C A R I B B E A N E X A M I N A T I O N S C O U N C I L

REPORT ON CANDIDATES' WORK IN THE SECONDARY EDUCATION CERTIFICATE EXAMINATION

MAY/JUNE 2007

HUMAN AND SOCIAL BIOLOGY

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GENERAL PROFICIENCY EXAMINATION

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The 2007 examination was the third June sitting of Human and Social Biology, offered at the General Proficiency level.

The format of the examination was the same as in previous years. Paper 01 consisted of 60 Multiple Choice items. Paper 02 consisted of ten compulsory structured questions in Section A, and four essay questions in Section B, of which candidates were required to answer any two.

General Comments

Candidate performance on the overall examination was poor. Performance on Paper 01, the Multiple Choice paper was better than performance on Paper 02, the structured essay paper. Also, candidates performed better on Profile 1, Knowledge and Comprehension, than on Profile 2, Use of Knowledge.

The Examining Committee believes that poor performance was to some extent, as a result of the following:

1. The population of candidates attempting this subject is drawn from all walks of life.

2. Some of these candidates feel that Human and Social Biology is an 'easy' subject and, therefore, do not spend as much time studying. This was especially apparent from candidates' inadequacies in basic knowledge of major organs and systems of the human body, such as the heart and eye.

3. It appears that some schools view Human and Social Biology as second rate science subject, and in so doing little resources are allocated to the teaching of the subject.

DETAILED COMMENTS

Paper 01

Candidate performance on this paper was average. Candidates experienced difficulties with the following topics:

- The nitrogen cycle
- The structure of the upper arm
- Functions of the endocrine glands
- Vital capacity as defined by a graph
- Negative feedback to control blood glucose levels
- Genotype of offspring, given the genetic cross/diagram
- Advantages of solid waste disposal in a landfill

Paper 02

Question 1

This question tested candidates' knowledge of food chains. Performance was poor.

In Part (a), candidates were not able to identify the principles of a food chain as:

- plants form food for small animals;
- small animals form food for larger animals.

Accounting for the variation of available energy in a food chain, a few candidates correctly stated that the least energy is at the level of the consumer, and the most energy at the level of the producer.

For Part (b), candidates were able to give an example of an aquatic food chain.

However, for Part (c), many candidates did not know that the lion would have the highest accumulation of pesticide.

Question 2

This question tested candidates' knowledge of the structure of a long bone, functions of the skeleton and characteristics of bones. Candidates' weakest answers were in Part (a), identifying the labelled parts of the long bone, namely the spongy bone, compact bone and the marrow. In Part (c), many candidates were under the misconception that bone is a dead tissue, only the marrow is alive.

Teachers need to emphasize that although bone stores calcium it is a living tissue due to the presence of bone secreting blood cells and nerves; also growth and repair take place. Students must also be taught the jargon of the subject. More hands-on teaching should be done.

Question 3

Candidates' knowledge of reflex actions was assessed by this question. Performance was fair but responses were marred by poor expression and poor spelling.

For Part (a) (i), only the better candidates gave an accurate and succinct definition for a reflex action – a quick, automatic response to a stimulus. Weaker candidates defined it as reflection of an object, reflection as in deep thoughts, flexing a muscle or reflex angles.

As an example of a reflex action in Part (a) (ii), a stimulus was given instead of the response to the stimulus. A common misconception among the weaker candidates is that all involuntary actions are reflex actions. Therefore, they gave incorrect examples of actions controlled by the autonomic nervous system and the brain.

For Part (b), many of the responses were vague and lacked structure. Some candidates incorrectly stated that the brain was directly involved in the reflex arc. Others focused on the word 'hot' and wrote detailed accounts of homeostatic control of the body's temperature by the hypothalmus.

In order to assist the students to conceptualise this content, it may be useful to engage them in the following activities:

- Build models to represent the pathway (for example, simple circuitry)
- Construct flow charts of the pathway
- Do worksheets – word find puzzles and crossword puzzles.

The majority of candidates were able to answer Part (b) (ii). They easily recognised that reflex actions are important to protect the body quickly from danger.

Question 4

This question assessed candidates' knowledge of gaseous exchange and breathing in human beings. It was poorly done.

In Part (a), most candidates were unable to clearly articulate the concept of gaseous exchange – the movement of oxygen across the alveoli into the red blood cells for circulation, while carbon dioxide is removed.

In Part (c) (i), candidates were under the misconception that high altitude and smoking were responsible for arrest (stoppage) of breathing movements, instead of events like partial drowning and electric shock.

It is recommended that teachers use computer simulation models, practical activities and videos to demonstrate gaseous exchange and the process of resuscitation, effectively. Students need to have access to a wide variety of textbooks to grasp the essence of gaseous exchange rather than regurgitating bits and pieces which are not coherent.

Question 5

Knowledge of vitamins was assessed by this question, which was poorly done by the candidates.

For Part (a) (i), most candidates named fat-soluble vitamins. However, some named sources of vitamins, while others named Vitamins A to H, instead of A, D, E and K.

Part (a) (ii) required candidates to say that fat-soluble vitamins are absorbed with products of fat digestion in the presence of bile salts. Most candidates discussed the digestion of fats and the absorption of glycerol, without linking the absorption of fat-soluble vitamins.

For Part (c), only a few candidates knew that enzymes oxidise Vitamin C. However, most knew that enzymes were destroyed by boiling. Some of the misconceptions which candidates had were:

- hot water preserves Vitamin C
- less Vitamin C is lost because hot water destroys bacteria
- vitamins are lost due to osmosis
- minerals and vitamins used interchangeably
- Vitamin C is sunshine vitamin so it is not easily destroyed by heat
- water increases the volume of Vitamin C.

For Part (c), candidates generally could not differentiate between symptoms and the names of deficiency diseases. Many stated beri-beri, scurvy, and listed treatment of these conditions, instead of writing the symptoms of a deficiency of Vitamin C.

Question 6

This question was designed to test the candidates' knowledge of, and use of knowledge on the topic 'excretion', as outlined in the syllabus. It was not very well done.

Part (a) (i) of the question was generally well done. The weaker candidates confused 'egestion' with 'excretion'. In many cases the candidates defined excretion as metabolic waste or metabolic activity.

Part (a) (ii) was also generally well done. In many cases the candidates named the liver and intestine as excretory organs.

Part (b) (i) was fairly well done. The majority of the candidates indicated that urea and salt were removed, but not excess salt as expected. The removal of glucose was included in many responses.

For Part (b) (ii), the candidates failed to provide the expected response, which was that the kidneys assist in maintaining blood pH by excreting excess hydrogen ions.

Part (c) posed difficulty. In many cases the candidates explained 'heat loss' instead of 'how sweating occurs.' The most frequent response was: sweat is formed in the sweat gland and reaches the surface of the skin through the pores. The candidates who gave complete responses were able to make the association between blood capillaries and sweat glands. Candidates confused sweat glands with sebaceous glands.

Question 7

This question tested candidates' knowledge of the effects of alcohol on the human body. Performance was not very good.

Most candidates responded very well to the effects of alcohol in an expectant mother and foetus, Part (b). Candidates had difficulty in naming the symptom and condition of an alcoholic in Part (a). Most responses were on the social effects of alcohol rather than symptoms such as hallucinations, reduced alertness and lack of co-ordination. There were misconceptions about the effects of alcohol on the heart rate and nerve impulses. Candidates should note that alcohol may cause the heart rate to increase; it is also a depressant drug which slows down the passage of nerve impulses. It is recommended that teachers use video presentations and invite guest lecturers to discuss alcohol abuse. An emphasis should also be placed on the physiological effects of alcohol on an individual, instead of only the common knowledge, such as, bad odour and frequent urination.

Some candidates had the misconception that an expectant mother was not a pregnant woman but one who plans to be pregnant in the future.

Question 8

This question assessed candidates' knowledge of a sewage treatment plant and solid waste management in a landfill. Candidate performance was average.

In Part (a), a diagram representing a sewage treatment plant was presented, and required candidates to explain what happened at three labelled points. The role of anaerobic bacteria in the first settling tank and aerobic bacteria in the filter bed was discussed by only a few strong candidates.

In Part (b) (i), most candidates were able to provide an explanation of the term 'disinfectant' as a chemical/ substance used to kill bacteria/microorganisms.

For Part (b) (ii), candidates were, for the most part, able to explain why spraying a landfill with disinfectant was not advisable, discussing the effect on decomposers; failure of decomposition and landfill ultimately. The effect on the water table/water pollution was also accepted.

Some weaker candidates discussed, instead, the effect of disinfectants on sewage treatment plants and others atmospheric/air pollution, clearly as a result of failure to read the question properly.

In Part (c) (i), most candidates were able to explain that plastics were inorganic and not biodegradable and, as such, a problem in landfills.

For Part (c) (ii), the role of recycling/reduction in the use of plastics, use of alternative packing material and biodegradable plastics was understood by most candidates. It is to be emphasized that burning is not a recommended method for the disposal of plastics.

Recommendations

Field trips to landfills and sewage treatment plants are suggested to give students a first hand view of these facilities.

Simple composting activities are suggested as a means to demonstrate the role of decomposers and as a useful means of managing household waste.

School recycling projects are to be encouraged.

Students can undertake garbage audits in their homes or schools in order to develop an awareness of their role in waste management.

Question 9

Generally, the question was poorly done.

In Part (a) of the question, most candidates were unable to define a "carrier" as it relates to cholera. It was expected that candidates would state that a carrier is a person who carries the bacteria/pathogen for the disease, cholera. Many failed to mention that the carrier in this case is a person/human and instead referred to the carrier as "host", "vector", "agent" or "organism". In some cases the carrier was said to have the disease "instead of carrying the pathogen which causes the disease". Many candidates confused it with the genetic term, some said it is a "disease carried in the genes". The second mark was awarded for stating that a carrier shows no signs or symptoms. A number of candidates were aware that a carrier is not affected by the pathogen he/she is carrying.

Part (b) required the candidates to describe the link between carriers, flood and disease outbreaks. A number of candidates attempted this section but most were unable to show the appropriate link, especially between the carrier and flood. The responses were generally vague and ambiguous. Many said that the "water carried the disease". Very few mentioned how the bacteria from the carrier get into the water. Many spoke of mosquitoes and the transmission of malaria, and rats and leptospirosis. Some candidates believed that cholera was contracted through cuts and from bathing/playing in dirty water.

Part (c) (i) dealt with the treatment that should be administered to Sushma, a victim of cholera, before she visited the hospital, while (c) (ii) asked why the treatment is necessary. Evidently, candidates did not read the question carefully and as such gave answers such as "saline drip", "antibiotics" and "injection". Other responses mentioned that the treatment could be "eating solid food" which would "reduce vomiting" and "boil (drinking) water" instead of "drinking water", "purging– to get rid of bacteria" and, give "dehydration salts" – which "prevent dehydration", "bathing – to remove germs from skin" or "wearing protective clothing" such as "face mask" to prevent "infecting others" by way of "coughing/sneezing" – here suggesting that cholera is an airborne/infectious disease.

It is recommended that teachers:

- emphasize the 'social' aspect of the syllabus and possibly teach it at the beginning of the course instead of at the end or not at all;
- emphasize key terms/ definitions relating to each topic;
- teach students to interpret questions more effectively using past paper questions.

Question 10

This question tested candidates' knowledge of the structure and function of veins and arteries, and of the right atrium and right ventricle.

Candidate performance was poor.

In Part (a), candidates wrote the correct structure and function for both arteries and veins but they did not compare, as the question required.

In Part (b), candidates did not interpret the question correctly, so they compared the right side with the left side of the heart.

Some common misconceptions were:

- veins are larger than arteries
- arteries are larger than veins
- arteries and veins pump blood
- veins carry only deoxygenated blood
- arteries carry only oxygenated blood
- ventricles are valves which stop the backflow of blood.

Question 11

This was a popular question with 50 per cent of the candidates attempting it. The performance on the question was average.

Candidates were able to describe the plant cell exceptionally well for Part (b) (i), and to state characteristics that were similar in both plants and animals in Part (a).

In Part (b) (ii), candidates had difficulty defining the processes, diffusion, osmosis and active transport, the most difficulty being encountered with osmosis. The terminology of high concentration to low concentration or vice versa with respect to osmosis was vague and lead to misinterpretation. Many candidates were unable to give specific examples of materials being transported by these processes, and the use of these materials in the plant. A common misconception was that sunlight diffuses unto the leaf. Weaker candidates thought that energy is transported in active transport and that the energy used is derived from sunlight. Strong candidates were able to give examples of minerals that were actively taken up and then used in the plant, for example, K^+ was used in metabolic activities. Stronger students were also able to realize that a living membrane is needed as well as carrier molecules.

Candidates must be able to appreciate that these processes are all movement of particles from one area to another, and in plants from cell to cell so that materials can move to where they are needed. Candidates should be taught to use the term "area of more water molecules to area of less water molecules", when defining osmosis.

Question 12

This question was not a popular question. It was attempted by about 13 per cent of the candidates. Most of the candidates who attempted the question did very poorly. Teachers need to spend more time teaching the eye, ensuring that all the objectives are fully covered in the syllabus, especially:

- control of light entering the eye and
- formation of images.

Most candidates knew that the process described in (a) (ii) was accommodation. They also knew at least one cause of long sightedness and how it could be corrected in (c) (i) and (ii).

Candidates had difficulties in interpreting (a) (i), where they described the formation of images rather than describing how adjustment is made to see near and distant objects. The correct response should have included the following:

- contracting/relaxing of the ciliary muscle
- tightening or loosening of the suspensory ligaments
- the lens become thicker or thinner.

It is evident that candidates are not clear about what astigmatism is and how it can be corrected. Candidates thought that it is caused by old age, water in the eye or burned muscle. They also felt that the problem can be corrected with the use of a contact lens, surgery, concave and convex lenses or bifocal lens.

The correct response expected for this question should have included the following:

- vertical or horizontal planes appear to bend and
- curvature of the cornea and lens.

Astigmatism can be corrected by wearing a cylindrical lens or by lens that will compensate for the defect which will refract the light in one plane only.

Question 13

This question was based on the topic, AIDS.

The overall performance on this question was fair. Part (a) (i) required candidates to say what is AIDS. Many candidates' responses were not specific, stating that AIDS is a sexually transmitted disease. A more detailed answer recognised the syndrome as a combination of illnesses resulting from a weakened immune system. Parts (a) (ii) and (a) (iii) were well done with most candidates knowing the virus which caused AIDS, and the methods of spread of the virus.

Part (b) (i) required candidates to identify how the virus entered the body. Many candidates were not sure about entry of the virus and repeated response to (a) (iii). Candidates were expected to say:

– the living virus in an infected person makes contact with the lining of the vagina/urethra or other body parts like bodily ulcers.

Part (b) (ii) required candidates to explain how full-blown AIDS developed from the time the virus enters the blood. Candidates scored marks for explaining that the virus destroyed the lymphocytes weakening the immune system, leaving the body vulnerable to secondary infections. However, details involving the replication of the virus in the lymphocyte were generally not addressed. Part (c) required candidates to give reasons why Caribbean people must be concerned about the AIDS epidemic. It was generally well done. However, there were a few misconceptions. Some candidates responded by highlighting precautions as opposed to identifying causes for concern about the epidemic.

Misconceptions

Part (a) (iii): some misconceptions included the AIDS could be spread by mosquitoes, sharing utensils, deep kissing and swallowing of saliva. In addition, oral sex and sexual intercourse were used interchangeably. Some candidates also incorrectly responded that AIDS is spread by inheritance by babies from infected mothers.

In part (b) (ii), the virus 'eats' or 'feeds on' the white blood cells was a common response. Some candidates stated that the HIV attacks the red blood cell.

In part (c), the most common misconception was that black races are more prone to HIV infection. Increasing homosexual activity was also stated as a cause for concern.

Recommendations

Teachers should encourage students to:

- pay attention to key words in the question to ensure more focused responses, in order to obtain full marks.
- provide details when asked to explain the development of a diseased condition. For example in this question, details expected were

  (i) attachment of the virus to the lymphocyte;
  (ii) shedding of the protein coat;
  (iii) entry or injection of viral RNA into the lymphocyte;
  (iv) multiplication of virus particles which destroy other lymphocytes.

Teachers should:

- use research projects and posters;
- invite health resource persons to provide students with expert information.

Question 14

This question assessed candidates' knowledge of water purification methods in the home, and the activities of man which negatively affect our water supply. It was a popular question with the candidates and was moderately well done.

In (a), most candidates were able to give two correct methods of purifying water. Marks were awarded for adding a small amount of bleach, boiling or filtering. Candidates were not awarded points for large scale or industrial methods of purifying water such as desalination or distillation. Misconceptions were that freezing or putting water in the sun purifies it.

In (b) (i), most candidates were able to state three activities of man which negatively affect water supplies. Acceptable answers included: water wastage; garbage disposal or sewage disposal in water sources; pesticide and fertilizer runoff from agriculture, oil spills, industrial pollution, industrial accidents (nuclear) and power plants (thermal effects).

Some candidates did not realize that sewage includes faeces and urine. Other candidates wrote three methods of water wastage and were only awarded one mark.

In (b) (ii), some candidates did not thoroughly discuss how the activities of man affected water supply. Instead they described general ecological effects. Many candidates did not always link effects to water supply.

Candidates confused the greenhouse effect with acid rain and some candidates stated that burning garbage would lead to water pollution.

It was pleasing that some candidates were able to describe the effects of eutrophication in some detail.

Suggestions to teachers

- A visit to the local sewage plant
- A project
- Making a flow chart poster
- A practical approach to purifying water