CARIBBEAN EXAMINATIONS COUNCIL

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

MAY/JUNE 2014

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 (SBA). Paper 02 is divided into two sections: Section A with three structured questions, one from each module, and Section B with 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

Paper 01 – Multiple Choice

For both units, there was a decline in the overall performance of candidates for Paper 01 mainly due to decline in the percentage of candidates in the Grade 1 category (5 per cent for Unit 1 and 25 per cent for Unit 2). For both units, performance on the questions was as expected with few questions proving to be challenging.

UNIT 1

Paper 02 – Structured/Essay Items

Section A – Structured Items

Module 1

Question 1

Syllabus Objectives: 1.8, 1.9, 2.1, 2.2
Highest Mark: 15 Mean Mark: 6.10 Lowest Mark: 0

The first part of this question examined candidates' knowledge of levels of organization of protein structure using haemoglobin as an example. In addition, in the second part of the question, candidates were required to apply this knowledge to explain the essential role of haemoglobin. The third part of the question focused on candidates' ability to identify features shown in a drawing of an electron micrograph of a general plant cell as well as their ability to interpret a given magnification.

Overall performance on this question was below average as evidenced by the low mean mark and with only 18 per cent of the candidates gaining 10 or more marks; less than one per cent attained full scores. Nonetheless, some candidates demonstrated a sound knowledge of the topics being examined and showed good understanding of key concepts.

Despite the straightforward nature of Part (a), some candidates were unable to provide clear explanations of the secondary and tertiary levels of protein structure; most were able to distinguish between the primary and quaternary structure of the protein; it should be noted that similar questions have been used for past examinations. A few candidates (about three per cent) did not score any marks as they provided no response. Part (b) proved challenging for some candidates who were unable to relate the essential role of haemoglobin, that is, transport of oxygen, to the levels of protein structure. While most stated the essential role, points such as the fact that the *quaternary structure increases the capacity to transport oxygen* or that *there is cooperative binding* were often omitted.

Part (c) (i) was excellently done as about 80 per cent of the candidates were able to correctly identify the labelled structures of the plant cell. However, Part (c) (ii) posed a real challenge for many as more than 50 per cent of the candidates were unable to either accurately measure the maximum length of the designated organelle or, for those who did, were unable to use the given scale to determine the actual length of the organelle; a few made errors in the calculations but were awarded marks for stating the correct formula. This below than expected standard of performance is puzzling as this skill is covered in the practical exercises and has been examined in previous examination papers.

It is suggested that use of visual aids and models to demonstrate levels of organization of protein structure may enhance student learning. Also, continual re-enforcement of practical skills is essential.

Module 2

Question 2

Syllabus Objectives: 1.1, 1.2, 3.2
Highest Mark: 15 Mean Mark: 8.03 Lowest Mark: 0

This is a standard question testing knowledge and understanding of protein synthesis and codominance – a pattern of inheritance. Also, ability to use a genetic diagram to represent a given genetic cross was examined.

Overall, this question was fairly well done with approximately 40 per cent of the candidates attaining 10 or more marks. This was mainly due to the performance on Part (a) since the genetic component, Part (b), continues to be challenging for some candidates. With respect to Part (a) (i), for which candidates were required to compare features of transcription and translation, many candidates were unable to give a comprehensive comparison. In particular, they were not able to identify the enzymes/cofactors or state the correct function of transcription. Though Part (a) (ii) was generally well done, some candidates did not do a sketch of the tRNA molecule using the representation in the given diagram as was expected but instead did sketches recalled from their textbooks.

In Part (b) (i), a few candidates were unclear as to the difference between key terms such as *gene* versus *allele*, *codominance* versus *incomplete dominance* and, *dominant* versus *homozygous*. In addition, many misinterpreted what was expected of rubrics such as *deduce* and *justify*. Part (b) (ii) proved to be the most challenging part of this question. About 50 per cent of responses for Part (b) (ii) a) identified the blood type rather than stating *alleles homozygous* for blood type B. In giving an explanation to justify the answer, some candidates did not refer to the alleles to explain *codominance* or gave unclear, poorly-written explanations. Poor representations of the Punnett square were seen in many responses for Part (b) (ii) b) with either the use of incorrect symbols or incorrect representation of the male and female genotypes. A few represented the material as a dihybrid cross or even a 'sex-linked' cross.

Greater effort must be made to ensure that students are familiar with and understand basic 'genetic' terminology and have the necessary skills for doing genetic diagrams.

Module 3

Question 3

Syllabus Objectives: 2.6, 3.2, 3.3
Highest Mark: 13 Mean Mark: 5.52 Lowest Mark: 0

For this question, candidates were required to do a detailed drawing of a section of a seminiferous tubule and to analyse and interpret graphical data on pollen germination.

Overall performance on this question was lower than expected with only 13 per cent of the candidates gaining 10 or more marks and less than one per cent being awarded full marks; mean score was below average. Both Parts (a) and (b) proved to be problematic for candidates as they were either unable to do a proper detailed drawing or correctly interpret the graph or both, as seen in some of the responses. In Part (a) (i), some candidates were unable to score full marks as they failed to accurately represent observable details even though they understood that details should be shown. Others gave a diagrammatic representation or did a plan drawing instead of doing a detailed drawing. Also, correct labelling of features drawn was problematic. It is clear that the drawing skills of candidates are not at the expected level and this is also evident in the SBA exercises. While Part (a) (ii) tested basic knowledge of key stages of spermatogenesis, several responses did not score full marks as answers were incomplete. This outcome was unexpected especially as the stages were observable in the given photomicrograph and only an outline was needed.

The majority of candidates were able to give an accurate description of the graphical data presented in Part (b) and to correctly quote numerical values to support descriptions, for example, *absence of germination at zero per cent sucrose concentration or maximum germination of about 40 per cent at six per cent sucrose concentration*. Marks were awarded for mention of the *decline in percentage germination beyond six per cent sucrose concentration or the fact that beyond eight per cent sucrose concentration, germination rate remained constant.* Part (b) (ii) proved to be the most challenging part of this question. Based on the responses, it was evident that the poor performance was due to failure of candidates to link the response shown in the graph, that is, pollen germination, to the pollination process and then to explain the significance of this. In addition to the obvious point that *sucrose facilitates pollen grains sticking to the stigma,* other expected points included *sucrose is essential for pollen germination*; *sucrose helps to nourish growth of the pollen tube*; and *sucrose concentration increases chances of pollen tube formation.* It is clear that interpretation of the term *pollination process* was problematic as many viewed this as simply the transfer of pollen grains to the stigma and did not consider pollen germination as part of the process. In teaching this topic it should be made clear that when a pollen grain lands on the receptive tissue of a pistil known as the stigma, the flower has been *pollinated.* However, this is only the first step in a complicated process that, if successful (for example if germination occurs), leads to fertilization. It is generally accepted that fertilization begins when the pollen tube begins to grow and move towards the egg.

Module 1

Question 4

Syllabus Objectives: 1.1, 3.2,
Highest Mark: 15 Mean Mark: 7.28 Lowest Mark: 0

This question tested candidates' knowledge of the structure of the water molecule and understanding of the solvent property of water. Also, they were required to discuss two major roles of water in cell function. The last part of the question focused on endocytosis and exocytosis.

Overall performance on this question was satisfactory with 28 per cent of the candidates gaining 10 or more marks. Part (a) (i) was well done as many candidates were able gain at least three of the five marks. Common errors included the incorrect use of the term 'atom' as synonymous with 'molecule' and explanation of various properties of water instead of its solvent property. Expected points for the structure were: *water consists of one oxygen and two hydrogen atoms, hydrogen atoms are covalently bonded to oxygen atom, structure is bent*, and for the solvent property: *water is a polar molecule hence it attracts other polar molecules (or ions) and surrounds them.* The responses to Part (b) were of a high standard as most candidates were able to discuss two major roles of water in cell function such as in *transport of substances, providing an environment for metabolic reactions, maintaining the shape and size of a cell, gas exchange, acting as a buffer*. However, a few incorrectly discussed the general properties of water. Part (c) was fairly well done with the majority of candidates being able to give at least one distinguishing feature between the two processes. Credit was given if correct examples were used to distinguish between the two processes. Some mistakes included incorrect descriptions of the processes and reference to the processes as 'entering or leaving the body' instead of being at the cellular level.

Module 2

Question 5

Syllabus Objectives: 4.4, 5.8, 5.10
Highest Mark: 15 Mean Mark: 4.44 Lowest Mark: 0

This question tested candidates' knowledge of a fundamental aspect of the theory of natural selection, that is, Darwin's observations and deductions. Also, an understanding of speciation in relation to natural selection was examined. Finally, candidates were asked to discuss potential threats of the use of genetically modified crops and to give a definition of the term *genetically modified organism*.

Overall, performance on this question was much lower than expected with a low mean mark and only 6.5 per cent of the responses being awarded 10 or more marks. For Part (a), many candidates did not give four observations and three deductions as asked. Also, in several responses, the points given were either not clearly identified as being an observation or deduction or were incorrectly identified. In addition, misconceptions in the meaning of terms such as *species* and *fitness* were evident. Part (b) was not well done as some candidates did not explain geographical speciation in context of the theory of natural selection and instead gave separate explanations or, as was seen in a few responses, explained types of natural selection. The concept of how barriers can lead to speciation appears not to be well understood. The concept of evolution is always a challenge for students to comprehend and therefore more time should be spent teaching this topic. Generally, Part (c) was well done with most candidates being able to state three threats. Marks were lost if the points were not discussed or if the definition was incomplete.

Module 3

Question 6

Syllabus Objectives: 1.1, 1.3, 3.7, 3.8
Highest Mark: 12 Mean Mark: 5.76 Lowest Mark: 0

For this question, candidates were required to give a definition of vegetative propagation, explain why it is not considered to be a form of sexual reproduction and comment on why this type of asexual reproduction is beneficial in agriculture and horticulture. The second part of the question focused on understanding *combine oral contraceptives* (COC) and how this type of contraceptive method should be used in context of a given scenario and in relation to the menstrual cycle.

Overall, this question was not well done as only eight per cent of the candidates were able to score between 10–12 marks. Part (a) (i) was quite well done as the majority of the candidates were able to attain full marks by explaining that *vegetative propagation does not involve gamete formation,* that *only parent is needed* and that *offspring are genetically identical to the parent.* Also, performance on Part (a) (ii) was quite good as most candidates successfully commented on the benefits in agriculture and/or horticulture. Typical responses included: *easy to do, can get a greater yield in a shorter time frame - hence more economical, can be used to preserve more desirable characteristics* or that *it is useful for propagating plants that are difficult to germinate.*

In comparison, Part (b) was not as well done. Most candidates were able to achieve at least two marks for Part (b) (i) for mentioning that the COC, which consists of *progesterone and oestrogen, altered the body's hormonal balance* as well as *promoted the thickening of the cervical mucus to from a plug thereby preventing the sperm from entering the uterus.* Many did not highlight the fact that the COC *prevented ovulation* or that it resulted in a *thinning of*

the uterine lining – hence reducing the probability of fertilization and implantation. Notable misconceptions were reference to the 'morning after pill' and the view that COC 'tricked the body into feeling pregnant'. Part (b) (ii) was the most challenging as many candidates were unable to give a comprehensive answer to score full marks. Most referred to the correct procedure for use of COC but neglected to relate this to the menstrual cycle as expected. Instead they gave descriptions of the cycle. Based on the quality of the responses and apparent lack of knowledge as to how COC functions, it is clear that the absence of an explanation for the relevant objective is a contributing factor.

UNIT 1

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

Module 1

Question 1

Syllabus Objectives: 1.10, 4.5
Highest Mark: 15 Mean Mark: 9.94 Lowest Mark: 0

Two skills were examined in this question — the ability to conduct a glucose test including making accurate records of findings and the ability to interpret graphical data.

Performance on this question was good; 62 per cent of the candidates scored 10 or more marks, with the mean being almost 10, and only 10 per cent scored less than seven marks. For Part (a), candidates competently conducted a semi-quantitative test for glucose using a solution of unknown concentration. Results recorded were as expected and most were able to justify their deduction of the concentration of sugar in solution of unknown concentration. In comparison, not as many candidates were able to correctly do the required calculation suggesting that the concept of serial dilution was not well understood. For Part (c) (i), candidates provided a reasonable description of the effect of temperature on the activity of the enzyme with most candidates scoring at least two of the three assigned marks. Similarly most candidates accurately determined the optimum temperature from the graph for Part (c) (ii). Part (c) (iii) proved the most difficult for candidates; few were able to give a suitable explanation for the steep decline in enzyme activity shown in the graph. Very few made mention that *an enzyme, as a protein, is denatured by the high temperatures* and even fewer made the link to the fact this is due to the fact that *the tertiary structure of the protein is disrupted at high temperatures.*

Module 2

Question 2

Syllabus Objectives: 2.2, 3.2, 3.3
Highest Mark: 15 Mean Mark: 7.78 Lowest mark: 0

Knowledge of the stages of mitosis and the ability to identify these stages from photomicrographs was examined in the first part of the question. Data of a dihybrid cross was used to assess understanding of the chi-square test.

This question was fairly well done as 36 per cent of the candidates scored 10 or more marks; with the mean score being just about average. For Part (a) (i), candidates were able to correctly identify the given stages with most scoring at least six of the eight assigned marks. In Part (a) (ii), only about half of the candidates could name two features that would be clearly observed during mitosis if the specimen was examined at a higher magnification of a compound microscope. A common error was to name features already visible at the existing magnification. For Part (b) (i), approximately one-third of the candidates successfully calculated the chi-square value to gain the full three marks. In Part (b) (ii), candidates were expected to recognize that the calculated chi-square value *supported acceptance of the null hypothesis* and therefore to conclude that the *observed ratio conformed to the expected ratio*. Most candidates were unable to do this and therefore failed to access any of the three marks allotted to this section.

Module 3

Question 3

Syllabus Objectives: 2.8, 3.2
Highest Mark: 15 Mean Mark: 8.54 Lowest Mark: 2

This question evaluated candidates' ability to examine a tissue section and ability to make a labelled plan drawing. Data on the lipid and sugar content of seeds during germination was used to test candidates' ability to draw a graph and to test their analytical skills.

This question was fairly well done as 36 per cent of the candidates scored 10 or more marks, with the mean score being slightly about average. For Part (a), many candidates were able to make a labelled plan drawing to show the distribution of tissues in the mammalian ovary. However, some failed to represent the tissues in their correct proportions and had very poor line quality. Many omitted magnifications and a title. Nonetheless, most were able to provide accurate labels. In Part (b) (i), most were able to construct a good line graph from the data provided and thus gained the full allotted five marks. Part (b) (ii) was also well done as almost all gave an appropriate description of the trend for changes in the sugar content of the

seeds. In Part (b) (iii), only a few candidates were able to suggest reasons for the changes in the lipid and sugar content as germination progresses. Most candidates failed to recognize that the seed resources were being converted and mobilized initially then declining as the seed utilized them for germination.

UNIT 2

Paper 02 – Structured/Essay Items

Section A – Structured Items

Module 1

Question 1

Syllabus Objectives: 1.5, 1.6, 2.3, 2.5
Highest Mark: 15 Mean Mark: 6.09 Lowest Mark: 0

The first part of this question examined candidates' knowledge of the structure of a mitochondrion. The second part of the question tested their ability to analyse and interpret graphical data.

Overall, the question was not well done as only 13 per cent of the responses were awarded 10 or more marks. Also, the mean score was below average. Generally, Part (a) (i) was quite well done with many candidates being able to identify at least two of the four labelled structures and to correctly indicate the location of the Krebs cycle. Nonetheless, some misconceptions and errors were noted; for example, some candidates identified chloroplast structures, stalked particles were thought to be phospholipids, and mitochondrial DNA was described as chromosomes. Typically chromosomes are thread-like structures located inside the nucleus of eukaryotic cells. Mammalian mitochondrial DNA is a closed-circular, double-stranded DNA molecule which is not enveloped, does not have normal histones and therefore is not packaged into chromatin.

Part (b) (i) was exceptionally well done with more than 80 per cent of the responses being awarded full marks for stating that the *rate of photosynthesis increased rapidly up to an optimum temperature (36 ^{o}C), beyond which it declined sharply*. However, some candidates appeared unable to make the distinction between optimum temperature and ideal conditions. Part (b) (ii) proved to be the most challenging as approximately 75 per cent of the responses gained only one mark, and about five per cent of candidates scoring full marks. The main challenge was an inability to interpret and explain the effect of increasing the carbon dioxide concentration on the rate of photosynthesis, and how this information could be used by farmers (Part (b) (iii)). Most were able to give the effect of concentration on the net

photosynthetic rate, for example, *increased levels of CO_2 resulted in a higher photosynthetic rate or that a higher optimum temperature was seen.* In many responses, separate descriptions were given. Few gained full scores by commenting on the significance of *increasing carbon dioxide levels – result in increased yield* or that knowledge of the optimum temperature can be used to *control the temperature in the greenhouse at an optimum level.*

Module 2

Question 2

Syllabus Objectives: 1.1, 3.3, 3.8
Highest Mark: 15 Mean Mark: 6.23 Lowest Mark: 0

This question tested candidates' ability to interpret graphical data, use a labelled diagram to illustrate pathways of water movement from soil into root cells, and identify structures from a diagram of longitudinal section of the mammalian heart.

Overall, performance on this question was below average as only 16 per cent of the responses were awarded 10 or more marks and the mean score was below average. About 70 per cent of the candidates gave comprehensive answers for Part (a) to gain all four marks. Of the remaining 30 per cent, about 50 per cent did not recognize that temperature was constant over the given time period, and hence both independent variables, with KCN uptake being the dependent variable. In addition, several misinterpreted the vertical arrow as being that time was held constant instead of KCN being added, as indicated. Performance for Part (b) was not at the expected standard given that the subject material is well covered in the texts. About 15 per cent of the candidates drew the cross section of the root even though the question gave specific and clear guidelines; failed to adhere to the instruction to limit the illustration to six to eight cells and did not realize that the diagram should be done at 'a high power level' to show details. A greater challenge for many candidates, was to show the pathways. In many responses, the symplastic pathway was omitted while other pathways were not accurately represented. Part (c) was well done by about 90 per cent of the candidates. Incorrect identification of the structures was the main reason for poor performance; occasionally there were spelling errors for the technical terms, for example 'tricupid' for *tricuspid* and 'barcupid' for *bicuspid*.

Providing an explanation of how arterial pressure is affected by a defective heart valve proved more problematic than expected for approximately 50 per cent of the candidates. However, a few were able to furnish good answers by mentioning *backflow* and *decrease in arterial pressure*. Only the more competent candidates, who scored between 12 and 15 marks for the question overall, managed to gain the full two marks for Part (c) (ii).

Module 3

Question 3

Syllabus Objectives: 2.1, 3.1, 3.4
Highest Mark: 15 Mean Mark: 10.29 Lowest Mark: 1

This question was designed to test candidates' ability to plot a line graph using data on obesity in pre-school children. In the second part of the question, candidates were required to use annotations to describe steps in phagocytosis and to outline the role of a macrophage as an antigen-presenting cell.

Performance on this question was very good with 65 per cent of the candidates scoring 10 or more marks, of which two per cent gained full marks, with a mean mark of 10 and with only seven per cent of the candidates scoring six marks or less. For Part (a) (i), many responses were awarded full marks. Marks were not awarded for omitting the title, not labelling the axes and not plotting a line graph. Similarly, most candidates were able to interpret the data and to provide good quality answers for Parts (a) (ii) and (iii). The high standard of the responses for Part (a) suggests that candidates have mastered the skill of plotting line graphs as well being able to competently analyse and interpret the data. For Part (b) (i), while most candidates demonstrated knowledge of phagocytosis, some were unable to provide comprehensive or correct annotations; Step 2 seemed particularly problematic. Also, Part (b) (ii) was somewhat challenging as many were unable to score full marks by stating that *some of the digested bacterial fragments combine with proteins and that the complex is displayed on the surface of the macrophage for presentation to lymphocytes.*

Section B – Essay Items

Module 1

Question 4

Syllabus Objectives: 3.2, 3.3, 4.1
Highest Mark: 15 Mean Mark: 7.29 Lowest Mark: 0

This question examined knowledge and understanding of energy losses across trophic levels and the importance of food web complexity. In addition candidates were required to describe six biotic interactions that occur in an ecosystem.

Overall, this question was reasonably well done with approximately 26 per cent of the responses being awarded 10 or more marks and with an average mean value. Generally, for Part (a), candidates demonstrated an understanding that only *a fraction of the energy available at one trophic level is transferred to the next trophic level* by giving a

comprehensive account of the various ways in which energy is lost across trophic levels, for example, through *respiration, digestion, excretion*. Part (b) was not as well done as expected; responses were to be lacking relevant and accurate information. Some candidates were unable to provide a clear explanation of a 'food web' that is a mesh of *interlinking food chains* and instead either gave a description of a food chain or referred to a food web as a diagram or illustration of feeding relationships. Comments on the importance were sometimes vague or incomplete. Expected points include *greater variety of food available for consumption, associated with high biodiversity, increased ecosystem stability* or *enhancing efficiency of energy flow and nutrient cycling*. Despite the very straightforward nature of the question, Part (c) was not well done as several candidates did not attain full marks because they did not describe all six biotic interactions or their descriptions were incorrect. Also, a few did not recognize that biotic relations involved living organisms. *Feeding, predation, competition, mutualism* and *parasitism* were some of the more common points; others such as commensalism and altruism were often omitted.

Module 2

Question 5

Syllabus Objectives: 2.4, 2.5, 4.1
Highest Mark: 15 Mean Mark: 5.66 Lowest Mark: 0

Translocation in plants and action potential are the two main topics examined in this question.

This question was not well done as approximately 19 per cent of the candidates gained 10 or more marks. Also, mean score was below average. The majority of candidates were able to give a concise explanation of the term *translocation*. Some errors included giving a definition of *transplanting* or referring to the xylem instead of the phloem. Several candidates were able to give an appropriate explanation of the scenario given in Part (a) (ii). An acceptable explanation should have included the fact that the *flow of sap if from source (leaves) to sink (e.g. roots) and that this flow is under pressure. The spiral slash prevents bulk flow to the root and thus more sap is available to go to other parts, for example fruit thus making it sweeter.* Part (b) (i) was not well done as many candidates did not score full marks. This was unexpected given that the topic examined is a fundamental aspect of the function of a neurone and specific guidelines were given in the question. While most were able to attain four or even five marks, accounts were incomplete as key points were omitted. Others included descriptions of repolarisation despite being told that it was not required. Part (b) (ii) was fairly well done with most responses gaining at least two marks for stating that Lidocaine *interferes with the depolarisation of the neurone and blocks the movement of sodium ions across the cell membrane and therefore no action potential is generated.*

Module 3

Question 6

Syllabus Objectives: 3.2, 4.5
Highest Mark: 15 Mean Mark: 5.19 Lowest Mark: 0

The association between excessive dietary fat intake and hypertension was examined in the first part of the question, while the second part focused on chronic bronchitis and emphysema.

Overall performance for this question was below the expected standard as only 11 per cent of the candidates gained 10 or more marks and the mean value was below average. Part (a) proved challenging as many candidates failed to link excessive consumption of dietary fat with high levels of low-density lipoprotein (cholesterol) in the blood which contributed to plaque formation and thus increased risk of developing atherosclerosis, is a condition that causes the walls of the arteries to thicken. Many candidates failed to get full marks as descriptions of plaque formation were vague and incomplete. Plaque formation is a complicated process and begins with the *damage of the endothelium; high cholesterol or high blood pressure can damage the endothelium, creating a place for cholesterol (LDL) to enter the artery's wall. As cholesterol starts to accumulate in the wall of the artery, white blood cells stream in to digest the LDL cholesterol. Over years, the toxic mess of cholesterol and cells becomes a cholesterol plaque in the wall of the artery.The growth of cholesterol plaques slowly blocks blood flow in the arteries resulting in an increased blood pressure (hypertension).* Part (b) was reasonably well done as most candidates were able to distinguish between chronic bronchitis and emphysema to provide clear explanations of how these conditions were linked to cigarette smoking.

UNIT 2

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

Module 1

Question 1

Syllabus Objectives: 2.8, 4.4
Highest Mark: 16 Mean Mark: 8.97 Lowest Mark: 2

In this question emphasis was placed on examining planning and design skills. Candidates' ability to interpret graphical data was also tested.

Overall, this question was quite well done as 52 per cent of the responses were awarded 10 or more marks. For Part (a), candidates were expected to design an experiment to investigate the effect of temperature on the rate of respiration in germinating peas, using a given list of apparatus and material, and to state two precautions. Very few candidates were able to use the given apparatus and material to design an appropriate simple respirometer but did manage to gain some marks for outlining the correct procedure. Most candidates indicated that the rubber and glass connections must be airtight as a precaution but could not state a valid second precaution. In Part (b) (i), many candidates could only give a partial description of the similarity between the trend observed for the rate of human population growth and the rate of species extinction shown. However, most could compare the rate of change in species extinction for the two periods stated and were able to state a threat to world biodiversity, though not always fully commenting on how the identified factor affected biodiversity.

Module 2

Question 2

Syllabus Objectives: 2.1, 2.3, 5.3
Highest Mark: 11 Mean Mark: 5.86 Lowest Mark: 1

This question tested candidates' ability to make a detailed drawing of a selected section of the cross-section of a renal corpuscle and to identify key structures. Ability to interpret features of vascular tissue in plants from a photomicrograph was included in this question.

Performance on this question was below the expected standard as only seven per cent of the candidates scored 10 or 11 marks; mean mark was well below average. Drawings for Part (a) (i) were adequate although in some responses, neat, clean lines were absent and tissues were not always in correct proportions. Most candidates were able to correctly identify two of the

three labelled structures in the corpuscle. In Part (b) (i), candidates were required to compare features of the companion cell with the sieve tube element as shown in the given figure. This part of the question was successfully done by most candidates. However, for Part (b) (ii), many could not identify the plasmodesma shown but could state its function. Very few candidates scored the full three marks on Part (b) (iii) finding it difficult to measure the widest point on the sieve tube element accurately and to correctly use the scale bar provided.

Module 3

Question 3

Syllabus Objectives: 1.3, 1.4, 3.6
Highest Mark: 14 Mean Mark: 9.41 Lowest Mark: 2

The ability to construct a bar graph, analyse and interpret data were tested in this question. The second part of the question examined knowledge of the transmission cycle of dengue fever.

This question was generally well done as 48 per cent of the candidates scored 10 or more marks and the mean mark was slightly above average. For Part (a), candidates were provided with a table of data on the mortality rates for some diseases in CAREC affiliated countries. Most gave incomplete explanations of the term *mortality rate*. The majority were able to construct good bar graphs to score at least four of the six marks for this question. Common errors seen were poor titles or improperly labelled axes. Almost all candidates successfully answered Part (a) (iii). For Part (a) (iv), candidates recognized that mortality dramatically increased but found it challenging to suggest two reasons to account for this trend. Part (b) was a very straightforward question focusing on the transmission of dengue fever using a diagram. Candidates were able to identify the causative agent as a virus, DENV. Most candidates could identify the events occurring in the life cycle shown as well as name *infectious/pathogenic* as the category of disease to which dengue belonged.

General and Specific Recommendations for Teachers

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

General Issues Concerning Paper 032

Despite an improvement in general performance over the past few years, the quality of preparation of candidates for this paper continues to be of concern especially as there is a noticeable decline in the standard of performance for 2014.

General Comments on the SBA

Summary SBA

As in the previous year, the practical activities indicated a general practical approach with wide syllabus coverage. However, there is still some persistence in selecting activities which are not the most appropriate for the skill being tested. Also, this year, there has been a noticeable decline in the quality of drawings being presented. However, there is a definite improvement in the quality of planning and design activities.

Planning and Design

In spite of the improvement seen in this skill, the following comments are still applicable:

- The use of CSEC level and textbook practical exercises should be discouraged.
- Candidates should be encouraged to submit original work for the Planning and Design (P/D) activity. P/D experiments should not be copied from the textbook. All candidates in a given centre should not have the same hypothesis, aim, material/ apparatus and method. It has been noted that teachers are now providing candidates with problem statements, questions or observations which allow students to design original labs for P/D. However, students should be instructed to check one variable at a time and to make the aim of the experiment very specific. Students should be reminded that the given observation should be used to generate the hypothesis, aim and method. A significant portion of students demonstrated that they do not have a clear understanding of what constitutes a proper hypothesis, for example, the hypotheses stated were sometimes too lengthy or badly worded.
- The method should be written in the instructional tense. Poor quality of expression was often an issue in the reports presented.
- A greater attempt to include a control was evident. However, students are not able to distinguish between controlled variables and the experimental control.
- The specific quantities of substances to be used should be stated.
- Candidates attempted to use biological principles in explaining predicted results but the supporting information was often basic and at the CSEC level.
- P/D activities selected this year did not reflect much originality or creative thought.
- While many exercises use an adequate sample size, very few include repetition of the activity in the design of their method.
- The marking by teachers, for some schools, has improved. However, overall the standard of marking continues to be lenient.

Analysis and Interpretation

For many samples inappropriate practical exercises were used, for example microscopy, meiosis models, drawings and electron micrographs particularly for the Unit 1 samples.

Teachers are reminded that the aim of the experiment should be properly worded that is, it should be specific, relevant and testable. There was a marked improvement in the quality of the discussion compared to 2013. Good reports had detailed background information and candidates linked the theory to the methodology being used. Analysis of results is still an area of weakness as trends were not always clearly described and explained using the relevant theory and in relation to the stated aim. There is evidence that candidates generally do not have a clear understanding of the difference between a limitation, a precaution and a source of error. Too often, where candidates stated a limitation they did not outline how this would affect the results. In constructing the conclusion, candidates should relate the discussion to the aim and do this in a concise manner. There was some indication that this year more of the students were being exposed to the skill being tested before being assessed.

Drawings

Although drawing was not assessed for Unit 2, a glance through the candidates' samples indicates that the drawing quality was not very faithful representations of what was being observed. For Unit 1, the quality of the drawings was still not at an acceptable standard.

Greater use of magnification on the drawings was observed this year but many of the values were incorrect. In many instances the magnification is still not calculated and recorded. Teachers need to ensure candidates can use the eyepiece graticule to correctly measure the actual size of the specimen being drawn. All working for calculations of the magnification must be shown and the magnification should be shown at the end of the title. Titles are not including the view and name of the specimen being drawn. The use of the word 'diagram' is not acceptable in the title. Copies of textbook drawings are still being presented for assessment, although less frequently than in 2013. These are not acceptable and were awarded zero during moderation. Use of clean, solid, continuous lines should be encouraged. Fewer drawings had unnecessary detail, for example showing the individual cells on a tissue plan; low power drawings should show the distribution of tissues only. Encouragingly, very little shading was evident; instead candidates opted to use stippling. This should be done appropriately so as not to detract from the drawing quality. High power drawings (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 specimen needs to be emphasized. Label lines need to be parallel and justified. More candidates made an attempt to meet the requirement that the lettering of the labels should be either in lower or upper case script. Use of annotations and quality were much improved this year but students must be reminded that a well annotated drawing should include brief notes on both structure and function.

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 lab in the table of contents assisted in making the moderation exercise a less frustrating task.

However, there were too many instances of incorrectly completed moderation sheets, inadequate cover pages and barely legible handwriting. Laboratory reports should be securely bound to prevent the candidates work from falling out of the books.