CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN ADVANCED PROFICIENCY EXAMINATION MAY/JUNE 2007

BIOLOGY

UNIT 1

PAPER 02

SECTION A

Module 1

Question 1

Syllabus Objectives: 1.1
Compulsory Question: Maximum Marks = 10
Highest mark 10. Mean mark 4.72. Lowest mark 0.

In part (a) (i) approximately 75 percent of the candidates were able to achieve two marks out of the three for this question. The expected responses were: X, reducing sugar/glucose; and Y, protein and starch. For X, candidates frequently added 'or sugar', for which no marks were awarded. Option Y was omitted from the question paper. Three marks were therefore awarded for answering X and Y alone.

In part (a) (ii) concerned the colour change in the Benedict's solution, the majority of the candidates referred only to the sequential change, blue to green, to yellow, to orange to brick red. They failed to comply with the question which required them to explain the colour change. Benedict's solution is blue, due to the presence of CuSO4 (Cu^{++} ions). Fewer than 50 percent of the candidates were able to explain the reduction of blue Cu^{++} to Cu^{+} ions by the reducing sugar, and relate it to the change in colour, due to the presence of brick red copper oxide.

In part (a) (iii) candidates found difficulty in devising a method to determine the concentration of the substance in Solution X. Responses were vague and poorly thought through, and candidates appeared unable to write in a logical sequence, even though there was evidence that they had some idea of the method. There were very few responses which gained all four marks. The expected response was to state that; 1) from the samples, one should perform progressive dilutions to form a range of solutions of gradually decreasing concentration; 2) identical amounts of known quantities of the each strength of the reducing sugar should be used; 3) standard volumes of Benedict's solution should be added; and 4) colour changes should be recorded to produce a colour chart, and the colour change of Solution X should then be compared with the colour chart of known concentrations to determine the concentration of Solution X.

In part (c) only 70 percent of candidates were able to describe the test for a lipid adequately. Many stated 'perform the emulsion test'. Marks were allotted for adding distilled water to the lipid, followed by alcohol. Vigorous shaking would create a lipid-alcohol emulsion which floats on the surface of the water.

Module 2

Question 2

Syllabus Objectives. 2.1, 2.2.
Compulsory Question. Maximum Marks = 10
Highest Mark 10 Mean mark 5.92. Lowest mark 0

In general this question proved to be challenging to most candidates.

In part (a), most candidates were able to identify Figure 1(a) as metaphase, but had difficulty in identifying B as prophase. Incorrect responses for B included pre-prophase, interphase and telophase

Those candidates who followed the instructions given in the question were able to draw cells accurately and realistically and obtain the allotted marks. Diagrammatic representations direct from the textbook which had no realistic depiction of A and B received no marks. It appears that candidates require more practice in the interpretation of photomicrographs. Also they need re-enforcement in observing the required criteria for drawing that is 'reasonable proportions, clean continuous lines and neatness. Easy marks were given for correct x2 magnification - just measure the cell's length and width, then double them.

In part (b), the majority of candidates were not familiar with the procedure required to prepare a slide of the onion root tip. Many incorrectly described the mounting of onion scale leaf base epidermis. They needed to emphasis the point that the tissue must be sliced extremely thin, and that staining is required to provide contrast and show up the chromosome structures. Acetic orcein is the best stain for DNA. If unaware of the name of the stain, they should communicate that chromosomes must be stained in order to create contrast and visibility. A water mount and a coverslip could be mentioned. Where prepared slides were used, candidates should be familiar with the same facts, thin slices, contrast staining, mounting. In some cases candidates described the preparation of squashes. Provided they clarified the necessary conditions, these were accepted.

Part (c) was poorly done. Responses were generally vague and included areas such as the stem, bark and leaves. More precise locations were required: the cambium, (vascular cambium) cork cambium, apical meristems of shoots and buds, damaged areas for regeneration, pollen sacs prior to sporogenesis, and in the ovule to form the nuclei of the embryo sac. Also, in the formation of the embryo itself.

Module 3

Question 3

Syllabus Objectives. 3.2, 3.4.
Compulsory Question Maximum Marks = 10
Highest Mark 10 Mean mark 5.42. Lowest mark 0

In part (a), candidates were required to identify the five kingdoms of Margulis and Schwartz, represented in Figure 2. Clearly number 1 represented Prokaryotes (v), and number 2 represented the Protoctists, (iii). Numbers 3, 4 and 5 on the diagram could be matched to (i), (ii) and (iv) in any order. Candidates performed so poorly that the mark scheme was adjusted to require them to identify only four kingdoms, and marks were transferred to other sections of the question where they had given much better, fuller answers.

The term 'discriminate' refers to the identification of significant differences between the kingdoms, by which a clear separation can be made. These can be based on phenotypic features or of metabolic/ physiological differences, which characterise one kingdom as opposed to another. Such a difference must be expressed as a pair of alternatives. For instance in part (b) (i), almost any prokaryotic feature could be used, 'Prokaryotes have 70S ribosomes in their cells while all the other kingdoms have 80S ribosomes in their cells'. To state a feature of one, without stating the distinguishing alternative of the other is to leave the distinction incomplete. No marks were awarded for incomplete distinctions. A pair is essential. One factor is to be compared with the other factor. A pair represents ONE answer, not two answers.

Concerning animals and plants in part (b) (ii), an acceptable distinguishing factor would be that plants are typically autotrophic, while animals are heterotrophic. Two answers were required, so another pair of distinguishing features was needed. Too many candidates gave very elementary answers. For animals, 'have two legs' was an example, or 'nurse their young'. No comparisons were given with plants, so these two responses did not score any marks.

Part (iii) also drew poor answers. That fungi 'release spores' did not distinguish them from plants. Almost no candidates mentioned mycelia, hyphae, septate, multinucleate, etc.

In part (b) (iv) few candidates were aware of the wide range of form in Protoctists, and this impaired their ability to identify precise distinguishing features.

Originally three marks were awarded for six paired distinctions, which were presumed to be easy responses. However, these expectations were lessened, and obvious unfamiliarity with this section of the syllabus required an adjustment.

In part (c), most candidates showed increased competence with the format of dichotomous keys this year and were able to recognise and select distinguishing features between the cells of the immune system. Unfortunately, the dark printing reduced the clarity of the photographs so that nuclear shape and cytoplasmic granules were difficult to distinguish, especially in lymphocytes numbers 1 and 3. In numbers 1, 2 and 5, nuclei were misinterpreted as vacuoles. The mark scheme was again adjusted to require three complete keys and four identifications instead of four keys and five identifications, as the photographs were difficult to decipher. This adjustment was appropriate. The innovative use of dendrograms and charts, which were functionally adequate, was accepted. Several candidates omitted the question - as they have done in previous years.

SECTION B

Module 1

Question 4

Syllabus Objectives. 1.8, 1.9, 4.5
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 9.61. Lowest mark 0
Candidates selecting this option, 48 percent

Part (a) concerned the meaning of the term, tertiary protein, candidates' responses were very poor, which was surprising, as in previous years they have written well about protein structure. Perhaps isolating tertiary proteins, instead of allowing candidates to present the whole scenario of protein configuration, made it difficult for them to focus on a specific level. Candidates mentioned the folding of the polypeptide chain into a globular shape, and listed some of the bonds found in the configuration. Only 5 – 10 percent of the candidates clarified the way in which the bonds and cross linkages actually secured the specific shape. Such answers were very brief without an attempt to give the quality that would earn both marks. Candidates need to understand that in essay questions two marks requires two full, generous sentences.

In part (b) (i), candidates were required to draw the haemoglobin molecule composed of four folded and coiled polypeptide chains, two alpha and two beta. Then they needed to add labels to identify these component structures. Again candidates gave poor performances with only five percent of the candidates producing diagrams of the required standard of accuracy. The majority of the candidates represented only one of the polypeptide chains, with one haem. Another common mistake was to depict four subunits with only one haemoglobin, shared by the four. As a result of the poor diagrams, the candidates were limited in scoring marks from the labels. Approximately 20 percent of the candidates earned the three marks available for accurate labels.
Part (b) (ii) concerned the function of the haemoglobin molecule, approximately 60 – 70 percent of the candidates gained one mark for stating that it carried oxygen or that it had a high affinity for oxygen. Only 30 – 40 percent of the candidates identified another function related to its structure, for example, that there are four haemoglobins in each molecule, which increases oxygen attraction fourfold, and only two percent of the candidates knew of the molecule's distortion which occurs when the first oxygen molecule bonds, facilitating the faster uptake of the second, third and fourth oxygen.

In part (c) candidates performed well with this section on enzyme activity. The most popular factors identified and accurately discussed were pH, range of temperature and enzyme concentration. Others were substrate concentration, inhibitors and allosteric effects. Four marks were awarded for four distinct factors, and a further six marks were available for any additional factors, or for elaboration and discussion. Candidates who cited competitive and non-competitive inhibitors demonstrated a clear understanding about their roles.

Question 5

Syllabus Objectives. 2.3, 3.2, 3.3.
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 11.11. Lowest mark 0
Candidates selecting this option 52 percent.

In part (a), approximately 75 percent of the candidates answered well on the topic of the cell membrane and earned six marks. Two marks were awarded for the cell membrane's structure and the additional four, for identifying component molecules and their biochemical nature. Very few gave the required answer, that the membrane is a continuous layer enveloping the entire cell, protecting it and forming a barrier layer controlling entry into the cell. Candidates added that the membrane is a phospholipid bilayer which has a flexible, fluid consistency. Weak candidates described only the phospholipids as having a hydrophilic head and hydrophobic fatty acid tail, while more advanced candidates added that the head faced the exterior and interior aqueous environments, and the fatty acid tails faced and interacted with each other, securing the membrane interior.

Other functional molecules included the membrane were various proteins, glycoproteins and glycolipids, whose functions as receptors or in cell-to-cell recognition were described. Cholesterol and its contribution to membrane flexibility and fluidity were included. A drawing was not requested, but when candidates provided a drawing, it was considered, along with adequate annotated labels, in areas where the candidate did not write an adequate description.

In part (b) (i), at least 40 percent of the candidates earned one of the two assigned marks. Most popular were the use of carrier proteins which utilized energy from ATP, (active transport) and the Na+/K+ pump. Only 10 percent mentioned that the potassium could enter via channel proteins by facilitated diffusion.

In part (b) (ii), approximately 30 percent of the candidates adequately described the process of endocytosis. Weaker candidates merely stated that the cell membrane engulfed the large molecules, without any further elaboration. This gained only one mark.

Part (b) (iii), two marks were awarded for the correct answer. This question was probed further into candidates' knowledge of the movement of non-ionic molecules into the cell. About 10 percent earned one mark by stating that the non-ionic sucrose entered the cell via carrier proteins by active transport. However, less than one percent indicated that sucrose needed to be carried by a protein or ion to use the ion pumps.

In part (b) (iv), candidates found it difficult to answer this higher level question. About 70 percent of candidates used their initiative and indicated that the membrane resisted the toxic ions by reducing its permeability in some way, or said that the protein receptors did not recognise the toxic molecules, thereby preventing their entry. Actual prevention of entry is due to the reduced transcription and translation of the membrane proteins or portals which enable these ions to enter, so that their uptake is limited. Such selective impermeability allows, for example, plants to tolerate soils containing mercury or copper, without ion penetrance into the root hair cells.

Part (c) tested osmosis and the candidates' ability to understand its physiology and utilize the vocabulary appropriately. About 70 percent of the candidates gave a good definition of osmosis but only rarely did candidates mention that water AND solutes in the cell caused the increase in volume.

None of the candidates mentioned that the membrane resists egress of solute molecules from the potato, causing the solutes to be retained inside the cell. Too many candidates are still using the elementary term 'semipermeable' to describe the selectively permeable membrane. The correct use of this term might assist them in understanding the membrane's discriminatory function.

Module 2

Question 6

Syllabus Objectives. 1.1, 1.2, 1.6.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 10.19. Lowest mark 0.
Candidates selecting this option 67 percent.

Part (a) (i) was fairly well done, and the majority of candidates were able to describe or draw and annotate the structure of the molecule of DNA. Many candidates misspelled the names of the four bases, or confused thymine and thiamine, cytosine and cysteine.

In part (a) (ii) candidates did not score as well as expected, possibly due to their assumption that the 10 marks were allocated equally between parts (i) DNA, and (ii) RNA, as five marks each, and they wrote to the value of five marks for both types of nucleic acid. The examiners had in fact awarded eight marks for the DNA description and two marks for the RNA differences.

Part (a) (iii) was very well done, as candidates probably assumed they would receive five marks, and gave detail to that value. This was not so however. The section was worth only two marks.

A common misconception was the use of the term 'single helix' rather than 'single stranded', to describe the structure of RNA. It is only in transfer RNA that the single strand is folded back on itself, (in a clover leaf shape), to give the appearance of a double helix for short sections.

In part (b), the majority of candidates recognised that the question was dealing with the point/gene mutation that causes sickle cell anaemia. They linked the change in the DNA to a change in the quaternary structure of the haemoglobin molecule. This results in the red blood cells' assuming a sickle shape, with a reduced efficiency of oxygen carriage. The distorted shape reduces the ability of the red cells to pass through the narrow capillaries. They then occlude the capillary, preventing blood flow, and causing pain and cramping in the tissues.

A few of candidates failed to score well. After recognising that a mutation was involved, they went on to elaborate on the different kinds of mutation, or to describe the entire process of protein synthesis. They neglected to describe the effect of sickling on the function of the erythrocytres.

Question 7

Syllabus Objectives 4.9, 4.10, 4.12..
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 10.88. Lowest mark 1
Candidates selecting this option 33 percent.

Part (a) (i) - In assessing the labelled diagram of the placenta, marks were awarded for accuracy of representation, clean clear lines and the required labels, correctly assigned. The majority of the candidates managed the labels, but found the drawing of the placenta challenging, and as a result, failed to score well. A plan diagram of the type used in the text, and illustrated by teacher on the blackboard would have been an adequate response for gaining an average mark. Candidates should try to fulfill requirements, rather than to leave a gap. Annotated labels could have been useful even with a very basic diagram.

In part (a) (ii), most of the candidates indicated the oxygenated blood in the umbilical vein flowing towards the foetus and the deoxygenated blood in the umbilical artery flowing towards the placenta. Candidates were asked to label these by means of arrows on a diagram, and should have followed these instructions, rather than writing about them.

Part (b) was generally well done, with the majority of candidates gaining full marks for parts (i) and (ii), (amnion function and the effects of the foetus on the mother). Several candidates failed to score full marks for part (ii) because the responses were either too generalised or focussed on changes in maternal behaviour rather than on the specific physiological effects of the foetus on the mother. Expected responses to this section included: hormonal changes leading to the cessation of the menstrual cycle; development of mammary glands; increased activity of the liver and kidneys in their functions; increase appetite and skeletal; posture and balance adjustments etc.

Part (b) (iii) was well answered, often too colloquially and rambling for an advanced Biology examination, since specifics such as essential vitamins, minerals, a well balanced diet, regular exercise which encourages blood flow, cessation of smoking and alcohol consumption, adequate rest, regular medical monitoring for blood pressure, oedema or other more serious symptoms, were required.

Module 3

Question 8

Syllabus Objectives. 1.2, 1.3.
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 9.2. Lowest mark 0
Candidates selecting this option, 54 percent.

Part (a) (i) had good responses from most centres. Two marks were available and candidates were given credit for any two of the following: explaining the sex-linked location of the allele; clarifying the female and male allelic combinations and incorporating the terms heterozygous, homozygous, carrier, dominant and recessive or carrier into the sentence.

In part (a) (ii) most candidates correctly answered that Prince Albert was a normal, (non-haemophilic) male, so his daughters were either heterozygous carriers or normal. In most cases the genotypes were given and the candidate scored the two marks.

In part (a) (iii) many candidates spent too long depicting diagrams or charts of inheritance of the haemophilia allele to arrive at their conclusion.
In part (a) (iv) six marks were given for stating and presenting the correct genotypes in the diagram. Candidates cited the six genotypes either as AA, AO, BB, BO, AB and OO directly, or they drew the chromosomes carrying the labelled alleles. To gain marks, candidates needed to be systematic in explaining the ABO system, referring to multiple alleles and matching the phenotypes to the genotypes.

In part (b), the candidates were required to outline the steps in applying the Chi squared test, but many unnecessarily undertook to do the series of calculations. Marks were allotted firstly for recognising the 1:1:1:1 ratio of a dihybrid back cross with the double recessive. Many candidates were only familiar with a 9:3:3:1 ratio, and laboured to make the figures fit this ratio. The expected ratio would be 1:1:1:1, and the observed results of 108, 102, 105, 101 totalled 116, giving an expected result of 104 each. Candidates needed to explain how the differences between the observed and expected results would be obtained, (O-E), and then progress to the square of the difference, $(O-E)^2$. Marks were allotted for describing each stage or for demonstrating each step in tabular form up to the Chi-squared formula. Reference to the table of values, degrees of freedom and selection of the probability should have been outlined on a “how to do it step by step” basis.

Determining acceptance or rejection of the null hypothesis, and significance or insignificance should have been explained. Candidates were awarded up to six points for describing at least six steps adequately.

Question 9

Syllabus Objectives.2.7, 2.8, 2.9, 4.2.
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 9.01. Lowest mark 0
Candidates selecting this option, 46 percent.

In part (a) (i), the definition of the term environment posed difficulty for many candidates and there was a wide range of answers. There should have been reference to the sum total of all conditions under which an organism lives - which affect lifestyle, adaptations and survival. Many candidates gave very brief answers and gained one of the two marks. Approximately 70 percent of the candidates were able to give a biotic factor, (tree cover, human influence, disease etc). Fewer candidates could explain a physical factor (climate, altitude, edaphic, etc). They may have been more familiar with the term 'abiotic' than 'physical'.

In part (a) (ii), examiners were looking for key words in the definition of 'evolution' such as a slow (in time), gradual change through successive generations, genotypes, survival and natural selection. Many candidates confused the terms allopatric and sympatric but furnished adequate descriptions of the two, indicating that they knew the difference between the two types of speciation. Some credit was given for displaying an understanding of the differences despite superficial forgetfulness.

In part (b) candidates were required to give generous reasons for the importance of maintaining biodiversity, not just lists or single words. At this level, candidates are expected to show competence in putting forward four coherent points.

In part (c), four marks were given for each of stabilizing and directional selection, eight in all, including two examples. Many candidates confused them with each other or with disruptive or natural selection in general. Approximately 70 percent of candidates gained three descriptive points but not all were able to give adequate details. The most common examples were industrial melanism in moths or neck length in giraffes for directional selection, and mean birth-weight for stabilizing selection.

In part (d) candidates should have clarified the meaning of both speciation and disruptive selection briefly. Since disruptive selection creates barriers to interbreeding, it promotes the separation of the gene pool into subspecies whose reproductive compatibility eventually becomes unsuccessful. Good candidates logically defined both terms and gave one supporting statement.

UNIT 2

PAPER 2

SECTION A

Module 1

Question 1

Syllabus Objectives 2.6.
Compulsory Question. Maximum Marks = 10
Highest Mark 10 Mean mark 5.66. Lowest mark 0

Part (a) - In explaining the usage of the apparatus in Figure 1, candidates stood to gain five points. The collection and measurement of oxygen is achieved in the school laboratory by using variants of the apparatus in Figure 1. As expected, 75 percent of the candidates showed familiarity with the principle of a photosynthometer, but many were unpracticed in its operation. They mentioned the movement of an air bubble along the capillary tube, the use of coloured water or the counting of air bubbles leaving the plant in a given period of time. The required response was to allow oxygen to accumulate in the flange of the tube, and then, using the syringe, pull the air bubble into the capillary tube alongside the scale, to measure its entire length. Candidates should state that the length of the bubble and the bore of the capillary tube could be used to calculate the volume of oxygen produced in a given time.

Many misconceptions were evident, including the idea that the oxygen pushed its way into the tube, forcing the meniscus along, and pushing the plunger out of the syringe - this is obviously confused with a respirometer, using sodium hydroxide to absorb CO_2, which creates a pressure deficit, drawing in a gas bubble.

In part (b) (i), the majority of candidates were able to interpret Curve A and state that the rate of photosynthesis increased as light intensity increased, and then levelled off.

In part (b) (ii) candidates needed to state that in both curves, as light intensity increased, the photosynthetic rate increased too, but that in Curve A, the low level of CO_2, (0.03 percent) is a limiting factor causing the levelling off in rate earlier than in Curve B. In Curve B, the 0.13 percent CO_2 allows the rate of photosynthesis to increase to almost double that in Curve A before levelling off due limitation. The question required candidates to compare the curves, but only 50 percent genuinely accounted for the difference in the shapes.

In part (b) (iii), there was about 90 percent accuracy, with candidates providing a satisfactory hypothesis - for which their teachers are to be commended.

Module 2

Question 2

Syllabus Objectives 3.2, 3.4..
Compulsory Question. Maximum Marks = 10
Highest Mark 10 . Mean mark 4.80. Lowest mark 0 .

Part (a) (i) tested the candidates' experimental skills by requiring them to make a plan diagram from a photomicrograph of right wall of the heart in longitudinal section. This section of the heart wall represented familiar material - it is part of the shape which the candidates produce every time they draw or diagram an LS of the heart. Almost all candidates drew the outline and valve flap correctly, for which they gained part of the marks. The better candidates recorded the outline of the thick muscle block in the ventricle wall, the thinner block in the atrial wall and the small blood vessels in the atrio-ventricular region. Some candidates drew cellular detail, even though a plan diagram was requested. Unfortunately the reproduction of the photograph was rather dark, and not nearly as clear as expected.

In part (a) (ii) candidates were asked to draw a rectangle on Figure 3(b), to indicate the location from which the photograph was taken. The majority of candidates enclosed the area around the bicuspid valve. Several candidates overlooked this part of the question, perhaps because it was typeset at the top of the opposite page, and may not have attracted their attention adequately. It was an easy mark lost for these candidates.

In part (b) (i), the labels proved challenging for many candidates. Since they were not expected to have seen the specimen, their ability to identify the structures depended on their application of biological knowledge. Those who drew the diagram well were better able to gain marks. However, the mark scheme was adjusted so that candidates needed only to identify two of the four structures.

In part (b) (ii), the left atrium (E), and left ventricle (F) were upgraded to one mark each, instead of one mark for both, so candidates gained more marks here.

In part (c), the proportions of the walls at G:H were 1:3, or one third, or 33.3 percent. Figures close to these gained marks. Most candidates scored well by following instructions.

In part (d) candidates were asked to give one reason for the difference in wall thickness between G and H. Examiners gave credit for any one of four reasons, including that wall G pumps blood to the atrium, while wall H pumps it to the body. Many candidates forgot to refer to both G and H in their comparison and lost marks. Teachers are requested to emphasise the use of a pair of statements when citing either comparisons or differences.

Module 3

Question 3

Syllabus Objectives. 2.4, 2.23.
Compulsory Question. Maximum Marks = 10
Highest Mark 10. Mean mark 7.07. Lowest mark 0.

In part (a) (i), the majority of candidates referred to Figure 4 and answered it correctly. Some paid little attention to the data provided, and provided vague answers from extraneous knowledge. When candidates are instructed to refer to the data provided in a figure or a graph, they must do so. The examiners have very specific answers which the candidates can only deduce by reading off values from the graph provided.

In part (a) (ii), the answer was straightforward. At age 45, all the graph lines were at zero.

In part (a) (iii), most candidates were able to use the data provided, and gave the correct answer: 2.28 percent.

In part (a) (iv) candidates were asked to predict an outcome based on data provided in Figure 4. They should have read off the percentage cumulative risk of 50 year old men who never smoked (0.00 percent), and 70 year old men (that is, 20 years later, 2007 - 2027), who continued to smoke. The difference was approximately 10 percent. Two marks were awarded, one for observing that the risk would increase, and one for using the data to suggest a percentage increase in risk. About 20 percent of candidates described the factors which cause lung cancer without any reference at all to Figure 4.

Part (b) - In this planning and design exercise candidates should have recognised two separate groups, A and B. Many candidates ignored the groups and failed to consider a hypothesis that there might be measurable differences between them. Procedurally, methods of measuring the pre-exercise values for blood pressure, pulse and respiration rates under controlled, timed conditions should be established, and the mean values for each group determined. Post exercise data was needed, and their mean values compared with the pre-exercise values for both A and B. Marks were available for a point by point outline. The presumed/ expected results should be related back to the smoking habits of the two behavioural groups. Candidates omitted many of the details, forgetting to record pre- or post-exercise values. Many candidates did not refer to the apparatus, the use of the stairs or the blood pressure equipment. In general at least 50 percent gained two of the four marks.

SECTION B

Question 4

Syllabus Objectives. 1.1, 3.1, 3.2, 4.1, 4.2.
Optional Question. Maximum Marks = 20
Highest Mark 20 Mean mark 11.85. Lowest mark 1
Candidates selecting this option 58 percent.

In part (a), approximately 65 percent of the candidates identified and explained specific cellular processes. Popular responses included the active transport of Na+ and K+ across the cell membrane via the Na+/K+ pump, anabolic reactions such as protein synthesis, and examples from photosynthesis and glycolysis.

In part (b) (i), approximately 80 percent of the candidates gained two marks by defining glycolysis as the splitting of a glucose molecule in a series of low energy, enzyme-controlled reactions to form two molecules of pyruvate.

In part (b) (ii), 50 percent of candidates identified six major sequential steps of glycolysis. Very few stated how glucose was phosphorylated and when. They merely wrote that it was phosphorylated to make it more reactive. They identified the cleavage of the phosphorylated hexose into two 3-carbon molecules, but most omitted the fact that one needed to be converted to the other isomer in order to continue along the glycolytic pathway. About 10 percent said the dehydrogenation of each GALP produced a reduced NAD molecule with two ATP molecules. Most candidates said that the end result of glycolysis was two reduced NAD, two molecules of pyruvate and a net gain of two ATP.

In part (c) (i), approximately 80 percent of the candidates stated that anaerobic respiration resulted in energy production in the absence of oxygen. However fewer than five percent acknowledged that the electron transport chains (and therefore the Krebs Cycle), cannot function in anaerobic conditions because there is no oxygen to finally accept the H atoms. About half of the candidates said that anaerobic respiration was inefficient since it resulted in a net gain of only two ATP molecules, while aerobic respiration produced as many as 36 ATP molecules.

In part (c) (i), approximately 10 percent of the candidates were able to earn all four marks. Most included the production of lactic acid under anaerobic conditions, by the muscles, and recognised that insufficient oxygen was being supplied during strenuous exercise, as opposed to insufficient ATP. Hence an oxygen debt was created. About 90 percent stated that an accumulation of lactic acid in the muscles was toxic and produced camps or pain until the oxygen debt was repaid. Some mentioned that lactic acid in the blood increased breathing rate.

Question 5

Syllabus Objectives 6.5, 6.6, 6.7.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 10.23. Lowest mark 0.
Candidates selecting this option: 42 percent.

In part (a), the majority of candidates (90 percent) were able to identify the sun as the energy source for producers, but most failed to identify the nutrient source of the producers. Those that did stated simply the soil. Most candidates, (90 percent) were able to identify that the source of energy and nutrients for consumers were the primary producers and other consumers, but focused on either energy or nutrients, not both.

Most candidates (80 percent) were aware of how decomposers feed, but were not specific as to what exactly the decomposers were obtaining in the process - as to whether it was nutrients or energy. The majority of candidates identified at least one difference between nutrient cycling and energy flow, including the cyclic nature of nutrient transfer and the unidirectional, linear flow of energy, with a diminishing value of energy, (by 10 percent), at each successive level. Only 10 percent stated that nutrient transfer remained relatively constant.

In part (b) candidates were unable to give clear distinctions between food webs and food chains, and in most cases gave only one clear point of comparison. Most correct answers referred to the varied diet in food webs versus single sources in a food chain. The loss or death of members of a food web would be less disruptive than in food chains. Almost no examples were given, referring to the names of plants or animals in a food chain, let alone, Caribbean examples.

Concerning the interference of the slash and burn method of deforestation on the nitrogen cycle, the majority of candidates, (80 percent), were able to identify more than four clear points where the cycle was affected. It was expected that candidates would write these point in prose. Diagrams of the nitrogen cycle were not accepted unless relevant points were annotated and incorporated exactly.

Overall the stronger candidates (58 percent), who were more competent with biochemistry, chose Question 4, and those who opted for Question 5, (42 percent), tended to be weaker, imprecise and rambling. Almost none referred to the tropical rain forests, fruits and branches referred to in the question, or displayed any familiarity with the organisms in a tropical environment. They were very theoretical. Candidates tend to avoid, or be uncomfortable with questions on ecology, as it is too broad a topic for them, and they appear to have little practical experience. In this section they failed to state specifically how the cycles would be affected by deforestation or slash and burn and were unable to visualise and demonstrate the link between these deaths and the disruption of the cycle.

Question 6

Syllabus Objectives 5.2, 5.4, 5.6.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 8.90. Lowest mark 0.
Candidates selecting this option: 64 percent

In part (a) (i), the drawing of the nephron was generally poorly done. Many candidates failed to differentiate between the Bowman's capsule and the glomerulus, while others drew the distal and proximal tubules as straight tubes. Many drawings were not proportionate, and lines were ill-defined. They were expected to have been more familiar with the structure of the nephron from their pre-requisite of CSEC Biology.

In Part (a) (ii) candidates were asked to outline the role of the loop of Henle in water conservation. They found this difficult and few scored the five marks available. The hairpin loop, the coutercurrent exchange and the vasa recta should be mentioned. Good candidates clarified the active removal of salt from the ascending limb and its deposition in the medullary tissue, decreasing its water potential. This causes water to diffuse out of the descending limb, where its potential is high, and into the vasa recta for rentention and conservation. These points are explained fully in the text books. The question referred primarily to the Loop of Henle rather than the proximal and distal convoluted tubules or the collecting ducts. Some candidates misinterpreted the question and wrote extensive accounts of the role of ADH in water conservation in the collecting ducts, and therefore failed to score.

In part (b) (i), the metabolism of both the mother and foetus in terms of water and salt regulation, as well as, the filtration of waste is managed by the mother's kidneys during pregnancy. Candidates identified the increase in removal of nitrogenous waste and other typical components of the urine, as well as the regulation of salt and an increase in the filterable volume of fluid, resulting in an increased frequency of urination. There is also an increase in the removal of hormones such as HCG.

The high glucose level in the urine indicates that the concentration in the blood plasma is being exceeded. This is typical of late onset, Type II diabetes, which suggests inadequate production of insulin by pancreatic cells, or failure of target cells to respond by taking up glucose as instructed. The high protein level indicates the loss of ability to restrain the passage of protein molecules in the plasma. The filtrate mechanism of the pores in the basement membrane which usually retains plasma proteins may be damaged or failing, due to impairment, hypertension, etc. The patient would need to regulate glucose levels by either diet, exercise or insulin replacement, and have further tests on kidney competency.

Candidates did quite well and were able to link metabolic, physiological and structural faults to the high glucose and protein level in the urine. Many candidates attained the eight marks available.

Part (c) was well done. Candidates linked the high glucose level in the urine to diabetes Type II or late onset, and went on to discuss the physiological changes such as inadequate insulin production taking place in the 60-year old patient. Similarly, high urinary protein levels were associated with kidney failure due to either disease or hypertension.

Question 7

Syllabus Objectives 6.4, 6.5, 6.6.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 12.65. Lowest mark 0.
Candidates selecting this option: 36 percent

Although this was not the more popular of the two questions from this module (36 percent), it proved to be the more high-scoring (12.6 versus 8.90).

In parts (a) (i) and (ii), most candidates gave large clear well-labelled drawings of the synapse and earned full marks. Some candidates failed to label the pre- and post-synaptic membrane exactly. They labelled the knobs or the axons, possibly confusing the sites with the pre- and post-synaptic neuron.

In part (a) (iii), most candidates knew about the method of transmission of an impulse across a synapse, gave excellent responses and scored full marks.

Part (b) (i) alluded to synaptic summation, and required candidates to relate an incoming impulse, (the gradually increasing sound of the cries of a waking baby), to the increase in number and frequency of impulses arriving at the sensory neuron's receptor membrane. When the stimulation reached the threshold level an action potential was generated, resulting in an awareness of, and response to the cries. Many candidates gained the three marks.

In part (b) (ii), the normal reflex to drop the hot dish is inhibited, increasing the difficulty for excitatory impulses to pass the synapse. The transmitter may be blocked or may cause the post-synaptic membrane to become more negative than usual, so that it does not become depolarised and an action potential is not generated, resulting in a muscle response to hold the dish. The mark allotment for this section was reduced, from three to two, to compensate for the challenge of the question and the marks were redistributed.

Part (c) centred on the differences between endocrine and neural systems and was well answered. It is familiar material from CSEC and most answers were set out clearly. However, candidates must remember that 'differences between' requires a pair of responses.

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Highest Mark 20. Mean mark 12.65. Lowest mark 0.
Candidates selecting this option: 36 percent

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Part (c) centred on the differences between endocrine and neural systems and was well answered. It is familiar material from CSEC and most answers were set out clearly. However, candidates must remember that 'differences between' requires a pair of responses.

Question 8

Syllabus Objectives 2.6, 2.7, 2.8.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 11.66. Lowest mark 0.
Candidates selecting this option: 84 percent

In part (a) (i) candidates knew that 1) HIV is a virus, (retrovirus), which affects T helper lymphocytes (CD4 cells) and that 2) The viral RNA is translated into DNA and incorporated into the DNA of the host nucleus, thus 3) Destroying/inactivating, the CD4 cells and 4) Preventing them from carrying out their normal immunological function. AIDS is a syndrome which describes a variety of opportunistic infections which would normally be controlled by the CD4 cells. Thus in AIDS, simple infections become lethal. 59 percent of the candidates achieved all three marks. Some, instead of describing how the infection eventually causes AIDS, described the methods of transmission of HIV.

In part (a) (ii), excellent answers were given to this question by the majority of the candidates.

In part (a) (iii), the mark scheme identified least 12 areas of impact of AIDS in the Caribbean and candidates were required to discuss four. They were quite knowledgeable and expressed strong opinions on the most popular topics: 1) AIDS is a major cause of death in the region, especially among the 15 - 45 age group; 2) The Caribbean ranks second in the world for infection rates and therefore continued infection is increasing; 3) The cost of AIDS treatment and prevention is a significant drain on the limited resources; 4) Funds allotted to AIDS medication are being taken from other essential budgets education, infrastructural development etc. and 5) The quality of family life, including the deprivation of parental care, income generation etc. are negatively impacted by AIDS morbidity and deaths.

In part (b), two marks were allotted for Malaria transmission, but the responses were too detailed and candidates wasted their time. Unfortunately candidates were unaware of the fact that part (b) (i) carried only two marks, and part (b) (ii) carried eight. Candidates answered part (b) (ii) as if it had a value of five marks, instead of eight, (which they did not know), and so they provided too few details, and lost marks. Many candidates said the causative agent was a bacterium or virus, instead of a protozoan. The text contain excellent accounts of preventative methods, taken from the following categories: life cycle and stage-related environmental factors, host blood management, vaccination, pro-active drug-taking, factors in the home (sprays, light paint, fans air conditioning, nets, clothing, etc), based on nocturnal activity. The text books also included the benefit of sleeping with pigs, in-so-far as mosquitoes may preferentially ‘bite’ domestic animals thereby sparing humans. Although not a Caribbean habit, many candidates quoted it.

Question 9

Syllabus Objectives.
Optional Question. Maximum Marks = 20
Highest Mark 20. Mean mark 12.36. Lowest mark 0
Candidates selecting this option: 16 percent.

In part (a) (i), this rubric was fairly well done. Many candidates knew what restriction enzymes were and gained both marks. About 60 percent could state the normal function of restriction. Endonucleotidases in life, for example, used by bacteria to sever and fragment DNA strands of infectious agents such as viruses or bacteriophages.

Part (a) (ii) - In previous years there have been some good answers on this topic. A straightforward knowledge and comprehension-based answer describing the process of genetic engineering was required. Guidelines were given to ensure that the candidates clarified the relevant points: plasmids, bacteria and gene probes. Only about 55 percent of the candidates scored well, giving eight generous and clear points. The remaining 45 percent did not furnish adequate details, and confused the sequence.

Part (b) (i), this higher level question, required candidates to describe the procedures of gene therapy and add factors affecting its use, for instance, that the debility must be one that can be remedied by a single known gene; that the gene can be preferentially transcribed - that is dominant; that it can be cloned and incorporated into a plasmid, lysosome or other vector, packaged into a 'dosage' and introduced to the host's specific target cells by an appropriate method., for example, nasal sprays, inhalation, and "shooting". The therapeutic effect may be temporary, and require repeated therapy, for example, where epithelial cells are shed. Many candidates were knowledgeable in describing the theory of gene therapy, but were not au fair with or aware of how it could be implemented, practically.

Part (b) (ii) was also well done. Candidates were able to express their views freely, but needed to make distinctly awardable points. Stem cells and ethical issues were discussed, but candidates failed to give specific reasons or support for them.

School Based Assessment

General comments

Overall the quality has improved since 2006. Some of the teachers at some Centres are doing excellent work, especially with coverage of the syllabus, using a range of activities and innovative approaches. There has been a good emphasis on drawing in general.

However, in several cases the practical/laboratory exercises which were chosen to teach skills to the candidates, and to make assessments, were sometimes inadequate and the criteria used to evaluate performance were below the appropriate descriptors. This resulted in the candidate being poorly prepared for Paper 02 Section A, or at a disadvantage when being marked against the Examiners' standardised marking scheme, which expects more than is being required by the school, during internal assessment.

Territory-based workshops which communicate the Council's expectations for CAPE SBA would make it easier for teachers to comply, and for Examiners to mark expeditiously. Where there are two teachers responsible for SBA at one centre, their mark schemes should be standardised across any exercise-in-common. In some cases, coverage of the syllabus seemed incomplete. It is useful to provide the students with handouts with practice questions to help explain the laboratory, and to provide sample mark schemes to show students how they will be evaluated.

Drawings

There are still major problems overall, and some Centres are giving marks too easily. A marking plan should include the following: 1) clarity of the drawing; 2) appropriate selection of the cells or tissue, so that it is typical of the cells being represented; 3) faithfulness and accuracy in recording the drawing; 4) correct proportions in all dimensions; 5) correct title, preferably at the top of the page to introduce the drawing. This needs some descriptors - the name, the view, the type (high power, low power - etc.; 6) the placement of the drawing on the page, for example, slightly left to allow room for labels; 6) labels and annotations - neatly set out, with planning to ensure the finished presentation is the best it can be; and 7) recording the correct magnification. Insistence on these seven factors, which the examiners must match to their mark scheme, is essential if candidates are to gain good scores.

Analysis and Interpretation

The following areas were selected by the examiners for improvement by 2008: 1) Adequate inclusion of background information to identify and explain relationships and patterns; 2) The ability to draw logical conclusions and make predictions from observations and data; 3) Understanding of the limitations of the observations and data; and 4) Understanding the relationship between the results obtained and the original hypothesis

Planning and Design

The major challenges were that Planning and Design exercises did not always following prescribed format guidelines, and that, in many instances the Planning and Design topics were found to be inappropriate. In addition, the examiners had some difficulty in evaluating activities that were clearly taken directly from a text book with few or no amendments, and were contrived to produce a specific result, which had been pretested, with well-known results. Candidates are required to show their capacity to confront an investigation, and to work out a managerial approach to cope with it. This involves teaching and re-enforcing: 1) A better understanding of how to formulate a hypothesis based on an observation and express it clearly, so that candidates can keep it in mind throughout, and return to it at the end of the exercise to indicate the extent to which it has been supported. This hypothesis should be logical and testable; 2) State a clear aim; 3) List or describe the appropriate material and apparatus. Candidates should review this to ensure that nothing is omitted. If it is, the investigation cannot be completed, and marks will be lost; and 4) A well thought out method, expressed clearly with a reasonable attempt to control other conditions or variables.

Furthermore, the procedure should be accurate and repeatable, the site for sampling and the size and cover of the samples should be reasonable. An understanding of the limitations which affect the design of the experiment and the extent to which limitations modify the outcome and results with limitations should be included. The method of collecting results, summarized and expressed using graphs, tables or pie charts should be visualized, and finally, the overall format should be suitable for a planning and design activity. As stated previously, it is expected that teachers will test the candidates' original approach and concept, because the examiners are not impressed by activities obviously and openly copied from the text book and presented as the student's own original plan and design.

In 2007, a decision was taken by the examiners to request the Council to hold workshops in the territories to provide teachers with more information on the criteria required, an understanding of the moderation process, and the communications intended in the feedback process.