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 EXAMINATIONS

JUNE 2007

INTEGRATED SCIENCE

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GENERAL PROFICIENCY EXAMINATION
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GENERAL COMMENTS

The CSEC examination in Integrated Science (Single Award) was offered this year (2007) at the General Proficiency Level only. This examination consisted of three papers: Paper 01 – Multiple Choice, Paper 02 – short-response questions and Paper 03 – the School-Based Assessment or Paper 03/2 – the Practical Paper (Alternative to the SBA).

In 2007, 19 665 candidates wrote the examination. This was comparable to the candidate population of June 2006. There was a general improvement in candidates' performance in 2007 when compared with 2006, with approximately 82 per cent of the candidates earning Grades I to III compared with 77 per cent in 2006.

Paper 01 – Multiple Choice

Paper 01 consisted of 60 multiple-choice items. The mean score earned increased by approximately 3.1 per cent, from 57.2 per cent in 2006 to 60.3 per cent in 2007.

Paper 02 – Structured Paper

Paper 02 consisted of six, short-answer, structured questions. The maximum mark for each question was 15 and the maximum mark for the paper was 90. The mean score for Paper 02 increased by approximately 1.1 per cent, from 35.6 per cent in 2006 to 36.7 per cent in 2007.

DETAILED COMMENTS

Paper 02

Question 1

This question tested the candidates' ability to use information provided in tabular form to construct a graph showing plant growth over a period. It also tested the candidates' knowledge of plant parts and their ability to measure.

Part (a) (i) tested the candidates' knowledge on the construction of graphs, using information given from a table. The response to this question was fair. Two curved lines were expected; however, some candidates constructed various types of graphs, for example, line, bar and histograms. More attention needs to be given to the relevant areas of the syllabus. Some candidates had difficulty in labelling the axes and plotting correctly the points. Part (a) (ii) required a candidate to find an appropriate title for the constructed graph and was fairly well done.

Parts (b) (i) and (ii) were based on using and interpreting data obtained from the graph. Parts (b) (iii) and (iv) focussed on the use of knowledge of the conditions necessary for effective plant growth, such as the process of photosynthesis. Some candidates, after naming the two conditions necessary for plant growth in (b) (iii), encountered difficulty in giving an appropriate explanation in (b) (iv) for the two named conditions. They were required to be specific in terms of the process involved (photosynthesis), and also to use more scientific terms (for example, increasing rate of photosynthesis or preventing deficiency disease).

Part (c) (i) required candidates to label parts on the plant: A – leaf and B – cotyledon. Most candidates labelled A (leaf) correctly, but did not give the correct answer to B. Part (c) (ii) required candidates to determine the length of the stem in the diagram provided. Too many candidates gave the incorrect length.

Recommendations

1. Students need to understand the details about the axes of a graph, such as:

   (i) Choosing the appropriate axis, X and Y, for each variable

   (ii) Naming the axis and labelling with the corresponding units required

   (iii) Ensuring equal spacing of the units on each axis.

2. Emphasis should be placed on the fact that the two main variables to be plotted on the graph should be given in the title.

3. More attention should be given to the construction of graphs and their use for deriving and extrapolating data.

4. Special attention should be given to observing and identifying the various parts of plants as they develop from a dry seed into a mature plant.

5. Students should be encouraged to use scientific terms in their responses.

Question 2

This question tested the candidates' knowledge of water-safety devices, floating and sinking, ethical and unethical practices related to performance enhancement, and nutrition relative to performance. This question was attempted by most candidates. Some of the candidates earned more than half the maximum score.

Part (a) required the candidates to name one of the two water-safety devices correctly. Some candidates in their responses seemed to have confused water-safety practices and water-safety devices. Additionally, some candidates were unable to differentiate between water recreational floatation equipment and water safety devices.

For Part (b) (i) many candidates were able to correctly identify the learner floating in sea water but were not able to give a reason in Part (b) (ii).

In Part (c), many candidates were able to relate the use of oxygen to the term "aerobic" activity.

Part (d) required candidates to use knowledge related to performance enhancement in athletes. The use of steroids and named hormones, for example, testosterone, were the most frequent acceptable responses. Some candidates confused techniques used for performance with swimming techniques such as "butterfly" and the backstroke.

Blood boosting which was an acceptable answer, was named by candidates most frequently as the unethical technique that improved the performance of swimmers. Weaker responses concentrated on explaining the removal and replacement of blood.

Part (d) (iv) – Candidates were able to correctly answer this section of the question.

Part (d) (vi) – Candidates who had an understanding of the functions of the nutrients were able to answer this section correctly. Many candidates incorrectly stated that proteins were needed primarily to provide energy for the body. It was expected that carbohydrates would be directly linked with energy production instead.

Part (e) – Some candidates were able to indicate that "stitches" or "cramps" would be experienced as a result of eating a heavy meal before a race. However, they were unable to explain the cramp. Unacceptable vague responses included "drowsing", "vomiting" or "becoming tired". In general, this section of the question was not properly answered.

Recommendations

1. It is recommended that a practical or hands-on method be used to teach floatation concepts. Emphasis should be placed on the comprehension and correct usage of the relevant scientific terms, such as "upthrust" and "density".

2. Clear distinction needs to be made between food nutrients and the type of foods which contain these nutrients. Emphasis should be placed on the roles of the nutrients.

Question 3

This question tested the candidates' knowledge of hormones and their functions, reflex action, as well as their ability to distinguish between "voluntary" and "involuntary" responses to visual situations. It was attempted by most of the candidates. Some responses were satisfactory.

Few candidates responded accurately to Part (a) (i). Several responses incorrectly indicated that a hormone was a feeling between a male and female. Several candidates indicated where hormones were produced instead of what they were.

Part (a) (ii) was generally well done. Candidates were able to state appropriate examples with oestrogen and progesterone being the most popular; however, many candidates incorrectly spelt these words.

Part (b) (i) was, in general, not well done. Some common misconceptions or incomplete understandings were that the pancreas lowers glucose instead of insulin and the ovary causes secondary sexual characteristics instead of the hormones oestrogen and progesterone. Many responses correctly indicated the hormones involved, but did not indicate their roles. Part (b) (ii) was generally well done. Many candidates correctly gave carbohydrate as their response. The question asked for food nutrient, but some candidates inadequately indicated sweets as a nutrient.

Some responses to Part (c) (i) correctly indicated that a "reflex action" is a quick, sudden, immediate or fast response, but needed also to point out that it was an automatic or involuntary response and did not involve thinking.

Part (c) (ii) was a simple, single-answer question with many of the responses correctly identifying Picture A as showing the activity where reflex action is taking place.

Part (c) (iii) seemed challenging to many of the candidates. Many candidates described what was seen in the pictures instead of giving the expected reason, that is, reference to the act of not thinking or automatic and quick response as in Picture A, compared to Picture B in which the boy thought of saving the vase.

Responses to part (c) (iv) were generally inappropriate. Many candidates gave the brain as the sense organ instead of the eyes as expected.

Recommendations

In general, candidates showed inadequate knowledge of the topic tested by this question. Many did not respond to parts of the question. More attention needs to be given to the teaching of this unfamiliar aspect of the syllabus. Students could be provided with opportunities for analysing everyday-life activities that involve voluntary and involuntary responses.

Question 4

Part (a) tested the candidates' knowledge of the physical and chemical properties of water, while Part (b) explored their ability to recall the processes of water purification. Part (c) (i) examined candidates' ability to identify and draw a food chain, while Parts (c) (ii) to (v) examined the candidates' understanding of various farming and industrial practices and how these may each have had effects on the aquatic environment. Part (d) tested the candidates' ability to relate poor environmental conditions with ethical economic practices. This question was attempted by most of the candidates with the majority of them giving satisfactory responses.

Part (a) of this question realised the poorest response as many candidates showed little knowledge of the chemical properties of water. Correct responses indicated chemical reactions in photosynthesis and with metals. Although more candidates were able to identify physical properties, many were unable to differentiate between physical and chemical properties as their responses were incorrectly placed.

Parts (b) (i) and (ii) were generally well done with many candidates correctly identifying processes involved in water purification and describing how each process is carried out. However, in Part (b) (i), the common name for the processes was inadequately identified. Instead of naming the process, explanations were given. There was a display of very poor spelling. Chlorination was a popular response with candidates correctly identifying its role in killing micro-organisms such as bacteria. Sedimentation and filtration were also identified, however, some candidates cited domestic methods such as boiling which would not be practical on the large-scale company operations as indicated in the question.

Part (c) (i) was adequately answered by many candidates; however, some misconceptions relating to food chains were quite apparent. These **misunderstandings** included:

(i) The arrows used in a food chain point away from the organism doing the eating rather than indicating the **flow of energy** from one trophic level to another and vice versa;

For example, ***water weed*** ⟵ ***small fish***

rather than (with direction of the arrow):

water weed ⟶ ***small fish***

(ii) Drawing a food chain literally meant to draw the organisms.

The majority of candidates were unable to differentiate between a food chain and a food web. Emphasis must be placed on constructing food chains **beginning with the producer**, plants.

In Parts (c) (iv) and (v), many candidates recognised industrial waste as being a possible source of water pollution and consequently affecting aquatic life. In Part (d), some students inadequately stated that the dead fish should not be sold because of the presence of bacteria and simply because the fish was dead. However, many of the candidates recognised that due to possible contamination, it would not be ethical to collect and sell the dead fish.

Recommendations

An inquiry approach to this topic could be taken while teaching. Students could be given scenarios involving projects that generate wastes. They could be guided through the questioning to infer the impacts on individuals and community activities and consider the related ethical issues. Students could also benefit from the construction of suitable models that reflect safe and ethical ways of dealing with wastes generated within communities.

Question 5

This question tested the candidates' knowledge and ability to use knowledge relating to controlling temperature, conduction, convection, use of a bimetallic strip and ventilation.

In Part (a), many candidates seemed to encounter difficulty in drawing a diagram to represent how the metallic strips were expected to expand as their temperature increased. A few of the candidates **incorrectly** thought that the strips would separate.

In explaining the term "thermostat" in Part (b) (i), about 50 per cent of the candidates used the term "measure" or "check" temperature or heat instead of indicating that a thermostat is a device used for **controlling** the temperature of an appliance. Many of the responses suggested that the candidates confused the term 'thermostat' with thermometer or thermos flask. Many of the candidates incorrectly suggested that a thermostat controls current or electricity.

In Part (b) (ii) many of the candidates **erroneously** assumed that if the strip is heated then current is flowing so the circuit is closed.

Part (e) (i) – This seemed to be the most difficult part of the question for candidates. Most candidates had difficulty using the appropriate terms:

For the cause of

_– "increased levels of mould and mildew", many candidates indicated that moisture was necessary but many thought that rain water had to get in from outside for the mould to grow.

– "headaches", the most popular answer was heat. The expected answers included fumes from paint and the accumulation of carbon dioxide.

– "allergies", many candidates strayed from the concept of ventilation and attributed the allergies to something that was eaten.

Part (e) (ii) was also fairly well done; opening of windows, use of fans and air conditioning were acceptable.

Recommendations

A practical approach to this topic could be taken while teaching. Models of thermostats corresponding to different temperatures could be made, compared, drawn and explained. Simulations depicting the appearance of thermostats while an appliance is in use can be considered where possible.

Question 6

Generally, candidates performed unsatisfactorily on this question. Many candidates scored less than half of the available points. The majority of candidates scored well in Part (a). Some candidates confused a force with energy and some incorrectly equated a force with pressure.

Part (b) was not well done. The majority of candidates were unable to give adequate responses to Parts (b) (i) and (ii). In Part (b) (i), candidates confused gravitational force with magnetic force, while some stated consequences of gravitational force. These responses were not accepted. Acceptable responses indicated that the gravitational force is the force with which a large object, for example, the earth or moon attracts another object. Friction is a force that "opposes motion" was an acceptable response to Part (b) (ii).

Many candidates were unable to score marks in Part (c) (i). Most candidates described how to set up the diagram rather than describe or explain how to manipulate the apparatus to determine the mass of the unknown (mango).

Part (d) was fairly well done. Most candidates were able to correctly define the term "machine".

Generally, Part (e) (i) was well done with only a few candidates unable to label the parts correctly.

Recommendations

A practical approach should be taken in teaching the concept of machines. In practical activities students can use a metre rule, strings and known masses, to find the masses of various small objects. Use of the appropriate equation should be emphasised.

Paper 03 – School-Based Assessment

Overall Performance

The overall performance was fair. Greater effort is needed in the development of the skills of Analysis/Interpretation and Planning/Design. Generally, notebooks and mark schemes were submitted. In many cases the student instruction sheets were not submitted.

Recommendations to Teachers

- All laboratory report books should have a contents page with the following format and headings.

Lab. No.	Page	Description of Laboratory Exercise	Date	Skills Assessed

- The pages of the laboratory notebook should be numbered.
- Each activity should begin on a new page and be properly dated.
- The skills assessed and marks allocated should be written next to the laboratory report and on the contents page.
- The maximum mark to be awarded to each skill is 6 marks. Skills marked out of other totals should be scaled to six.
- The dates when each practical was assessed should be included in laboratory reports.
- All skills except P/D should be assessed at least four times over the two-year period. P/D should be assessed at least twice over the two-year period.
- **The mark scheme used to assess skills must include components of (a) and (b) as outlined in the syllabus.**

Observations, Recording and Reporting (ORR)

- Proper laboratory format should be used, for example:

  Title
  Aim
  Apparatus/Materials
  Diagram
  Method
  Results/Observations
  Discussion
  Conclusion

- Reporting should be concise and observations should be recorded in a suitable format. The use of tables is recommended whenever possible.

- Numerical tables should have the physical quantities and units stated in the heading, and the number of decimal places should be consistent.

- Non-numerical tables should have appropriate headings. Details of data recorded should include all observations, for example, the solution turned from blue to green to orange upon heating.

- Graphs should have axes labelled, appropriate scales, points plotted accurately and a **smooth curve or best fit line drawn.** (Only growth curves should have the points joined dot-to-dot.)

- Where prose is used to record observations, details of data are necessary.

Analysis and Interpretation (A/I)

- For assessing this skill, avoid choosing laboratory exercises that are too simple, for example, 'testing milk for protein'.

- Laboratory exercises must lend themselves to the identification of trends, patterns and relationships.

- Inferences must be linked to the results/observations.

- Evaluations should not be general statements. Conclusions need to be linked to the aim of the laboratory activity stated and the data obtained.

- Calculations shown must include formulae and units.

- Questions from the textbook should not be used as A/I laboratory exercises. Laboratory exercises must be carried out and the data generated should be analysed and interpreted.

Planning and Design (P/D)

- P/D laboratory exercises need to be more original whereby students are required to formulate a hypothesis and design a scientific experiment to test the hypothesis.

- P/D laboratory exercises do not have to be done to prove a scientific fact. If they are carried out they can be used to assess other skills and the plan can be modified as necessary.

- **Textbook laboratory exercises are not acceptable as P/D experiments.**

- Some laboratory exercises did not lend themselves for assessment as P/D laboratory exercises, for example, 'making soap', 'reactivity of metals' and 'model of lungs'.

- **A hypothesis is a statement and should not be written in the form of a question.**

- Procedures should reflect a direct link with the hypothesis.

- Procedures should include the number of times the experiment is to be repeated and any precautions to be taken.

Paper 03/2 – Alternative to the SBA

Question 1

Observations, Recording and Reporting (ORR)

For this skill, candidates achieved an average of 4.5 out of 9. Some candidates did not adequately indicate their observations pertaining to the contents of the tube. Many inadequately used terms such as murky, dirty and cloudy instead of recording the observed colour.

The drawing of the boiling tube with the contents was in general, well done; however, the labelling needed improvement.

Manipulation and Measurement

In general, it was evident from the candidates' responses that they effectively used the materials provided. The candidates were able to carry out the instructions.

Analysis and Interpretation (A/I)

Analysis and interpretation relative to the candidates' ability to determine the pH from the colour chart was generally well done.

Planning and Design (P/D)

The skill was not well demonstrated by many candidates. Some candidates did not adequately indicate the hypothesis and state the required precautions.

Question 2

Observations, Recording and Reporting (ORR)

For this skill many candidates responded satisfactorily. Their tables were usually correct except for the data concerning volume of HCl. Instead of an accumulative value, for example, 5, 10, 15 and 20, many candidates wrote, 5, 5, 5 and 5.

Manipulation and Measurement

It was evident from the responses that the candidates were able to carry out the instructions.

Analysis and Interpretation (A/I)

Some candidates seemed challenged in writing the expected word equation and in identifying the type of reaction involved. The interpretation of the graph to give the correct quantity of acid by extrapolation also seemed to be a challenge for the candidates.