

CARIBBEAN EXAMINATIONS COUNCIL

**REPORT ON CANDIDATES' WORK IN THE
SECONDARY EDUCATION CERTIFICATE EXAMINATION
JANUARY 2007**

HUMAN AND SOCIAL BIOLOGY

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HUMAN AND SOCIAL BIOLOGY
GENERAL PROFICIENCY EXAMINATION

JANUARY 2007

GENERAL COMMENTS

The January 2007 examination in Human and Social Biology at General Proficiency level was the fourth sitting of this subject offered by CXC. Human and Social Biology is offered at both the January and June sittings of the examinations. The first Human and Social Biology examination was offered in June 2005. The January 2007 examination was the second sitting for the January population.

Candidate entry increased by approximately 82 per cent in January 2007 over January 2006.

The examination consists of two papers: Paper 01 comprises 60 Multiple Choice items; Paper 02 comprises 10 compulsory structured questions and four optional extended response questions, of which candidates are required to answer two. There is no School-Based Assessment.

The overall performance of candidates in January 2007 improved over January 2006. However, there is much evidence that candidates are not prepared for the examination. Even though the syllabus clearly outlines the content required in Section A, Living Organisms and the Environment, candidates' responses to questions on this section were superficial and sometimes non-existent. Genetics continue to prove challenging to most candidates. In some instances, candidates knew the content but were unable to select, organize and synthesize the required answer.

Candidates need to use the correct jargon when answering questions, Spelling of biological terms is presenting difficulties for candidates. Candidates are advised to read the questions carefully, underline key words, take note of the number of marks allotted to parts of the question, and where relevant, the space allocated for the answer. These should be used as guidelines when formulating an answer.

DETAILED COMMENTS

Paper 01- Multiple Choice

Paper 01 consisted of 60 multiple-choice items. Performance on this paper was better than performance on Paper 01, January 2006. This paper tested candidates' knowledge of all five sections of the syllabus.

Some topics that presented the most difficulties for candidates were:

- The nature and structure of viruses
- The structure of plant cells
- The passage of a nerve impulse in a reflex action
- Exocrine and endocrine function of the pancreas
- The function of FSH (follicle stimulating hormone)
- Variation in genetics

Paper 02 – Structured and Extended Response Questions

Paper 02 consisted of two sections: Section A – ten compulsory short-answer structured questions; and Section B – four optional essay questions, from which candidates were required to answer any two. Each question in Section A was worth 10 marks, and each question in Section B 20 marks. The two Profiles, Knowledge and Comprehension, and Use of Knowledge, were tested on this paper.

Even though candidate performance on this paper was slightly better in January 2007 than in January 2006, candidate performance was poor. The mean was greater than 50 per cent on only one question on the paper. Candidates were able to attain marks across the allotted range for nine out of ten of the structured questions. However, candidates did not access all the marks allotted to the essay questions.

Question 1

This question dealt with photosynthesis and food chains. Part (a) (i) required a balanced chemical equation for photosynthesis. Most candidates did not know this. Part (a) (ii) required candidates' knowledge of the process of photosynthesis – the location, stages and organelles involved. This was poorly answered. Part (b) required candidates to construct a food chain. This was generally well done. However, some candidates presented a cycle rather than a chain, by including an arrow linking man to cabbage.

Question 2

This question dealt with muscles and joints. For Parts (a) and (b), candidates were presented with a diagram of the upper arm, to identify the biceps and triceps muscles, and to explain how these muscles function to raise and lower the arm, engaging the concept of muscles working in opposing pairs. Part (a) was well done. Part (b) was fairly well done. However, candidates omitted details for which they lost marks. For example, candidates said that Muscle X contracts, but omitted that muscle fibers become shortened. Similarly, for Muscle Y, the fibers become elongated. Candidates were able to identify the ball and socket, and hinge joints, and to say how they differed on movement.

Question 3

This question tested candidates' knowledge of a simple spinal reflex and the effects of heroin and alcohol on the body.

Part (a), requiring candidates to draw three neurones which make up the simple spinal reflex arc and to label the motor neurone, was well done by the few candidates. In Parts (b) (i) and (ii), candidates were able to state that heroin was addictive and that increasingly large doses were needed to produce the same results.

Part (c) was not well done. Candidates should have named two regions of the body affected by alcohol, for example, the heart and the brain (among others), and describe the effect, for example, the heart rate is increased, the brain slows down the passage of nerve impulses.

Question 4

This question was based on knowledge of hormones in the human body. For Part (a) candidates were expected to identify the hormones associated with the pancreas and adrenal bodies, as presented on a sketch of the human body. Most of the candidates could not name insulin or glucagon as the pancreatic hormone. Most of them identified adrenalin.

Some candidates correctly named adrenalin as a rapid-acting hormone but few were able to name a slow-acting hormone, such as insulin, or thyroxin, for Part (b). Performance in Part (c) was unsatisfactory. Candidates should have given the gland responsible for thyroxin production as the thyroid gland, and the location as the base of the neck. In Part (c) (iii), candidates did not know the effect of normal levels of thyroxin, which include: control growth, affect metabolism, development of personality. The effects of abnormal levels of thyroxin were fairly well known by candidates.

Question 5

Part (a) assessed candidates' knowledge of mechanisms of inspiration (breathing) as presented in a table. This was fairly well done. "The diaphragm muscles and the external intercostals muscles contract" were stated by most candidates. Many of them, however, failed to relate to the larger volume – low pressure concept of the thorax as itemized in the table. As a result, candidates failed to gain the full score of four.

Part (b), which required candidates to give a reason for the difficulty in breathing at high altitudes, was fairly well done. For Part (c), candidates were able to give "the abdominal muscles" as the muscles which contract to force air out of the thorax during deep breathing. In Part (d), candidates demonstrated little understanding of the link between breathing rate and the nervous system. A good answer should have included:

A respiratory centre in the medulla of the brain controls the reflex breathing movements (which occur unconsciously). The brain initiates the respiratory movements.

Question 6

Knowledge of the circulatory system was required in this question. For Part (a), candidates were expected to identify the left pulmonary artery and the right ventricle from a representation of the external structure of the heart. This was poorly done. Part (b) was also poorly done. Candidates should have outlined how the structure of the left ventricle assists with its function. Candidates were expected to present any of the following:

- The walls are thick and muscular.
- Contraction of the thick ventricular walls builds up the pressure.
- This pressure is required to pump oxygenated blood around the body.

Part (c) was also poorly done. Candidates were expected to relate the structure of the arteries and veins to their respective functions. Their responses should have included: *the arteries must have thick elastic walls to withstand the high pressure and pumping action of the heart, to facilitate the movement of blood from the heart; the veins have thinner walls because they carry blood under lower pressure; also veins have valves to prevent the back-flow of blood.*

Question 7

This question tested candidates' knowledge of the structure and function of the kidney.

In Part (a), candidates were required to identify the cortex and the medulla from the given representation of the kidney. Most candidates identified the cortex. Many candidates did not identify the medulla. For Part (b), candidates could not describe the functions of the medulla and ureter, often confusing the medulla of the kidney with the medulla of the brain, and the ureter with the urethra.

For Part (c), very few candidates were able to explain that death occurs after ten days of kidney failure because of the accumulation of toxins/urea/excess potassium ions in the blood.

Question 8

This item tested the knowledge of genetic terms. This was followed by items related to the application of the knowledge that the presence of the sex-linked genes on the X chromosome of the male leads to the more common occurrence of sex-linked diseases in males than in females, the latter being carriers. A genetic diagram was required to further test candidates' ability to apply information to determine the physical and genetic make-up of the offspring.

For Part (a) (i), candidates did not know the term 'sex-linked genes'. 'Heterozygous' and 'genotype' in Parts (a) (ii) and (iii) were better known. Parts (b) and (c) were poorly done.

Part (b) required candidates to explain why colour blindness was more common in males than in females; and Part (c) required candidates to show the genotype and phenotype of offspring from a father with normal vision and a mother who was heterozygous for colour vision.

The concepts in genetics seem to be difficult for candidates to grasp. Perhaps the topic should be taught early during the course of study, and reviewed and integrated with other topics, where relevant. For example, when studying the eye various crosses on eye colour and colour vision may be done. Haemophilia may be reviewed when the section on blood is being studied.

Question 9

Candidates' knowledge of two diseases – dengue and leptospirosis – was tested in this question. Candidates performed well, demonstrating knowledge of symptoms, methods of spread and methods of prevention of the diseases.

Question 10

Candidates demonstrated familiarity with the topic of this question – water pollution and water treatment for drinking purposes. Parts (a) (i) and (ii) were generally well done. Candidates' responses correctly included: *heavy industry and agricultural activity caused pollution; used large quantities of water, thus depleting water resources.*

Part (b) (i) was not well known. Parts (b) (ii) and (iii) were fairly well known. Candidates should have stated: *exposure to UV light – destroys microorganisms; fluoridation – prevents dental decay; chlorination – destroys microorganisms.*

Part (c) required candidates to describe the process of aeration and give two benefits of the process. Candidates demonstrated a lack of knowledge of this process. A good answer should have been:

Tiny bubbles of air are blown into the water. The benefits of this process are (any two): displaces carbon dioxide; raises the pH/removes acidity; removes iron and manganese as hydroxides; assists the sludge to rise prior to its removal; provides oxygen for aerobic bacteria to assist in purifying the water.

Question 11

This was the least popular of the four optional questions. It tested candidates' knowledge of the nitrogen cycle.

In Part (a), candidates were required to give two uses of nitrogen in living organisms. Most candidates knew synthesis of protein, but could not give synthesis of DNA/ATP as another use.

For Part (b), a part of the nitrogen cycle was given, and candidates should have identified 'lightning/rain', 'nitrogen-fixing bacteria' and 'denitrifying bacteria'. This was poorly done.

In Part (c), candidates were required to use their knowledge of the nitrogen cycle to explain why it is unwise to destroy all bacteria on earth. Candidates demonstrated their inability to apply knowledge to a given situation. Candidates should have included:

- Bacteria convert trapped nitrite to nitrate;
- Some bacteria are responsible for returning nitrogen gas to the atmosphere, to ensure that it is not depleted;
- Bacteria are involved in processes that convert nitrogen to a usable form (nitrates);
- Nitrates are used by plants in synthesizing proteins;
- Bacteria decompose dead plants and animals, converting them to nitrates;
- Bacteria convert nitrogen-containing waste products (urea) from animals to nitrates.

Question 12

Candidate performance on this question was fair. For Part (a), candidates gave three use of water in the human body, choosing from: *as a solvent; transport; osmoregulator; excretion; main constituent of the body.*

For Part (b), the response to the correct sequence of structures through which water passes from the mouth to the circulation of the blood should have been: *mouth!oesophagus!stomach!duodenum!small intestine!large intestine/colon.*

For Part (c), candidates were unfamiliar with why prolonged diarrhoea could be dangerous: loss of water leads to dehydration; loss of electrolytes/salt/ions leads to shock; changes in osmotic pressure lead to organ failure.

For Part (d) (i), candidates were required to draw a section through a villus and label some given parts. This was not well done. Part (d) (ii) required candidates to give two functions of the epithelial cells of the villus: secrete mucus; protection; facilitate absorption.

Water must be recognized as one of the essential nutrients that has the same passage as solid foods, through the digestive systems. Water is a solvent for other simple, soluble nutrients and therefore, undergoes the process of absorption in the villus along with the other nutrients. Further, water and ions are absorbed from faeces in the colon.

Question 13

This question tested candidates' knowledge of diabetes mellitus. It was not very well done.

For Part (a) (i), candidates should have said that diabetes mellitus is a clinical disorder/condition/disease where high blood sugar persists or where there is low/no insulin. Candidates identified two symptoms of the disease in Part (a)(ii), from among thirst; increased urine output; recent weight loss; increased appetite; blurred vision; lethargy/tiredness. Differentiating between Type I and Type II of the disease (Part (b)) presented difficulties.

Some possible responses included: *Type I versus Type II: lean versus obese; treated with insulin versus managed by diet; exercise versus tablets; more prone to coma versus less prone; less likely to have family history of the disease versus more likely.* For Part (c), candidates generally did not know how obesity may possibly bring about diabetes, namely: as weight increases the receptors for insulin become adversely affected in terms of both numbers and effectiveness; thus insulin produced by the pancreas cannot bind effectively; there is insulin resistance; glucose persists in the blood and cannot pass to the body cells, resulting in high blood sugar levels.

Part (d), requiring how therapy is used to manage diabetics, was fairly well answered.

Question 14

This was the most popular question, of the four optional questions. This question tested candidates' knowledge of recycling and garbage disposal.

Part (a) (i), naming three materials commonly recycled, was fairly well known. For Part (a) (ii), most of the candidates could not explain that recycling meant reduced chemical processes needed for production of the material, hence industrial waste is decreased.

Part (b) required candidates to discuss the proper handling and disposal of refuse. Most of the candidates concentrated on two points – burying refuse; harbouring vectors for spreading diseases. This part of the question was worth 15 marks. Therefore, candidates should have been aware that more was required of them. They should have included; *scattered garbage presents a threat to health, provides a breeding ground for rats, flies, mosquitoes, roaches, become a reservoir for water collection and water-borne diseases; faeces present lead to parasitic infections like hook worm, schistosoma.* To reduce the risk of diseases construct pit latrines and keep them covered; create areas for burial of organic waste; top soil should be removed and replaced after burial of material, construct a brick furnace for other refuse that could not be buried, use bins with tightly fitting covers.