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

JUNE 2009

INTEGRATED SCIENCE (SINGLE-AWARD)

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(Single-Award)

GENERAL PROFICIENCY EXAMINATION

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GENERAL COMMENTS

The CSEC examination in Integrated Science (Single Award) was offered at the General Proficiency Level in 2009. The June 2009 examination consisted of three papers; Paper 01 – Multiple Choice; Paper 02 – Structured Questions and Paper 03 – School-Based Assessment.

A Paper 03/2 – Practical Paper was taken by private candidates.

The number of candidates entered for this examination was approximately 20 000, an increase when compared to 2008. The overall performance of candidates in the 2009 examinations was consistent with the performance in 2008. At the General Proficiency level approximately 89 per cent of the candidates earned Grades I to III.

DETAILED COMMENTS

Paper 01 – Multiple Choice

Paper 01 consisted of sixty (60) multiple choice items which tested the knowledge and comprehension profile. The mean score increased from 41 in 2008 to 43 in 2009. The performance on the questions from Sections A and B of the syllabus was very good while that for Sections C and D was only satisfactory.

Paper 02 – Structured Response Questions

Paper 02 consisted of six (6) short-answer, structured questions. The maximum mark for each question was 15 marks and the maximum mark for the paper was 90 marks. The mean score earned on this paper was 63.50.

Question 1

This question tested the candidates' understanding of sexual and asexual reproduction and their importance as well as conditions which influence population changes. In general, this question was not very well done.

For part (a) many candidates correctly identified the structures – petal, bud, fruit and stem in Figure 1. However, for part (b) many candidates were unable to state the differences between the diagrams in Figures 1 and 2. Examples of satisfactory responses were: the absence of fruits, leaves and flowers from Figure 2 as compared to Figure 1 and Figure 2 is microscopic while Figure 1 is not. Most candidates only provided partial responses such as the plant in Figure 1 was reproducing

by sexual reproduction and they did not state the expected parallel point that the organism in Figure 2 reproduced asexually.

For part (c) some candidates did not identify the names of the structures, as required, but gave definitions and characteristics of sexual and asexual reproduction. Part (d) was not well answered. In part (d) (iii) with respect to the advantage of producing genetically identical plants, most candidates responded appropriately in terms of mass production/yield/quantity. However, few candidates responded with satisfactory responses such as, "If the parent plant is superior then the offspring will also be genetically superior" and "if the parent is good, then all of the offspring will be good".

With respect to the disadvantage of producing genetically identical plants, some candidates responded correctly by stating that there would be a lack of variety because the fruits produced would have the same characteristics.

Parts (e), (i) and (ii) were generally well answered. For part (e) (iii) few candidates responded as expected to indicate that 'the population would decrease because proteins will be denatured by the high temperature'. Partial response provided by the candidates were "it was too hot for the organisms to survive"; "it was too hot" and "the organism could not withstand the high temperature".

Recommendation

Candidates should be encouraged to express differences in terms of parallel points to improve completeness of responses.

Question 2

This question tested candidates' understanding and ability to use knowledge relevant to the following areas:

- Nutrient content of foods
- Nutrition requirements of different age groups and
- Food contamination and precautionary measures to prevent it

This question was fairly well done by most of the candidates. Part (a), (c) and (e) were generally well done.

For part (b) some candidates:

- confused 'function' with 'nutrients' – for example, 'carrots for good eyesight' instead of 'carrots contains vitamins'.
- failed to identify the major nutrients in the stated plant, minor nutrients were identified instead.

For part (c) a few candidates were unable to differentiate

For part (d)

- Many candidates ticked more than the required two boxes for each age group as the criteria for the food selection.
- Some candidates selected one criterion for each person.
- Some candidates repeated the criteria instead of giving the reasons in (d) (ii); for example, vitamins and minerals instead of the reason for which the age group required the nutrient.

The expected responses for part (d) were:

Five-year-old child

- Vitamins and minerals – for growth and development
- Energy content of food – more energy/lot of energy required due to active lifestyle, for example, running and playing.

Seventy-five-year-old man

- Vitamins and minerals – for maintenance of good health
- Softness of food – loss of teeth/problems resulting from mechanical digestion.

Few candidates indicated correctly that a person of seventy-five years old required less energy due to their decreased activity. Part (e) was done well by many candidates; however a small percentage did not see it as a safety question. Responses on 'time management', nutritional needs of the five and seventy-five year old' and 'safety in the kitchen' with respect to fires were popular as opposed to 'sanitary practices' and 'food contamination' which were expected.

Recommendations:

1. Teachers should pay attention to the spelling of science vocabulary. Suggested activities: word search, anagrams and spelling quizzes.
2. Attention should be given to examples of foods that contain vitamins and minerals as **major** sources of nutrients.
3. Students must be able to distinguish between 'nutrients' and 'foods'.
4. Encourage students to read the entire question before attempting to answer any section of the question.
5. In working through with then students past examination questions, teachers should discuss strategies for identifying and responding appropriately to key words in the questions.

Question 3

This question tested the candidates' understanding of temperature, the thermometer, expansion of materials as well as the need for appropriate physical conditions such as ventilation and sanitation in the home and workplace.

Overall, this question was satisfactorily attempted by many candidates. For part (a) (i), many candidates responded correctly and included responses such as narrow constriction for clinical thermometer.

For part (a) (ii) many candidates explained rather than gave the requested names of the processes: evaporation and cooling.

For part (b) many candidates correctly indicated metal A as the least expanded metal represented in the graphs presented.

Most candidates responded appropriately to part (c) (i); responses included 'installing extractor fans' and 'more windows or doors'.

Recommendations:

1. More attention should be given to analysis and synthesis which require students to think and provide explanations for their designs.

2. Students should be encouraged during lessons to pay attention to instructional terms such as "state" to avoid providing explanations when not requested.

Question 4

This question tested candidates' understanding of concepts related to energy conversion and factors affecting man's use of energy. Emphasis was placed on the use of solar energy as an alternate source to fossil fuels. Students were expected to exhibit a working knowledge of how a solar water heater is constructed and functions. This question further tested the candidate's knowledge of the process of fractional distillation; the problems associated with the use of fossil fuels; solar energy and the methods of heat transfer.

Generally the responses ranged from weak to fair.

Parts (a) (i) to (iii) were not well done by many candidates. The performance in (a) (ii) was satisfactory; many candidates explained the processes for B (condensation) and C (boiling or evaporation) instead of naming the process as required by the question.

In (a) (iii) candidates showed that they did not understand the concept of fractional distillation.

Part (b) (i) was well done, many candidates showed a good knowledge of the environmental effects of the use of fossil fuels.

Candidate's performance in (b) (ii) was poor. The majority of candidates misunderstood "limit the use" and as a result gave responses opposite to what was expected. They instead gave answers which would promote the use of solar energy.

Part (c) (i) was fairly well done by candidates. Most candidates knew the heat transfer methods but were not sure of the correct response required based on the stimulus provided.

Part (c) (ii) was well done. Most candidates were able to correctly state the purpose of the black paint. However, some candidates could not give the correct explanations of increasing the absorption of heat energy; some inappropriately used words such as "*attraction, contract* and *draw in* of heat".

Performance of many candidates in (c) (iii), (iv) and (v) was poor. For part (c) (v), reasons given for the material of choice for a cover of the solar water heater very rarely indicated that the choice was essentially to allow the transfer of heat energy by radiation.

The performance in (c) (vi) was satisfactory with a high percentage of candidates giving creditable responses. Many candidates showed an understanding of appropriate uses of the water from the solar water heater and gave answers such as washing and bathing. However, a few candidates incorrectly indicated that the water could have been used to sterilize objects.

In (c) (vii) many candidates showed an understanding of the preferential reasons for using a solar water heater above a heat or electrical water heater. Reasons such as conservation of fossil fuels and cleaner or cheaper source of energy were acceptable.

Recommendations

1. Students require more practice sessions at school answering questions that require them to demonstrate knowledge and use of knowledge.

2. Teachers and students should place more emphasis on the use of correct scientific terms.

3. Students should be exposed to the practical components of this topic; suggestions are:

    - Design, build and use simple water heaters at school.
    - Perform simple experiments to illustrate the idea of separation by distillation.
    - Tours to distilleries and houses equipped with solar heaters.
    - Perform simple experiments to demonstrate the different methods of heat transfer.

Question 5

This question tested the candidates' understanding of the conTm[ )[ )VQa&DÒo ibome (ng)10(.)--(sponsedE

For part (d) (i) some candidates seemed not to have understood the meaning of the term 'hypothesis' and wrote statements or questions which inappropriately referred to a title, method or aim of an experiment. In part (ii), many candidates did not understand the term 'variables'. For Part (d) (iii) most candidates who constructed tables placed the headings in inappropriate positions.

Recommendation

Students need practice in tabulating data. Special emphasis needs to be placed on assigning appropriate column and row headings.

Question 6

This question tested candidates' understanding of some basic concepts involved in motion on land, centre of gravity and scientific principles relevant to road safety practices.

This question was attempted by many candidates. Knowledge and comprehension were weak overall for this question.

Part (a) of the question was attempted by almost all candidates; however, most candidates failed to give a proper definition of centre of gravity (for example, "the point in a body at which all the weight acts or the body balances")

Part (b) was not attempted by most candidates. There was little evidence that candidates were familiar with this method of determining the centre of gravity.

Part (c) required the marking of the likely position of the centre of gravity of Figure 9 and was well done by most candidates.

For part (d) many candidates provided unclear responses with a general idea of balance. Complete responses indicated that "with one bag, her centre of gravity would shift to one side making it difficult to balance (more effort would be required to remain stable).

Part (e) (i) seemed to pose a great difficulty for most candidates. Candidates did not distinguish between the two types of equilibrium.

Part (e) (ii) – (v) was well done with most candidates gaining marks in this section.

Recommendation:

- Teachers should engage students in more activities for determining the centre of gravity.

General Recommendations

Students should be exposed to the practical components of topics in general; emphasizing the relationship between the properties of materials and their uses as well as safety precautions and reasons for them. More attention needs to be given to:

- The naming of parts of plants and their function in sexual and asexual reproduction.

- Reducing students' spelling errors for scientific names.

- Encouraging students to focus on the instructional words in questions from past examination papers.

- Encouraging students to participate in activities that will assist in the development of their ability to apply scientific concepts to everyday life.

Teachers should also provide practice in answering analysis and use of knowledge type questions.

Paper 03 – School-Based Assessment

Overall performance

The overall performance in the School-Based Assessment was fair. However, greater effort is needed in Analysis and Interpretation and Planning/Design. Generally notebooks and mark schemes were submitted. In most cases student instruction sheets were not submitted.

Recommendation to Teachers

- All laboratory report books should have a content 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 in 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.
- Dates when the practicals were 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 marks 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/Material

Diagram

Method

Results/Observation

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)

- Laboratory exercises chosen for assessment were often 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.

- Evaluation should not be general statements. Conclusions need to be linked to the aim of the lab 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 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 should not 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 exercise 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.

Checklist for guiding teachers in the performance, marking and submission of Integrated Science SBAs.

1. **LAB BOOKS**

    - Laboratory book is no longer than 9" x 12".
    - All pages are securely bound.
    - All pages and labs are numbered according to table of contents.
    - Student's name and registration number are included on the cover.
    - Each lab includes the date on which it was done.
    - Inserted pages (e.g. drawings and graphs) are secured.
    - Drawings and graphs included in appendix are accurately referenced and/or identified.

2. **TABLE OF CONTENTS**

    - Title of experiment
    - Date of activity
    - Page number of activity
    - Lab number
    - Skills assessed
    - Marks awarded

3. **OBSERVATIONS, RECORDING AND REPORTING**

    - Reports are written in logical sequence.
    - All sections are named.
    - Reports are written in third person, past tense and passive voice.

- Report is written in concise form.
- Appropriate form of observation is presented.
- Graphs are drawn on graph paper.
- At least two labs are marked for ORR each year.

4. DRAWINGS

- Large, clear and fully labelled including title, magnification and view
- Includes fruits, seeds, flowers, storage organs and organisms. *NOT* laboratory apparatus and non-living objects
- Each drawing is on a clean page with no writing on the page
- Pencil only used for all drawings

5. ANALYSIS AND INTERPRETATION

- Discussion does not include raw data.
- Explanations for all observations are discussed.
- Trends/patterns/relationships are identified.
- Predictions/Inferences are made.
- Calculations are accurate and relevant.
- Data are evaluated.
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- States expected inferences
- Final score out of six (6)
- Breakdown of marks clearly indicated
- Appropriate to skill being assessed

Paper 03/2 – Practical Paper

Question 1

Question 1 tested the candidates' knowledge of chromatography. This question was generally well done and attempted by most candidates.

This section was fairly well done with most candidates easily setting up the experiment. However, severe blotting indicated that few candidates may have added ink instead of the solvent at intervals.

In some centres the ink did not spread as it was expected to. Generally, a good spread of more than 3 cm in diameter was expected over the half-hour period.

In recording values in the table for 1(e) candidates stated the actual time the reading was taken instead of the time intervals. The units (minutes) were generally not stated.

Recording the description of colours was generally well done. Marks were awarded if colour seen was stated. Although candidates were able to deduce that the ink was composed of different colours, many did not infer that the different colours moved at different rates on the filter paper.

Candidates attached their filter paper and recorded the results in the table.

Several candidates were unable to produce a two-dimensional diagram. Teachers must ensure that two-dimensional drawings are practised without shading and label lines must be straight without arrowheads. Labels must accompany each diagram.

Candidates generally understood the concept of the aim of an experiment and most answers were well stated.

The conclusion was sometimes not relevant to the observation or linked to the aim. It was not specific enough for full marks to be awarded. Detailed colours of the spread needed to be accounted for. Candidates generally stated observations instead of conclusions.

Many candidates confused the aim and hypothesis. Teachers should emphasis the difference between the aim and hypothesis. A hypothesis is a statement indicating a suggested explanation for an observable phenomenon.

In part (k) candidates were not specific in stating the variable, for example, stating 'ethanol' instead of 'amount of ethanol'.

Question 2

Part A

Part A tested whether candidates could set up a series circuit using different materials in it to take current and voltage readings.

In some examination centres, bulbs were not provided to candidates and they therefore only recorded voltage and resistance readings in the table. Instructions did not indicate that bulbs were required; hence many candidates attempted the question without using bulbs. In such instances candidates were not penalised.

For the table in part (d) recorded values were not consistent with respect to significant figures. Teachers should make students aware of the importance of significant figures.

Part B

This part of the question tested the candidates' knowledge of Ohm's law. Candidates were expected to manipulate the equation used to calculate resistance in the circuit.

Most candidates were able to correctly deduce which were conductors and insulators in part (a) of the experiment: that W and Y were conductors and Y and Z were insulators.

Many candidates seemed confused about which values to use in the calculation of resistance. They did not know how to manipulate the equation $V = I \times R$. Substitution of values was well done only where it was correctly rearranged. Many candidates did not record the unit for resistance (ohms).

Candidates generally confused the hypothesis with the aim. A hypothesis is a statement indicating a suggested explanation for an observable phenomenon.

Most candidates were able to state the relationship between the wattage, voltage and current. The word or symbol equation $P = I \times V$ was accepted.

Some candidates failed to attempt parts (b) and (d), the parts of the question that required the use of the equation.

Teachers should ensure that students have sufficient practice in the manipulation of equations, particularly when using data derived from experiments.