REPORT ON CANDIDATES’ WORK IN THE
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION
MAY/JUNE 2006

BIOLOGY
Two thousand two hundred and nine candidates registered for the Unit 1 examination, compared with one thousand two hundred in 2005. For Unit 2, nine hundred and eighty-eight candidates registered for the examination compared with seven hundred and fifty-eight in 2005.

The Examiners were satisfied with the standard of performance, especially in Unit 1, where there was an increase in both the maximum scores and the mean scores in Papers 1 and 2. In Paper 1, the maximum score increased from 79% (2004), to 87% (2005) to 91% (2006), and the mean scores also improved from 34.9% in 2004, to 52% in 2004, to 54% in 2006. Paper 2 showed a similar trend. In Unit 2, Paper 1 showed improvements in all modules, but the results in Paper 2 remained about the same, mainly due to the responses to Module 2 and 3 essay questions. Candidates need to read the questions and answer them precisely. Perhaps teachers could spend time analysing questions and planning the content of the responses. The mark allotment shown can be used as a guide to determine the amount of information/number of content points to be given to gain full marks.

Examiners took careful note of the areas where the School-based assessments needed to be improved, and these suggestions have been set out at the end of this report.

There were more candidates and more Grade A’s in 2006 than in previous years. The keen participation of teachers from throughout the Caribbean in the marking exercise, and their continued determination to improve teaching and examining standards augurs well for future of CXC CAPE Biology.

Structure of the Papers

**Paper 01 of Unit 1 and Unit 2**

Paper 01 for both Units was composed of nine compulsory questions each of which carries a 10-mark maximum. The questions present stimulus or challenge material such as graphs, micrographs and flow charts, which require interpretation and analysis. Questions were designed to give a 50:50 distribution of ‘KC’, (knowledge and comprehension), and UK, (utilization of knowledge), answering skills.

**Paper 02 of Unit 1 and Unit 2**

Paper 02 of both Units 1 and Unit 2 was composed of nine questions, arranged into Sections A and B. Section A consisted of three structured questions, one from each Module, based on practical/laboratory applications, particularly on those sections of the syllabus with a single underlining. Scale drawings, genetic crosses, and calculations to determine significance were included in questions presented in Section A. Section B comprises three balanced pairs of questions, providing a choice between the pair. There was a pair of questions for Module 1, 2 and 3. They permitted freedom of expression and a choice of presentation style. They also tested KC and UK skills in equal proportion.
UNIT 1
PAPER 01

Question 1

Part (a)(i), (ii), (iii). The majority of candidates were able to achieve all three marks for stating gaseous (vapour), liquid, (but not water), solid. However, some candidates left this section blank, and others wrote solid, liquid and gas, in that order, probably through rote learning.

In Part (b), about 80 per cent of the candidates earned full marks by stating that in lakes or seas, a protective, insulating surface layer of ice allows survival of organisms underneath, where temperatures can remain constant.

In Part (c), most candidates stated two properties of water which supported the pondskater, but did not follow through with a correct explanation, e.g. ‘surface tension’, due to hydrogen bonding between water molecules at the surface and to molecules below, or ‘cohesion’ due to hydrogen bonding between water molecules continually breaking and reforming to make a strong dynamic structures. Weaker candidates gave the same description for both properties as being bonding between water molecules, without being exact.

For Part (d)(i)(ii), approximately 60 per cent of the candidates named Molecule A as sucrose and stated that it was a disaccharide. Many incorrectly identified it as glucose or cellulose. Others failed to gain a mark because they did not give both, the name and the type, as was asked. Many referred vaguely to sucrose as a source of short term energy. Very few said it was a means by which carbohydrate is transported in a plant.

For Part (e), approximately 60 per cent of candidates identified cellulose as the major structural polymer that is found in plants, but many cited starch.

For Part (f), even though a comparison of the structures of glucose and cellulose was not required, many candidates did so, and only 30 per cent of the candidates correctly answered this question. Most responses were very vague and did not properly state that cellulose has hydrogen bonds between its polymeric strands, and there are no free groups to form hydrogen bonds with water. Rarely did any student mention that water molecules surround individual water molecules and prevent them from re-associating.

Question 2

In Part (a)(i), this question tested the candidates’ knowledge of movement of water into and out of cells and the role of hydrostatic pressure in the support of herbaceous plants. A surprising number of candidates were unable to express osmosis in terms of water potential, as required by the question, but many others referred to the movement of water from a region of high to low concentration (a CSEC concept rather than CAPE). Many definitions omitted mention or involvement of a selectively permeable membrane, and these therefore received no credit.

For (a) (ii), the term ‘water potential’ was again omitted, but some credit was given as long as it was clear that there was no net movement of water between the two solutions.

In (b), candidates correctly identified the 0.3 molar solution as the isotonic solution since this matched the curved shape of the section when released from the stem. About 30 per cent chose 0.4, presuming the section should be straight. Most students scored full marks for this section, though some did not respond to the word “precisely”, and gave vague answers. Incorrect terminology was frequent: cells “crinkled or burst”, despite being plant cells. Candidates stated that sucrose moved in or out, rather than water, highlighting their deficiencies in confidence with osmosis.
Part (d) was not well done. Only a few candidates recognised that the turgid cortical cells, when released from the constraining force of the epidermis, would be able to expand at their unconfined edges, resulting in the backward curving of the inelastic epidermis.

Very few candidates scored full marks in Part (e). Most answers restated the question, or referred to fibres and lignified cells. Excellent responses referred to the turgidity of the cortical cells, with their turgor pressure being opposed by that of the rigid, restraining epidermis, (small, tightly continuous cells covered with cutin). This creates an inflexible column.

**Question 3**

Candidates performed well in labelling the drawing of a plant cell from an electron micrograph.

Most candidates could identify six labels, as required. The large nucleus with its many nucleoli proved challenging for some. The mark scheme allowed some leniency.

For Part (b)(i), most candidates correctly identified the Golgi apparatus. A minority stated it was the smooth ER, which caused them to lose marks in Part (ii). In Part (b)(ii), credit was given for any of the following functions: synthesis and secretion of material such a glycoproteins and glycolipids; chemical modification of proteins; packaging of materials to be used in the cell for export. e.g. in vesicles or lysosomes. A number of candidates incorrectly cited protein synthesis and intracellular transport as functions of the Golgi.

For Part (b)(iii), in spite of the error in the scale, the unit Km had no effect on the calculation, and the majority of candidates recognised this and used um or Km in their responses. They correctly calculated the width of the vesicle to be 0.375 (um or Km). A range of 0.3 - 0.4 was accepted.

In Part (c), most candidates correctly identified the electron micrograph as a standard chloroplast, despite the introductory statement that it was found in both plant and animal cells. To compensate for the error, the examiners also allowed full marks to those candidates who identified the organelle as either a mitochondrion or a nucleus, provided the two functions sited were correct.

For Part (d), candidates were required to name two structures, selecting from: lysosomes, microvilli, centrioles, flagella, cilia, many small vacuoles, glycogen granules, centrosome or peroxisomes.

**Question 4**

In Part (a)(i) - (v), most candidates scored well: the stages of mitosis are well understood, and must have been well taught.

For Part (b)(i) and (ii), the intention of this question was to determine the relative increase in ploidy at prophase and anaphase. During replication the 24 pairs of chromosomes duplicate, forming 48 pairs of chromosomes, or 96 chromatids.

In Part (c), candidates scored low, and seemed unclear as to what to write, and there were some far-fetched answers. If spindle fibres cannot be formed, the chromosomes cannot be separated accurately, and would not be pulled to the poles of the cells before the medial cytokinesis occurs. Uneven numbers or extra chromosomes may result; nondisjunction may occur. Suitable answers were credited.

For Part (d), most candidates were not able to distinguish between the two terms, chromatin and chromatids. In this situation, a chromosome is a pair of replicated chromatids joined at the centromere, while chromatin is composed of the condensed/stained nucleic acid of the chromosomes combined with protein/histones. Some marks were given for a correct definition, but the question did ask candidates to make a distinction.

For Part (e), the responses to this question were balanced and mainly accurate.
Question 5

For Part (a), in general, the candidates’ performance was very good, the majority, 70-80 per cent, were able to accurately label 3 out of 4 of the structures, with label Number 1, the chorion being the most difficult.

For Part (b), approximately 50 per cent of the candidates earned both marks for stating two functions of the amnion. A full clear explanatory sentence was needed, not a single word, nor a brief phrase. Thus, ‘it protects the foetus’ is inadequate, whereas, ‘the amnion protects the foetus from mechanical shock or injury by enclosing it in a cavity containing fluid.’ would be better.

In Part (c), at least 40 per cent of the candidates were able to correctly identify two of the three membranes. The most popular responses were the amnion and the chorion. Few candidates responded with the allantois. One mark was given for any 2 correct answers.

In Part (d), performance was poor. Candidates needed to focus how the membranes (the chorion-allantois), develop into functional structures. They grow into the villi which project into the uterine wall, which responds by enclosing them the relationship between the villi and the placenta although very close, always remains separate. The area becomes the placenta, an interface/barrier area for exchange by diffusion of substances between the mother and the foetus.

For Part (e), candidates were unable to reach “A” level responses. Vague responses included ‘provides food, carries away carbon dioxide’, without naming the nutrients, the method of transfer or the state - that is, bicarbonate ions in solution. The terms villi, lacunae or membranes were absent. Candidates, at ‘A’ level, should be fluent with the correct terminology for structures or processes.

For Part (f), fewer than half the candidates correctly identified this statement as false and wrote the amended statement. Some changed oxygenated to de-oxygenated, or artery to vein, but both should have matched correctly. Reference to the texts will enable students to review the answer they gave.

Question 6

In Part (a), most candidates scored one mark, with the main error being the interchange of LH and FSH. Similarly many candidates interchanged the ovarian hormones, oestrogen and progesterone in C and D.

In Part (b), the events at E and F were recognised as menstruation/endometrial breakdown and proliferation/repair and thickening of the endometrium respectively. While candidates realised that G involved maintenance of the endometrium in preparation for fertilization, only the more competent candidates referred to increased vascularization. Weaker candidates did not focus on the endometrium as required.

Most candidates were able to score on part (c), and use their knowledge of progesterone to suggest a suitable explanation. Some candidates actually knew the mechanism by which RU486, operates and scored full marks. More careful attention needs to be paid to the difference between contraceptive methods, and birth control methods in general.

Part (d) was well done, and candidates gave answers as (i) four, (ii) one, and (iii) polar body respectively, gaining three marks.

Question 7

Answers in Part (a) were repetitive, and most candidates gained one mark. The Chi squared test is a statistical test using ratios (observed and expected), which allows one to determine if the observed data differ significantly from the expected data. There is a need for candidates to concentrate on the purpose of the Chi squared method, rather than just ‘crunching numbers’, and obtaining an answer.
Part (b)(i) was very well answered, (9:3:3:1), but in Part (ii), candidates should explain that the figure ‘3’ represents one less that the number of classes of data. To state ‘n-1’ is insufficient.

Part (c) was also well done. In Part (ii), marks were awarded for 0.4, and in Part (iii), approximately 50 per cent of the candidates were able to use the probability tables, and read off 7.82 at 5 per cent probability. Again the examiners advise that candidates need to understand what they are doing, rather than just be instructed on what to do at each stage. This question endeavored to determine if candidates understood their manipulations.

**Question 8**

In Part (a), most candidates were able to explain the term ‘mutation’.

In Part (b), this section was generally misinterpreted, as the word ‘conditions’ was not always observed. Most candidates gave correct responses, which included X-rays, UV light, colchicines, mustard gas, benzene, virus-effects and alternating hot and cold temperatures. Some candidates gave types of mutations and diseases rather than conditions, for example, changes in chromosome number or arrangement.

In Part (c) (i), candidates did not seem to grasp the concept of chiasma, and as a result spent very little time studying the diagram or reading the instructions. Some candidates did very well, and others, faced with unfamiliar material, scored poorly.

In Part (c)(ii), the centre of the sequence, E F G H was inverted, so the answer was ‘inversion’. Many candidates stated ‘translocation’.

In Part (d)(i), most candidates were able to cite the cause of Down’s Syndrome as being due to an additional chromosome, no 21. Those who did not know said there was an extra chromosome. Some related it to oogenesis. Few used the term ‘non-disjunction’ or ‘trisomy 21’.

For Part (d)(ii), the relative incidence of Down’s Syndrome increases with age. Using the data in Figure 13 as requested, candidates should have added that while at age 20, the relative incidence is only 1:2300 (one in two thousand three hundred), it increases at age 45 to one in every 46 births. However, candidates did not refer to the data, nor quote specific figures. They appeared to revert to their previous knowledge only and lost marks.

In Part (d)(iii), after reaching a peak at age 40, Down’s Syndrome birth rates decline, because births in general decline, due to a decrease in maternal fertility.

For Part (e), in gene/point mutation the actual DNA molecule is affected, that is, one or more nucleotides are affected, but not the entire chromosome, as in Part (c)(ii) and (d). This was fairly well answered.

**Question 9**

For Part (a), more than 90 per cent of candidates gave a satisfactory definition of natural selection.

For Part (b), few candidates were able to produce three accurate points to describe how the widespread use of DDT could lead to the evolution of resistance in insects. Most candidates gained two, by stating that some insects which had a greater variation of resistance were able to survive and pass these resistant genes on to the next generation. In addition, greater ecological fitness would favour mating with other survivors, so DDT would gradually exert a selection pressure, resulting in the resistant genotype becoming more prevalent in the insect population. The most popular inaccurate response was when candidates linked DDT resistance to the development of immunity or antibodies in the insect, which was then passed on by memory cells (no reference made to genes) to offspring.
In Parts (c)(i) and (ii), approximately 70 per cent of the candidates correctly identified sympatric and allopatric speciation respectively. Too many spelling errors were encountered.

In Part (d), the majority (60 per cent), correctly responded that all races of humans can interbreed or mate with each other and create fertile offspring. Inaccurate responses were very vague or simply defined species in terms of similarity in genetic karyotype and matching chromosome numbers.

In Part (e), most candidates achieved at least one correct response, the popular answer being that organisms gradually adapt to the environment in which they live and they take time to grow and reach sexual maturity in order to pass down their genes. The infrequency of mutations; the need for a beneficial gene to achieve penetrance of expression; appropriate environmental changes to permit natural selection; the fact that most mutations are unsuccessful, were other points which the examiners expected.

There were approximately 47 non-responses for Question 9. This indicates that candidates are not managing their time well and hence they are not able to complete the last question. The responses for Parts (b) and (e) were essay-like and perhaps candidates could not cope. However, 7.83 per cent of candidates scored full marks.

**PAPER 02**

**Question 1**

For Part (a), most candidates performed quite well, but others were unable to complete the table of food tests for the dessert correctly, and reach a conclusion as to a result. Candidates appear to require practice in applying the results of food tests rather than simply testing for a known single substance.

For Part (b) mostly, candidates who got the contents of the dessert were able to suggest the components.

In Parts (c) (i) & (ii), candidates lost marks because most of them used a model, diagram or simplified version of a phospholipid molecule, whereas the question asked for an accurate drawing. Two errors for each drawing were allowed, so most candidates gained some marks. For the cellulose molecule the most common error involved the location of the oxygen molecule on the ring, and the alternation of the 1-4 beta glucose bonds.

**Question 2**

For Parts (a)(i) & (ii), most candidates were able to illustrate crossing over in the correct way with chromatids by the homologous chromosomes. The most common error was confusing the labels of chromosomes and chromatids on their drawings. Frequently the centromere was omitted.

Part (b) was done fairly well, but about 20 per cent of the candidates were unable to utilize the columns and rows of the grid and identify the points of the chromosome being identified. They did not recognise that crossing over could only occur in rows ‘c’ to ‘g’, controlled by the shorter chromosome, and the chromatid in column ‘B’. No crossing over was possible at the centromere.

Part (c) of the question was well done, and most candidates got the correct answer, by citing chiasma, which permit rearrangement of gene blocks between homologues, and orientation at the spindles, allowing maternal and paternal chromosomes to separate to opposite poles at random.

In Part (d), testing the utilization of knowledge of the cell cycle showed that some candidates were insufficiently confident with the material to complete Table 3. In interphase, DNA is replicated and the diploid chromosome number doubles (200 per cent). After cytokinesis it would be halved (100 per cent). Coming out of the cell cycle of interphase where DNA is replicated and chromosome is doubled. Following cytokinesis II, it would be 50 per cent or one quarter of 200 per cent. However, the mark scheme was liberal, and allowed for two errors, so approximately 40 per cent of candidates gained full marks.
**Question 3**

For Part (a), many candidates had a good knowledge of classification. While the majority produced the standard dichotomous key - which is what was expected, about 20 per cent used other designs, such as dendrograms and flow diagrams. Some allowance was made if they communicated what was expected accurately, but again for the fifth year, this report endeavours to persuade teachers to review this topic, which is relatively simple, and which annually gifts 4 marks.

Many candidates were not focused, and gave descriptions of faces, (skulls), flaps, boulders, shells, (dorsal scales) and arms, (forelimbs). Appropriate expression and terminology is expected at this level. Horney skins were referred to, but the diagrams were of skeletons. However, marks were available for a set of viable keys.

For Part (b), the prose in this unusual question was clearly understood by the candidates, but they were uncertain of the names of the three types of selection. They chose appropriate phrases from the passage, but could not apply the terms stabilizing, directional or disruptive selection. One mark was offered for the general term ‘natural’ for any one of the selected sentences.

**Question 4**

Part (a), was generally well done but many candidates failed to describe the features of a typical plant cell, and just listed them. Others used diagrams of plant cells, but failed to annotate them. A simple labelled diagram does not communicate specific information, and needs to have a method of drawing appropriate attention to its characteristics. Otherwise full credit is not realised. Candidates were able to point out at least 3 features of contrast between plant and animal cells, and scored full marks.

For Part (b), in elaborating on the differences between Prokaryotic and Eukaryotic cells, too many candidates were not comparative in their answers, and stated what applied in one group, but not in the other - there were incomplete comparisons. The average candidate identified half of the required number of six differences. Too many candidates were not comparative in their answers, and thus only stated what happened in one case but not in the other.

Part (c) was not well done by the majority. Some candidates seemed unfamiliar with the term ‘endosymbiont theory’ and proceeded to discuss symbiosis and parasitism. For those who knew the work required in the syllabus, specific objective 2.5, there were some excellent answers.

**Question 5**

In Part (a) the majority of candidates gained full marks for distinguishing between competitive and non-competitive enzyme inhibition.

Part (b) was generally well done but there were misconceptions about enzymes and substrates, and too much time was wasted by giving a pre-amble about enzymes in general. The mark scheme identified ten relevant points, of which six points with adequate elaboration were required for full marks. The Question (b) had six clues in it, as a guide to achieving a full answer.

In Part (c)(i), some candidates made reference to the enzyme’s being killed, as opposed to denatured and thereby inactivated.

In Part (c)(ii), candidates gave generalized statements rather that focus on specific note of reference which was made to the neutralizing effect of the bicarbonate on the acid contents from the stomach. They should have clarified the link between high pH and pepsin structural denaturation, resulting in cessation of activity.
In Part (c)(iii), there was some difficulty by candidates in expressing rate of reaction as the amount of time taken for clarification. The enzyme concentration, now increased, will cause the clarification of apple juice in a shorter time.

In Part (c)(iv), examiners felt that candidates were not reading the instructions and using the information properly. With the reduction of concentration of the enzyme, a longer time is taken to clarify the juice.

For Part (c)(v), the majority of candidates had difficulty in interpreting the question. Many of the candidates’ responses reflected a lack of understanding of the topic and points were often not represented in a sequential order. There were a few centres where mature responses gained full scores. Generally, if xylulose digests the glucose backbone and releases the xylans, then this causes clarification, and the cane juice should become clear.

**Question 6**

For Part (a)(i) concerning the sequence of nucleotides in the RNA molecule, a majority of candidates gained at least 3 of the 6 marks, but more details of the sequence were required and several points expected were not mentioned. A majority of candidates gained at least 3 points, getting 3 marks. Several points expected were not mentioned. Candidates should note that the RNA strand which is formed is complementary/reciprocal and NOT identical to the DNA template.

For Part (a)(ii), the roles of rRNA, mRNA and tRNA need to be well known to the candidates in order to use them with ease. Credit was given if candidates included mRNA’s leaving the nucleus or being enclosed by the ribosome to facilitate the reading of the code as well as the role of tRNA in recognition of a complementary codon and bringing the appropriate amino acid into its relevant position for polypeptide synthesis. The majority of candidates used the term ‘anticodon’ out of context.

Part (b)(i) was the most difficult part for the candidates, and the majority of candidates generally scored low. Candidates were unable to link the organisms DNA to the precision of folding of globular proteins. Such proteins: biochemically active proteins such as enzymes and hormones, and structural proteins such as collagen etc must be precise in their structure, (folding), to be effective in their role. Reference to secondary structure, type of amino acid affecting the pattern of folding, and types of bond stabilizing the tertiary structure, were expected.

For Part (b)(ii), the majority of candidates knew that sickle cell anaemia was due to a gene/point mutation caused by substitution of a DNA base, and the consequent change in mRNA. However, further details were lacking, reducing their scores. Candidates should have mentioned the change in the codon, and the resultant mis-transcription with the wrong anticodon. Naming the specific amino acids, valine substituting for glutamic acid and the reason for the subsequent change in the haemoglobin molecular configuration also gained marks.

**Question 7**

For Part (a), candidates knew the structure of the anther to CSEC level very well, and some candidates used too much time with drawings and explanations. Some good diagrams were done, but not always well labelled. Annotated drawings would have been more precise and have saved time. Over 50 per cent gained 2 of the 4 marks, but few candidates were able to give the required details for pollen formation. There was confusion concerning mitosis and meiosis and the term ‘pollen mother cells’. The role of the tapetum and vascular bundle was often left out.

For Part (b), all candidates responded by using the word ‘pollination’ despite the inaccurate use of the word fertilization in the stem of the question. These pollination methods are listed in the syllabus, (Module 2, page 15, objective 3.4), and it was expected that candidates should know and use these terms. Many candidates re-described the facts given in the question as a method of gaining marks for describing the mechanism used.
For Part (c), the majority of candidates scored full marks in this question by describing at least two advantages and two disadvantages. Obvious familiarity with CSEC descriptions surfaced, and candidates wrote much more than required. Very few candidates referred to the ‘these plants’ that is, the bananas, sweet potatoes or tomatoes and peppers, (which were used as Caribbean examples).

**Question 8**

In Parts (a)(i). & (ii), most candidates could recall and repeat the meanings of ‘gene’ and ‘allele’. The question did not request a definition, so there was no need to condense the meaning into one concise sentence. Elaboration in order to nail the marks would have been wise.

Part (b) was understood by most. Many candidates spent time on the explanation of multiple allele operation and scored well. Four of the marks were derived from the genetic diagrams, and four from the dialogue. Well-laid out (non-squashed) diagrams were commendable.

In Part (c)(i), approximately 95 per cent of those who attempted this question provided much information and did well. Candidates needed to describe the structure of the sex chromosomes, distinguish them from autosomes, outline their functions, and then, preferably by means of a diagram, chart, or small Punnett square, demonstrate how they control the inheritance of sex.

Part (c)(ii) was mostly explained satisfactorily. Some candidates described inheritance of blood groups rather than colour blindness, which was requested. For candidates who knew their work and who wrote a clear sequential, appropriately illustrated account, good scores resulted.

**Question 9**

Part (a) of this essay question, worth 10 marks had three components. Firstly candidates had to describe the five kingdom classification system. Then they had to discuss the principles on which it was based, and finally to discuss the importance, (that is, use), of modern classification systems. Candidates, who read the question, broke it down into these components and timed themselves, did well. Disorganised answers ran out of information quickly, or were confused and difficult to evaluate. Unfortunately, many candidates were not comfortable with classification. They could not remember the names of the phyla, nor the critical features on which the divisions are based. Long descriptions of phyla were not needed, and those who did this left little time for the principles and importance.

For Part (b), most candidates spent little attention to the methodology of classifying organisms but instead focused on the procedure of identification. The key word was ‘classify’ not ‘identify’, since if it was not known, there would be no identity to find. The features which permit categorization and separation include physical characteristics, e.g. morphology and anatomy; monocot/dicot: herbaceous/woody: floral characteristics; seed/fruit type and dispersal. Further, DNA profile, habitat and adaptation, comparison with herbarium specimens, and examination of diagrams/photographs in Flora.
UNIT 2

PAPER 01

Question 1

For Part (a), although strictly speaking, chlorophyll a is the major pigment in photosynthesis, the examiners decided to accept just ‘chlorophyll’ as so few candidates made the distinction between chlorophyll a and b. The accessory pigments were more precisely identified, being carotinoids, xanthophylls and for some, chlorophyll b. Approximately 80 per cent provided these straightforward memorised answers.

For Parts (b)(i) & (ii), Photosystem I, as P 700, and II, as P 680 - 690 were identified by 75 per cent of the candidates.

For Part (c)(i), most candidates correctly identified Box 1 as Photosystem II and Box 2 as Photosystem I. All the above were simple recall answers.

For Part (c)(ii)(a), only 30 per cent correctly explained that incident light at reaction Centre 1 caused the accessory pigments to become stimulated and pass electrons to chlorophyll a which was also stimulated to release electrons.

For Part (c)(ii)(b), candidates needed to give more comprehensive responses such as - ‘When an electron is ejected it leaves a “hole” and another electron moves in to fill it’, or, ‘losing an electron is equivalent to oxidation and leaves a charge on the molecule which attracts an electron’. Candidates’ responses were too simplistic, for example, ‘losing an electron attracts another electron’ or, ‘to replace the electrons lost in Box 1’.

For Part (c)(iii), forty percent achieved 1 of the 2 marks: ‘the electron is accepted by an acceptor and is passed along a series of carriers, (cytochromes),’ or ‘as the electron is exchanged energy is given off and is used to make ADP and P combine to make ATP.’

For Part (c)(iv), the question asked for two events which occurred between Boxes 4 and 5. The most obvious event was the boosting of an electron in the chlorophyll of photosystem 2 to a higher energy level. Additionally, the electron is trapped by an acceptor, then passed down an electron cascade. Several candidates chose, unnecessarily, to go beyond Box 5 and identified NADP+ as the final electron acceptor. Approximately 20-30 per cent of candidates earned a mark for (iv).

For Part (c)(v), almost 60 per cent of candidates identified the substances as follows; Box 6, hydrogen ions, hydrogen, protons; Box 7, NADPH (reduced NADP); Box 8, ATP. The competency to get two correct gained one mark.

In Part (d), most candidates correctly stated that it was hydrogen that was stored in the thylakoid space.

Question 2

In Part (a), the maximum respiratory rate is 550 - 590 um1 O2/g-1/h-1. While the value given was often correct the units were often incorrect or in a few cases not stated at all. The different quantities represented on the same set of Y axes gave candidates difficulty in deciding which values to use. More practice is needed with challenging graphs, which reach a standard above CSEC.

In Part (b), the concentration of oxygen is 3.4 - 3.8 mg/L O2. Again, candidates made errors with the units.

In Part (c), most candidates correctly identified aerobic respiration on day 3 and anaerobic on day 28. However, reasons for these answers were not well articulated. Candidates need to be more precise and convey adequate information in limited time and space.
In Part (d), few scored full marks here because many suggestions incorrectly referred to lactic acid in spite of the cell suspension being derived from plants. Most candidates were able to gain one mark for stating that CO₂ was produced, and when dissolved in water, hydrogen ions are produced which decrease the pH. Ethanol which is also produced is weakly acidic.

In Part (e), several candidates failed to score on this section because they attempted to determine the values without using a ruler and thus obtained an incorrect answer. The correct answer was 118 - 130 μg cm⁻³.

In Part (f), most candidates focused on the fact that the lack of oxygen was responsible for the number of cells. It seemed as though they did not remember that respiration can occur without oxygen, but if nutrients are lacking, there can be no further growth.

In Part (g), too many candidates were unable to give a balanced equation. Those who did rarely gave the correct formula for ethanol. Most neglected to refer to energy/ATP in their equations. But the majority of candidates gave the correct response (the medium becomes too acidic and growth is inhibited). The use of the process included industrial, medicinal and fuel related ethanol, (gasohol), wine and spirit production, soy sauce, etcetera.

**Question 3**

In Part (a)(i), few candidates scored really well here, even though the mark scheme accepted the stage or the organism. Identifying items 5 and 6 presented most difficulty. Credit was given in 5 for amino acids in animals/assimilation in animals, and in (6) for excretion/defecation/loss of hair, skin, horns etcetera.

For Part (a)(ii), the majority of candidates were able to define the term mutualism. A few candidates referred to it as a feeding relationship or a parasite/host relationship. No credit was given for those responses.

For Part (a)(iii), a range of responses was accepted here so that the majority were able to obtain 2 marks. In some instance the answers were too brief or vague. The removal of trees causes loss of nitrogen, minerals and humus; removal of roots results in erosion; there is loss of edible material, shelter and niches for animals. Increased water loss from the soil due to direct evaporation and run-off affects the water cycle and weather; oxidation of minerals and less removal of CO₂ from the air, results in global warming. Any two of these, well expressed, would gain the two marks.

For Part (b), the mark scheme listed five benefits, all available from the texts. A well-expressed, substantial sentence was required for the answer; nothing vague, weak or minimalistic. The most common error was in referring to the role bacteria play, rather than the benefits derived by the bacteria.

For Part (c), candidates did not relate their answers to effect on the nitrogen cycle. They were able to state the effect of flooding on the soil, (drives oxygen out of the soil; reduces plant uptake of minerals; drowns soil organisms, leaches mineral, etcetera.), but the effects of these on the bacteria and processes of the cycle were omitted, (death of bacteria, non-functioning of aerobic bacteria, denitrifying bacteria, nitrogen fixing bacteria). The actual interference to the cycle should be cited.

For Part (d), the largest reserve of nitrogen is as atmospheric gas, but many candidates did not give the ‘support’, as requested in the question. Credit was given if they stated any percentages between 70-80 per cent.

**Question 4**

For Part (a), many candidates were unable to differentiate between the TS of a stem and TS of a root. In place of the named plant organs, candidates filled in names such as sclerenchyma, collenchyma, parenchyma, vascular bundles. Many candidates could not recognise nor label the phloem.
For Part (b)(i), candidates broadly identified the dark cells as phloem rather than identifying the sieve tube elements (b)(ii). The majority of the candidates were able to explain that the radioactive carbon was incorporated into the sugar molecules, and that these were transported in the phloem. Since they are the only cells that transport carbon containing compounds, (other than minute traces occasionally in the xylem), this confirmed their identity as sieve tube cells. Some candidates stated that the dark regions were chlorophyll.

For Part (b)(iii), a range from 22 - 30 micrometres was accepted. Several candidates failed to read the question carefully. It requested the WIDTH in the LONGITUDINAL section: not the length of cell A.

For Part (c), in stating the pressure flow hypothesis, many candidates confused translocation with the transpiration pull, and its associated root pressure, cohesion and adhesion. Many candidates wrote of the movement of substances from high to low pressure.

**Question 5**

In Part (a)(i), approximately 70 per cent of the candidates scored the two marks by correctly identifying 3 of any 4 substances present in the tubule lumen. Popular responses included glucose, amino acids and urea.

In Part (a)(ii), candidates surprisingly had difficulty defining processes such as osmosis, diffusion and active transport, but at least they were able to name the substances being ‘transported’, for example, water in osmosis.

In Part (a)(iii), virtually no candidates were able to provide even one well-explained reason why substances which accumulate at the intercellular space, between the tubule and the capillary, moved into the capillaries and did not return to the tubule. If they mentioned it was due to the presence of a diffusion gradient, they failed to express that this gradient was created when blood moving through the capillary carried away the diffused substance. Reasons were only partially or incorrectly expressed.

In Part (b)(i), about one third of the candidates did not attempt to draw the transverse sections of the loop of Henle at T1 and T2. Half of the remaining 60 per cent drew longitudinal sections instead of transverse. The remaining 30 per cent failed to meet at least the requirement of a magnification of X5, and accurate drawings as requested. For T1, there should be a wall of thin cells adapted for diffusion, and for T2, a wall of thicker, cubical cells adapted for active transport. In both T1 and T2, the lumen should be of similar diameter.

In Part (b)(ii), almost all candidates failed to provide a proper functional reason for the differences in structure between T1 and T2. They did not relate the thinness of T1 to the function by its cells of diffusion only, nor did they state that the difference with T2, (having the same diameter lumen, but cubical cells in the wall) was related to active transport and more control being applied by the cells to modify the contents of the lumen.

**Question 6**

Part (a)(i) was well done. Almost every candidate got this correct, but they made reference to the atrium, instead of the atria, (left & right).

In Part (a)(ii), there were generally good responses on the AVN. Several candidates said the AVN distributed the excitation throughout the muscles of both ventricles, thereby confusing its role with the Purkinje tissue.

In Part (a)(iii), most candidates knew that the Purkinje tissue distributed the excitation, but omitted to include both the right and left ventricles.

In Part (b)(i), any one of the following points: to allow time for the atrial entrance to seal off; to allow time for the atrial muscles to complete their systole; to allow time for the ventricles to fill completely; to prevent premature contraction of the ventricles. The candidates referred to the closing of the valves, and some answered quite well.
There were some satisfactory answers in Part (b)(ii). Candidates should have emphasised that the blood must be squeezed from the base to the apex, to propel it out of the aorta/pulmonary artery.

In Parts (c)(i) - (vi), there were vague imprecise answers in many of the boxes. A brief statement, rather than one word, would have helped the examiners to give the benefit of the doubt and award marks. All these answers are available from the texts.

In Part (d)(i), even though this section was well within their competence, candidates misinterpreted it and for a low pH made mention of a decrease in heart rate rather than an increase. In Part (ii), where the body temperature is low, the candidates incorrectly made reference to an increase in heart rate. The relationship between a drop in temperature and a slower rate of metabolism was not made.

**Question 7**

**Part (a)(i)(a)** was generally well answered. The question related to the drinkers in relation to their age, not their gender, but many candidates based their comparison on the males/females, and strangers versus acquaintances rather than focus on age. Most candidates actually referred to the data, and the mark scheme required that the figures they selected supported, for the age range, the point they were making. Some candidates were confused, and read the table as if it were a grid. They explained that the strangers and acquaintances attacked the males and females, with little reference to age.

In Part (a)(i)(b), the answer should contain the fact that males attack strangers more so than females, (one mark), and this should be justified by selecting relevant data (1 mark). Next; the females attack acquaintances more so than males, (one mark), and this should be justified with supportive data (1 mark). Total: 4 marks. Some candidates did this quite well, but many failed to support the observations they had made.

In Part (a)(ii), candidates were requested to provide a sociological reason as to why males typically commit violence against strangers, and females respond to situations by preferentially attacking females. This open ended question was attempted by 70 per cent of the candidates who gained a mark for a logical answer. Mainly, answers referred to the fact that males drink in public, alone or with a supportive group, while females drink in public less frequently; they often know the person with whom they have contention, either as a domestic or inter-relationship quarrel.

In Part (b)(i), candidates were asked to write the totals on the bar charts. Over half of them did not comply.

In Part (b)(ii), candidates were asked to refer to the data in Figure 6 and comment on the relationship between alcohol consumption in units per day and the total assault rate. Four lines were allotted for the answer, which should have included the following: ‘as units of alcohol per day increase, (from 1 - 10 units), the incidence rate of assaults also increases, (from 104 to 868 per 10,000).

(Two to four units of alcohol per day is the accepted safe limit for the average person. Also accepted was 20-40 mls, 1 pint of beer, 1 glass of wine or 1 measure of spirits).

**Question 8**

In Part (a)(i), the majority of candidates, about 90 per cent, were able to name the disease as CHD or atherosclerosis. Few candidates were able to spell atherosclerosis correctly. The most common error was to use the term arteriosclerosis.

In Part (a)(ii), candidates were required to show their competency in the knowledge of coronary artery disease by citing four symptoms, (without descriptions). Two marks were awarded. Most candidates were able to give three or four symptoms, and gain two marks, but many gave one or two symptoms and gained one mark.

In Part (a)(iii), most of the candidates estimated a 65-85 per cent obstruction of the lumen of the coronary artery.
In Part (b), the majority of the candidates were able to identify 2 components of cigarette smoke, but the effect on the body was not well done. The major misconception was that nicotine was a carcinogen rather than the tar. Browning of teeth and smelly breath were not the biological factors most suited for this answer.

Part (c) was generally well answered, by reading the information from the Figure. The incorrect placing of the information in the squares was the most common error.

In Part (d), one comparative fact, for each country was required to gain the two marks. Even though the candidates were able to identify the factors that contributed to CHD levels the comments were too general, and the two countries for which the comparative information was given, Japan and the USA, were not mentioned. A high fat diet contributes to plaque and occlusion of the coronary arteries. In the USA the diet is high in saturated fats, including cholesterol, low in fibre (which absorbs fat in the colon) and high in sugar and alcohol content, both of which, in excess, are converted to fat, while in Japan, the diet is low in saturated fats, high in fibre, vitamins and minerals and low in sugar content. The candidates did not correlate how the dietary contents related to CHD in the two countries.

**Question 9**

For Part (a), most candidates showed competency, and gave sufficient reason to gain one or two marks. These methods can be found in the texts, and should have been basic knowledge.

For Part (b), candidates understood the requirement for water in the life-cycle, and the mark scheme listed five suggestions for this answer, where the candidates needed to provide only two.

For Part (c), only 40 per cent of the candidates were able to reason that *A. bellator* bred in bromeliads, between the overlapping branches where water accumulated, and these were not affected by spraying the swamps. The majority of the candidates did not factor in this alternative habitat, but stated that the *A. albimanus* mosquitos developed resistance or immunity to the insecticide sprayed in the swamps, and were able to survive and spread the disease.

For Part (d)(i), eighty per cent of the candidates could identify *Plasmodium*, (or a protozoan) as the malarial parasite. Of those candidates who chose dengue, very few could cite a virus, (Flavivirus), as the causal factor.

For Part (d)(ii), about half of the candidates were unable to score full marks by listing four symptoms of malaria or dengue fever. The examiners did not accept a mixture of symptoms from the two diseases.

In Part (d)(iii), for both dengue and malaria, most candidates were able to identify the part of the day when an individual would be most likely to receive a ‘bite’. For dengue this is daylight hours and for malaria, dusk to dawn.

In Part (e), the appropriate precautions for the time of day were given, for example, sleeping under a net at night, or wearing clothing to cover the body during the day. Some candidates gave the same reasons as they did for (a), but in this question, personal and individual protection was being examined. There was a variety of answers, and these were assessed by the Examiners.
Question 1

In Part (a), the highest yield is with 87 kilograms per hectare urea. Most candidates gained full marks in this section as they were simply required to take the value from the graph. Those who gave their answer as ‘urea’ gained no marks, for failing to recognise that more than one treatment contained urea.

In Part (b), the majority of candidates also gained full marks here, but some actually tried to calculate the percentage increase. They failed to recognise that the values were already given in percentages, hence a simple subtraction to obtain 5 per cent was all that was required.

In Part (c), most candidates were able to subtract the two values to obtain the difference of 212 kg/ha-1.

For Part (d), in order to test the candidates’ knowledge of the factors affecting photosynthesis, two factors other than the availability of nutrients from fertilizer were required. They included light intensity, carbon dioxide availability, moisture/water in soil and temperature. The question was fairly well answered.

In Part (e), the plant compound could be protein, amino acids, nucleic acids, nitrogen bases, NADP etcetera, and most candidates gained the mark. Those who did not appeared not to understand the meaning of the term ‘compound’.

For Part (f), most candidates could only give one good reason, not two. The texts explain why it is better to use manure rather than chemical fertilizers, and students should refer to them.

For Part (g), in assessing the drawing of a TS of a leaf, marks were awarded for correct proportion, (1 mark); clean, clear lines, (1 mark); accuracy, (1 mark) and at least four labels, (1 mark). Drawings were very fair, and drawing skills need to be further developed to accurately represent what is actually seen. Some candidates drew a few individual cells within the rectangle, rather than showing the packing and arrangement of cells relative to each other.

Question 2

For Part (a)(i), the majority of candidates did well, and drew the graph required. Four marks were given for having the X and Y axis values and identification correct, and Graph A and B drawn correctly. The difficulty encountered by some candidates lay in their uncertainty about the zero line.

For Part (a)(ii), two differences were required between the peaks in A and B. In A the peak reaches +50 millivolts and in B, it reaches +15 millivolts. In A the peak occurs at 0.45 milliseconds., and in B it occurs later, at 0.8 milliseconds. Most candidates said ‘A is earlier’, or ‘B is lower’. This was inadequate. Candidates could do much better with guidance on how to cite data from tables to substantiate their observations. A comparison between two items must refer to both items, not just one .One mark was the usual score.

For Part (a)(iii), the strength of the response is determined by the availability of sodium ions. There are more sodium ions in normal seawater than in 50:50 sea and distilled water mixed. (Therefore the action potential of the neuron in a higher sodium ion concentration was greater and faster). Candidates did quite well with this question.

For Part (b), in this relatively simple recall question, candidates were presented with four items to label on the motor neuron. Competency in correctly labelling three of these gained one mark. Examiners were understanding and always gave the benefit of the doubt — especially with the minutely misplaced ‘Node of Ranvier’ label, and any appropriate alternatives.
Question 3

For Part (a), gene therapy, genetic engineering and recombinant DNA technology were all accepted. Most candidates gained the mark.

For part (b), the types of enzymes used to remove the normal gene are restriction enzymes or restriction endonucletidases. Those candidates who knew about this topic got this answer correct.

For Part (c), most candidates could identify one benefit, (cure patient, relieve symptoms, improve quality of life). However, it must be noted that the faulty gene is not replaced. It remains, but the newly implanted gene is transcribed preferentially and is expressed. A hazard would be unintended effects, when the treatment does not work as intended. About 50 per cent of candidates made an effort to suggest a hazzard.

For Part (d), candidates who attempted this question gained one mark for stating that the change in genome is not passed on to the individual’s offspring. They gained the additional mark for stating that the gene remains in the body (somatic) cells and is not present in the sex cells or gametes.

Part (e). Candidates must read carefully and distinguish between the terms ‘detection’, which refers to the method of investigation and ‘observation’ which relates to the result obtained. Examiners were looking for these concepts in the answers. Approximately half the candidates attempted this section and in most instances the responses lacked clarity. In (i), detection would involve tetracycline and kanamycin sensitivity/resistance, or the production of corn protein. The observation would be that if no DNA was taken up, then Ecoli would be sensitive to both antibiotics, or that no corn protein would be produced. In (ii), detection would be to use antibiotics tetracycline and kanamycin sensitivity/resistance or the production of corn protein by bacteria, and the observation would be that if DNA was taken up, the bacteria would be sensitive to tetracycline and resistant to kanamycin and produce corn protein. Examiners were asked to tweak correct points, even if the answer was not so well expressed.

Question 4

The majority of candidates did not select this question. The quality of responses showed that only the better and more prepared candidates were able to answer fully.

For Part (a)(i), candidates stated that CO₂ was removed from pyruvate by decarboxylation for the purpose of reducing it from a 3-carbon compound to a 2-carbon compound. They could have added that the 2-carbon compound is acetyl co-A, which is an entry point for carbon into the Kreb’s cycle. Hydrogen is also removed from pyruvate and is accepted by NAD in order to be passed to the electron transport chains to form ATP. Any two actions and two purposes gained four marks.

For Part (a)(ii), candidates gained three marks if they drew an accurate diagram of the Krebs cycle which explained its actions. Otherwise they needed to describe them individually. Also in their account, they needed to clarify the purposes of the three actions they chose from the Krebs cycle to gain three marks, six in all.

In Part (b), for ten marks, candidates had to accumulate ten good points, four from the diagram which they were asked to provide, and six from their account in which they showed the roles of: (i) hydrogen, (ii), electron carriers, (iii), phosphates, (iv) the production of ATP and (v) the role of oxygen. Provided they analysed the question properly and wrote clearly about each of these stages they should have done well. Although in general responses were good, marks were lost when candidates failed to link the actions to the appropriate purposes.
**Question 5**

For Part (a), the definitions were correctly answered by approximately 75 per cent of the candidates. Weaker definitions were vague or overly simplistic, e.g. ‘Habitat’ was defined as the home of the animal, while ‘niche’ was its occupation/job - with no further comprehensive insight. When defining ‘ecosystem’ candidates tended to omit the interaction of the living organisms with their physical environment, or between organisms, Habitat was defined poorly, and many candidates could not adequately define a food chain. This problem may be due to the fact that candidates have little real understanding of these environmental factors, and they are not supported by actual field work. Many candidates also have the concept of ‘one fact, one mark’, whereas, in fact, definitions need to be a synthesis of a number of points, to gain the single mark.

Part (b). This section was only fair, and about 25 per cent of candidates demonstrated a comprehensive understanding of the question’s requirements. Candidates must be aware that many of the aspects of the ecosystem are constantly changing, as well as how closely they interact and contribute to returning the ecosystem to normal equilibrium. Their responses included comments such as ‘too much competition is bad’ or ‘factors which move the ecosystem away from equilibrium should be eliminated’. Candidates needed to identify four components of an ecosystem and state how they maintained ecological balance, for example, a food chain is a component of an ecosystem where a food net develops between primary producers and three or so levels of consumers. It ensures varied, food sources and a balanced diet, and if some members are depleted in number from time to time, the group of interdependent species still survives.

For Part (c)(i), the flow of energy through ecosystems is linear, not cyclical because it begins with a single extra-terrestrial source - solar energy, which cannot be recycled back to the sun. It is captured in photosynthesis to make carbohydrates, then used for respiration or by decomposers. Small amounts of energy are lost sequentially as heat, or are incorporated into chemical bonds some of which may be fossilized and not available for recycling. Three good points gave three marks.

For Part (c)(ii), three marks were available for citing three points to show why food chains are limited to three or four links. These answers are available from the text.

For Part (d), very few candidates earned all 6 marks, the majority earning 2 or 3 for this question. Rather than using their knowledge of the three types of pyramids and relating them to the ecosystem of the tree, they simply stated the advantages/reliability and disadvantages of each type of pyramid. Some candidates used only diagrams with no commentary, and several did not identify the tree as a single organism - referring to it in terms of the ‘many leaves’. Most pyramids were inaccurately drawn because candidates did not recognise that snails and caterpillars were both herbivores, and together they represented the primary consumers level. Snails were frequently cited as consumers (that is, carnivores), of caterpillars.

**Question 6**

For Part (a), most candidates demonstrated a good knowledge of homeostasis and set point. However, the concepts of detectors and regulators were not well understood, (See syllabus p 29, U2 M2 4.1). Some candidates were unable to define the terms but instead focused only on explaining the events involving glucose. Some accounts made no mention of either the liver or the pancreas, so these candidates did not really read the question, nor attempt to create an answer which responded to the requirements of the question.

For Part (b), most candidates were familiar with the reactions performed by the liver on proteins, but many accounts lacked detail. The liver converts protein to amino acids by enzymes in the hepatocytes; de-aminates them by the removal of the NH2 groups; utilizes the amino group to synthesise needed amino acids; utilises the NH groups to synthesise nitrogenous bases for nucleotides; converts the ammonia to urea, transaminates amino acids; creates a pool of amino acids to make plasma proteins, albumins and globulins for carrying minerals, hormones & lipids; destroys bacteria in capillaries (Kupffer cells), and deaminates them. Any five of these points well explained, would gain ten marks.
Question 7

In Part (a), the design of the question and half of the answer was provided for the candidates. They had to describe the ascent of water (and were reminded to start outside the root, and continue to the intercellular spaces of the leaf), and include five given components in their answer. It was almost impossible to go wrong. The Examiners note that many candidates do not understand and can not explain the cause of root pressure. Too much information was given on the apoplast pathway to the detriment of the mechanisms of ascent to the leaves. Candidates need practice in this area.

In Part (b), candidates did quite well at relating the xylem vessels to their function.

In Part (c), plant 1 was placed in potassium cyanide, but most candidates did not recognise this as a metabolic/respiratory inhibitor, and assumed it was a fertilizer and a source of potassium. It prevents ATP formation, and active uptake of minerals is inhibited. and membranes cannot pump ions against a concentration gradient to accumulate in the cells, where they would reduce the water potential and encourage osmosis. Briefly, transpiration would continue, flaccidity and dehydration would occur, and the plant would become water-stressed. Plant 2, in 100 per cent humidity would experience slowed transpiration, and a reduced supply of mineral and fresh water due to a sluggish transpiration pull. Candidates understood the effects on Plant 2 better than Plant 1, but the answers did not utilize the depth of botanical knowledge and expression expected.

Question 8

For Parts (a)(i) & (ii), candidates must read the question carefully. It asked about the mode of action. The role of phagocytes was well known, but candidates were not as familiar with plasma cells, and often confused them with platelets.

For Part (b), the question asked candidates to distinguish between the origin and maturation of B and T lymphocytes. It did not require information how the cells operate, which many candidates describe at length. Candidates were not certain whether the T cells matured in the lymph nodes or the spleen.

For Part (c), those who knew about and understood monoclonal antibodies and were familiar with the operation of the test answered this question very well and were able to give four convincing facts. Others struggled to remember a text book description. Since these mini-kit monoclonal tests are increasing in diversity, schools could purchase and demonstrate a few.

Part (d) was disappointing in general. This section offered a relatively easy way of scoring 6 marks. Candidates appeared to be confused about active and passive artificial immunity. Active artificial immunity includes Polio, MMR, Small Pox, etcetera. It uses attenuated antigens which these simulate epitopes; the immune system responds and produces antibodies, etcetera. Passive artificial immunity involves snake and spider bites. Because the patient is so ill, and does not have time or strength to make the antibodies, stored antibodies for the specific disease, which have been taken from the blood of a person who has already been exposed to the disease, are used. These antibodies counteract the antigen and control its effect. The effect is short in duration, and a booster of antibodies may be needed. (Some candidates should be reminded that there is still no effective malaria vaccine available for active artificial immunity). Three marks were allotted to each type of immunity, and there were some very good answers, indicating that some centres have successfully dealt with this area of the syllabus.

Question 9

In Parts (a)(i), (ii)&. (iii), for each example, candidates needed not simply to state the necessity for specific nutrients, since these are the basic components of a generic diet, but to identify the relative amounts of such nutrients, and to indicate why each category had such a requirement. The individually tailored difference particular to the condition should have been discussed. There was no requirement in the question to plan a menu. A common misconception was that lactation is the result of accumulation of lactic acid by athlete.
In Part (b)(i), for each disease, at least two categories were required to gain full marks. There were several possible alternatives for each disease: for AIDS, chronic, mental, infectious, and for diabetes, inherited (genetic predisposition), chronic and self-inflicted. Although diabetes has a very strong genetic predisposition, it is not strictly categorised as a genetic disease, in the same way a sickle cell anaemia - this was one of the most common errors.

In Part (b)(ii), there was much overlap in this area. Candidates also gave both reasons for the global distribution of AIDS and diabetes together, rather than dealing with each disease. Quite a few candidates read the term ‘global distribution’ and linked it to global travel with points that were not relevant to the answers. Diabetes is largely due to high carbohydrate in the diet, and a shift from the traditional staple diet of root crops to the more fashionable fatty fast food diet. With an increased workforce, there is less time to prepare foods, and more processed packaged food are successfully marketed. Increasingly sedentary lifestyles limit exercise and cause obesity. Similarly, for AIDS, candidates needed to highlight the factors which contribute to world-wide spread.

In Part (e), while most candidates gave an acceptable definition of ‘healthy’ there was much more difficulty with the term malnutrition. This results from a deficiency or imbalance in the necessary molecules/nutrients required for metabolism and maintenance of proper body function. Candidates should have reviewed the components of Betty’s diet, and commented on the over-representation, or under-representation of required nutrients, and the effects that such discrepancies would have created in the long-term. Five well-described points would have gained five marks.

**School Based Assessment. Unit 1 and Unit 2**

The Examiners made the following assessment of the School-based submissions.

**DRAWINGS.**

Candidates have shown an overall improvement, but there are issues which need to be considered:

CXC suggests the use of pencil in labelling, but candidates still use ink. Label lines are not parallel to each other, and are often seen above and below the drawing. Clarity has improved even though very few candidates are managing to score the full 3/3 marks available. Most drawings were of reasonable proportions with structures typical of the specimen, but reality/faithfulness of reproduction was poorly represented. Drawings from textbooks are not acceptable for assessment: the slide or specimen should be used.

There has been an increased incidence of 3-dimensional drawings being submitted, whereas the standard 2-D drawings are accepted by CXC CAPE. The standard of drawings was fair with a few schools showing more proficiency. There are still too many candidates using sketch lines and unwelcome shading. There should be clear distinction in the titles between plan drawings and high power renditions, and obviously the degree of detail must be appropriate. Plan drawings should not contain individual cells - just areas of tissues or particular structures.

Magnification is a requirement. Candidates unable to perform this skill lose marks. The magnification of the specimen in relation to its actual proportions is required. Simply reading off the figures etched on the objective lens is not acceptable.
ANALYSIS AND INTERPRETATION

Generally, these skills have been quite good, and teachers are definitely using the labs that are applicable to this area. However, there is still a small percentage of schools using models of mitosis and meiosis to assess A & I. Candidates do not always provide sufficiently detailed explanations of their results, based on correct Biological principles. Candidates should be encouraged to include a ‘background to the activity’ to orientate the reader to their topic.

The ‘conclusion’ should be separate from the general discussion, and must relate to the experiment. In too many cases the conclusion is included in the discussion, and therefore difficult to separate and assess properly. Therefore it was not credited. Candidates deserve proper instruction on this matter.

The standard of presentation and arrangement of content of tables and graphs is still poor at some centres, and in most cases, they were not properly titles, and no reference was made to them in the results or discussion. Limitations of the method must also be included, and sources of error, or the need for precautions should be clarified.

PLANNING & DESIGN.

In most cases the exercises chosen to assess this skill were inappropriate. Frequently, exercises in the texts were simply re-written in the P & D format. Examiners are familiar as a Group with all the texts. In several cases, it was noticed that the candidates also appeared to have tried to modify existing text book procedures, but not always to the extent that they were appropriate.

GENERAL COMMENTS.

Teachers need to assess a minimum of two Labs per skill. These labs need to be clearly indicated in the candidate’s report, that is, they must provide sufficient information to identify exactly what the report is, so that the examiners can understand how to accept it as either a Drawing or an Analysis skill, and assess it appropriately. Planning and Design Labs are not to be taken from the text. Original topics or problem situations need to be used. It is suggested that body fluids such as blood, saliva or urine are not used in experiments.