membrane structure. However, the diagrams were not as well done. Errors included incorrect orientation of the phospholipid molecules, incorrect representation of the glycoprotein/glycolipid and omission of the range of protein molecules. Many neglected to highlight what components of the model contributed to the 'fluid' or 'mosaic' nature of the membrane. A common misconception was that cholesterol was directly responsible for the fluid nature rather than having a regulatory role in maintaining fluidity in animal cells. Rarely did candidates correctly relate 'fluidity' to *ability of the phospholipids to move laterally within their own bilayer.* Even fewer made reference to the fact that *integral membrane proteins, when viewed from above one surface or the other, contribute a mosaic pattern to a membrane* or that *these proteins are capable of lateral movement and hence are linked to the fluid nature.* A small percentage of responses were awarded full marks for Part (b) (ii). The majority of candidates gained at least one mark for stating that *proteins were important in the transport of polar molecules and ions.* Not all, however, correctly discussed other aspects such as the specific roles of channel and carrier proteins and hence many did not score full marks.

**Module 2**

Question 5

Syllabus Objectives: 5.6, 5.7, 5.8, 5.10
Highest Mark: 15 Mean Mark: 4.56 Lowest Mark: 0

This question tested candidates' knowledge and understanding of natural selection using the example of antibiotic resistance in the bacterium that causes tuberculosis. In addition, understanding of the relationship of mutation to evolution, as well as knowledge and understanding of a process leading to speciation, was examined.

Overall, performance on this question was less than expected with only nine per cent of responses being awarded ten or more marks.

In Part (a) (i), most candidates scored at least one mark for explaining that natural selection involved *survival of the fittest* but many neglected to mention that those *best suited produce more offspring*. Only a small percentage of the responses gave a clear discussion of antibiotic resistance in relation to Darwin's theory. Expected key points included *existence of variation to susceptibility in the bacteria population*, that those that are *resistant to antibiotics are more likely to survive and reproduce* and that as a result the *frequency of resistance will thus increase from generation to generation*. For Part (a) (ii), most candidates were able to score one mark for explaining that *mutation, a driving force, involves a change in DNA or chromosomes*. However, many failed to state that *the change is random* or to link mutation to variation in the gene pool of a population.

For Part (b) (i), most candidates were able to define *speciation* as being the *process which leads to the formation of a new species* but some failed to include *reproductive isolation* as part of the definition. About 60 per cent of the responses gave an accurate explanation of how geographical isolation leads to speciation where a *population of a species becomes separated by a physical barrier (lake, ocean, mountains), allowing each group to diverge along separate evolutionary paths*. However, many included explanations of sympatric, disruptive and directional selection. Most candidates gained two marks for providing relevant examples such as *mountains* or *lakes* as isolation barriers and reference to speciation in Darwin's finches.

**Module 3**

Question 6

Syllabus Objectives: 3.8, 3.10, 3.12
Highest Mark: 15 Mean Mark: 8.10 Lowest Mark: 0

Knowledge of the process of fertilization, a complex of events designed to ensure a spermatozoon meets an egg, and understanding of its significance, were the focus of one part of this question. Additional parts examined knowledge of the functions of the placenta and understanding of how maternal behaviour can affect foetal development.

Overall, this question was fairly well done with approximately 35 per cent of candidates being awarded ten or more marks.

Part (a) (i) was generally well done with at least 85 per cent of the responses giving good descriptions of the key stages and scoring between three and four of the allotted five marks. Expected stages included

> *acrosome reaction which results in the release of hydrolytic enzymes which digest a path through the layer of follicle cells (corona radiate) that surround the oocyte, the sperm 'swimming' to reach the outer surface of zona pellucida, the sperm head fusing with microvilli surrounding secondary oocyte and penetrating into the cytoplasm, the fusion of the male nucleus with that of the oocyte to form a zygote.*

A common error was that candidates commented on mitosis and meiosis. Part (a) (ii) posed little difficulty as about 75 per cent of candidates gained at least one of the two allotted marks with more than 15 per cent gaining full marks for stating *genetic variation emerged, determines the sex of the embryo* or *restoration of the normal diploid condition.* However, a few candidates mistakenly commented on the significance of reproduction rather than fertilization.

For Part (b) (i), at least 70 per cent of candidates were able to give good descriptions of two functions of the placenta to gain the full four marks. Excellent responses included *production of hormones, exchange of gases, acting as a selective barrier and removal of excretory products*. Part (b) (ii) was quite well done with about 90 per cent of the responses attaining full marks for discussing any two of the following: nutrition, smoking, alcohol and drugs or maternal self-care.

## Paper 032 – Alternative to School-Based Assessment (SBA)

Despite an obvious improvement in general performance especially for Unit 1, the quality of preparation of candidates for this paper continues to be of concern.

### Module 1

Question 1

Syllabus Objectives: 2.2, 3.3
Highest Mark: 16 Mean Mark: 6 Lowest Mark: 4

This question tested candidates' knowledge of the ultrastructure of a cell by focusing on their ability to interpret an electron micrograph. Manipulative and measurement skills, as well as the ability to record and interpret results, was assessed in the second part of the question.

This question was fairly well done with approximately 59 per cent of candidates gaining above average scores.

For Part (a), experimental values were not accurately recorded in the tables provided. Candidates had difficulty stating a relevant aim for the experiment. Similarly, stating an appropriate title proved challenging. Based on the results obtained, some candidates deduced that they were given an isotonic solution. The expected results for changes in length in the hypotonic and hypertonic solutions were not always evident. Hence, the explanation accounting for movement of water was poor. It was evident that candidates did not understand what was required for Part (a) (iv) as few were able to provide a correct explanation of the results.

Part (b) also proved challenging for some candidates who identified the endoplasmic reticulum as Golgi.

**Module 2**

Question 2

Syllabus Objectives: 3.2, 12.1
Highest Mark: 12 Mean Mark: 4.46 Lowest mark: 0

Candidates' knowledge of dihybrid inheritance, ability to represent a genetic cross using a Punnett square, and ability to identify and draw a stage in mitosis were examined in this question.

The question proved difficult for most candidates as approximately 65 per cent of them scored between zero and six marks; no candidate was able to gain full marks.

For Part (a) (i), candidates were asked to complete the table of data which consisted of filling in six values for a total of three marks. Unfortunately, very few candidates were able to do this successfully. They were not aware that the selfing of such parental genotypes led to a typical 9:3:3:1 ratio and that simple mathematical calculations were required to complete the table of data; not many scored the full quota of three marks allocated to this question. Candidates seemed unclear as to whether 9:3:3:1 was the required answer to the ratio requested versus the calculated values 639, 213, 213, 71 (the calculated expected ratios). For Part (a) (ii), few candidates were able to state the expected answers *pure breeding* and *dominance* to gain two marks. Very few understood the concept of pure breeding and as such, references to the parents being 'homozygous' were also accepted. For Part (a) (iii), few candidates were able to identify all four symbols correctly, in order to state the phenotypes. Unfortunately, some candidates did not know how to construct a grid/table for the Punnett square data and even fewer understood that the backcross or testcross meant that the homozygous recessive condition was being crossed with a heterozygote. Few candidates were able to gain more than four of the five marks for the drawing of metaphase in the onion root tip for Part (b). A proper title, a reasonably correct magnification, clean, clear lines without shading, cell wall, and chromosomes aligned along the equator were key points for which marks were awarded. It was encouraging to note that some candidates were able to show calculations for the magnification value.

**Module 3**

Question 3

Syllabus Objectives: 3.4, 3.9
Highest Mark: 16 Mean Mark: 10.9 Lowest Mark: 3

This question tested candidates' ability to identify a spermatozoon and relevant structures from photomicrograph. Other skills tested included candidates' ability to plot data in the form of a histogram and to analyse the given data.

This question was quite well done, with 60 per cent of candidates gaining ten or more marks. Most candidates were able to score two of the three allotted marks for Part (a) (ii). Many lost marks for Part (a) (iii) as they failed to give a complete comment on the function of the middle region as: *containing many mitochondria to produce large amounts of ATP needed for rapid movement*. Parts (b) (i) and (ii) were fairly well done with many candidates gaining at least two marks for both parts. Part (b) (iii) posed no difficulty as almost all candidates were able to identify the *female condom as an alternative barrier method.*

## UNIT 2

### Paper 01 – Multiple Choice

There was a decline in the overall performance of candidates on this paper as a result of the decline in the percentage of candidates achieving Grade I.

### Paper 02 – Structured/Essay Items

**Section A – Structured Items**

**Module 1**

Question 1

Syllabus Objectives: 1.6, 2.2, 3.6
Highest Mark: 15 Mean Mark: 8.49 Lowest Mark: 0

The first part of this question tested candidates' knowledge of the energy investment phase of glycolysis. In the second part, candidates were given a general model of nutrient cycling and were required to use critical thinking skills to make deductions about elements and processes. A third part focused on the effect of increasing light intensity on the rate of photosynthesis.

Overall, the question was fairly well done with about 40 per cent of the responses being awarded ten or more marks.

Part (a) (i) was quite well done with the majority of candidates stating *cytoplasm* as the part of the cell where glycolysis occurs; a few candidates incorrectly stated mitochondria. For Part (a) (ii), most candidates were able to correctly state the events occurring at the highlighted stages as being *phosphorylation of glucose, isomerization, transfer of another phosphate molecule to the sugar molecule and splitting of the 6C sugar molecule into two 3C sugar molecules.* Similarly, Part (a) (iii) was quite well done with many candidates being able to score full marks for suggesting that *glycolysis was significant because glucose was made reactive or ready for use in the Kreb's cycle.*

In comparison, Part (b) was not as well done. Several candidates were unable to correctly identify the reservoirs as being *A* and *D*. In Part (b) (ii), many mistakenly referred to the nitrogen cycle in attempting to name the processes. For Part (c) (i), many candidates were able to correctly identify the regions on the graph where light and other factors were limiting photosynthesis. Errors included using arrows that were too small, incorrect labelling, or neglecting to label the arrows. Part (c) (ii) proved to be the most challenging as the majority of candidates was unable to explain that *point D represents the optimum light intensity with light no longer being a limiting factor* and that *point E represents the maximum rate of photosynthesis*.

**Module 2**

Question 2

Syllabus Objectives: 1.3, 1.4, 3.7, 3.8
Highest Mark: 15 Mean Mark: 7.84 Lowest Mark: 0

This question tested candidates' ability to do a detailed drawing of a section of vascular tissue based on a photomicrograph. In addition, analytical skills as well as understanding of the difference between systolic and diastolic blood pressures were examined based on graphical data.

Overall, performance on this question was reasonable with just over 25 per cent of the responses being awarded ten or more marks.

Part (a) (i) was not well done. Doing the drawing at the actual size proved to be more challenging than expected. In addition, many candidates failed to state a title and of those who did, some did not give an appropriate title. The quality of the drawings was not of a high standard and it was evident that several candidates were unclear as to what constitutes a

detailed drawing. Part (a) (ii) was quite well done with the majority being able to correctly identify all four structures as *phloem, sieve plate, companion cell* and *xylem*. Many candidates did not score full marks for Part (b) (i) as they were unable to correctly distinguish between systolic and diastolic blood pressure. For example, systolic blood pressure was described as high blood pressure instead of *maximum pressure on the arterial wall.* Similarly diastolic blood pressure should have been described as *minimum pressure on the arterial wall* instead of low blood pressure. Though some made a link to the contraction of the ventricle, the majority made vague references to the heart contracting.

In Part (b) (ii), many candidates were able to deduce that the overall trend was an increase in blood pressure with age for both males and females. However, some did not focus on the overall trend and opted to give a description of the changes in blood pressure with age. Part (b) (iii) was generally well done as most candidates correctly suggested a *gender difference.*

**Module 3**

Question 3

Syllabus Objectives: 1.3, 3.4
Highest Mark: 15 Mean Mark: 8.45 Lowest Mark: 0

This question was designed to test candidates' ability to plot a histogram based on mortality rates for various cancers and to interpret the data. The second part of the question focused on knowledge and understanding of the concept of $VO_2$ max.

Overall, this question was fairly well done with approximately 35 per cent of candidates gaining ten or more marks; full scores were attained by about one per cent of candidates.

Part (a) (i) was generally well done with about 80 per cent of candidates being able to score full marks. It is clear that most candidates have mastered the skill of plotting a histogram (a form of a bar graph) and also, were able to interpret the data to attain full marks for Part (a) (ii). A small percentage of candidates plotted a line graph while others either failed to plot all the data or did so incorrectly. In a few cases, the bars were not clearly defined as pencil lines were faint and almost imperceptible.

Part (b) was low scoring as candidates were unable to define $VO_2$ max as being a *maximum rate of oxygen consumption attainable during maximal or exhaustive exercise.* Explanations of the change in shape of the graph were equally poor as few were able to clearly state that *continuing increase in exercise intensity does not result in an increased rate of oxygen consumption*. Similarly, few candidates were able to state two factors which affect $VO_2$ max. Full marks would have been awarded for mention of any two of the following factors: *genetics which defines the upper limit, $VO_2$ max declines with age, level of fitness — $VO_2$ max*

*improves with training, gender — men have a higher $VO_2$ max rate than women or that at high altitudes $VO_2$ max declines.*

**Section B – Essay Items**

**Module 1**

Question 4

Syllabus Objectives: 4.3, 4.5
Highest Mark: 15 Mean Mark: 8.62 Lowest Mark: 0

This question tested candidates' ability to explain the concept of 'biodiversity' and understanding of why biodiversity loss is a major concern. The second part of the question focused on knowledge of conservation methods and their limitations.

Performance on this question was quite good with approximately 48 per cent of candidates being awarded ten or more marks and one per cent gaining full marks.

Candidates did not perform well on Part (a) (i). About 70 per cent of the responses were awarded at least one of the two allotted marks for mentioning *species diversity*. For many, full marks were not awarded as candidates failed to include genetic or ecosystem diversity. Part (a) (ii) was the most challenging as the majority of candidates did not address the issue of biodiversity loss and failed to recognize the value of biodiversity both to humans and ecologically. Hence, many did not adequately discuss why biodiversity loss is a major concern and instead devoted more time to dealing with the benefits. Greater emphasis was placed on ecosystem disruption instead of other factors. In citing the benefits, many failed to clearly indicate which one was direct versus indirect. Acceptable responses for biodiversity loss were *essential for benefits provided to humans, impact of loss on ecosystem functioning, loss of concern in relation to climate change and pollution, and importance of the need to conserve.* In citing benefits, many options were available to candidates including *a range of goods and services provided, economic importance, ecological value, tourism, recreation and future potential* among others.

Part (b) (i) was mostly well done. About 80 per cent of candidates were able to distinguish between *in situ* and *ex situ* conservation and to give appropriate examples to gain at least three of the four marks. Responses for Part (b) (ii) were quite good with about 80 per cent being awarded at least two of the three marks. Expected limitations included *difficulty in recreating natural habitat, expensive to maintain organisms out of natural environment, loss of genetic diversity, organisms difficult to maintain in artificial environment and risks of exposure to pathogens.*

**Module 2**

Question 5

Syllabus Objectives: 4.1, 5.2, 5.3, 5.4
Highest Mark: 15 Mean Mark: 7.03 Lowest Mark: 0

The concept of homeostasis and key components of a homeostatic system as well as the role of collecting ducts in kidney function were the main topics examined in this question.

The question was fairly well done with approximately 28 per cent of the candidates gaining ten or more marks.

For Part (a) (i), the majority of candidates gave an accurate explanation of the concept of *homeostasis*, describing it as *maintenance of an internal steady state in living organisms*. Components of a homeostatic system were generally well explained with most candidates being able to state that a *receptor detects changes in an internal environment*, that a *set point is the optimum condition under which the system operates* and that an *effector responds to changes to restore balance or to bring a system back to set point*.

A lack of knowledge of the structure of the collecting duct was evident by the poor responses given for Part (b) (i). Many candidates were able to score at least one mark for stating that the duct was long or thin. Very few applied the knowledge gained from practical exercises to describe the cellular nature, for example *consisting of cuboidal epithelial cells*. In commenting on the role of the collecting duct, several focused on general kidney functions instead of focusing on the regulation of water/ions or transport of the filtrate from cortex to renal pelvis. However, many were able to state that *it transports filtrate* to gain at least one mark. The majority gave good responses to explain how ADH regulates the function of the collecting duct mentioning that *ADH targets the membrane of the duct to make it more permeable thereby allowing water molecules to be reabsorbed.* Not as many mentioned *the role of the hypothalamus in monitoring the water content of the blood and in synthesising ADH — that is, ADH is then transported to the pituitary from which it is secreted in response to detection of low water potential.*

**Module 3**

Question 6

Syllabus Objectives: 2.3, 3.5, 4.5
Highest Mark: 15 Mean Mark: 7.51 Lowest Mark: 0

This question tested candidates' knowledge of the effects of cigarette smoke on the cardiovascular system. The second part of the question focused on knowledge of T lymphocytes and how they function.

Overall, this question was fairly well done with about 36 per cent of candidates being awarded ten or more marks and three per cent attaining full scores.

Part (a) proved challenging as less than 40 per cent of candidates were able to score the full four marks. While many commented on the cardiovascular diseases, they were unable to link them to cigarette smoke. Effects such as *atherosclerosis, damage to blood vessels, impairment of oxygen transport, impairment of blood clotting, and elevated blood pressure and heart rate* were some of the more typical answers. Part (b) (i) was fairly well done as most candidates correctly stated that *T lymphocytes originated in the bone marrow and matured in the thymus*.

Overall, Part (b) (ii) was quite well done as candidates displayed a good knowledge of the types of T lymphocytes and their respective functions. More than 90 per cent were able to score at least five of the six marks for stating three types of T lymphocytes, *helper, cytotoxic* and *suppressor cells*, and for describing their respective functions. Part (b) (iii) was reasonably well done as many candidates were able to explain that *HIV infects T helper cells rendering them ineffective to fight infections.* However, some did not make the link to the T helper cell.

## Paper 032 – Alternative to School-Based Assessment

Despite an obvious improvement in general performance, the quality of preparation of candidates for this paper continues to be of concern.

### Module 1

Question 1

Syllabus Objectives: 1.2
Highest Mark: 14 Mean Mark: 8.43 Lowest Mark: 2

This question was designed to test candidates' ability to do a detailed drawing as well as their knowledge of the structures in a section of a dicot leaf. Knowledge of trophic levels, using a wetland food web, and understanding of abiotic and biotic factors were examined in the second part of the question.

Overall, this question was not done at the expected standard. While most candidates were awarded one mark for doing a detailed drawing and showing cellular details, they were unable to score additional marks for neatness, accurately drawn cells, tissues in the correct proportions and an appropriate title and correct magnification. Part (b) (i) was well done with the majority of responses being awarded full marks for correctly identifying components of the food web. Part (b) (ii) was fairly well done with candidates gaining at least one of the two marks for naming an abiotic factor and explaining how it affects the heron. Treatment of the biotic factor was not as good since in many instances candidates were unable to explain how the named biotic factor affected the heron.

### Module 2

Question 2

Syllabus Objectives: 1.3, 1.6
Highest Mark: 15 Mean Mark: 6.5 Lowest Mark: 0

In this question, emphasis was placed on examining, planning and design skills. Knowledge of synapse transmission and ability to describe highlighted events were also examined.

Overall, this question was reasonably well done despite the below average mean. For Part (a) (i), most candidates correctly assembled the apparatus but few provided good sketches. In Part (a) (ii), most candidates experienced challenges with the formulation of a null hypothesis. Part (a) (iii) was not well done as many candidates failed to provide a clear

account according to the guidelines given. For Part (b), most candidates were able to give a concise description of almost all the highlighted events.

**Module 3**

Question 3

Syllabus Objectives: 1.2, 1.2, 1.4
Highest Mark: 15 Mean Mark: 12.2 Lowest Mark: 8

Candidates' ability to plot a line graph and interpret data were tested in this question.

This question was generally well done by most candidates as evidenced by the above average mean and the fact that about 84 per cent of the candidates gained ten or more marks. For Part (a), candidates had no problems interpreting the data but gave specific details of the trends instead of focusing on general aspects. A similar failing was seen in responses for Part (b) (ii). Performance on Part (b) (i) was quite good with candidates being able to produce good graphs to score full marks.

**General and Specific Recommendations for Teachers**

Teachers should continue to encourage students to cover all objectives and guide them as to appropriate and adequate interpretation of questions especially with respect to rubrics.

In general, the practical activities indicated a true practical approach with wide syllabus coverage. However in several instances, the activities selected were inappropriate for the skill being tested. With respect to organization of the reports, many books were well organized with a detailed table of contents and correctly numbered pages. Placement of the marks awarded and the skill being assessed, for each practical exercise, in the table of contents contributed significantly to alleviating the frustration of having to painstakingly search for the information during moderation. However, there were too many cases of incorrectly completed moderation sheets, inadequate cover pages and barely legible handwriting. Also, laboratory books should be securely bound to prevent students' work from falling out of the books.

Planning and Design

While some improvement in this skill was evident, many of the concerns raised in the 2012 moderation exercise are still applicable. For some centres it was noted that teachers continue to use CSEC level and/or textbook practical exercises for CAPE practical exercises; it is suggested that this practice be discontinued.

Students should be encouraged to submit original work for the P&D activity. Planning and design experiments should not be copied from the textbook. All students, in a given centre, should not have the same hypothesis, aim, material/apparatus list and method. Teachers are reminded to provide students with problem statements, questions or observations which allow them to design original practical exercises for P&D. Students should be instructed to work with one variable at a time. Students should be given an observation which should be used to generate the hypothesis, aim and method; the aim of the experiment should be very specific to the observation under investigation. A significant percentage of students demonstrated that they do not have a clear understanding of what constitutes a proper hypothesis. For example, the stated hypotheses are sometimes too lengthy. The method should be written in the instructional tense.

A control needs to be included. Also, the specific quantities of substances to be used should be stated. Students attempted to use biological principles in explaining predicted results but the supporting information was often insufficient and done at the CSEC level.

Planning and design activities should reflect original and creative thoughts. While many practical exercises quoted an adequate sample size, very few included repetition of the activity in the design of their method. For some schools, the grading of practical exercises by teachers has improved but overall, the standard of marking was found to be lenient.

Analysis and Interpretation

There were many books in which the laboratory exercises used for the A&I activity were inappropriate. For example, microscopy, meiosis models, drawings and electron micrographs. Again teachers are reminded that the aim of the experiment should be specific, relevant and testable. A noticeable improvement in the quality of the discussion, compared with 2012, was noted.

Good reports gave detailed background information and students linked the theory to the methodology being used. In analysing the data reported in the laboratory results, it was found that students continue to be weak in the areas of clearly indicating the trends seen and using the theory to explain the results obtained in relation to the aim. Also, students did not clearly understand the difference between a limitation, a precaution and a source of error. Too often when students stated a limitation, they did not outline how this would affect the results. In constructing the conclusion, students should make a link to the aim and do so as concisely as possible. Teachers should ensure that the skill being tested is taught before it is assessed; this was not evident in some books.

Drawings

Although drawing was not a skill assessed for Unit 2, a brief review of students' samples indicated that the drawing quality was at a lower standard compared with that of Unit 1. For Unit 1, the quality of the drawings, though improved compared with 2012, was still not at the

standard expected for this level. For example, the magnification was not calculated and recorded for many drawings. Teachers need to ensure that students can use the graticule properly in order to correctly determine the actual size of the specimen being drawn. All calculations of the magnification must be shown.

While there was an increase in the number of drawings with stated magnifications, in many instances the values given were incorrect. Teachers are reminded that the magnification should be shown at the end of the title. Also, titles are in need of improvement as several students neglected to include the view and name of the specimen being drawn. Students must be reminded that a *title should be a full, clear and concise explanation of what is being illustrated.* The use of the word *diagram* is not acceptable in the title. Copies of textbook drawings are still being presented for assessment. This practice is not allowed and therefore textbook drawings were not considered during moderation.

Drawings should have clean, solid, continuous lines. Many drawings had unnecessary detail. Teachers are reminded that plan drawings should not show the individual cells of tissues. No shading should be used and stippling should be done appropriately so as not to detract from the drawing quality. Low power drawings should show the *distribution of tissues.* High power drawings, *showing cellular details*, should be done separately instead of being included as part of a hybrid plan-cell drawing. Correct proportions and faithfulness in reproducing the details of the specimen need to be emphasized. Label lines need to be parallel and justified. Students continue to ignore the requirement that the lettering of the labels should be either in lower or upper case script and not a mixture of styles. Drawings of any reproductive organs should be annotated. Annotations, when done, were found to be inadequate. A well-annotated drawing should include brief notes (simple phrase or a few words) on structure and/or function.