

CARIBBEAN EXAMINATIONS COUNCIL

**REPORT ON CANDIDATES' WORK IN THE
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION
MAY/JUNE 2009**

BIOLOGY

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GENERAL COMMENTS

The CAPE Biology examination comprises Paper 01, a multiple choice paper consisting of 45 items, 15 from each of the three modules; Paper 02, consisting of six questions and Paper 032, the alternative paper for candidates who do not register for the Internal Assessment. Paper 02 is divided into two sections – Section A and Section B. There are three compulsory structured questions in Section A, one testing each module and three essay questions in Section B, one testing each module. Each question on Paper 02 is worth 15 marks. Paper 032 was offered for the first time this year, to the out-of-school candidate population.

The modules in each Unit are:

Unit 1

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

Unit 2

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

UNIT 1

Paper 02

Section A

Module 1 - Structured Items

Question 1

Part (a) (i) was challenging. However, most candidates were able to identify structures (A) and (D) as the cell membrane and nucleus/nucleolus respectively. Candidates were also credited for identifying (B) as either centrioles or glycogen granules and (C) as mitochondria.

For Part (a) (ii), candidates were required to name a structure that is present in an animal cell and not in a plant cell. Correct responses were centrioles and glycogen granules.

For Part (a) (iii) of the question, in order to gain full marks, candidates were expected to give responses of the smooth endoplasmic reticulum and Golgi apparatus as the two structures that work together to make lipids available to the cell. Some candidates lost marks for failing to correctly identify both of the structures.

In Part (a) (iv), very few candidates gained full marks. Most of the candidates knew that smooth endoplasmic reticulum was responsible for lipid synthesis followed by processing and packaging in the

Golgi body. However, candidates did not clearly state that the lipoproteins finally bud off as Golgi vesicles to complete the delivery process.

In Part (b) (i), most candidates were able to gain full marks. Candidates need to be reminded that basic mathematical skills are required for plotting graphs. Some candidates did not know which variable should be the x-axis and which the y-axis.

In Part (b) (ii), candidates were required to explain the shape of the curve. A few candidates failed to answer the question since they limited their responses to describing the shape of the curve. The correct response was the link between the effect of kinetic energy on molecules and temperature. Many candidates failed to mention that denaturation occurs only above the optimum temperature for activity of the enzyme.

In Part (b) (iii), approximately 80 per cent of the candidates scored full marks for stating factors that affect enzyme activity such as enzyme or substrate concentration.

Module 2

Question 2

In Part (a) (i), more than 50 per cent of the candidates obtained one mark for stating the term ‘epistasis’; however, it was often incorrectly spelt. Many did not obtain full marks for the explanation. A simple statement about one gene at one locus inhibiting a gene at another locus would have been awarded the marks.

Part (a) (ii) was fairly well done with most candidates gaining full marks for the ratio 9:3:4 for black to brown to white. Many candidates correctly matched the genotypes with the colours. To obtain full marks, candidates also needed to match ratios to colours.

In Part (b) (i), approximately 75 per cent of the candidates gained full marks. They correctly identified the stages of Meiosis 1 as Prophase, Metaphase and Anaphase.

In Part (b) (ii), most candidates obtained full marks by describing the changes that occur at Telophase 1.

In Part (b) (iii), at least 60 per cent of the candidates earned one of the two marks allotted. The most popular answers were chiasmata formation and crossing over between homologous chromosomes involving exchange of genetic material that contributed to heritable variation.

Module 3

Question 3

For Part (a) (i) of the question, candidates were required to define the terms ‘sexual reproduction’ and ‘vegetative propagation’. At least 60 per cent of the candidates scored full marks. Some good responses included ‘one organism only, one parent only, no gametes used and no fusion of gametes’. It was necessary to state that vegetative propagation referred to plants only.

In Part (a) (ii) of the question, candidates were required to state one characteristic of the tissue of structures, such as corms, that facilitate the function of vegetative propagation. The majority of the candidates provided good responses, such as, ‘the structure contained meristematic tissue, or undifferentiated tissue, were totipotent or were mitotic’.

In Part (a) (iii), most candidates answered the question correctly. Other functions carried out by bulbs, tubers and corms include (food) storage and perennation. Tissue culture and genetic engineering were not accepted as answers.

Part (b) (i) of the question required the candidates to describe the four main features of the unlabelled pollen grain shown in the diagram. Candidates were expected to choose from exine, intine, pits, (large) generative nucleus and (smaller) tube nucleus. This proved to be challenging, as many candidates identified structural features of somatic cells.

For Part (b) (ii), candidates were required to draw and label the pollen grain at the end of germination. Only about 40 per cent of the candidates produced a labelled diagram of the required standard to earn the maximum three marks. It was expected that the drawings would show a long pollen tube with three nuclei near its tip; these structures would be labelled. Some candidates redrew the mature pollen grain provided in (b) (i) and labelled it.

For Part (b) (iii) of the question, candidates were asked to state one major change that occurs when a pollen grain germinates and to state its significance. Only about 30 per cent of the candidates answered correctly. Responses expected included that the pollen tube grew out to allow the nuclei to enter the ovule; the generative nucleus divides into two nuclei that will contribute to the zygote and endosperm formation. Some candidates explained the process of germination of seeds.

Part (c) of the question posed a great deal of difficulty for the candidates. The majority failed to clearly outline the role of the stigma in fertilization. Candidates were expected to state that the stigma produces sucrose which leads to the germination of the pollen grain and the production of the pollen tube. The sucrose also prevents the bursting of the pollen tube. The release of factors that prevent germination of incompatible pollen grains could also have been mentioned. Instead, many candidates wrote detailed accounts of pollination and germination.

Section B - Essays

Module 1

Question 4

For Part (a) (i), although candidates were required to use a simple diagram to describe the structure of phospholipids, and a detailed chemical formula was not required, many candidates still drew the detailed structure. However, they were not penalized for so doing. A simple diagram with a single polar (hydrophilic) head and two non-polar (hydrophobic) fatty acid tails, or even a polar head with a phosphate group attached to the glycerol was appropriate.

In Part (a) (ii), candidates did not emphasise the properties of the phospholipid (hydrophilic and hydrophobic) portions to explain why lipids are arranged as a bi-layer in the plasma membrane. Instead, they concentrated on the membrane and the movement of substances across it. A few candidates mentioned the hydrophobic interactions between the tails of the phospholipid molecules which hid in the interior of the membrane.

In Part (b) (i), most of the candidates scored at least 50 per cent of the marks. Many candidates did not contrast osmosis with endocytosis. Instead they gave definitions or descriptive statements of each. When explaining osmosis, candidates used terms such as molecules, particles and solvents instead of water and frequently mentioned the obsolete term 'semi-permeable' rather than 'selectively permeable' membrane. Good responses included that during osmosis only the movement of water occurs, while endocytosis involves the movement of larger particles. Osmosis requires a concentration gradient for movement of water to take place while endocytosis does not require such a gradient. Finally, osmosis, unlike endocytosis, can take place in both directions across a membrane and is passive, not active.

In Part (b) (ii), few candidates provided two examples of the use of endocytosis for the uptake of nutrients in animal systems. Acceptable answers include feeding in *Amoeba*, phagocytosis by white blood cells and the uptake of nutrients by human egg cells from the follicle cells. A large number of candidates appeared to misunderstand the use of the phrase 'in animal systems.' They seem to have

interpreted this to mean ‘in humans’ and consequently neglected to mention organisms like *Amoeba* and other protists.

Module 2

Question 5

Part (a) (i) was relatively well done by the candidates. However, many of them did not identify the ‘vector’ as the carrier of the DNA and the ‘recipient’ as the cell accepting the DNA of the donor during genetic engineering. A common error was to describe the vector and recipient in relation to diseases such as malaria.

In Part (a) (ii) of the question, candidates were asked to discuss the role of *E. coli* as a vector and recipient in the production of insulin, utilizing genetic engineering; this part of the question was not well done. Responses should have included that as a vector, *E. coli* cells are broken, the plasmid DNA is extracted by centrifugation and the gene/cDNA for insulin is then inserted. As a recipient, *E. coli* picks up the plasmid from a solution containing calcium ions and is then cloned to make several copies of the gene.

In Part (b) (i), candidates’ scores were better, as they described the structure of RNA as being made up of a polynucleotide strand with pentose sugars, phosphoric acid and organic bases. Some confused the term polynucleotide with polypeptide. Differences in the structure of DNA and RNA were well known; however, candidates were not given full marks for a comparison when the structural feature was provided for one nucleic acid without the corresponding feature for the other nucleic acid, for example, ribose but not deoxyribose.

In Part (b) (ii), more than 80 per cent of the candidates gained full marks. Candidates had knowledge about protein synthesis but were not always clear about the different roles played by DNA, mRNA, tRNA and rRNA. Mention of the role of all four of these molecules was necessary for the award of full marks. Some candidates also confused the terms, DNA replication, transcription and translation.

Module 3

Question 6

Part (a) of the question was poorly done. The majority of candidates explained the functions of the five main regions which make up the human female reproductive system; they were expected to describe their structure. Good responses from some candidates included that the fallopian tube is a narrow tube-like structure with cilia; the uterus is a pear-shaped muscular organ; and the cervix is a narrow tube with a ring of muscles.

In Part (b), candidates were required to demonstrate that they understood that despite some similarities between the male and female reproductive systems, there are ways in which the female system is unique. About 75 per cent of the candidates obtained at least three of the four marks that were allotted to this section. An example of a good response was that the uterus facilitates internal fertilization and houses the developing embryo.

Part (c) of the question was well done, as approximately 75 per cent of the candidates scored at least five of the six marks allotted. Some responses were exceptionally good. However, about 10 per cent could not apply their understanding of negative feedback mechanisms to explain the role of hormones in the menstrual cycle. Full marks were also awarded for detailed diagrammatic representations. Good responses included that FSH stimulates growth of follicles in the ovary; LH results in follicle maturation, and release and development of the corpus luteum.

UNIT 2**Paper 02****Section A****Module 1 - Structured Items**Question 1

Part (a), which tested understanding of some aspects of practical work, was most challenging for the candidates and few scored full marks. Many candidates were unable to make the distinction between photosynthesis and respiration and incorrectly stated that CO₂ was used as opposed to being produced by the seeds. Candidates should be reminded that a control is for comparison and the tube with the beads was used for compensation for any atmospheric changes. A common misconception was that KOH gives off CO₂.

In Part (b), a few candidates inaccurately stated that the apparatus could be modified to determine the effect of temperature on oxygen uptake by removing the syringe or the capillary tube and replacing it with a thermometer, since the apparatus for this investigation had to be a closed system. Answers such as refrigerators, air conditioners and light/ bulbs were not accepted. Approximately 80 per cent of the candidates provided good responses, such as, placing the apparatus in a water-bath or conducting the experiment at different temperatures.

Part (c) (i) of the question tested candidates' knowledge of the Krebs's Cycle; it was well done. About 80 per cent of the candidates scored at least three of the five marks for correctly indicating where decarboxylation and dehydrogenation reactions occur in the cycle and preceding reactions. Some candidates lost the marks for not placing the letters on/near the lines connecting the two compounds but beside the compounds in the boxes.

Part (c) (ii) was well done and good candidates correctly identified the matrix of the mitochondria as a site of Krebs's Cycle.

In Part (c) (iii), most candidates were awarded the two marks for explaining the role of NAD in the Krebs's Cycle in relation to energy production. Candidates knew that NAD is a carrier/acceptor of hydrogen ions/electrons; it is reduced to form NADH₂ that will eventually generate ATP/energy.

Module 2Question 2

Part (a) of this question tested candidates' knowledge of the structural features of the xylem vessel. The majority of the candidates were able to provide excellent responses such as narrow, hollow or elongated tubes with pits, lignified walls or cells fused end to end with perforated end walls.

In Part (b) of the question, candidates were required to explain three functions associated with the features identified in (a) above. Candidates provided a wide range of good responses, such as, the pits aid in lateral flow of water, lignified walls provide mechanical support, and narrow tubes aid in capillary action. However, weaker candidates incorrectly wrote detailed accounts of the sieve tube and the apoplast, and symplast pathway, consequently losing the marks.

Part (c) (i) of this question was challenging; many candidates failed to identify four tissues from the cross-section of a mammalian artery. Stronger candidates provided appropriate responses which included: (A) Blood, (B) Tunica media/adventitia, smooth muscles or elastic muscle, (C) Tunica intima/elastic tissue/middle coat, (D) Tunica externa/ collagen fibres/ outer coat.

Part (c) (ii) of this question required candidates to make a plan diagram and to show the distribution of the tissues of the artery; it was well done by a majority of the candidates. They were awarded marks for accurate magnification, both (width and length), correct proportions, major tissues identified and an appropriate title. *Titles must include the view (T.S, L.S), what is drawn and the magnification. It should be written in capital letters, underlined and placed at the base of the diagram.*

Module 3

Question 3

For Part (a) (i) of the question, candidates were provided with data on the use of psychoactive substances by males and females and asked to per cent it as a bar chart. About 95 per cent of the candidates scored the three marks for this section. Candidates accurately placed the bars for females next to the bars for males (that is, touching) and also used the key to identify these bars.

Part (a) (ii) was very well done. Candidates were able to describe three trends seen in the data. Competent candidates gave accurate responses such as:

- More males than females use these substances.
- The greatest use by both males and females is of alcohol followed by tobacco.
- Many persons used more than one substance.
- The only psychoactive substance that is used more by females than males is tranquilizers.

For Part (b) (i), many candidates scored two of the four marks awarded for the question, which solicited information on the effects of consistent use of alcohol on the liver. A brief mention of fatty liver, hepatitis, cirrhosis and cancer impaired function of the liver was awarded marks. Good candidates gained the full four marks by explaining two of these stages of liver deterioration. The link between alcohol consumption and the progressive harmful effects of the resulting diseases was rarely mentioned.

Part (b) (ii), which focused on the effects of consistent use of alcohol during pregnancy on the foetus, was very well done, as was reflected by approximately 90 per cent of the candidates getting the mark. Popular answers included foetal alcohol syndrome, mental retardation/mental disorder, small brain, deformed foetus and foetal abnormalities.

Part (c) of the question sought to ascertain whether candidates understood what additional data needed to be collected before it could be stated that the use of a particular psychoactive substance presented a health or social risk. Many candidates scored four marks in this section. Candidates were able to mention quantity/ frequency of the drug used and correlated this with the drug users' medical records to gain marks. Collection and correlation with data on relevant social problems, such as, abuse and unemployment was a popular answer.

Section B - Essays

Module 1

Question 4

Overall this question was well done. For Part (a), an appropriate definition illustrated by an example was sufficient to gain full marks. Good responses described the ecosystem as a biotic community and its abiotic environment, for example, the frogs, fishes and plants and the pond water in which they live. The ecological niche is simply the role played by each biotic component in the ecosystem, for instance, what it feeds on.

Part (b) was fairly well done. Good candidates were able to explain why energy is said to flow through the ecosystem rather than cycle. The answers were variations of ‘the energy constantly enters the ecosystem as solar radiation which plants absorb to make food that animal eat, and then drains away as respiratory losses. The movement is linear and less and less energy is available at each trophic level as energy is continuously lost’.

Part (c) (i) was very well done by most candidates. They were able to explain the term ‘in situ’ as the natural environment, for example, natural parks and protected areas and ‘ex-situ’ as specially prepared environments, such as, zoos, botanical gardens and seed banks. A few candidates gave incorrect examples for the two terms.

Part (c) (ii), was answered very well and most candidates were able to score full marks. However, some misunderstood the word “challenges” and gave reasons for maintaining biodiversity. Some good examples included the need to avoid inbreeding, transport of stock for breeding would be expensive, overcrowding due to long life or that lessons learnt in the wild cannot be learnt in captivity. Some candidates clearly did not understand the concept of maintaining biodiversity and confused it with variation.

Module 2

Question 5

Part (a) (i) of the question, which tested candidates’ knowledge of how hormones contribute to the maintenance of a fairly constant internal environment, was fairly well done. Approximately 70 per cent of the candidates were able to score three or four marks out of the five marks allocated. Good responses clearly explained terms like detector/receptor and effectors and included, in a logical sequence, the role of hormones in regulating the negative feedback mechanism. Most candidates who performed well in this question used the regulation of glucose concentration in the blood to illustrate their points. However, some candidates were more focused on explaining the term homeostasis than explaining the role of hormones in maintaining homeostasis and so lost marks.

Part (a) (ii) of the question inadvertently tested candidates’ knowledge outside the syllabus and so posed a problem to most of them. They were asked to suggest two ways, other than speeding up of the ripening of fruits, in which ethane plays a regulatory role in plants. A number of extra points were added to the mark scheme, so that the majority of the candidates obtained at least one out of the two marks allotted for this section. However, some candidates were able to produce the expected responses, like promotes growth, respiration, and abscission of fruits and leaves.

Part (b) (i) of the question was not well done, as candidates failed to define the terms ‘ultrafiltration’ and ‘selective reabsorption’ using the key words. Expected definitions were “ultrafiltration is the movement of substances out of the capillaries (glomerulus) into the Bowman’s capsule under high pressure; selective reabsorption is the movement of useful materials from the glomerular filtrate back into the blood”.

Part (ii) was the best done part of the question. Candidates were required to discuss, with reference to three structural features, how the proximal convoluted tubule is ideally suited to carrying out selective reabsorption. About 70 per cent of the candidates were able to gain four to five marks. Good responses included microvilli to increase surface area; rich supply of blood capillaries to provide quick reabsorption/diffusion of useful materials from the glomerular filtrate; and thin, partially permeable membrane to facilitate easy diffusion. However, the use of semi-permeable membrane instead of selectively/partially permeable was not accepted.

Module 3

Question 6

Part (a) (i) was well done except that a few candidates only outlined the symptoms of diabetes rather than discuss the key features of the disease. Some expected responses included a chronic, metabolic disease, characterized by high blood glucose levels (hyperglycemia), resulting from defects in insulin secretion by the pancreas, or that the body could not use the insulin produced efficiently.

Part (a) (ii) was also well done. Candidates were able to list the factors that contribute to the increase in diabetes in the Caribbean. However, they were unable to clearly explain how these factors contributed to the disease and hence could not gain the full four marks.

Part (b) was also well done. Some candidates stated that natural (even in relation to immunity) meant something with which you are born instead of stating that it was acquired naturally, for example, by exposure to infectious agents or from colostrum in mother's milk. Most of the candidates were able to accurately explain artificial immunity as being achieved by vaccination/injection of attenuated antigens or antibodies.

In Part (c), approximately 90 per cent of the responses were excellent. Many candidates stated that monoclonal antibodies are produced by a single clone of B-cells. Sometimes the definition was not concise but very descriptive and often the key term, B-cell, was omitted. The benefits of monoclonal antibodies include rapid, specific or accurate diagnosis, early detection of cancers and the ability to distinguish closely related pathogens. Occasionally candidates described the treatment rather than the diagnosis of the disease and mentioned organ transplant and early pregnancy testing which are not considered diseases.

Internal Assessment

Overall the quality of the candidates' practical/ laboratory assignments has improved noticeably since 2008. Several of the teachers at the centers are ensuring that a high standard is maintained by their students as it relates to their Internal Assessments. The improvements seen were in the generally weaker areas of *drawing* and *planning and design*.

However, despite this pleasing trend, there were still some cases where the laboratory exercises used were inappropriate for the skill(s) being assessed.

It is suggested that workshops be held in the territories and internal standardization of teachers responsible for practical activities at a given center, be implemented, as this is pivotal in ensuring that candidates are provided with all the necessary tools to produce work of a high quality.

A reminder to teachers is that each experiment should be assessed for only two skills at any given time. A pair of laboratory practical exercises can be used to provide the average score for each skill. Despite this, teachers still have to reinforce the standards expected by practising and presenting several other experiments in each area (AI, DR, P&D, ORR and MM).

Finally, the mark awarded for the assignment must be clearly shown and presented out of a score of 16.

Drawing

There is still great concern in this area of assessment. Some teachers have allowed students to submit textbook drawings as theirs. It is important that students provide true representations of specimen/ slides with which they are provided. Reproductions of drawings in textbooks are not appropriate for assessment of drawing skills.

An assessment of the drawing needs to include:

- Clarity of drawing.
- A selection of cells that is truly representative of the section being viewed.
- A low power plan of the tissues and high power details of a FEW representative cells should be done for each specimen. There is no need to attempt to draw all the cells seen.
- Faithfulness and accuracy in recording the drawing.
- Correct proportions of all components of the specimen is pivotal.
- Title must be placed at the base of the drawing, in uppercase and underlined.
- The view must be stated in the title, where applicable, for example L.S (Longitudinal Section) / Whole Mount.
- Neat placement of labels and annotations.
- Justification of labels to the left, right or evenly distributed on either side of the drawing is expected.
- Magnifications must be calculated and all working shown. The correct size of the specimen needs to be used in the calculation.

Insistence on these areas will afford candidates the opportunity to score highly in this area of internal assessment.

Analysis and Interpretation

Areas for immediate improvement highlighted by Examiners for 2010:

1. Adequate inclusion of background information.
2. Deducing trends and relationships from data collected.
3. Presenting concise explanations of the observed trends and relationships.
4. Understanding the relationship between data obtained and the original aim/ hypothesis of the experiment.
5. Formulation of a conclusion that summarizes the findings from observations and data [with reference to the link between data collected and the aim] is essential. Generally, conclusions were of poor quality because the aim of the experiment was poorly crafted to begin with.

Planning and Design

The major challenge still remains where teachers are not encouraging their students to refrain from the use of textbook laboratory activities. Students need to be encouraged to use original approaches and concepts, as they seek to formulate their hypotheses and plan their procedures.

Over the years, students have found this skill to be somewhat challenging. However, with continuous reinforcement of criteria, students will be able to grasp these concepts:

- Hypotheses need to be logical and testable.
- Aims must be concise and clearly stated, and relate to the hypothesis.
- A complete list of all materials and apparatus to be used must be stated. Items critical to the execution of the proposed method should not be omitted.
- Methods/ Procedures need to be in instructional/ point form.
- A control is essential and should be evident in the method proposed. simply identifying the controlled variable is not enough.

- Repetition of the procedure under identical conditions is needed to ensure validity.

Paper 032 - Alternative To Internal Assessment

CAPE Biology has attracted a number of candidates who are not registered as full-time students at any educational institution and therefore have difficulty assembling the Internal Assessment journal. The alternative to IA (Paper 032) was developed for these candidates. This paper was offered/piloted for the first time in 2009 to a small number of candidates in a few territories. Paper 032 comprised the following activities which were conducted in a laboratory under appropriate supervision.

Activity	Unit 1	Unit 2
Investigation to be conducted during examination	*	
Drawings	*	*
Analysis and Interpretation	*	*
Planning and Design		*

Teachers and candidates need to be reminded that this is an alternative to the IA and **NOT** an alternative to practical work. As such, candidates should have availed themselves of every opportunity to develop their practical skills, particularly in manipulation and in drawing, since these practical activities are carried out under examination conditions for Paper 032. This misunderstanding is reflected in the reports on the questions that are provided below.

UNIT 1

Module 1

Question 1

- (a)-(d) Candidates were required to carry out a simple investigation of the effect of substrate concentration on the rate of reaction of the enzyme amylase, and to complete a table to show the colour changes with Benedict's solution. This question was generally poorly done.
- (e) The expected results (since the Benedict's solution was not heated) were a pale blue colour for all test tubes; no colour change was expected. However, some candidates recorded the expected colour changes rather than what they actually observed. The starch concentration column was incorrectly completed; some candidates wrote the volumes instead of concentrations and percentages.
- (f) Writing an appropriate title for Table 1 was poorly done. Most candidates did not mention the effect of amylase on varying concentrations of starch.
- (g) Based on the observations from the investigation, no apparent relationship should exist. However, candidates described the expected relationship between substrate concentration and enzyme activity.
- (h) This part was well done as many candidates recognized that test tubes A1 to D1 were the controls for their respective mixtures.

- (i) Many candidates explained the expected colour changes; however, no changes were actually seen.
- (j) Very few candidates were able to outline the procedure that can be used to produce quantitative colour standards for reaction mixtures using Benedict's solution. In a simple procedure, a series of solutions of known concentrations should be made and Benedict's solution added to each. Each should be heated and the colour changes graded according to the specific concentrations of reducing sugars.

Module 2

Question 2

- (a) (i) Several candidates found it difficult to calculate the mitotic index even though information was given on what the term meant, that is, per cent cells examined in mitosis and an example was provided.
- (a) (ii) Many candidates were able to gain at least one mark for deducing that the steroidal plant hormone, BL, promotes cell division in onion root tip. Candidates need to practise analyzing data and determining trends.
- (b) (i) Most candidates did not deduce that the cross was sex-linked or that independent assortment was involved.
- (b) (ii) This part of the question was very poorly done. Drawing genetic diagrams proved to be very challenging for candidates. The simple lay out of a cross involving parents, phenotypes, genotypes, meiosis, gametes, random fertilization and the F_1 progeny was not done.
- (b) (iii) More than 50 per cent of the candidates were able to use the data from the table to calculate the percentage of offspring exhibiting non-parental phenotypes.
- (b) (iv) Candidates found it difficult to explain the significance of finding the offspring from the second cross (F_2) exhibiting non-parental conditions. Responses such as independent assortment of alleles and recombination between alleles on the X chromosome were expected.

Module 3

Question 3

- (a) (i) The drawings of the stained transverse sections of the ovary of a mammal were poorly done. Candidates had difficulty in accurately labelling an ovary and some drew a mature Graafian follicle instead. Most drawings lacked the title, labels and magnification.
- (a) (ii) Several candidates omitted this section of the question. They had difficulty calculating the diameter of the mature oocyte.
- (b) (i) Many candidates drew the entire anther rather than locating and making a detailed labelled drawing of one pollen sac. The quality of the drawings was poor. The title, labels, and magnification were again omitted.
- (b) (ii) Very few candidates were able to describe two key differences between the pollen sac observed and a section of a completely mature anther. Differences included splitting of the pollen sac in the mature specimen and separate pollen grains with sculptured walls.

UNIT 2

Module 1

Question 1

- (a) (i) Candidates were required to make a labelled **plan** drawing of the slide of the artery that was provided. Many produced well-labelled plan drawings with clean continuous lines. However, the title and magnification (which should accompany all drawings) were sometimes omitted, and the features not drawn in correct proportion.
- (a) (ii) More than 50 per cent of the candidates commented on two features of a vein rather than an artery, as was requested.
- (a) (iii) Again, candidates made deductions about the nature of blood flow of a vein and missed the point that blood flow is under high pressure in an artery.
- (b) (i) Candidates were asked to draw a palisade cell from a transverse section of a dicotyledonous leaf. About 90 per cent of the candidates omitted the vacuole in this simple drawing of a typical plant cell. Many could not label four parts of a plant cell accurately.
- (b) (ii) The majority of the candidates were able to give one difference between palisade and mesophyll cells, for example, a rectangular shape compared to an oval shape. Very few candidates mentioned that chloroplasts were more numerous in palisade cells.

Module 2

Question 2

Candidates were provided with apparatus and materials to design an experiment to test the effect of an environmental factor on transpiration in plants.

- (a) More than 90 per cent of the candidates were able to formulate a suitable hypothesis for the factor being tested.
- (b) Many candidates could write a suitable aim based on the hypothesis written in response to (a).
- (c) Candidates were asked to design an experimental procedure to test the aim stated in (b), that is, the effect of light on the rate of transpiration in plants. A description with a suitable and logical sequence of the set-up was not done. The controls and repeat trials to ensure reproducibility of the experiment were not included. The candidates correctly wrote the experiment in the present tense and also included the duration of investigation.
- (d) Two precautions when setting up the experiment were required. Many candidates explained why the fittings must be airtight but omitted the point that the plant stem must be cut under water.
- (e) This was poorly done. Candidates made an inference rather than writing about the results that might be expected from the investigation, for example, the amount of water (changes in volume) taken up by the plant will increase when the cutting is exposed to increased light intensity.
- (f) Candidates were required to design an appropriate table to show how the results could be represented. This was poorly done. The title and the units of measurement were often omitted. Many candidates inaccurately designed a table for the movement of a bubble.

- (g) Candidates were asked to suggest two factors that may affect the accuracy of the experiment. Many listed two factors but did not give the required explanation. Many correctly mentioned that the heat from the lamp would also increase the temperature of the leaves.

Module 3

Question 3

- (a) (i) Candidates were required to construct a graph from a table that showed the effect of exercise on blood pressure in 12 human subjects. Most candidates plotted the points accurately and labelled the lines for the systolic and diastolic pressure. However, many candidates lost marks for omitting the base lines and the title of the graph. Students should be encouraged to learn when to represent two sets of data on one graph instead of drawing two separate graphs.
- (a) (ii) Candidates did not demonstrate much ability to comment on the effects of exercise on blood pressure using quantitative data from the graph. A few mentioned that the immediate effect of exercise was a dramatic increase in systolic blood pressure and a decrease in diastolic blood pressure followed by decrease in systolic pressure when exercise stops.
- (a) (iii) Candidates had difficulty explaining the physiological significance of the change in systolic pressure that was recorded after exercise. Only a few suggested that there is a dramatic increase in blood flow to supply muscles with oxygen and glucose.
- (b) (i) Candidates were asked to construct a histogram to display the data provided in a table showing the yearly incidence of cancer. This was well done; the bars were well drawn. However, some candidates lost a mark for either writing a poorly worded title or for omitting the title entirely.
- (c) (ii) This part required that the candidates comment on the change in incidence of cancer over the five-year period. Values from the histogram were not used to answer the question but general trends were noted.