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 2005

INTEGRATED SCIENCE

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GENERAL AND BASIC PROFICIENCY EXAMINATIONS
JUNE 2005

GENERAL COMMENTS

The CSEC examination in Integrated Science (Single Award) is at present offered at the Basic and General Proficiency. The June 2005 Examination consisted of three papers: Paper 01 – Multiple choice; Paper 02 – Short answer questions and Paper 03 – the School-Based Assessment.

The number of candidates writing the examinations at the General Proficiency Level increased by 12 per cent from 15 929 in June 2004 to 17 766 in June 2005. At the Basic Proficiency Level, the number of candidates increased by 17 per cent from 370 in June 2004 to 398 in June 2005. The overall performance of candidates in the 2005 examinations was consistent with the performance in 2004. The number of candidates achieving Grades I to III remained at 80 per cent at the General Proficiency Level and at 40 per cent at the Basic Proficiency Level.

DETAILED COMMENTS

Paper 01 – Multiple Choice

Paper 01 consisted of 60 Multiple Choice items. Performance on this paper remained on par with Paper 01 in 2004. The mean score for the General Proficiency Level in June 2005 was 33, or 55 per cent, and the mean in June 2004 was 32, or 53 per cent. The mean score for the Basic Proficiency Level in June 2005 was 29 or 48 per cent and the mean score in June 2004 was 34, or 57 per cent.

General Proficiency

Paper 02 – Structured Questions

Paper 02 comprised six, short-answer, structured questions. The maximum mark for each question was 15 and the maximum mark for the paper was 90 marks. The mean score for Paper 02 was 34, or 38 per cent.

Question 1

Question 1 (a) tested the candidates' knowledge of the structures associated with breathing and the mechanisms of inhalation and exhalation. Question 1 (b) tested the ability to apply knowledge about the respiratory system and environmental pollutants.

Approximately ninety-five per cent of the candidates attempted this question. Over 60 per cent obtained a mark of between 8 and 15 with about 5 per cent obtaining the maximum 15 marks.

Although the model representing the respiratory system in 1 (a) (i) was well known, a few candidates interpreted the stimulus material to be reproductive, circulatory or excretory organs. Candidates tended to generalize and did not use appropriate terminology to give a reason for the answer. Candidates were awarded marks if they identified two lungs or the trachea leading to two bronchi. Partial credit was awarded when they stated the "two balloons" or "two tubes" instead of lungs or bronchi as better representatives. Candidates tended to confuse the inhalation and exhalation processes in (a) (iv) and (v), especially with reference to the position of the diaphragm during these processes.

In (b), the majority of candidates were able to extract accurate readings from the bar graph. However, a few candidates were confused about the cement plant, mistaking it for an organism or living thing. Many candidates correctly noted the presence of pollutants given off from the plant and the likely effect of making bronchitis more severe.

Recommendation

Candidates should be exposed to an appropriate model that explains inhalation and exhalation so that they can visualize this internal mechanism. Candidates need to understand the effect of the changes in pressure and volume associated with the breathing mechanism.

Question 2

This question tested objectives C. III. 1, 2, 3 and B. III. 1 of the syllabus.

This question tested candidates' knowledge and understanding of the elasticity of three types of strings under different loads and the application of this understanding to practical situations. It also tested their understanding of

(i) the properties of aluminum metal as it relates to its use in protective headgear and
(ii) the conditions that favour fungal growth on sports wear and preventative measures that can be taken.

Although the majority of the candidates attempted this question, only a few of them gave satisfactory responses.

Part (a) (i) of the question was generally not well done. The expected response was 'length' or 'thickness of string'. The weaker candidates incorrectly responded that the "load" and "elasticity" must be controlled as a feature of the strings. This indicated both a lack of understanding of the term control, when used in the context of an experiment and a lack of good comprehension skills, since "load" is not a feature of the string.

Part (a) (ii) showed a similar trend as Part (a) (i) with great confusion as to what should be done. Many used the terms "measure the string", "check the string" and "measure the elasticity" very loosely. 'Measure the length of the string' was the acceptable response.

In Part (a) (iii), many candidates had difficulty interpreting the graph. Some candidates repeated the experimental procedure instead of giving reasons for the shape. Very few were able to identify the straight-line part and the curved part of the graph in their responses. This indicates a lack of understanding of what happens when a string is stretched until it reaches its elastic limit.

Part (a) (iv) was not well done. Only a few candidates were able to attain full marks with the majority unable to express their responses in clear statements. Many candidates simply transcribed the question as their response. A common misconception was that String P (instead of R) was able to withstand the greatest load because its line was the highest on the graph and vice-versa for String R. Only a few candidates were able to identify and compare the points at which deformation took place in the three strings.

Part (a) (v) was reasonably well done. The weaker candidates had some difficulty in expressing their responses clearly. Force was frequently interchanged with strength, power, load and weight. The question required candidates to focus on the properties of the two strings; however, many responses focused on the speed of the tennis ball. Although two of the strings were used for the rackets, many candidates listed all three strings in their responses.

Part (b) (i) was generally well done with many candidates correctly identifying 'light weight' and 'strong' as properties. Some of the poor responses however included, **"metals, zinc, copper, brass, magnesium, bauxite and alloys"** as properties of aluminum and did not relate the properties of the metal to its protective function in the headgear as stated in the question.

Part (b) (ii) and Part (b) (iii) were generally well answered with the majority of candidates scoring maximum marks in these two sections.

Recommendation

Based on the common misconceptions encountered in the responses to this question, candidates need to

- understand terms such as 'control' in relation to variables in experiments and 'property' of substances with respect to their function or use
- understand the importance of each step in a practical activity (Emphasis should be placed on giving reasons for performing each step in a procedure.)
- develop a sound science vocabulary; thus, minimizing the need for using 'street science terms' when answering questions
- conduct simple experiments on elastic limits, plotting and reading load extension graphs and importantly, interpreting these graphs, for example, curved line at end indicates elastic limit has been reached
- evaluate the quality of sporting materials based on their elasticity and strength.

Question 3

This question tested objectives B. V. 3, 5, 6, 7 & 8.

Generally, the responses throughout the paper showed that the majority of candidates had some basic knowledge and understanding about the topic.

Part (a) – Reading the analogue meter was not well done.

- The direction of the dials was not generally known.
- The place value also created a problem.
- The stimuli given by labelling of the dials, first and second meter readings, were ignored. This could explain why the values derived were placed in the wrong spaces.

In Part (b), many candidates were able to calculate the costs; however, they need to be reminded to show all necessary working.

Part (c) (i) presented some difficulty. Few candidates achieved maximum marks because of the incorrect units, that is, they multiplied the watt used by the appliance, by the time in hours used, but the column heading required that the answer be in kWh.

Part (c) (ii) was well done; candidates were aware of the ways of conserving energy in the home but did not pay full attention to the reference in the question to those appliances specifically mentioned in the Table 1.

Part (d) (i) presented some difficultly. Candidates generally understood that a fuse is a protective device in an electrical system. However, they needed to be more precise in indicating, "protect from high voltage", "protect from current surges."

In a large number of responses, the definition of a fuse was confined to

(i) physical description, that is, glass tube with wire and metal ends; piece of wire in a circuit

(ii) for example, something (an object or appliance,) used to control or regulate current in electrical appliances.

These, however, do not suggest limiting current flow by destruction of the fuse as expected.

In Part (d) (ii), the function of a fuse was well understood. However, the direction of current flow was largely confused, as many responses incorrectly suggested that it was after the hairdryer became overheated that the fuse blew.

Part (d) (iii) was well done by the candidates. Water as a conductor of electricity and the consequence of water being used to put out electrical fire was fairly well known.

Part (d) (iv) was well done by the candidates. Candidates were aware of the methods used for putting out an electrical fire. Acceptable responses included CO_2 and foam fire extinguishers, fire blanket, and sand.

Recommendations

Candidates need

- to understand that conservation is not just about any alternative way, but involves practical cost-effective alternatives. This showed in some of the suggestions, for example, to "hire a washer person" rather than using the washing machine.
- to pay full attention to the units in calculations
- to pay attention to stimulus materials.

Question 4

This question tested the candidates' knowledge of the effect of boiling and freezing on contaminated water and the candidates' analysis and evaluation skills.

In Part (a) (i), the candidates were required to explain why contaminated water should be boiled. Any response which suggested that boiling would kill organisms present in the water was credited, for example, to destroy germs, bacteria or harmful organisms. Most of the candidates were able to give a correct response.

Many candidates were unable to give a response to Part (a) (ii) which indicated they knew that many organisms are not destroyed by freezing.

Some responses credited were:

– "Yes, because freezing only slows down the bacteria while boiling kills them."
– "Freezing slows down the growth process but they are alive."

Some responses not credited were:

- "Freezing preserves things."
- "When water freezes, bacteria can't get in."

Part (a) (iii) was fairly well done. Responses credited included

- "broken or cracked pipelines"
- "dirty storage tanks/storage tanks with dead organisms."

A vague answer such as "water becoming contaminated from the pipeline" was not credited.

Part (a) (iv) required the candidates to name one disease that individuals may be exposed to if they drink contaminated water. Any water borne disease was credited, for example, typhoid, cholera, dysentery, gastroenteritis.

However, symptoms were not credited, for example, diarrhoea.

Part (b) (i) described steps taken to carry out an experiment to compare two brands of mouthwash, S and L. The candidates were asked to give reasons for the steps. This was poorly done.

Many candidates were unable to identify 37·C as body temperature and therefore it would be the ideal/ best/suitable temperature for the bacteria to grow.

Parts (b) (ii) to (b) (v) were based on a bar graph comparing the bacterial growth in three agar plates, one with mouthwash S, one with mouthwash L and the third without any mouthwash. The candidates were required to analyze and evaluate the data. These questions were fairly well done.

Recommendation

Candidates need more opportunities to analyze and evaluate experimental data in its various forms, for example, graphs, charts or tables.

Question 5

This question examined the candidates' understanding of

(i) the structure and function of the kidney and associated organs and

(ii) the role of insulin and glucose in the body.

Few candidates performed satisfactorily in this question.

In Part (b), the majority of candidates had little knowledge of how urea is formed or excreted. Common misconceptions included excretion of whole protein molecules instead of a simple molecule, urea. Answers not credited included "protein is let out as waste" or "more protein in the diet leads to more urea." Credited answers included "urea is not reabsorbed by the kidney/nephron" and "urea is excreted by the kidney."

Part (b) (ii) was fairly well done with a large percentage of candidates offering creditable answers such as "malfunctioning pancreas." A common misconception was "malfunctioning kidney."

Most candidates achieved a good score in Part (b) (iii) with the majority of responses demonstrating an understanding of the function of the collecting duct/ureter and bladder.

Parts (b) (iv) and (v) were fairly well known by most candidates. However, there seems to be confusion with the terms 'glucose' and 'energy'. Most candidates used these two terms interchangeably.

Recommendation

Candidates are urged to pay close attention to the proper use of scientific terms and the correct spelling of these terms and to spelling in general.

Question 6

This question tested the candidates' knowledge of the relationship between fronts and weather patterns as well as their knowledge of tides and certain organisms in the sea.

The response to Part (a) (i) of the question was not satisfactorily answered as most candidates were unable to define the term 'front'.

Part (a) (ii) was satisfactorily done and most candidates were able to gain at least three of the four marks.

Part (a) (iii) was not satisfactorily answered. Although candidates were aware of the correlation between 'fronts' and 'weather patterns,' they ignored the stimulus material, and held firmly to the Caribbean being hot and the U.S.A. being cold.

More than 90 per cent of the candidates attempted Part (b) of the question. However, there was some confusion as many candidates felt that the height of waves determined whether it was high or low tide.

Part (c) (i) was poorly done. Most candidates assumed that the organisms were found there because the rocks provided food and protection.

Part (c) (ii) was well done. Most candidates indicated that the features were necessary to prevent the organisms from being washed away.

Part (c) (iii) was well done. Most candidates were able to name one other organism likely to be found in Region B.

DETAILED COMMENTS

Basic Proficiency

Paper 2 – Structured Questions

Question 1

This question tested the candidates' knowledge of reproduction. The overall performance on this question was satisfactory.

The performance in Parts (a) (i) and (ii) which referred to definitions and examples of sexual and asexual reproduction was generally unsatisfactory.

In Part (a) (i), candidates had tremendous difficulty in distinguishing between sexual and asexual reproduction. Few responses were correct. Responses credited included:

- Sexual reproduction involves both parents while asexual reproduction involves one parent.
- Sexual reproduction involves the fusion of gametes while asexual reproduction has no fusion of gametes.
- Sexual reproduction produces offspring with different genes while asexual reproduction produces offspring with identical genes.
- Sexual reproduction produces new organisms that are not identical to the parents or each other while asexual reproduction produces new organisms that are identical to the parents and each other.

In Part (a) (ii), candidates were asked to give one example of each type of sexual and asexual reproduction. The responses to this also were generally unsatisfactory.

Responses credited:

- Asexual reproduction, for example, cuttings, corms, runners, rhizomes, tissue cultures (orchids), bulbs
- Sexual reproduction (plants), for example, development of seed/plant from flowers, pollination (wind/cross/insect)
- Sexual reproduction (animals), for example, development of a baby from a fertilized egg

In Part (b), candidates were provided with a graph representing the growth of two plants of the same species, with the leaves of Plant A broader than those of Plant B.

In Part (b) (i), candidates were asked to complete the table, inserting the heights of Plants A and B in the spaces provided. This was very well done with most candidates accurately recording the heights required. Responses credited:

- Plant A, Week 2 - 30
- Plant A, Week 4 - 45
- Plant B, Week 3 - 58
- Plant B, Week 5 - 60

In Part (b) (ii), candidates were required to make inferences from the graph as to which plant would be best for a farmer who wants to sell at the market every four weeks. Responses credited:

- The plant that should be grown for market is Plant B.
- One reason for the answer in (b) (i) is that Plant B will be bigger or taller than Plant A.

Part (c) stated that a farmer wants to produce plants that are identical to their parents:

In Part (c) (i), candidates were asked to state which method of reproduction he should choose to produce the plants – this was poorly done. Response credited was – asexual reproduction.

In Part (c) (ii), candidates were asked to provide one reason for their answer in (c) (i). This was also poorly done.

Responses credited:

- Do not involve combination of genes which could cause variations.
- Cuttings do not involve fusion of gametes.
- No variation occurs in asexual reproduction.
- Is easier to reproduce to get identical plants.
- Produces large numbers of offspring, therefore, a lot will survive.
- Produces new independent organisms more quickly.

Question 2

The performance of candidates on this question was satisfactory. It tested candidates' knowledge of exercise and energy requirements, effects of exercise on the body and the effect of air [wind] on sporting activities.

The stimulus provided in Part (a) was a table listing various sports and their energy values.

Part (a) (i) and (a) (ii) were generally well done with most candidates being able to provide a correct response.

Responses credited:

- Swimming was the sport requiring the greatest amount of energy.
- Swimming and cycling were the two sports that were ideal for persons who want to lose weight quickly.

The performance in (a) (iii) was unsatisfactory. Few candidates were able to state the reason why exercise improves the respiratory and circulatory systems.

Responses credited:

- Respiratory system
  Exercise promotes the development of stronger lungs, increased lung capacity and increased efficiency in breathing.
- Circulatory system
  Exercise promotes improvement in the flow of the blood and strengthening of the heart muscle.

In Part (b), candidates were provided with a stimulus diagram that showed an athlete throwing a javelin.

Parts (b) (i) and (b) (ii) were fairly well done with some candidates being able to provide a correct definition of energy and name one type of stored energy.

Responses credited:

- Energy is the capacity to do work.
- Types of stored energy, for example, chemical energy, potential energy, nuclear energy, solar energy, fat, or specific examples such as glucose.

Part (b) (iii) required candidates to plot a graph of distance against angle using information provided in Table 3. This was fairly well done. However some candidates had difficulty in accurately plotting the graph. Responses credited included:

- Axes accurately placed and values listed
- Points correctly plotted
- Straight lines linking points

Part (b) (iv) required candidates to determine the best angle at which to throw the javelin. Many candidates presented the correct response of 30 degrees and achieved full marks.

Part (b) (v) required candidates to explain why the angle in (b) (iv) gives the athlete the throw with the longest distance. Only a few candidates were able to provide acceptable explanations.

Responses credited:

- More power is produced at this angle.
- A large force is provided.

Part (b) (vi) required candidates to suggest how wind direction affects the distance of the throw. Most candidates were only able to provide one of the two possible explanations.

Responses credited:

- If the wind is blowing in the opposite direction to the throw of the javelin, the distances will be shorter and the wind pushes back the javelin.

- If the wind is blowing in the same direction as the throw of the javelin, the distances will be longer and the wind pushes the javelin forward.

Question 3

This question tested the candidates' knowledge and understanding of the heart and the circulatory system. The question proved to be very challenging. There were many vague responses, and a lack of responses for some parts. A general lack of knowledge was displayed by many of the candidates.

The performance in (a) (i) was unsatisfactory. Many candidates were unable to identify Organ A as the lungs despite the stimulus diagram given. Many stated that it was the head or brain because it was above the heart.

Part (a) (ii) required candidates to give TWO reasons for identifying **Organ A as the lungs**. For candidates who were able to answer (a) (i), they had difficulty in relating the pulmonary vessels to pathways from the right ventricle to the lung and from the lung to the left atrium.

In Part (b) (i) and (b) (ii), candidates had to draw arrows on the diagram to show the direction of blood flow (i) from the heart to the cells of the body and (ii) between the heart and Organ A. The majority of candidates were unable to complete this task. Students should be reminded that arrows contain a pointed head [this shows direction] and not straight lines.

In Part (c) (i), candidates were required to identify **Vessel B as the aorta**. Many students seemed unfamiliar with the circulatory system and were unable to gain this mark. In Part (c) (ii), some students were able to gain a mark by correctly suggesting one difference between an artery [Vessel B] and a capillary.

Responses credited:

- Thinner blood vessel
- No outer layers
- Less muscle than blood vessel B
- Less fibers than blood vessel B

In Part (d) (i), about 50 per cent of candidates were able to suggest that there would be a decreased blood flow or a decrease in blood pressure through B if the muscle at C [left ventricle] was weakened.

In Part (d) (ii), many students failed to achieve marks for giving a reason to (d) (i) , for example, Muscle C [left ventricle] need to provide the force for blood to flow through to Vessel B.

In Part (e) (i), most candidates were unable to suggest that **cells may die or function inefficiently** when too little blood flows to them.

In Part (e) (ii), only 5 per cent of candidates were able to relate **decreased food or oxygen supply** as a reason for (e (i).

Part (f) proved to be the most difficult section with very few candidates naming **diffusion** or **osmosis** as the processes by which substances in the blood enter the cells of the body.

In Part (g), many candidates correctly stated one cause of heart attack.

Responses credited:

- Too much saturated animal fats
- Too much cholesterol
- Too much salt
- Stress
- Inherited tendencies
- Obesity
- High blood pressure
- Presence of a blood clot in the coronary artery
- Narrowing of the coronary artery reducing blood flow to the heart muscle

Question 4

This question assessed several properties of light – effect of light on colour, shadow formation, the spectrum and effects of UV radiation on humans.

This topic was not well known by the candidates.

Part (a) (i) was fairly well done. However, some candidates misinterpreted the 'cost of lighting' to mean the cost of purchasing the lamps.

Response credited: Fluorescent lighting is cheaper/more economical than filament lighting.

In Part (a) (ii), most candidates seemed to understand the concept of sharp and soft shadows but were unable to describe them.

Responses credited:

- Filament lamps provided sharper/bigger/better/darker shadows.
- Fluorescent lamps provide softer shadows.

Part (b) (i) was poorly done with candidates showing an inability to use the data in the table to explain the effect of different lighting on the red lipstick.

Responses credited:

- Fluorescent light is deficient in red light.
- Less red light is reflected by the lipstick.

The majority of candidates responded appropriately to Parts (b) (ii) and (c).

Responses credited:

- (b) (ii) Filament lamp
- (c) More red light from the fluorescent lamp or normal amount of red light from the filament lamp

In Part (d), only about 50 per cent of the candidates responded to this section; and of this number, most drew an incorrect representation of the shadow formed on the screen.

Responses credited:

- Drawing of a circular shadow on the screen
- Size of shadow according to light rays entering

In Part (e), the majority of candidates seemed to lack knowledge of the order of colours in the light spectrum, similarly in Part (f) where they had to determine the colour of the red pigment in white light and in green light.

Responses credited:

(e) Colours at the end of the spectrum are red and violet.
(f) (i) In white light, it appears red while in green light it appears black.

Responses credited:

(g) (i) Sunglass Y
(g) (ii) a) Protection against dangers of UV radiation (partial credit)
b) UV radiation damages the retina (the light sensitive cells of the eye)

Question 5

This question tested the candidates' understanding of the reactivity of metals and its relationship to their properties as well as the use of plastics.

Part (a) showed the results of an experiment conducted to compare the reactivity of four metals A, B, C, and D. Figure 17 showed the amount of effervescence released by each metal.

The performance in (a) (i) was satisfactory. Most candidates provided answers that implied the control of the experimental conditions.

Response credited: **Control of variables**

Part (a) (ii) was generally fairly well done. Most candidates were able to give the order of reactivity of the four metals.

Response credited: **C ∅ A ∅ D ∅ B**

Part (a) (iii) was poorly done. Most candidates were not able to write the word equation for the reaction stated.

Response credited:

Aluminium + sulphuric acid ∅ Aluminium sulphate + hydrogen

In Part (b), candidates were presented with Table 5 which listed the order of reactivity of eight metals.

The performance in Part (b) (i) was satisfactory. However, some candidates did not relate the suitability of copper in the manufacture of utensils to its property identified in the table, but rather, stated other properties such as good conductivity.

Response credited: Copper is not very reactive.

In Part (b) (ii), candidates were asked to state which metal was most appropriate for the canning of juices. Several candidates provided a correct response.

Response credited: Aluminium

Part (b) (iii) was poorly done. Most candidates could not express a reason for their choice in (b) (ii). Responses credited:

- Aluminium is very light.
- Aluminium is un-reactive due to its oxide coat.

Part (c) (i) required candidates to state two uses of plastics. This was generally well done with most candidates being able to provide correct responses. Many candidates relied on real life experiences to provide examples of uses of plastics.

Responses credited:

- Covering of cables [insulation]
- Manufacture of containers [bowls/dustbins/food containers/disposable cups]
- Used as packing material
- Wrapping film
- Clothes/clothing material

Part (c) (ii) required candidates to state one advantage and one disadvantage of plastics. This was fairly well done as candidates utilized everyday experiences to provide correct responses.
Responses credited:

Advantages	**Disadvantages**
– Light	– Non-biodegradable
– Non-conductor	– Can cause pollution
– Cheaper	– Creates waste and litter
– Can be recycled	– Impacts on environmental sanitation
– Provides shelter/covering	

Question 6

This question tested the candidates' knowledge of 'force' and 'moments'.

Part (a) (i) required candidates to define the term 'force'. This was widely known and most candidates were able to give a correct response.

Response credited: Force is defined as a push or pull.

Part (a) (ii) required candidates to name the 'turning effect of a force'. Most candidates demonstrated little knowledge of the term 'turning effect'. In most cases the word 'movement' was given as the particular response.

Response credited: The turning effect of a force is known as the moment of a force.

In Part (a) (iii), candidates were provided with a stimulus diagram in Figure 8.

Responses credited:

- The rule would turn in a clockwise direction.
- To turn in an anti-clockwise direction, you would need to hang the object on the other side of C.

Parts (b) (i) and (ii) were poorly answered. Candidates were unable to calculate 'moments'. They seemed not to know the appropriate formula to be used. Most displayed little or no knowledge of how to find the mass of a small fruit using the given arrangement in Figure 9.

Responses credited:

(i) 50 x 20 = 25 x d; the calculated distance is 20 cm.
(ii) Experiment to find mass of a small fruit; procedures –

1. On balance rule, hang fruit by string in position [d] [i].
2. Hang 50 g mass [m1] on other side, in position [d2], where rule is balanced.
3. Calculate the mass of the fruit [m2] using the formula m1 x d1 = m2 x d2.
4. Repeat the procedure using different distances for d1.
5. Find the average mass.

Part (c) was fairly done. A stimulus diagram showing the use of a crowbar was provided.

In Part (c) (i), most candidates were able to interpret the stimulus diagram and provide a correct response. However, most of them were unable to give the correct reason for the chosen arrangement.

Responses credited:

- Diagram B requires less effort to move the load
- Less force or larger distance between E and F

Parts (c) (ii) and (c) (iii) were poorly done.

In Part (c) (ii), most candidates could not state the process of the body which provided energy.

Response credited: Respiration provides the energy needed to operate the crowbar.

In Part (c) (iii), most candidates could not write the word equation for the process of respiration.

Response credited: Glucose + Oxygen ∅ Carbon Dioxide + Water + Energy

Overall, this question proved to be very challenging for the majority of candidates and as such the overall performance was unsatisfactory.

School-Based Assessment

Overall Performance

The overall performance at the General Proficiency Level was fair. However, greater effort seems to be needed in Analysis/Interpretation and Planning/Design. Generally, notebooks and the mark schemes were submitted. However, Student Instruction Information Sheets were missing.

At Basic Proficiency, the overall performance was fair. However, the practical activities assessed were too simple and all the skills were not assessed.

Recommendation to Teachers

- All laboratory 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 exercise and in the contents page.
- **All skills must be marked out of six (6)**. Skills marked out of other totals should be scaled to six.
- Dates when the practicals were assessed should be included.
- All skills except P/D should be assessed at least four (4) 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 from (a) and (b) as outlined in the syllabus.**

Observation, Recording, 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 quantity 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 scale, points plotted accurately and a **smooth curve or best fit line drawn**. (Only growth curves 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 too simple, for example, 'testing milk for protein'.

- Laboratory exercises should 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 stated and the data obtained.**

- Calculations shown must include formulae and units.

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

Planning and Designing (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 need not be done for proven scientific facts, for example, 'Moisture and air are needed for rusting' and 'Sunlight and water are necessary for germination'.

- **Textbook laboratory exercises are not acceptable**.

- Some laboratory exercises do 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**.

- Students should be encouraged to write an Aim, which is directly linked to the hypothesis.

- Procedure should reflect a direct link with the hypothesis.

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

- **P/D laboratory exercises do not have to be carried out**. If they are executed they can be used to assess other skills and the plan should then be modified if necessary.