CARIBBEAN EXAMINATIONS COUNCIL

REPORT ON CANDIDATES' WORK IN THE CARIBBEAN SECONDARY EDUCATION CERTIFICATE

JANUARY 2005

BIOLOGY

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SECONDARY EDUCATION CERTIFICATE

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GENERAL COMMENTS

The January 2005 examination in Biology consisted of four papers:

Paper 01 – Multiple Choice
Paper 02 – Structured questions
Paper 03 – Extended essays
Paper 04 – Alternative to the School Based Assessment.

There was a decline in the performance of candidates in this examination compared with January 2004. The greatest decline was seen in Paper 04/2, the Alternate to the School Based Assessment. Performance of candidates in Paper 01, the Multiple Choice paper, remained satisfactory and stable, while there was a marginal decline in Papers 02 and 03, the Structured and Essay Papers respectively. There is need for improvement in the preparation for the examinations. Particular attention should be paid to the following comments in preparing candidates for the examination, if the desired improvement is to be realized:

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

- Candidates wasted time providing irrelevant information in the essays. They shouldfocus on key words such as 'describe' and 'explain' when reading questions to ensure that their responses are relevant. In many cases responses were too brief and did not satisfy the requirements of the questions.

- Very often responses were written too simply, without using appropriate biological terms. It was evident that candidates were not comfortable using scientific language in their responses. Teachers must therefore emphasize appropriate biological terminology throughout the course.

- More attention should be paid to the stimulus material provided in the question, particularly in Paper 02. This usually guides students to the correct responses. Too often candidates responded by providing information on the topic which did not relate specifically to the question.

- More emphasis should be placed on practical skills. Many candidates seemed to be unfamiliar with the materials and equipment mentioned in the examination, especially in Paper 04/2. They did not fully understand the precautions and limitations of an experiment, and were unable to state the aim of an experiment or formulate a valid hypothesis.

DETAILED COMMENTS

PAPER 02 – STRUCTURED QUESTIONS

Paper 02 consisted of five short-answer structured questions. The first was a data analysis question worth 30 marks. The paper tested all skill areas in the Biology syllabus. Performance of the candidates was satisfactory. The overall mean was 34.42 or 38.29 percent.

Question 1

This question tested the effect of temperature on enzyme action. Stimulus material was provided in the form of a series of experiments showing the reactions of a human digestive enzyme at various temperatures. Candidates were expected to make observations, interpret data, draw conclusions and apply their practical skills to plan an experiment. They were also asked to describe the procedure for a food test. The mean for this question was 11 and the highest score was 24 out of 30.

In Part (a) candidates were required to record observations after starch was mixed with an enzyme and the product of the reaction tested with iodine. Performance was unsatisfactory. Many candidates were unable to complete the key based on the data illustrated in the Figure. The blackened circle represented blue-black/purple/dark blue while the non-blackened circles represented brown/yellow.

In Part (b) (i) performance was satisfactory. Candidates were expected to explain why the colours of the drops in rows A and E remained the same. Although most candidates knew that enzymes were denatured at high temperatures only a few realised that enzymes were inactivated at very low temperatures. For Part (b) (ii) candidates were expected to identify maltose as the product of starch digestion. The performance was generally good, although weaker candidates stated 'glucose'. In Part (b) (iii) candidates were expected to describe the test for reducing sugar but, in many cases, they described the test for

starch. Where an attempt was made to describe the reducing sugar test the need for heat was often omitted.

Performance in Part (c) (i) was satisfactory although a few candidates plotted a bar chart instead of a graph. Part (c) (ii) was well done. Most candidates correctly identified the temperature at which the reaction took place most rapidly as 30°C. For Part (c) (iii) most candidates correctly stated that there would be an increase in enzymatic activity as temperature increased from 0°C in Tube A and that a change in tube E would have no effect since the enzyme was already denatured.

In Part (d) (i) candidates were asked to describe the method used to set up the investigation. Many failed to provide the correct sequence of steps for the method and were unable to state appropriate precautions. Examiners expected precautions such as use the same size drops; keep the temperatures of the water baths constant; leave the mixture to stand for the same length of time; stir before moving drops. Part (d) (ii) was well done as candidates were able to explain that it was important to stir the mixture so that the contents would be thoroughly mixed. Mixing would ensure even distribution or heat and the reaction of all starch with the enzyme.

The Performance in Part (e) (i) was generally good. Most candidates were familiar with the procedure for preparing the cotyledons for testing. In Part (e) (ii) they were asked to explain what happens to the starch stored in cotyledons when a seed germinates. Few candidates were able to explain that the starch is converted to glucose in the presence of enzymes and then translocated to the growing points of the seedling when the seed germinates. Topics on germination should not be confined to the conditions necessary for it to take place but should also include reactions taking place during the process.

Part (f) had as its stimulus, an illustration of a box of germinating seedlings. Most were bending in one direction. Candidates were asked to explain the appearance of the seedlings. Performance was fair but some candidates had difficulty explaining the representation as growth in the direction of unilateral light and, instead, explained it as 'wilting' due to lack of water. Candidates who were unable to correctly explain the appearance in Part (f) (i) found it difficult to set up an appropriate investigation to show that their explanation was correct using a shoebox with a hole. Many of them suggested placing seeds in the box for germination.

Question 2

Breathing and respiration were the topics targeted in this question. Candidate performance was moderate with a mean of six and the highest score 15 out of 17. In Part (a) (i), candidates were required to identify the parts of the chest cavity involved in breathing, while in Part (a) (ii) and (iii) they were to indicate the positions of the diaphragm and rib cage while breathing. Part (a) was generally well done as most candidates were able to identify the parts and gained at least three of the six marks.

In Part (b) (i) most candidates indicated the correct location of the alveoli. However, in Part (b) (ii) the two major blood vessels branching to form capillaries in the alveoli were often given only as arteries and veins and not more specifically as pulmonary arteries and pulmonary veins. Students should be more precise in their language and be able to use biological terms with facility. In Part (b) (iii), they were required to explain how oxygen in the lungs moves to the rest of the body and into cells where it is needed. Few candidates gained full marks. Most could not provide an explanation using scientific terms and did not use key words such as 'haemoglobin' and 'diffusion'. However, among the good responses was 'when deoxygenated blood enters the lung from the right side of the heart CO_2 is diffused outward, oxygen is diffused in the blood returns to the heart and pumped around the body, O_2 is transported via oxyhaemoglobin in red blood cells'.

In Part (c), most candidates correctly responded to the importance of breathing. However, one noted misconception was that breathing is the same as respiration. The responses to the importance of respiration were generally poor. It was evident that students still have difficulty understanding that respiration takes place at the cellular level. One good response was: 'Respiration is the process where food is broken down by oxygen to carbon dioxide, water and energy. Energy is used for metabolic processes'. In Part (c) (iii) candidates were asked to suggest why plants do not need to breathe, although respiration is important to them. Few candidates gained marks in this section since most wrote about photosynthesis rather than respiration.

Question 3

Question 3 dealt with photosynthesis and respiration and the changes in environmental carbon dioxide concentrations as these processes take place during the day. Performance was satisfactory with a mean of 7 and the highest score: 16 out of 16.

In Part (a), candidates were required to study a graph of the carbon dioxide concentration in the air of a rain forest and describe the changes during the period. Some described the lowering of the CO_2 concentration between 4.00 a.m. and noon but failed to mention the subsequent steady increase, followed by a period of levelling off. The better candidates gained all the available marks by using the available data to state more precisely the amount by which the levels rose and fell. For example, the initial decline was from 5.5 percent to 3 percent. In some cases, candidates gave explanations for the shape of the graph and did not describe the changes in carbon dioxide concentration. They failed to gain the available marks.

Part (b) (i) was well done. Most candidates stated that respiration and photosynthesis would affect the amount of carbon dioxide in the atmosphere. In Part (b) (ii), candidates were asked to explain the changes taking place in the carbon dioxide concentration over the forest between 4.00 a.m. and 4.00 p.m. Although the majority of the candidates named respiration and photosynthesis in Part (b) (i), they were unable to explain the relationship between those processes and CO_2 concentration over the forest. Many focused on photosynthesis indicating that CO_2 concentration would decrease as photosynthesis increased from 4.00 a.m. to noon and failed to mention that respiration would also be taking place but giving off CO_2 at a much lower rate than it is being used in photosynthesis. After noon more CO_2 was released into the atmosphere as the rate of photosynthesis steadily decreased.

For Part (c) (i), candidates were asked to state which environmental factor was mainly responsible for the changes observed over the period 4 a.m. to 4 p.m. The majority of the candidates correctly identified the factor as sunlight. In a few cases, responses indicated that candidates did not understand the term environmental factor.

Performance on Part (c) (ii) was similar to Part (b) (ii) where candidates only provided an explanation for the decline during the first part of the day from 4.00 a.m. to noon without any mention of the remainder of the data provided.

Part (d) required candidates to give three biological reasons for the importance of forests. This was generally well done. Many candidates scored full marks. An example of a good response was:

> 'Forests recycle the air and help to reduce pollution. They produce oxygen and reabsorb carbon dioxide from the air. They provide a habitat for many organisms. They provide a food source for organisms and help to prevent erosion and hold soil together.'

Question 4

Several objectives were examined in this question: the structure and function of the plant cell, distinguishing it from an animal cell, and the basic principles of genetics and osmosis. Performance was satisfactory with a mean of 6 and the highest score: 13 out of 13.

In Part (a), candidates were required to identify the structures of the plant cell. The majority of the candidates were able to identify at least 2 of the 4 structures. A common error was that the chloroplast was often identified as the mitochondrion. In addition, a few candidates incorrectly labelled the cell wall as the cell membrane.

In Part (b) candidates understood the functions of the chloroplast while the common response for the vacuole was storage; very few mentioned turgidity and no one wrote transport.

In Part (c), candidates were asked to state two ways that the plant cell is different from a human white blood cell. Almost every candidate was able to score at least 1 mark, correctly noting the presence of the cell wall, chloroplast or large central vacuole which does not occur in the blood cell.

In Part (d), the number of chromosomes of the plant cell was given as 12 and candidates were required to determine the number of chromosomes that would be present in the petals and pollen grains of its flowers. A few candidates gave unexpected responses such as thousands and thousands in the petal. A common response, however was 46 in the petal and 23 in the pollen grain. This was probably due to simple recall of irrelevant information without an understanding of the basic concepts in genetics and cell biology. The petal has somatic/vegetative cells with the diploid chromosome number 12, while the pollen grain is a reproductive cell which has the haploid number of chromosomes 6, resulting from meiosis.

In Part (e) candidates were asked to describe what would happen if the plant cell were placed in a 50 percent sugar solution. It is evident that the concept of osmosis is not well understood since this question gave a large number of candidates difficulty. Many felt that since the sugar solution was more concentrated it would diffuse into the cell causing it to swell. However, those who understood the principle of osmosis with regards to plant cells did justice to the question. A notable response was

> 'Water will move out of the cell sap into the more concentrated solution making the solution outside dilute. The process of osmosis will occur. As water leaves the plant cell it become(s) more flaccid and if the cell membrane tears away from the cell wall, the cell may be plasmolysed'.

Question 5

The topics dealt with in this question included genetics; plant breeding (artificial selection) and pollination. Performance was below the standard with a mean of 4 and the highest score: 13 out of 14.

In Part (a) (i) candidates were asked the meaning of the term homozygous. Responses were generally poor. Some candidates believed that similar alleles were found in the same chromosome and also confused homologous with homozygous. Part (a) (ii) was poorly done A common problem was to show the parents' genotypes with different letters, for example LS, this response indicates that candidates failed to recognize that the question stated that the parents were true breeding (homozygous), or based on the responses to Part (a) (i) many did not know the meaning of the term homozygous; consequently, their responses were incorrect. In the question the small flowers were dominant, but a few candidates used the recessive alleles for the small flowers. It is necessary for students to follow and apply the international conventions in genetics where the upper and lower case of one letter represent dominant and recessive alleles of a gene respectively. For example flower size: Ss not Sr, or SR.

In part (a) (iii) candidates were asked why the breeding programme had to continue for many generations. This was challenging for many candidates though understanding the stimulus material would have allowed candidates to provide the correct response as it showed that the large flowers and large leaves were only produced after several generations. At the end of the process, both characters were true breeding.

Part (b) (i) was done very well. Candidates were able to state that one advantage of having large flowers is to attract more insects for pollination and having large leaves allows absorption of more light for photosynthesis. Part (b) (ii) was also fairly well done. However, a few candidates did not read the question properly and gave advantage to the plant and not the flower farmer. For Part (b) (iii), candidates were asked to give one other characteristic of the new flower that the flower farmer would want and to say why it would be important to the farmer. This was fairly well done, although a few candidates explained why it was important to the plant and not to the farmer. Many candidates correctly stated the characteristic 'resistance to disease' and that it was important to ensure the crop was not wiped out by disease so the farmer will make more money.

PAPER 03 – EXTENDED ESSAYS

Paper 03 consisted of three sections, each section consisting of two questions from which candidates were to choose one. Candidates were required to write extended answers to the questions. Performance on this paper was unsatisfactory; the mean mark was 21.42 or 35.70 percent. Candidates' performance was marginally depressed when compared with their performance in 2004 where the mean was 22.33 or 37.22 percent.

Question 1

This question tested the difference between diffusion and osmosis, the role of osmosis in transport in a plant, the importance of osmosis in controlling diabetes and the reasons for adjusting the diets of patients with malfunctioning kidneys. The question mean was 4 out of a total mark of 20.

In Part (a) (ii) candidates were required to describe two differences between osmosis and diffusion. Very few candidates gave complete comparisons. One common misconception was that only gases diffuse. In Part (a) (ii) they were asked to describe how osmosis is used in transport by a plant. Many referred to the osmotic uptake of water by root hairs from soil solution. No reference was made to the soil solution being less concentrated than the cell sap which allows osmosis to take place; or that water moved from cell to cell across the roots through partially permeable membranes; and from the xylem vessels to the mesophyll cells of the leaves - all by osmosis.

Part (b) (i) of the question presented a challenge to all candidates. The performance was poor. Here candidates were required to explain why osmosis in cells is an important part of the control of diabetes. Candidates were expected to explain that in diabetics blood sugar levels become elevated; blood concentrations become higher than in surrounding cells; water will move out of these cells into the blood by osmosis because their contents are less concentrated than the blood. The cell contents become dehydrated, metabolism is disrupted and the cells may eventually die.

In Part (b) (ii) candidates were required to explain why diabetes is considered a physiological disorder and not a nutritional disease. Most candidates wrote good responses, recognising that diabetes was caused by a physiological breakdown in the functioning of the pancreas and not by poor nutrition.

Part (c) (i) asked candidates why patients whose kidneys had stopped working efficiently were put on strict diets with little salt, very small quantities of meat, beans and peas and given very little water when they were thirsty. It was evident that candidates had some knowledge of kidney function but were unable to interpret the question, or to apply and articulate their explanations with clarity using appropriate scientific jargon. Urea from the metabolism of proteins and a high level of salt and water would increase the work-load of the kidneys. Part (c) (ii) candidates were asked to suggest how a kidney machine is able to 'clean' a patient's blood. This was difficult for most candidates. Few understood that the waste products in high concentrations would diffuse from the blood, across the membranes, into the fluid and that water levels would be adjusted depending on its concentration in the blood relative to that in the fluid.

Question 2

This question tested the candidates' knowledge of the structure of the red and white blood cells, the role of the white blood cells; the functions of the skin and blood in protecting the body when cut; differences between the skin of a human and the epidermal tissue of a leaf and the role of the transport system of a plant in spreading disease causing organisms throughout the plant. The question mean was 8 out of a total mark 20.

Performance in Part (a) (i), on this part of the question was unsatisfactory. Comparisons were seldom made, although some details of the structure of red and white blood cells were mentioned. Performance in Part (a) (ii) was fair. Candidates were required to describe the role of white blood cells, but no one mentioned that 'white blood cells confer immunity and immunity may be long-lasting'.

Candidates' performance in Part (b) (i) was poor. They were asked to describe one way in which the skin offers protection. A complete description such as the following was seldom given. The malpighian layer of the skin provides protection from the sun's ultra violet rays. The skin contains sensory cells which respond to adverse stimuli; glands which produce sweat and blood vessels that dilate to prevent overheating of body. In Part (b) (ii) candidates were asked to describe how the skin and blood work together in order to protect the body when it is cut. Candidates were knowledgeable about mechanisms involved in the formation of a blood clot and scab. This part of the question was very well done.

In Part (c) (i) performance was generally poor. Candidates were required to identify two differences between the structure of epidermal cells of a leaf and the human skin. Many could not give two comprehensive differences. They were more knowledgeable about the structure of the epidermal layer of the leaf than the skin. Candidates were expected to make reference to the fact that epidermal tissue is a single tissue while skin is made up of many tissues. The outer covering of the leaf is non-cellular, but the skin's outer covering is cellular. The epidermis of the leaf is made up of living cells but the outer covering of the skin is made up of dead cells. Performance in Part (c) (ii) was satisfactory. Candidates were expected to explain the mechanisms of transport in a plant which would allow a disease to spread. Explanations were not developed in a logical manner, but candidates were able to score some of the available marks.

Question 3

This question dealt with ecology and the environment. Performance was satisfactory with a question mean of 9 out of a total mark 20.

Performance in Part (a) (i) was generally fair. In some cases candidates confused the physical and biotic factors. When referring to one of the factors, both types of examples were given. Acceptable examples of physical factors included: temperature, soil, wind, rain and humidity. Examples of biotic factors included: predators, herbivores, carnivores, trees/forests, man, bees, etc. Part (b) (ii) required candidates to explain how a biotic factor might affect one of the physical factors in the habitat. This was well done by some candidates but others seemed not to have been

familiar with the concept that a biotic factor could affect a physical factor and vice versa. For example, trees may affect shade, temperature and change humidity. Animal waste will change the soil's nutrient content and texture.

Performance in Part (b) (i) and (ii) was satisfactory. Candidates were required to give two methods of dispersal that brought the plants back to the area and to explain why plants returned before the animals. In a few cases, candidates confused dispersal with pollination but most recognized the importance of plants as producers in food chains and webs and thus their necessity to return before animals.

Performance was again satisfactory. Candidates' were aware that if the soil was damaged plant growth would be affected and consequently animals would not be able to inhabit the area. In Part (c) (ii) candidates were knowledgeable about the long-term effects of loss of a large part of a forest, for example loss of species; extinction of endangered species; and deterioration of soil and air quality.

Question 4

This question tested the candidates' knowledge of diseases; their mode of transmission; and the AIDS epidemic. It was the more popular of the pair of questions in Section B, and overall performance was fair. The question mean was 8 out of a total mark 20.

In Part (a) (i) candidates were required to link the frequency of diseases to their methods of transmission. Candidates were unable to give logical responses and merely gave definitions and examples. They did not frame their responses by stating the characteristics of pathogenic diseases cause more persons to have them than inherited diseases. In Part (a) (ii), candidates were required to use their knowledge of genetics to show that heterozygous parents who are carriers for a disease could produce a child with the homozygous recessive genotype where the disease is manifested.

Part (b) (i) sought to test candidates' knowledge of the characteristics of AIDS that cause it to be a deadly disease. While some candidates were aware that HIV affects the white blood cells and the body's ability to fight disease, many simply wrote the symptoms of AIDS without linking to the fact that the body's defence is breached and other diseases become fatal.

In Part (b) (ii) candidates were asked whether they thought it was possible for humans to eventually become resistant to AIDS and to give a reason for their response. Candidates' responses did not focus on the acquisition of resistance through artificial selection but instead mentioned the virus mutating, thus making resistance difficult.

Part (c) asked candidates to agree/disagree with the seizing of plants brought into a country without permission and isolating persons with AIDS. Most agreed that the former was a good practice because the plants could carry infectious diseases. However, they disagreed that persons afflicted with AIDS should be isolated positing that it is inhumane except in cases where persons wilfully spread the disease to others.

Question 5

The objectives tested in this question included digestion, absorption, enzymatic reactions and the diet. It was the more popular of the pair of questions and performance was satisfactory. The question mean was 7 out of a total mark 20.

In Part (a) (i), candidates correctly identified the products of digestion of bread, eggs and butter. However, in Part (a) (ii) many were unable to state the fate of all the end products of digestion. In many cases only one of the possible responses for each end product was given. Responses such as the excess amino acid being converted to urea or the fatty acids and glycerol being absorbed into lacteals or bloodstream were hardly stated.

Part (b) described a situation where a student investigating the actions of the enzyme lipase places a piece of fat in lipase solution and left the test tube in an air conditioned room. Candidates were asked to explain why the student did not get the results he expected. Many focused on the temperature and only few mentioned pH and size/surface area. Further, even when one factor was given, no explanation was provided for the enzyme's inactivity as the candidates were required to do. This underscores candidates' inability to interpret questions and to provide logical, complete responses.

In Part (c), candidates were knowledgeable about the reasons why people should reduce fat in the diet and why fat should not be completely eliminated from the diet. Fat as an energy source and for formation of adi

pose tissue were frequently mentioned while its importance for the production of necessary organic substances was not stated.

Question 6

This question examined candidates' knowledge of types of systems in the human body – coordination and reproduction and the role of hormones. Generally candidates' performance was satisfactory. The question mean was 6 out of a total mark 20.

In Part (a) candidates were required to identify two systems in the human body that are responsible for co-ordination and explain the reason why co-ordination is important to living organisms. Many candidates mentioned only the nervous system. Very few mentioned the endocrine system. A common misconception was that the blood system is also involved in co-ordination. Performance in Part (a) (ii) was fair. However, a large number of candidates gave the reason why co-ordination is important to living things as the need to find food, a mate and protection instead of mentioning - detection of changes in the external and internal environments and responding appropriately to changes.

For Part (b), a discussion was required on how low oestrogen levels would affect a 7 year old girl's future life. While performance was fair, some candidates failed to give in-depth analysis of the problem in a logical, cohesive and clear manner. Their responses were limited. Candidates were expected to mention the abnormal development of the sex organs; effect on the menstrual cycle and possible inability to produce children.

Part (c) (i) candidates were asked to state and explain which hormone was present in greater quantities in birth control pills. This was fairly well done. Most candidates correctly stated that progesterone was the hormone and that it prevented ovulation. However, very few mentioned that the hormone mimics pregnancy. In Part (c) (ii), a situation was presented where an ovum was removed from one woman, fertilised in a test tube and the embryo implanted in the uterus of another woman. Candidates were required to suggest three problems that may be associated with the procedure. Performance was fair and the common responses included rejection of the embryo and parental rights. Few mentioned the difficulties associated with harvesting the eggs.

PAPER 04/2 – ALTERNATIVE TO SBA

This paper consisted of three compulsory questions, which tested the practical skills areas: planning and design; observation, recording, reporting; analysis and interpretation; drawing and measurement and manipulation. Performance was generally below the required standard.

Question 1

In this question candidates were expected to draw and label a chive plant, make detailed observations on a single leaf, plan and design, carry out and report on an investigation; and draw conclusions based on additional information provided. Performance was less than satisfactory. The question mean was 12 out of a total mark of 30.

In Part (a) the performance was poor. Drawings were not accurate; and lines were fuzzy. Lines used for labelling were not drawn with a ruler and were too short. Labels were not printed. The title, magnification and view of the drawings were seldom stated and where stated were incorrect. For example, some candidates wrote 'A Diagram of Specimen A' instead of 'Drawing of the External View of a Chive Plant'.

Part (b) of the question required candidates to give a description of a leaf of the plant. The responses were generally vague; few candidates identified the longitudinally running veins and the white rolled leaf base.

The performance on Part (c) (i) of the question was satisfactory, although there was seldom any logical sequencing in the method. Many candidates observed a negative starch test, yet inferred that starch was present. They obviously made some assumptions about the expected results. In Part (c) (ii) candidates were expected to perform a test for a reducing sugar using Benedict's solution and they were to compare their results with those in Part (c) (i). This was difficult for most candidates. They did not know how to use the new information given along with their previous findings to come to a logical conclusion. The expected response was - a positive result for non-reducing sugar was obtained, there was no starch in the leaf of the chive plant therefore sugar (sucrose) is produced in photosynthesis and not starch.

Question 2

In this question candidates were given diagrams of several pieces of equipment and materials and were asked to show by drawing how one would

assemble them to demonstrate the positive and negative response of small organisms to light and dark conditions. Performance on this question was poor.

Examiners expected candidates to show the Petri dishes divided into four quadrants, each with a different set of conditions created with the materials illustrated in the figure. Very few candidates were able to provide the expected response. Many divided the dish into only two quadrants while others had no divisions at all. In some cases, the wood lice were placed in the container that held the water. Most candidates were unfamiliar with the procedure and could not design an experiment using the apparatus and materials provided. In the view from above examiners expected candidates to use a circle to represent the Petri dish. The circle would be divided into four quadrants of equal size with materials to provide the following conditions:

- damp and dark (moist cotton wool in the quadrant and covered with black paper)
- damp and lighted (moist cotton wool in the quadrant and uncovered)
- dry and dark (dry cotton wool in the quadrant and covered with black paper)
- dry and lighted (dry cotton wool in the quadrant and uncovered)

The side/lateral view would show a rectangle to represent a cross section of the Petri dish. The gauze would divide the rectangle into lower and upper halves and the petri dish cover would be situated over the dish like a wide 'n'. The lower section would be divided into two parts, right and left of centre, with moist cotton to the left or right and dry cotton wool on the other side. Paper would be drawn over one half of the Petri dish cover. The organisms would be placed near the1 centre of each diagram, resting on the wire gauze above the quadrants.

In Part (b) (i), candidates were expected to suggest why all the organisms did not go to the dark, damp area. Few provided the following expected responses: sensory system not working well; organisms damaged during handling; damaged wood lice had difficulty moving or died. In Part (b) (ii) more candidates were able to obtain marks by correctly stating the risks to the organisms that were unable to respond by moving towards dark, damp areas. The question mean was 3 out of a total mark of 12.

Question 3

In Part (a) (i) not enough candidates were able to take correct readings from the three measuring cylinders. They also had difficulty doing basic calculations to determine the proportions of soil particles in Plot I. In Part (a) (iii) precautions, such as ensuring glassware was clean, were not credited. Examiners expected precautions such as: ensure same volumes of water used; shake mixture vigorously; allow same time for settling. The term hypothesis was not understood by all, since some candidates gave the aim of the experiment rather than a possible explanation for the observation which could be tested.

In Part (b) (i) candidates had difficulty deducing the aim of the investigation and linking it to a possible observation for Part (b) (ii).

Part (c) required candidates to describe a method to show that the amount of water the soil holds affects growth of the plant. Candidates lost marks if they merely outlined the method. They needed to pay attention to details such as controlling variables. For example: specifying soil type and volume; indicating the manipulated/independent variable (the amount of water) and responding/dependent variable (amount of growth). Some candidates simply stated that they would measure the growth rather than the indicator of growth such as height or number of leaves. The question mean was 5 out of a total mark of 18.