CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION

JANUARY 2010

BIOLOGY
GENERAL PROFICIENCY EXAMINATION

GENERAL COMMENTS

The January 2010 sitting of the CXC examination in Biology consisted of three papers on which all questions were compulsory. The papers were as follows:

- Paper 01 – Multiple Choice
- Paper 02 – Structured/Essay Questions
- Paper 03/2 – Alternative to School-Based Assessment (SBA)

As in the previous year, performance of candidates in this examination was as anticipated, particularly performance on Paper 02. Performance on Paper 03/2 was again disappointing and highlighted the lack of practical experience, inadequate development of required biological skills and insufficient practice. Also contributing to weak candidate performance was the lack of attention to test-taking techniques and suggestions made by the examining committee which have been made repeatedly and which have been further embellished and detailed. These suggestions are reiterated hereunder because of their critical importance to future candidates of the Biology examination:

- Candidates must improve their test-taking skills. This includes practice in reading questions carefully and planning responses so that answers are organized in a logical and coherent manner.

- Candidates continue to waste a lot of valuable time supplying irrelevant information in the essays even though guidance has been provided in the spaces allotted regarding expected responses. Candidates should focus on key words such as 'describe' and 'explain' when reading the questions and be guided by the mark allocation and quantitative descriptors within the text of the question as far as possible.

- There was also the question of choice of terminology and descriptions provided. Familiarity with biological jargon allows candidates the opportunity to express themselves more accurately and reduces errors caused by oversimplification.

- Candidates should pay more attention to the stimulus material provided in the questions, especially in the first three questions on Paper 02 and on Paper 03/2. They did not use the stimulus material to answer the questions or, as happened in Paper 03/2, referred to experimental activities outside of that requested. The stimulus material is meant to guide candidates to the expected responses. Candidates too often responded by providing obscure information in their responses that did not relate to the scenario presented, or they ignored the obvious in favour of little-known phenomena.

- More emphasis should be placed on practical skills and candidates' ability to demonstrate these skills in responding to questions on Paper 03/2. Too many candidates seemed unfamiliar with basic laboratory equipment and material and even the simplest of biological/scientific methods. Candidates demonstrated particular weakness in stating aims and in describing methods of the commonest of experimental activities, for example, transpiration investigations.

- The spelling of common biological terms is generally so poor that candidates cannot be rewarded with marks. It is also difficult to explain why candidates would incorrectly spell biological terms that are actually used in the question.

- Candidates also showed a decided lack of appreciation for and understanding of biological jargon they are expected to know and use at this level. Terms like 'physical factors' and 'adaptations' have specific meanings for biologists.

- Candidate preparation for the examination requires a comprehensive knowledge of the syllabus content and an ability to use the information to address biological issues.

Paper 01 – Multiple Choice

Paper 01 consisted of 60 multiple choice items. Performance on this paper was similar to that of last year's. Some of the topics that *continued to be* problematic for candidates were:

- Aspects of ecology, including feeding relationships and food chains
- Cell structure and function
- Specifics of photosynthesis
- Specifics of respiration
- Cell specialization
- Morphology of root, stem and leaf
- Gas exchange
- Reproduction in plants
- Aspects of nutrition, for example, the role of different vitamins
- Aspects of respiration and excretion
- The functioning of sense organs
- Metabolic rate and effect on the body temperature

Paper 02 – Structured/Essay Questions

Paper 02 consisted of six essay questions, three of which followed the short-answer format while the other three were more extended in structure. The first question, which carried the heaviest weighting, 25 marks, was the data analysis question which assessed candidates across all profiles - Knowledge and Comprehension, Use of Knowledge and Experimental Skills.

Candidates were able to attain marks across the allotted range for only one of the six questions. For more candidates to give their best performance, attention must be paid to observations and suggestions the Biology examiners have repeatedly noted. In particular, candidate attention is drawn to the use of the stimulus material in responding to the questions and the guidance provided by the spaces allotted to each question - answers should relate to the stimulus material and should be kept within the allotted spaces. In addition, in preparing for the examination, all topics on the Biology syllabus must be studied and adequately prepared. It was quite obvious that inadequate attention was paid by this candidate population to segments of the Biology syllabus, including flower structure, seed and fruit dispersal and experimental activities, such as choice-chamber investigations of invertebrate behaviour.

Candidates must note that they are not required to repeat the questions to begin their responses for the first three questions of the paper. This usually takes up the space allotted for the answer.

Candidates sometimes missed key words in the questions and provided answers which were off the point. It is thus suggested that candidates should be advised to read through each qu*estion carefully, highlighting key words on which the questions hinge, so that they would be less likely to misread and misinterpret questions*. Candidates also continued to misspell common biological terms, for example, *epidermis* and *dermis*.

Question 1

This question dealt with some practical aspects of Biology, including methods of investigating the behaviour of selected invertebrates under certain physical conditions, data analysis, and plant responses to light and gravity. Candidate performance on this question was satisfactory. Marks were accessed across most of the range, though no candidate scored the two highest marks available for the question. The mean was approximately 9 with a mode of 8.

Part (a) of the question required candidates to assemble pieces of apparatus used to create a choice-chamber for investigating the behaviour of invertebrates (house-fly larvae) in response to light. Many candidates were unable to accurately assemble the apparatus given and this underscores the candidates' lack of exposure to, and experience with simple biological investigations.

Part (b) assessed candidates' ability to interpret experimental data as well as their knowledge of investigating the behaviours of invertebrates. Candidates generally displayed weak knowledge and skills in this regard.

In Part (b) (i), candidates were to complete a table by making calculations based on data provided. Most candidates were able to do the calculations, though many made simple arithmetic errors.

In Part (b) (ii), candidates were to determine, based on the information provided, whether the hypothesis of the investigation was supported and to provide a reason for their response. This part was fairly well done as a fair number of candidates were able to indicate that most of the larvae were found on the dark side of the apparatus. While some of the candidates were able to suggest at least one factor, other than light, that could have influenced the response of the larvae in their response to Part (b) (iii) of the question, many could not suggest the two factors expected - *moisture* and *temperature*.

Further, Part (b) (iv), following on from Part (iii), required candidates to suggest how the apparatus might be adjusted to investigate one of the factors that they had identified and was very badly done on the whole, even though the candidates were able to identify a correct factor. Candidates were also expected to indicate the *separation of the choice-chamber into dry and moist areas using silica gel and water*, or *keeping one side at a lower temperature, perhaps using ice on one side* or some such adjustment that illustrated a mechanism for the chamber to be set up, so that the organisms choose one area over another.

Part (b) (v) was fairly well done, in that most candidates were able to gain at least one mark as they were able to cite that the response shown by the organisms could help them escape predation. However, few candidates mentioned prevention of *desiccation* which was an acceptable response.

Part (c) of this question examined candidates' knowledge of plant response to sunlight. In Part (c) (i), candidates were to explain how the response to sunlight illustrated in the diagram benefitted the plant. This part of the question was reasonably well done. Quite a few candidates were able to make the link between the response and improving the photosynthetic process. Candidates were expected to include among their responses: *maximal exposure to light; keeping the rate of photosynthesis at a maximum throughout the day* and *palisade layer (leaf) at best angle to obtain light throughout the day.*

In Part (c) (ii), candidates were to describe an experiment to determine whether a potted plant had been photosynthesizing. A good response to this part of the question was:

> *A starch test can be used; leave the plant in a dark area for 24 hours to rid it of starch, and then place it in the sun for an hour. Take a leaf; dip it in boiling water to soften it, then in ethanol to rid it of chlorophyll, then again into boiling water. Next, drop iodine solution on the leaf and note the resulting colour change.*

Candidates performed creditably on Part (c) (iii) of the question which asked for conditions other than light that are necessary for photosynthesis. Candidates generally selected from among the expected responses: *carbon dioxide, water and chlorophyll*.

Part (d) of the question explored candidates' knowledge of the response to gravity shown by germinating seedlings. In Part (d) (i), candidates were asked to suggest why, in such an investigation, the seedlings in the control were constantly rotated. This part of the question was fairly well done. Candidates included in their responses such ideas as: *for even distribution of auxins* and *effects of gravity evenly distributed*. A good response was: *This is an important step because the constant rotation allows for even distribution of auxins (growth hormones in the plant).*

Part (d) (ii) asked candidates to explain why the response to gravity was important for the survival of the plant. Many candidates were unable to relate the response to the proper orientation of the plant with the roots responding positively to be able to access water, mineral salts and nutrients, and the shoot responding negatively to obtain light for photosynthesis.

Responses that earned full marks were:

- *Gravity helps roots grow into the ground to absorb water and necessary nutrients. However, shoots should grow against the pull of gravity in order to receive sunlight. Photosynthesis will be able to occur and plants will survive.*

- *The response to gravity is essential because the roots need to grow into the soil for water and to anchor the plant while leaves and stems need to grow up for light to photosynthesise.*

Question 2

This question tested candidates' knowledge of the structure and functioning of the alveolus and other aspects of the human lung, relevant to its efficiency as an organ of gaseous exchange. Candidate marks ranged from 0 to 14 out of a maximum of 15. The mean for this question was 5.1 and the mode was 4.

Part (a) of the question examined candidates' knowledge of the structure of the alveolus and the movement of gases across its membrane. In Part (a) (i), they were asked to label specific parts of a diagram of a section through an alveolus. This part of the question was only fairly well done. Many candidates seemed not to know that the alveolus has an inner lining of moisture and thus could not identify this on the diagram. In Part (a) (ii), candidates were required to identify the gases that were indicated by arrows placed on the diagram. This part of the question was fairly well done.

Part (b) of the question addressed aspects of gaseous exchange across the alveolus. In Part (b) (i), candidates were asked to name the process by which the gas moves across the alveolar membrane. Many candidates recognized that this process was *diffusion* but fewer were also able to identify one feature shown in the diagram that made the alveolus suitable for this process. The diagram clearly showed that the alveolar membrane was *thin* — just *one cell thick*. Some candidates indicated that the balloon shape increased the surface area for diffusion and were awarded the mark.

Part (c) asked candidates about the role of breathing in the movement of gases into and out of the alveolus. This part of the question was not at all well done and it may mean that candidates are unclear about the meaning of the term 'role'. In many cases, candidates provided explanations about respiration which were not related to the movement of the gases. Candidates were expected to include in their responses: *breathing moves air in and out of alveoli; air coming in has high oxygen and low carbon dioxide concentration; air leaving has low oxygen and high carbon dioxide.*

Part (d) of the question asked candidates to give reasons why a person who is exercising vigorously breathes more deeply and rapidly. Candidates were expected to include in their responses references to: *the need for more energy; the need for more oxygen; oxygen debt; build up of carbon dioxide*. A response that earned full marks was:

- *To supply a sufficient amount of oxygen which is needed to release more energy which will be utilized during strenuous activity.*

- *To repay the oxygen debt and get rid of the lactic acid formed during exercise so it will be broken down.*

Part (e) asked candidates to explain how cigarette smoking reduces the efficiency of the lungs. This part of the question was not well done. Candidates were expected to include in their responses ideas that related to the reduction of the surface area of lung for gaseous exchange, such as: *tar/smoke particles clog alveoli; coughing ruptures alveoli; frequent infections and destruction of the alveoli; possibility of lung cancer*. Good responses were:

- *This can cause the lining of the lungs, to be broken down, also cause the lung to have a smaller surface area for gaseous exchange and also cause lung cancer.*

- *Cigarette smoking can reduce the efficiency of the lungs because the tar it contains would clog the walls of the lungs thus diffusion of the oxygen would not be efficient since the surface area is reduced.*

Question 3

This question tested candidates' knowledge of fruit and seed dispersal. Performance on this question was poor. Many candidates seemed unfamiliar with the concept of 'adaptation' of fruits and seeds for dispersal. Candidates' scores ranged from 0 to 13 out of a maximum of 15; the mode was 0 and the mean was 2.6.

Part (a) of the question tested candidates' knowledge of structure of the fruit and seed. In Part (a) (i), candidates were required to provide labels for some common structures of fruit and seed and for a structure that is peculiar to the fruit. This part of the question was not very well done. Most candidates seemed unaware that the fruit is attached to the plant at the receptacle which leaves a scar. Some candidates referred to the scar left by the style which was at the other end of the coconut fruit shown in the diagram. Also, candidates labelled 'radicle' when the lines pointed to both radicle and plumule. The appropriate term in that case was *embryo*. Similarly, the cotyledon and endosperm should have been labelled *food store*. In Part (a) (ii), candidates were to give the function of the food store. They were expected to know that the food store *provides nutrients for the germinating embryo*.

Part (b) of the question examined candidates' knowledge of dispersal in fruit and seed. In Part (b) (i), candidates were required to name a method of dispersal for the red bean and the coconut. Candidates were generally able to gain at least one of the marks, as they knew that the coconut was dispersed by water. They were more challenged in providing an accurate method for the red bean. Either one of *explosive mechanism, self or mechanical method was an acceptable response.*

In Part (b) (ii), candidates were to suggest features of the coconut shown in the diagram that are important in dispersal. Candidate performance was weak in this part of the question. They were expected to consider: *flotation device, food store* and *size*. Candidates often only mentioned the flotation device. Part (b) (iii) was even more challenging for candidates and was thus very poorly done. Candidates were asked to explain why coconut trees are usually found along the coastline of islands while red bean plants are found inland. Candidates were expected to explain that: *waves carry*

coconut fruits to shorelines, they lodge there, have best opportunity to germinate; red bean is a domesticated crop/cultivated by man, normally planted inland. An example of a good response was:

- *Coconut trees are mostly found at coastline areas because the waves bring in coconuts from other places to the shore where they germinate; red bean plants are found inland because people plant them.*

Part (c) investigated candidates' ability to distinguish features that relate to the dispersal of fruit and seed as illustrated in photographs of a fruit before and after dehiscence. In Part (c) (i), candidates were asked to identify the method of dispersal illustrated. This part of the question was fairly well done. Many candidates indicated *self* or *explosive mechanism*. In Part (c) (ii), candidates were to suggest why plants were usually found growing in clusters around the parent plant illustrated in the diagram. The responses were expected to include: *dispersal method involves self-explosion of the dry fruit; seed not dispersed very far from the parent plant.*

Question 4

This question examined candidates' knowledge of the process of photosynthesis, aspects of translocation in plants; conditions under which plants store food and the importance of 'green spaces' in built communities. Candidate performance on this question was fairly good. There was general familiarity with the topics and candidates were able to gain marks across the spectrum from 1 to 15. A number of candidates were unable to gain any marks at all. The mode was 3 and the mean 5.2.

In Part (a), candidates were to describe the process of photosynthesis. Many candidates were unable to provide an adequate description of the process. Some were unable to clearly define the roles of light and chlorophyll or ignored these factors completely. Others did not show evidence that they knew the source of reactants, carbon dioxide and hydrogen, nor the name of the product glucose, providing instead the term carbohydrate which was given in the question. A good response was:

The process is called photosynthesis. It is represented by the equation:

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

This process occurs in two stages — the light-dependent stage and the light-independent stage. In the light-dependent stage, the water molecules are split into hydrogen and oxygen using sunlight energy. The oxygen molecules are released as a gas. After this, is the light-independent stage, when hydrogen molecules reduce carbon dioxide molecules forming glucose (carbohydrates).

Part (b) of the question asked candidates to explain how non-green structures in a large tree obtain food materials for their livelihood. Candidates were expected to include in their responses such ideas as: *manufactured food from leaves would be supplied through phloem; food transported as sugar/sucrose; mineral salts transported from roots via xylem — used in protein synthesis*.

Part (c) asked candidates to suggest factors or conditions which determine whether plants store either very little or very much of the food they make. This question proved challenging for candidates and few provided adequate responses. Candidates were generally expected to refer to: *length of the growing season; climatic conditions, stages in the life cycle of the plant; soil factors — water availability, fertility*. Good responses were:

- *Factors or conditions which determine whether plants store very little or very much food are if the plant is reproducing and needs to make and disperse seeds it would have to store a lot of food for energy. If the plant is young it needs to get a lot of energy by having good food storage. Also, if the plant is seasonal and faces hard conditions such as drought or winter…*

- *If the plant is in an environment where all factors for photosynthesis are close to their optimum state, not much food will be needed to be stored since there is a constant supply produced due to the favourable conditions.*

- *Little food will be stored when the plant is growing since most of it will be needed at growth areas and as a result of growth more food will be produced.*

- *When the plant is ready to reproduce, stored food results in the production of fruits and flowers …*

Part (d) asked candidates to outline reasons for leaving green spaces within crowded cities even when there is a shortage of land for housing and industrial development. This part of the question was fairly well done, although some candidates had difficulty expressing themselves adequately. Good responses to this part of the question were:

- *Three reasons for leaving 'green spaces' are so that the trees take in carbon dioxide … from the cities and make oxygen, a useful product of photosynthesis which we need for a vital life process, respiration, to make energy. Also the 'green lands' may provide cross-pollination of plants, some may be for medicinal purposes. 'Green lands' also provide a habitat for animals so that they may continue their species.*

- *Three reasons for leaving these 'green spaces' are to reduce global warming; allows for recreation within cities and also leaves habitats for wild life, for example, birds. Global warming can be reduced since the green plants/trees absorb carbon dioxide for photosynthesis. If these plants were not there, there would be an excessive amount of carbon dioxide in the air which leads to global warming. These parks may be used for recreation, for example, children playing on swings and slides, that is, for enjoyment. Having woodlands enables the development of habitats, for example, birds and squirrels. If these 'green spaces' were not there then this may lead to extinction of some species.*

<u>Question 5</u>

This question tested candidates' knowledge of the structure and function of the human digestive system, aspects of diet and modifications to the vegetarian diet, endocrine functions relative to food digestion and deficiency diseases in plants. Candidates were able to gain marks across most of the range from 1 to 14, even though several candidates did not score at all. Performance on this question was reasonable. The mean for this question was 5.3 and the mode was 4.

Part (a) of the question dealt with the structure and functioning of the alimentary canal as well as some issues related to special diet. In Part (a) (i), candidates were required to draw a diagram to show the relative position of the major organs of the human digestive systems and for Part (a) (ii), they were to annotate the diagram to show the functions of the labelled parts. These parts of the question were fairly well done, although a substantial number of candidates did not know the relative positions or functions of the major organs of the digestive system. Candidates need to be better prepared to follow the instructions of the questions. Candidates displayed poor drawing skills in preparing the outline required.

In Part (a) (iii), candidates were asked to suggest how vegetarians can make up for any limitations associated with their diet. This part of the question was fairly well done. Candidates were able to zero in on the *limited availability of protein* in such diets and means of compensating for protein deficits through the inclusion of *legumes*, such as *peas* and *beans* in their diets. Many candidates, however, failed to mention *varying the diet* to include sources of *minerals and vitamins* and using dietary supplements which are also important in ensuring a balanced vegetarian diet. A good candidate response was:

- *Vegetarians can compensate for their lack of proteins by using milkshakes or taking tablets that boost the proteins in their body as they do not get protein from meat as regular omnivores do. Certain vitamins also, like vitamins B and D which come from animals, vegetarians could get pills with those vitamins.*

Part (b) investigated candidates' knowledge of the endocrine functions of the pancreas by asking how the removal of the pancreas would affect this function. This part of the question was only fairly well done. Candidates' responses were expected to include ideas such as: *no insulin produced; no conversion of sugar to glycogen; need to eat constantly to provide energy; no regulation of the blood sugar; onset of diabetes; presence of sugar in the urine*. The following responses earned the candidate full marks:

> *If the pancreas is removed, there would be no means of the body getting insulin ...when needed. If the blood glucose level is too high insulin is secreted to lower it. If the blood sugar is too low ... glucagon is secreted to boost the level. Removal of the pancreas would definitely cause diabetes — either hypo or hyperglycemia.*

In Part (c), candidates were to explain how deficiency diseases are likely to arise in plants. This part of the question was only fairly well done. Many candidates incorrectly associated deficiency disease in plants with the *unavailability of sunlight* and thus the inability to photosynthesise and not to the lack of minerals. Candidates were expected to describe concepts including some of the following: *absence of minerals from soil/soil lacks water for mineral uptake; minerals from soil needed to make several compounds/structures in plants;* examples — *nitrogen/sulphur to make protein; magnesium/iron for chlorophyll; phosphorus for ATP; calcium for cell wall.* Good candidate responses to this part of the question were:

- *Deficiency disease may arise in plants if they don't have all the essential nutrients in soil. Essential nutrients are nitrogen, phosphorus and potassium. A lack of nitrogen can lead to leaves yellowing and a lack of phosphorus would lead to root weakness.*

- *Plants do make their own food but need other nutrients which they get from the soil. Nitrogen in the form of nitrates is in the soil, phosphorus ions and potassium ions as well. Without these the plant will suffer root problems, poor shoot growth and poor fruit production respectively.*

<u>Question 6</u>

This question dealt with the structure of unspecialized plant and animal cells; features of a nerve cell and adaptations of organisms to their environment. The mean was approximately 3.5 and mode 0. Candidates earned scores in the range of 0–12 out of a maximum score of 15.

Part (a) of the question required candidates to draw and annotate diagrams of unspecialized plant and animal cells to compare their structures. Candidate performance on this part of the question was weak. Many candidates were unable to draw an adequate representation of the plant cell to show the relationship between the cell wall and cell membrane and the vacuole. Candidates were expected to make reasonably accurate representations of the two types of cells and show that they both had the

following: *cell membrane, cytoplasm, nucleus* and *mitochondria* while only the plant cell had a *large central vacuole, chloroplast* and a *cell wall*.

In Part (b), candidates were required to identify features of a nerve cell that allowed it to carry out its function. Performance on this part of the question was weak. Few candidates were able to gain full marks for this part of the question. Candidates were expected to frame their responses using ideas like: *elongated axons for passage of impulses, branching dendrites cover a larger area; myelin for insulation; synapses and neurotransmitters*.

Part (c) dealt with adaptations by organisms for living in a particular habitat. Both parts of this question were very poorly done by candidates. Candidates displayed very limited understanding of the concept of 'adaptation'. They apparently thought that animals could adapt almost immediately to new environmental conditions or situations of stress. The idea must be conveyed that adaptations are usually the result of survivors having structures and/or processes that allow them to survive changed conditions and the establishment of those characteristics in future generations.

In Part (c) (i), candidates were required to identify physical factors that animals in a freshwater habitat encounter. This part of the question was not very well done as many candidates seemed unclear about physical factors. Candidates were expected in their responses to refer to the following: *excessive amounts of water*; *oxygen availability/unavailability; fluctuation in tides/variable water levels; change in environment/turbidity, nutrients/pH.*

In Part (c) (ii), candidates were to suggest adaptations that animals in a freshwater pond might have and offer an explanation of the usefulness of the adaptation to the organism. This was very poorly done. Apart from being unclear about the meaning of adaptation, candidates who mentioned a reasonable adaptation failed to indicate how this was beneficial to the organism. A good response was:

> *... fresh water organisms also produce a large quantity of dilute urine since in fresh water there is little or no salt, and the organism would not have a good balance of salts in its blood stream. This ensures correct salt concentration in the fish.*

Paper 03/2 – Alternative to SBA

This paper assessed all the practical skills required of biology students. Candidates continued to display weak practical skills especially in aspects of planning and designing, including manipulating apparatus, describing methods of experiments and in drawing conclusions from data. These observations indicate that teaching for developing practical skills *must include actual experimenting and investigating scientific phenomena, discussions, explanations and rationalizing of procedures and outcomes*, so that candidates become capable of developing and manipulating experiments and experimental data on their own. Also, candidates continued to display weak drawing skills and lack of knowledge of the conventions of biological drawings, such as the inclusion of magnification and titles of the drawings. In addition, many candidates presented untidy drawings with crooked labelling lines.

<u>Question 1</u>

This question tested a range of candidates' experimental skills as would be required in undertaking an investigation of a range of organisms in their environment. Performance on this question was satisfactory although no candidate achieved marks at the top of the range. The mean for this question was approximately 7.6 out of 18 available marks, while the mode was 8.

Given a table of data showing a range of organisms and their estimated populations in a habitat, candidates were required in Part (a) to identify methods by which the information shown could have been gathered. Candidates were expected to choose from methods such as: *bottles, nets, traps,*

Tullgren funnel, *quadrats* and *counts*. Many candidates mentioned line transect which is typically used across obviously uneven terrain, for example, across terrain with a stream or river.

In Part (b), candidates were to explain how two of the methods they identified would have been used to collect the information. This part of the question showed that many candidates, even though they could identify a method, had no idea how to use it. For example, while some candidates mentioned bottles, they indicated that the bottles could be placed near the nest of the organism with bait to attract them, when in fact *bottles are to be placed with tops at the level of the ground overnight so that nocturnal organisms can randomly fall into them*. The point being made here is that there are techniques in using the methods and Biology students need to be familiar with these methods and techniques, preferably through practice and experience. In addition, the question asked *how* the methods were likely to be used, but many candidates described *where* the methods could be used, suggesting the need for greater attention to be paid to the question asked.

Part (c) of the question required candidates to construct a bar graph to show the relative population sizes of selected organisms from the table. The most common error candidates made was to use a histogram instead of a bar chart. This reflects on the candidates' lack of understanding of how discrete data are represented as compared to continuous data. Also, candidates are reminded that in presenting graphical data straight lines should be used for purposes of accuracy.

Part (d) asked candidates to identify organisms that were likely to be at the same trophic level and to offer an explanation for their choice. This part of the question was fairly well done. Candidates were often able to correctly identify pairs by the size of their population as was expected. Some indicated that such population were unlikely to prey on each other, for example, snail/slug; iguana/kiskedee.

Part (e) asked candidates to offer an explanation as to why a pyramid of numbers may not have been appropriate to show the feeding relationships between the tree and the organisms it supports. They were expected to include in their responses ideas contained in one of the following: *mass of the tree versus its number; organisms at lower trophic levels have larger numbers in a pyramid; one tree supports many organisms; numerous herbivores*.

<u>Question 2</u>

This question tested candidates' ability to make observations and carry out investigations on diffusion and the rate of transpiration in plants, including the assembling of relevant apparatus. The mean score was approximately 7.6 out of a total of 25 and a mode of 9.

In Part (a), candidates were required to demonstrate knowledge of experimental skills related to an investigation of movement of water in plant tissue. While candidates were able to attain some marks on this question, it was clear that there were many gaps in their understanding.

In Part (a) (i), candidates were to provide an aim for the investigation illustrated by the apparatus. Candidates generally found difficulty stating an appropriate aim for an investigation. Candidates were expected to suggest an aim, for example, *to show diffusion of water across plant tissue*. Many aims consisted of a description of the process rather than the end result.

Part (a) (ii), which required candidates to explain the results of the investigation after 20 minutes, was fairly well done. Most candidates recognized that water entered the potato 'cup' and dissolved the salt crystals it contained. Their greater challenge came in accounting for the movement. Very few candidates recognized that a concentration gradient was formed with movement from high to low water concentration. Candidates were thus expected to include in their responses: *diffusion from surrounding cells; water moves along a concentration gradient; salt crystals help establish gradient (low concentration).* A good response was:

> *The salt placed in the cavity caused the water concentration to decrease this meant that the water outside had a higher concentration … water moved along this concentration gradient via osmosis through the plant tissues to inside the cavity until the concentrations outside and inside that cavity were the same.*

In Part (a) (iii), candidates were asked to suggest precautions that should be taken in carrying out the investigation on diffusion. Many candidates were able to gain the relevant marks for this section. Candidates were expected to indicate precautions from the following: *no punctures in cucumber cup; epicarp completely removed; water does not spill into the cup before the start of the investigation.* A candidate response that obtained full marks was: *make sure the cucumber is healthy so that none of the tissue is damaged; make sure inside the cucumber is dry at the start of the investigation.*

Part (a) (iv) asked candidates to describe how a control for the investigation may be set up. The vast majority did not earn marks on this part of the question. Candidates were expected to describe a method in which: *salt would be excluded; all other conditions would remain the same including the preparation of the cucumber*. A good response was presented as follows: *A control for the investigation would include the same as the investigation but without the salt.*

In response to Part (a) (iv), which asked how the control would confirm the results of the investigation, many candidates again failed to provide a suitable answer. Candidates were expected to focus on: *presence of no/little water in the control after the same period of time.* A candidate earning full marks worded his/her response as follows:

> *If after 20 minutes no significant amount of water was seen in the cavity then the water flowed due to a concentration gradient.*

In Part (b) of the question, candidates were to make a drawing of a cross-section of the cucumber from a stereodiagram of a half of the cucumber. Candidates generally displayed poor drawing skills and equally important did not observe many of the drawing conventions. These are reiterated here:

- Use only sharpened pencils with points. Drawings should not be done in ink.
- Clarity of drawings relate to the size and technique for drawing lines. Lines should be of even thickness and drawings should be of reasonable size.
- Drawings should include magnification which should be as accurate as possible.
- Drawings must have a title that indicates the view of the specimen being drawn.
- Drawings must be accurate line representations of the specimen.
- Drawings should **not** be shaded.

Part (c) investigated candidates' experimental skills through an investigation of certain water relations in plants. In Part (c) (i), candidates were to assemble apparatus illustrated for an investigation of water uptake in a plant. This was another example of too many candidates demonstrating limited knowledge of common biological investigations and lack of associated practical skills. Candidates were expected to draw a diagram showing: *water in the measuring cylinder; root immersed in the water and shoot exposed; rubber bung sealing measuring cylinder, with Vaseline as a sealant spread over the rubber bung and mouth of cylinder.* Apart from numerous inaccuracies in the assembling of the apparatus, many candidates also omitted the title and magnification.

For Part (c) (ii), candidates were to prepare a table to record the data to be collected at two-hour intervals for the investigation. Most candidates were able to construct a reasonable table. However, there were often obvious omissions, for example, the title and the units in the headings. Sometimes candidates used a most inefficient method of recording the interval changes. This table would have been best configured with 12 columns and two rows.

Question 3

This question tested candidates' ability to manipulate, represent and interpret health information data. Candidate performance on this question was fair. The focus of the question was on data representation and interpretation skills. The mean was approximately 7.8 out of 17 and the mode was 8.

Given a table of reported AIDS cases in Caribbean countries over a period of years, candidates were to construct graphs of the data. This part of the question was fairly well done; most candidates could plot reasonably accurate graphs. However, many candidates plotted one or two graphs when data were given for three. They are reminded that for graphs, charts or diagrams they should include a title.

In Part (a) (ii), they were to draw a conclusion from the data and graphical representation. The major error candidates made in this part of the question was to provide a description of trends rather than a conclusion. They were expected to conclude: *incidence increased sharply in the early years; incidence first occurred in male; incidence in females increased faster than males in the latter years.*

In Part (b) (i), candidates were to prepare a pie chart of data on the methods of transmission of reported AIDS cases. In preparing a pie chart candidates must:

- Accurately compute the relative proportions of each category using a total of 360˚.
- Use a compass to prepare the outline of the chart.
- Use a protractor and ruler to accurately construct the segments of the pie.
- Label each segment/ use a key to identify respective segment.
- Include a title.

In Part (b) (ii), candidates were to suggest a social implication of all the data presented on the incidence and transmission of AIDS. This part was very poorly done as it appeared that candidates made no distinction between an 'implication' and a 'conclusion'. Many of them stated from the data the group that had the highest transmission rate. Candidates were expected to make references to ideas like: *behaviours of heterosexuals may be contributing to incidence of AIDS; large numbers of persons are not aware that they have contracted the disease; people need to be more aware; homosexuality may not be responsible for incidence.* A good response provided by one candidate was: *Heterosexuals need to refrain from having unprotected sexual intercourse because this can lead to costs for the government and to a lot of deaths.*