

**CARIBBEAN EXAMINATION COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2008**

**HUMAN AND SOCIAL BIOLOGY**

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**HUMAN AND SOCIAL BIOLOGY**  
**GENERAL PROFICIENCY EXAMINATION**  
**MAY/JUNE 2008**

**Structure of the Examination**

This is the fourth June sitting of the Human and Social Biology examination.

The examination consisted of two external papers. Paper 01 consisted of 60 Multiple Choice items, each worth one mark. Paper 02 consisted of ten structured compulsory questions, each worth ten marks, and four optional structured essay questions, each worth 20 marks. Candidates were required to answer two out of the four optional structured essay questions. There was no School-Based Assessment.

**General Comments**

A total of 25,017 candidates registered for the examination. This represents an increase of approximately 17 per cent.

Approximately 64 per cent of the candidates achieved acceptable grades, Grades I to III. This is an improvement in candidate performance over 2007.

**DETAILED COMMENTS**

**Paper 01 – Multiple Choice**

There was a significant improvement in candidate performance on Paper 01. However, the following topics presented some challenges to the candidates:

- Blood clotting mechanism – fibrinogen changing fibrin in the presence of thrombin.
- Test for protein.
- Siting of a pit latrine.

**Paper 02 – Structured Essay**

Candidate overall performance improved on Paper 02 in 2008 when compared with 2007. However, candidates need to improve on the Use of Knowledge Profile when answering questions.

**Question 1**

This question tested candidates' knowledge of photosynthesis. For Part (a), candidates were required to complete a word equation for photosynthesis, and to give one condition necessary for photosynthesis to occur (apart from chlorophyll). This was well done.

For Part (b) (i), candidates were asked to list the steps involved in testing a leaf for the presence of starch, given an experiment to investigate photosynthesis. Part (b) (i) required candidates to suggest the results of the experiment. Candidates performed poorly on this part of the question, demonstrating a lack of knowledge.

### **Recommendations**

Candidates are advised to:

- prepare thoroughly for the examination
- follow the instructions given
- pay attention to the number of marks for each part of the question, as well as use the spaces provided for the answers as a guide in answering the question
- express themselves clearly
- answer the questions asked.

### **Question 2**

Candidates' knowledge of plant and animal cells was required in this question. Candidate performance was satisfactory to good. For Part (a), candidates were given a table to complete to show the differences between a plant and an animal cell. This was a recall question, since candidates were given the words from which to choose the correct answers. Candidate performance was good.

Part (b) required candidates to describe the structure and function of the cell wall and cell membrane. This proved difficult for candidates. Most were more familiar with the function than with the structure.

Part (c) was known by most of the candidates. It tested candidates' knowledge of the energy requirement of muscle cells.

### **Recommendations**

- Teach structure using models.
- In assessing students, teachers should place more emphasis on structure since function is widely known.
- Teachers need to develop more hands-on skills in the teaching and learning process.
- Teachers need to develop critical thinking skills, so that students will be able to analyze information.
- The learning experience should be both theoretical and practical.
- Teachers should encourage students to read widely on the topic, in order to garner as much information as possible.

### **Question 3**

Candidates' knowledge of the nervous system was required in this question. Performance was average.

For Part (a), candidates were required to say what is a reflex action, and for Part (b), the difference between a reflex action and a voluntary action. Most candidates were able to correctly answer these

two parts of the question. Some candidates, however, defined a reflex action as the antagonistic action between muscles that move the limbs.

For Part (c), candidates were given two scenarios, for them to explain the action of the nervous system to produce the responses (the knee jerk and blinking). This required a description of the spinal reflex and the cranial reflex. Many candidates were not able to ‘describe’ the actions. Many candidates were too general in their responses and did not use the biological terms necessary in their answers, for example, stimulus, sensory neurone, motor neurone.

### **Recommendations**

- A glossary of the terms (measureable verbs) is provided in the syllabus. Teachers are encouraged to use these terms to give students the practice they require in answering questions.
- Teachers must emphasize biological terms during their instruction.

### **Question 4**

This question tested candidates’ knowledge of the circulatory system. This question was poorly done.

Parts (a) (i) and (ii) were both poorly done. Candidates defined lymph as ‘drained tissue fluid’ and did not state the acceptable answer – lymph is the liquid in lymph vessels. Part (a) (ii) posed even more difficulty, as candidates confused the formation of lymph with the production of white blood cells and sometimes phagocytosis.

Parts (b) (i) and (ii) were fairly well done. Weaker candidates failed to state that the tonsils contain lymph which have lymphocytes to fight bacteria, and had the misconception that the tonsils produce lymph and white blood cells.

Part (c) (i) required candidates to describe the function of the tricuspid valve. This part was generally well answered.

For (c) (ii), candidates were unable to relate the structure of the tricuspid valve to its function. Candidates failed to state that the tricuspid valve tendons are tough connective tissues which prevent the flaps from being forced back into the atrium. Instead, candidates compared the structure of the tricuspid valve to a doorway or gate.

Candidates also incorrectly answered that the tricuspid valve is made up of three valves rather than three flaps.

For (c) (iii), candidates vaguely responded that a weak tricuspid valve causes a ‘lack of energy’ or ‘lack of oxygen’: A detailed response expected for this question is as follows:

- less blood is pushed into the lungs by the ventricle
- therefore, less oxygenated blood will reach the cells for respiration, producing less energy.

### **Recommendation**

- Teachers need to emphasize the structure and function of the lymphatic system and use video presentations so that this topic can be better understood.

### Question 5

Candidates' knowledge of respiration was required in this question. Performance was average.

Part (a) (i) asked candidates to complete the word equation for aerobic respiration. Part (a) (ii) tested candidates' knowledge of the definition for anaerobic respiration. Both parts were well answered.

Part (b) required the application of knowledge of respiration. Performance was below average. Part (b) (i) tested candidates' knowledge of the effects of cigarette smoking. This was more widely known than (b) (ii), which tested knowledge about the causes and symptoms of asthma. In many of the responses, it was evident that candidates did not pay attention to the stem of the question. Therefore, responses outlining the effects of cigarette smoke were given for (b) (ii).

In each case, candidates tended not to explain why a chronic smoker (b) (i) or an asthmatic person (b) (ii) may have difficulty in breathing. Instead the effects of each, and in some cases the treatment for asthma, were given.

A number of candidates misunderstood the term 'chronic smoker'. They wrote about smoking marijuana, which in some cultures is colloquially called 'chronic'.

Candidates wrote extensively on the effects of nicotine.

A good response should have included:

- (b) (i) A chronic smoker has difficulty breathing because the build-up of tar can lead to a breakdown in the alveolar structure, and the development of much larger air spaces. This results in the drastic reduction in the surface area of the lung. As a result the person is always short of oxygen.
- (ii) 'Free flow of air is restricted; the bronchial tubes constrict, thus affecting breathing; increased mucus secretion also blocks the air passage'.

### Misconceptions

There were a number of misconceptions including:

- Smoke directly affects the circulatory system, liver and kidneys.
- Animals breathe in oxygen. Oxygen was used interchangeably with air.
- Cilia referred to as villi.
- Bronchi/bronchioles referred to as blood vessels.
- Trachea referred to as oesophagus.
- Asthma is an illness resulting from getting wet, doing exercise and inhaling allergens.
- Asthmatics have difficulties breathing if they are not using a 'pump' or asthma inhaler.
- Asthmatics have smaller or underdeveloped lungs.
- Candidates confused the absence of oxygen with the absence of light in photosynthesis.

- Anaerobic respiration occurs in the absence of light.
- Anaerobic respiration occurs only in plants.
- Anaerobic respiration takes place in the absence of energy.
- Anaerobic respiration takes place only during aerobic exercise.
- In anaerobic respiration, food is combined with carbon dioxide instead of oxygen.

### **Suggestions for teachers**

- Invite resource persons to/for talks/workshops.
- Use visual aids, for example, films or models.
- Allow students to be involved in role play.
- Allow students to do research project followed by meaningful worksheets.

### **Question 6**

This question tested the candidates' knowledge and use of knowledge of homeostasis, feedback mechanism, and water and temperature control as outlined in Section B 6.5, 6.6, 6.8, 6.10 of the syllabus.

This question was attempted by the majority of candidates. The performance on the question was poor.

In Part (a), the candidates restricted their responses to the maintenance of body temperature, instead of the expected all encompassing definition of homeostasis. Homeostasis is the maintenance of a constant internal environment in the human body.

In Part (b), the majority of the candidates' explained gaseous exchange without reference to the correct response to feedback mechanism – faster and deeper breathing; increased supply of oxygen, and the removal of carbon dioxide. Many mentioned increased heart rate and circulation. Many candidates explained anaerobic respiration, production of lactic acid, and pulmonary circulation, for which they were not awarded any marks.

In Part (c) (i), the majority of the candidates were able to state the use of water to 'cool the body through sweating'. Most candidates did not explain evaporation of sweat as a means of cooling the body. Two common misconception: drinking water cooled the organs in the body; and 'body heat leaves the body through the pores with the sweat'. Few candidates stated that increased breathing and water vapour lost through the lungs, as a method of controlling body temperature.

In Part (c) (ii), the majority of the candidates explained that less urine was produced because the water was used for 'sweating' and for 'cooling down the body'. Candidates did not state that the kidneys produced less urine to preserve the ions and salts, which are lost by sweating. Many lengthy responses were given explaining how less urine was produced—the role of ADH and the re-absorption of water, and this was not asked in the question.

## **Recommendations**

- Emphasize
  - (i) breathing as a means of controlling body temperature
  - (ii) the function of the kidney to conserve water.
- Provide ample opportunities for students to practise answering questions to differentiate between 'how' and 'why' responses.
- Use varied methods of teaching the concept of negative feedback and provide many examples to aid understanding.
- Use experiments and models to explain temperature control.

## **Question 7**

This question was designed to test the candidates' knowledge of the reproductive system. Candidate performance was average.

In Part (a), a diagram representing the female reproductive system was presented, and candidates were required to identify two labelled points. Most candidates were able to identify the ovary. However, weaker candidates identified the ovary as an egg and the cervix as the uterus.

Generally, Part (b) was well done, as candidates were able to identify, one birth control method for males.

In Part (c) (i), candidates were required to outline the process of fertilization. Most candidates were able to identify that the sperm swims up to the oviduct and if the female gamete is present, one sperm may penetrate the egg. There were few responses which indicated that semen is released on ejaculation and that the sperm combines with the nucleus of the egg. There were misconceptions that fertilization takes place inside the ovary, as well as that the fallopian tube and oviduct are two different structures. Candidates used the word ovary, instead of ova or egg to describe the female sex cell. They also used the term fertilized egg for mature egg.

Part (c) (ii) required candidates to explain how a female can become pregnant on the first occasion she has sexual intercourse. Many failed to mention that once sperms are present and a female ovulates, pregnancy can occur. There were misconceptions that a female can become pregnant at any stage during the menstrual cycle, as well as engaging in sexual intercourse without using contraceptive would most likely result in pregnancy.

## **Recommendation**

It is recommendation that students familiarize themselves with the spelling of biological terms. Also, teachers use visual aids so that students can conceptualise the content.

## **Question 8**

This question assessed candidates' knowledge of genetics. Performance was below average.

Part (a) required candidates to complete sentences based on information about cells. Candidates performed well.

In Part (b), candidates were asked to deduce the genotype of individual. Guidelines were given for the genetic cross for candidates to sequence their responses logically. Many candidates were able to derive the F<sub>1</sub> generation. However, some difficulties were observed:

- Some candidates did not complete the information for ‘gametes’.
- Some candidates did not understand the word ‘genotype’ and hence answered with words such as ‘heterozygous dominant’ or ‘heterozygous recessive’.
- Even though candidates were asked to use ‘D’ to represent the dominant gene for dimples, some candidates used ‘T’.
- A few candidates assumed that the characteristic was sex-linked.

In Part (c), candidates were required to say whether the genes determining the presence or absence of dimples also determined the gender of a person. This was poorly done. Most candidates did not know that gender was determined by sex chromosomes. Many candidates wrote that the male chromosome was ‘superior’, ‘dominant’ or ‘stronger’ compared to the female chromosome, and was the sole factor for sex determination. Acceptable responses included: sex is determined by sex chromosomes/presence of X and Y chromosomes/the 23<sup>rd</sup> chromosome/XY chromosomes in males and the XX in females.

### **Recommendation**

Teachers should:

- Expose students to a wider range of genetic crosses, using different symbols.
- Spend more time explaining and using the terminology, such as, dominant versus recessive, heterozygous versus homozygous, genotype versus phenotype, and sex-linked characteristics.

### **Question 9**

This question assessed candidates’ knowledge of AIDS, tuberculosis, and reducing the spread of mosquitoes. Performance was good. In Part (a) (i), which required candidates to state two methods of limiting the spread of AIDS and tuberculosis, candidates generally, responded well.

Part (a) (ii) presented difficulties for the candidates, as most of them could not suggest how tuberculosis was related to AIDS.

A good response should have included:

With AIDS the human immune system is compromised, hence a number of diseases which the body would normally fight off, takes hold. Tuberculosis is one such disease.

Candidates performed very well on Part (b) – controlling the spread of mosquitoes.

### **Recommendation**

Teachers should:

- not teach the diseases in isolation, but should teach students to make the connections
- reinforce concepts taught, to assist students in the learning process.

### Question 10

This question was based on Section E of the syllabus, and tested Syllabus Objectives 13, 15, 16 and 26. In general the question was poorly done, as the mean score was four out of the ten marks allotted for the question.

Part (c) of the question was done well as most candidates were able to identify that the microorganisms would be killed if disinfectant was added to the sewage. Some candidates, however, had the misconception that the plant being referred to was a producer rather than the sewage plant.

Parts (a) and (b) of the question were poorly done by most candidates. They were only able to identify faeces as a part of sewage, and did not give the definition of sewage as faeces, urine and household waste water. Candidates were unable to differentiate between sewer and sewage, as most students saw sewage as a place rather than what it is. For Part (a) (ii), candidates were unable to define biodegradable. Most candidates had the misconception that it meant non-biodegradable. An acceptable answer would have been, ‘being able to be broken down by microorganisms’.

For Part (b), candidates viewed the question in terms of pollution. They did not apply their knowledge of the concept to explain how the oxygen content, the water and the food chain were affected. Some had misconception of the sewage preventing oxygen from diffusing into the water.

An acceptable answer in terms of oxygen content is:

Sewage provided food for microorganisms and microorganism populations expand rapidly. This depletes the oxygen in the water, causing life in the water to die.

An acceptable response for food chain should include:

Sewage can block out the sunlight, and this will cause plants in the water to die. This destroys the starting point of some food chains, thus affecting plant and animal life.

### Recommendation

Take students on a field trip to sewage plant. This concretizes the concept.

### Question 11

This question tested Section B, Syllabus Objectives 4.1 to 4.12, and Section D, Syllabus Objective 9 (i). Generally, candidates' performance was below average. Parts (a) and (c) were done creditably. Part (b) presented the most challenge. Candidates focused more on breathing mechanism as opposed to gaseous exchange. Some candidates' paraphrased the preamble given in the question. Under the heading ‘the role of blood in the lungs’, candidates did not confine their answers to the lungs but also included circulation of the blood to the heart and around the body. Many candidates described the respiratory system, without relating the structure of the lungs to its function in gaseous exchange.

### Misconceptions

- Characteristics of respiratory surface, the alveoli, were applied to the lungs generally.
- Many candidates confused gaseous exchange of oxygen and carbon dioxide and indicated the ‘used oxygen’ becomes carbon dioxide.

- Candidates were unable to identify the causative organism of the flu as a virus. Many responses named bacteria, pathogen, and weather conditions.
- Part (c) (iii), was generally well done. However, some candidates indicated that exercising and ‘sweating out’ the fever would relieve symptoms of the cold/flu.

### **Recommendation**

- Use internet to promote greater understanding of the structure of the lungs and how it relates to its function in breathing and gaseous exchange.
- Use models of alveoli to show increase in surface area.
- Invite expert personnel/resource persons to discuss/eliminate misconceptions about what would relieve of the symptoms of the flu.
- Debates on ‘home remedies’ and their effectiveness versus modern medicine.

### **Question 12**

This question assessed candidates’ knowledge of digestion and constipation. Performance was satisfactory.

For Part (a) (i), most candidates knew the function of HCl, (kills bacteria/stop the action of salivary amylase), pepsin (breaks down protein to polypeptides) and renin (helps in the digestion of milk).

For Part (a) (ii), some candidates thought that bile was produced in the gall bladder, instead of in the liver.

Part (b) (i) presented some difficulty for candidates who could not distinguish between egestion and excretion.

A correct response should have included:

Faeces consists of food materials that have not been metabolized, therefore, egestion occurs, not excretion.

In Part (b) (ii), candidates were vague in their responses as to what occurs in the colon to cause constipation. Candidates should have said:

When faeces remain in the large intestines for too long, too much water is removed from it. This then becomes hard, compacted and difficult to evacuate from the body.

Candidates were well able to explain the effects of constipation, Part (b) (iii), and ways to ease constipation (more roughage and water needed in the diet).

### **Recommendation**

- Students need to use biological terms, not colloquialism.
- A distinction should be made when using the term ‘carbohydrate’, since cellulose/fibre is required to prevent constipation.

### Question 13

This question tested Syllabus Objectives B 5.4, B 6.6 and B 6.7 of the syllabus. The question was poorly done with a mode of approximately 5. Candidates found it difficult to recognize the links between the topics nutrition and homeostasis, tested in the question.

Part (a) (i) tested the candidates' ability to identify food nutrient. In this part of the question, candidates had difficulty in identifying the food nutrient tested, as a result this part was poorly done. The food nutrient tested was reducing sugar.

Part (a) (ii) tested candidates' ability to identify the correct colour change for the food nutrient tested. The expected colour change for the food nutrient tested with Benedict's solution was brick-red.

Part (a) (iii) asked candidates to identify the colour change expected with a negative test, using Benedict's solution. The correct response expected was a blue colour.

Part (b) of the question asked candidates to explain how a healthy body maintains its blood sugar levels after a meal rich in carbohydrates is eaten and several hours after the meal. This part was highly misinterpreted. Candidates wrote extensively on the digestion of carbohydrates before, in some cases, discussing the homeostatic mechanism of the glucose. A typical example:

After a meal rich in carbohydrates is eaten, salivary amylase in the mouth begins to break down the starch. The food then travels to the duodenum via the oesophagus and stomach. In the duodenum the pancreas secretes pancreatic juice which further digest starch breaking it down to simpler sugar (glucose) so that the body can absorb it in the blood. The pancreas secretes the hormone insulin which regulates the blood sugar.

The correct response should have explained the negative feedback mechanism of glucose level in the blood. A typical answer should have included:

- After a meal rich in carbohydrate is eaten the blood glucose level increases, insulin is released from the pancreas.
- The uptake of glucose by the body cells is increased.
- Excess glucose is converted to glycogen in the liver facilitated by insulin.
- Insulin also converts some glucose to fat and increases the oxidation of sugar.
- Several hours after the meal is eaten the blood glucose level starts to fall.
- The pancreas secretes the hormone glucagon which acts on the liver cells to cause the breakdown of glycogen to glucose, thus restoring normal sugar levels.

Part (c) of the question tested candidates' knowledge of the symptoms and management of the disease diabetes mellitus. Most candidates were able to gain marks in this part of the question. However, there were a few misconceptions. One such misconception is that diabetes results from eating too much sweet.

Candidates also had difficulty in differentiation between signs and symptoms.

#### Question 14

This question tested Syllabus Objectives E 2, 5, 9, 11, 12; D. 9

Question 14 was a popular question but it was not well done.

Part (a) (i) and (ii) were well answered. Candidates were able to state how water is purified in the home; they were also able to list sources of water pollution.

A few candidates had the misconceptions that straining and filtering were the same and that freezing could be used to purify water. Purification methods that were accepted included: boiling, adding bleach, purification tablets and filtration systems.

Part (b) (i) was badly done. Candidates were unable to state the causative agents of diseases spread via faecal matter or diseases caused by parasites. Some misconceptions included:

- Diarrhoea is a disease.
- Tapeworm infestation can occur by drinking contaminated water.

Candidates did not read the question carefully and most of them wrote about diseases spread by mosquitoes.

Diseases which were accepted were as follows:

- by drinking contaminated water – typhoid, cholera, amoebic dysentery, poliomyelitis
- by parasites – anaemia, schistosomiasis, ringworm.

In Part (b) (ii), candidates were not able to list treatments of diseases. The answers were vague, for example, stating ointment instead of antifungal cream, medicine from the doctor instead of antibiotics, water instead of rehydration fluids. Home remedies were not accepted.

In Part (c), many candidates did not realize that the question was asking about the role of plants in the water cycle. Candidates wrote about deforestation and its environmental impact in a general way, with no links to the water cycle, even though the question clearly asked for the impact on the water cycle.

#### Recommendation

- Improve on spelling. The spelling was particularly poor, especially of cholera and diarrhoea. Teachers should encourage students to learn the causative agents, specific symptoms and treatments of the diseases listed in the syllabus. The use of crossword puzzles and similar activities would be useful.
- Students need to practise their analysis and interpretation skills when answering questions.