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 2006

INTEGRATED SCIENCE

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GENERAL AND BASIC PROFICIENCY EXAMINATIONS
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GENERAL COMMENTS

The CSEC examination in Integrated Science (Single Award) was offered at the Basic and General Proficiency Levels. The Basic Proficiency Level was offered for the final time. The June 2006 examination consisted of three papers; Paper 01 – Multiple Choice; Paper 02 – Short-response questions and Paper 03 – the School-Based Assessment.

The number of candidates writing the examinations at the General Proficiency Level increased by 479 from 19,763 in 2005. At the Basic Proficiency Level, the number of candidates decreased significantly, from 727 in 2005 to 342 in 2006.

The overall performance of candidates in the 2006 examinations was consistent with the performance in 2005. At the General Proficiency Level, 77.1% of the candidates earned Grades I to III while at the Basic Proficiency, 44.4% earned these grades.

DETAILED COMMENTS

Paper 01 – Multiple Choice

Paper 01 consisted of 60 multiple choice items. The mean score earned at the Basic Proficiency Level increased by 6.5% from 47.9% in 2005 to 54.4% in 2006. At the General Proficiency Level, the mean score increased by 2% from 55.2% in 2005 to 57.2% in 2006.

General Proficiency

Paper 02

Paper 02 comprised of 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 35.6%.

Question 1

Question 1 tested candidates' knowledge of the reactions between aluminium and hydrochloric acid; iron and water; rusting; the relevant word equations; and factors that result in rusting. The knowledge questions were followed by questions on the causes and control measures of respiratory ailments. It also included the results of a laboratory experiment based on the reaction of different metals with hydrochloric acid and tested the candidates' analytical skills.

Generally, the responses were poor. Few candidates earned full marks. There were a few "no responses". Candidates had difficulties in answering the question correctly. It was noted that approximately fifty per cent of candidates scored below seven marks.

Question 1(a) and (b) tested the candidates' knowledge of reactions between aluminium and hydrochloric acid; iron and water and the completion of the respective word equations. Also tested was the chemical process by which rusting takes place and the word equation for the formation of rust. This section constituted the knowledge profile and was poorly done. Very few candidates earned full marks in this profile.

The concept of equations was not clearly understood by some of the candidates. Some candidates rewrote the words from the questions as their answers and there was a clear indication that the answers to this section were not known.

The latter part of the question required use of knowledge skills and was answered much better than the knowledge profile. Most candidates writing Question 1(b)(iii) were able to explain to some extent why rusting of the gate occurred rapidly. This was worth two marks and most of the candidates were unable to earn the full two marks. They were unable to present the accredited answers as either water and salt or moisture and salt. In addition, for this question most candidates wrote 'seablast' as causing the gate to rust. 'Seablast', without a scientific explanation was not accepted. However if it was qualified by water or salt, it was accepted as correct.

Parts (c)(ii) and (iii) dealt with the rusting of kitchen windows. The materials that were used included aluminium, steel and plastic. The question required candidates to state the type of material used to make the kitchen and the bedroom windows and to explain their choice of material with respect to rusting or not rusting.

Candidates answered this section well. Most candidates knew that the plastic and aluminium would not rust as much as steel would rust. However, candidates were confused about 'the reason the steel rusted'. Most of the candidates indicated that steel will rust but did not identify the conditions of rusting or that steel is an alloy containing iron.

Parts (d)(i) and (ii) dealt with a family living close to several factories and the children being affected by respiratory ailments, as well as the family moving to the beach to live. Candidates were required to suggest reasons for the respiratory ailments as well as to suggest reasons for the decline of respiratory ailments on moving to the beach to live. Generally this question was answered well by most candidates, however, weaker candidates had some difficulties because the terms 'respiratory ailments' and 'decline in frequency' were misunderstood.

Parts (e)(i), (ii) and (iii) dealt with an experiment carried out using 1 gram of metal X, Y and Z and 5 cm^3 of hydrochloric acid which was added to 3 separate test tubes. Candidates were asked to arrange the metals in order of increasing reactivity and to name a metal which is not reactive with hydrochloric acid. In addition candidates were required to give the reason for the addition of 5 cm^3 of hydrochloric acid to each of the three metals. The majority of the candidates answered (e)(i) very well. In (e)(ii), some of the candidates were unable to suggest the correct name of the metal which is not reactive with hydrochloric acid. The acceptable answers were the coinage metals: silver, gold, copper and platinum. For (e)(iii), answers were either 'control or accuracy'. However, these terms were not fully understood by some candidates. Many candidates responded correctly to this part.

Recommendations

(i) Teachers must emphasise the importance of the terms accuracy and control in experiments.

(ii) Students should be encouraged to use scientific terms correctly and avoid non-scientific terms.

(iii) Students should be encouraged to express themselves clearly, concisely and scientifically.

(iv) Students should have more practice sessions at school in answering knowledge and use of knowledge questions.

Question 2

This question tested the candidates' knowledge of energy, energy types, energy conversions and the causes and treatment of inefficiency in machines. This question also tested the candidates' ability to perform calculations.

The candidates' responses to the question were poor.

Part (a)(i) required the candidates to define energy and Part (a)(ii) required the candidates to name two forms of energy. These parts were well done.

Part (b)(i) presented the candidates with three activities and required them to state the energy conversions for the activities. Less than fifty per cent of the candidates were able to identify the correct energy conversions for the activities.

Part (b)(ii) presented the candidates with a see-saw scenario and required them to calculate the distance one child would have to sit from the middle for the see-saw to balance. Most candidates were able to give the correct answer, but of those with the correct answer less then twenty per cent showed working.

In Part (b)(iii), candidates were asked to state the class of lever that the see-saw represented. This part was very well done with over ninety per cent of the candidates correctly answering first class lever.

In Part (c), the candidates were asked to calculate the mechanical advantage of a machine. This part was poorly done with less than fifty per cent of the candidates giving the correct answer. Of those who answered correctly, very few were able to show working.

Part (d)(i) required candidates to know the causes of inefficiency in machines. This part was poorly done.

Part (d)(ii) required candidates to know the methods used to reduce the inefficiency of machines. Those candidates who correctly answered (d)(i) were able to answer correctly (d)(ii).

Recommendation

Teachers should explain the importance of showing working with calculations.

Question 3

This question tested the candidates' understanding and ability to use knowledge relevant to the circulatory system.

Part (a)(i) tested the candidates' knowledge of the functions of the circulatory system. Most of the candidates stated less than the four functions required by the question.

In Part (b)(i), many candidates responded, "The animal will 'bleed to death'". This was the most common response and far too general. The expected responses included death due to insufficient oxygen taken to the tissues.

Part (b)(ii) was done well by the majority of candidates. Many candidates answered "the lumen and the thickness of the wall". They did not specify that A had a thicker wall than B, and that A had a smaller lumen than B as expected.

Some common misconceptions that occurred were that candidates identified A as an artery with plaque and B (a vein) as a healthy blood vessel.

A few candidates incorrectly identified the blood vessel as a xylem and phloem. Also many candidates gave functional differences between A and B, as their answer.

In Part (b)(iii), less than fifty per cent of the candidates were able to correctly identify the blood vessel.

Part (c)(i) was generally well done. Most candidates listed the name of the foods, salted fish and fried potato chips. A few candidates wrote a sentence stating that these were examples of greasy, oily and salty foods.

Part (c)(ii) posed a moderate amount of difficulty. Many candidates were unable to identify factors not related to the diet, that could contribute to hypertension.

Part (c)(iii) revealed a common misconception that moderate exercise would have adverse effects such as fainting, increased blood pressure, heart attack and strokes. Candidates who performed well were able to cite lowered cholesterol levels, improved breathing rates, reduced stress levels, improved blood flow, improved circulation, 'strengthening of the heart', and increased lung activity as ways in which moderate exercise can effect the body.

Part (c)(iv) posed the greatest degree of difficulty to candidates. Candidates responded that weaker heart muscles would make the blood pressure in the heart increase. Very few candidates gave a reason.

Recommendations

Students need to

(i) understand clearly the differences in structures and function between plant and animal circulatory systems

(ii) understand that exercise in its many forms generally improves bodily functions in many ways and should generally be considered in a positive light

(iii) develop a thorough understanding of the nature of the circulatory systems

(iv) conceptualise that structure mirrors function and that deficiencies in structure almost always mirror deficiencies in function

(v) conduct simple experiments with pumps and hoses to serve as analogies to the circulatory systems in animals showing how defect deficiencies in these apparatus affect its efficient functioning.

Question 4

This question examined candidates' understanding and use of knowledge relating to the topic, Nutrition. The area examined included:

(i) Balanced diet
(ii) Food nutrients and their uses
(iii) Digestion of food substances

In general, this question was well done.

Part (a) examined candidates' understanding of the concept of a balanced diet. Many candidates were unable to state correctly a definition of the term 'balanced diet'. The expected response was:

> A balanced diet is one with the correct proportion of each food nutrient depending on the person's age, sex and occupation.

A few responses included the conditions of a balanced diet, for example, sex and occupation.

Part (b) was fairly well done with most candidates gaining maximum marks. However, some candidates did not understand the term 'nutrient'.

In Part (c), candidates were expected to choose and justify a lunch option for (i) – an athlete and (ii) – a pregnant woman.

Some candidates were unable to justify their option. Candidates were expected to state the nutrients found in the lunch option and the increased need for that nutrient by the individual involved.

Expected responses included:

Part (c)(i) Option C for athletes because it contained foods high in carbohydrates which provide energy or high in proteins to help build up muscles to repair damaged tissues.

(ii) Option B for pregnant women because it contained foods high in iron/protein/vitamins for development/growth and/or good health of the body.

In Part (d), some candidates explained aspects of mechanical digestion instead of chemical digestion as required.

Good responses included:

- Protein is chemically broken down by the enzyme pepsin into polypeptides which is further broken down into amino acids, before absorption.
- Fat is broken down by the enzyme lipase to fatty acids and glycerol.

Recommendations

Students should

(i) place more emphasis on using correct scientific terms

(ii) use the stimulus material presented to answer the questions.

Question 5

This question tested the candidates understanding of the differences between pests and parasites, the methods of pest control and the feeding relationship between organisms in a community. The majority of responses ranged from fair to satisfactory. Few candidates obtained full marks.

In Part (a)(i), the candidates were required, to describe in tabular form, the characteristics of pests and parasites. Many candidates provided the expected responses which included:

- Parasites live in or on other living organisms
- Parasites depend directly on other organisms for food.

Many candidates stated that 'Parasites live off other organisms' rather than 'Parasites live in or on the organisms'. Some candidates gave examples of parasites and pests rather than answer the question.

Part (a)(ii) required the candidate to name TWO common household pests. Most candidates were able to name two pests: rats, mice, termites, housefly, cockroach, bed bugs, mosquitoes and ants. Pests and vague responses such as dogs, cats, bugs, lizards and wasps were not accepted.

In Part (b)(i), the candidates were required to suggest TWO factors that might be responsible for the increase in the number of flies in a rural community near a small river where kitchen gardens, livestock rearing and fishing were done.

Expected responses included:

Manure heaps, accumulation of garbage, the presence of fish, waste matter from livestock and unwanted parts of fishes.

Vague answers such as dirty conditions, place was not clean, disposal of garbage, livestock, gardening or fishing are unacceptable.

In Part (b)(ii), the candidates were asked for ONE method other than the use of insecticide to control the number of flies. Expected responses included:

- Proper disposal of garbage
- Use of disinfectants
- Cleaning the pens/washing the livestock
- Use of fly bait
- Use of sticky fly paper
- Biological method

In Part (c), the candidates were told that after spraying with a particular insecticide, the gardener observed that even though large numbers of blossoms were produced by the vegetable plants there was a decrease in the number of vegetables produced.

Part (c)(i) required the candidates to explain why there was a decrease in the produce from the garden. Based on the information provided, the expected response was 'The insecticide killed the insects responsible for pollination and therefore fertilisation could not take place'.

Rarely did the responses reflect an understanding of the role of insects in the production of fruits.

Part (c)(ii) required the candidates to explain why there was also a decrease in the population of fish in the river. Many responses correctly suggested that the river had been polluted by the insecticide and the fish were killed or moved away from the sea.

In Part (d)(i), a food web was provided and the candidates asked to state the effect on the weed population and the spider population if the insect population was reduced. Any response indicating that the weed population would increase while the spider population would decrease was credited.

Part (d)(ii) required the candidates to choose and write ONE food chain from the food web provided. Most candidates were able to write a food chain with at least three organisms. Common mistakes made were:

- Not starting the chain with the weeds

- Using arrows pointing in the wrong direction
- Not using arrows at all
- Using arrows pointing to the correct organism but organisms listed in descending order through the trophic levels.

Recommendations

Teachers should

(i) emphasise that all food chains must begin with a green plant (producer)

(ii) encourage use of scientific terms and proper names of organisms

(iii) emphasise the effects of removing any organism from a food web.

Question 6

This question tested the candidates' knowledge of refraction, reflection, methods of fishing and colour.

Generally, the response to this question was poor with about five per cent of candidates failing to attempt any part of the question.

Part (a) of the question assessed the candidates' knowledge and understanding of the behaviour of light rays – reflection (from a mirror surface) and refraction (through a body of water). Many candidates displayed satisfactory knowledge of the pathway of a light ray under reflection, but knowledge of the pathway of a ray of light under refraction was poorly portrayed. Most candidates who attempted this part knew that the ray of light bent, however, they were unable to show this occurrence in relation to the normal.

Part (b)(i) was well done. Many candidates identified the actual position of the fish as below the point X.

Part (b)(ii) was poorly done, as many candidates could not relate the occurrence to the refraction of light. Some of the misconceptions included – water magnified the size of the fish, poor eyesight of the fisherman.

Part (b)(iii) was well done, as many candidates were able to indicate that the fisherman should have aimed below the apparent position of the fish. Answers accepted included – Below X, In front of X, Before X, Bottom of X, Under X, Ahead of X – all of which seemed reasonable in relation to 'Below X' as the preferred answer and as indicated in the stimulus material.

In Part (c), about 50 per cent of the candidates accurately indicated a method of catching deep-sea fish. Responses accepted for method of deep-sea fishing included – trawl nets, trawling, long liner, towlines, fish pots, fish traps, drift/drag net. Poor responses included – big nets, casting nets, seines, fishing rod and harpoon.

In Part (d), the lack of knowledge resulted in about twenty per cent of the candidates being able to identify dispersion or diffraction as a term used for the splitting of a ray of light. Poor responses included – chromatography, prisms, refraction and rainbow.

Part (e) required candidates to give a definition of a primary colour – 'colour that cannot be formed by mixing' was given in about fifteen per cent of responses. Other responses accepted were – colours

mixed/combined/used to make secondary (another, other) colours. Colours from which different colours (meaning other than primary colour) are formed were also accepted.

In Part (f), the expected answers are: X – Yellow; Y – Magenta; Z – White. Only about thirty per cent of the candidates correctly answered this part.

Candidate responses to Part (g) were poor. Generally, candidates were unable to distinguish the effect of coloured light on pigments.

Recommendations

Students should

(i) investigate through practical activities – rays of light through prism and other mediums; coloured lights and pigments

(ii) apply their knowledge to everyday experiences.

DETAILED COMMENTS

Basic Proficiency

Paper 02

Question 1

This question tested the candidates understanding of and ability to use knowledge relating to the endocrine and nervous systems. The overall performance on this question was satisfactory.

Part (a) presented candidates with an incomplete table (Table 1: Stimuli, their Receptors and Effectors) and they were expected to supply the missing information. Performance in this section was satisfactory.

In Part (b) candidates were asked to state one major difference between the ways in which these systems coordinate the activities of the body. Most candidates could not earn full marks, as they were unable to give one difference. Acceptable answers dealt with differences in both structure and function of the two systems.

In Part (c), candidates were asked to explain what is meant by the term 'reflex action'. This part was generally well done with most candidates being able to provide an accurate explanation of the term 'automatic or involuntary action' – occurs without thought, very quick response, the knee jerk.

Parts (d)(i) and (ii) referred to Table 1 in (a) where candidates were asked to identify one reflex action in the Table and give a reason for their choice. Most candidates were able to correctly identify Action C (Without thinking, Ms Cato quickly drops the hot pot cover). Many of the candidates were able to validate their choice with a reason – the action happened quickly or without conscious thought.

Part (e)(i) referred to Activity B in Table 1 with candidates being asked to state whether the activity would increase or decrease the level of adrenaline in Indar's body. The correct response was that the level of adrenaline would be increased. Many candidates seemed not to have read the question carefully and responded with answers of yes or no and as such did not earn marks.

Parts (e)(ii) and (iii) were not well done. Candidates were unable to identify the adrenal glands as the endocrine organ responsible for the production of adrenaline and that these glands were located above

the kidneys in the upper back of the abdomen. This reflected a general lack of knowledge of the endocrine system.

Recommendations

Teachers should

(i) use diagrams or drawings of the endocrine and nervous systems in doing comparison.

(ii) emphasise the function of the spinal cord in reflex actions.

Question 2

This question tested candidates' understanding of the respiratory system and their ability to read and interpret graphical data. It was attempted by over 80 per cent of the candidates and the performance was generally satisfactory.

Part (a) required candidates to distinguish between 'breathing' and 'respiration'. Quite a number of candidates confused respiration with perspiration and gave definitions that referred to 'sweat'. Most were able to give accurate definitions of the term 'breathing'; however, the definitions/descriptions of 'respiration' proved difficult. Also many of the candidates seemed not to have understood what the term 'distinguish' meant. Few candidates showed awareness that respiration occurs in the cells.

Parts (b), (c) and (d) which related to Figure 1 were fairly well done. Candidates were able to read and interpret the graph given, and compute correctly from the graphical data.

Part (e) which required candidates to give one reason for the change in the number of cases of lung disease in Town A between 1996 and 1997 was not well done.

Part (f) was satisfactorily done. Candidates were asked to state what advice they would give to a family who wanted to move from Town B to Town A. Candidates were able to give both the advice and the reference; many of the candidates were able to link the advice to the specific reference.

In Part (g), candidates were asked to explain why it was important for an individual to have healthy lungs. Most candidates were able to provide a correct response using their knowledge of the function(s) of the lungs.

In Part (h), candidates were asked to describe how oxygen from the lungs entered the blood stream. This part presented great difficulty, as candidates seemed to have misconceptions of how oxygen enters the blood stream from the lungs. The concept of 'diffusion of gases' across the 'respiratory surface' was generally not evident.

Recommendations

Teachers should

(i) after explaining 'breathing' and 'respiration', provide students with comparative tables requiring them to supply the missing information. This would help to identify any misconceptions

(ii) use diagrams/drawings/charts and models to explain the two terms

(iii) include assessment work where graphical interpretations and evaluations have to be made

(iv) include basic graph work – structure.

Question 3

This question tested the candidates' knowledge of hurricanes, the energy conversions that occur within a hurricane as well as volcanoes, and their effects. The overall performance on this question was generally satisfactory with some centres producing very good responses.

Part (a) of the question was generally well done. Candidates were asked to define the term 'energy'. Responses credited – the ability to produce a change, the ability to do work.

Part (b) provided a photograph (Figure 2) which showed a satellite view of a hurricane taken from above it.

In Part (b)(i), candidates were required to name the part of the hurricane labelled X in Figure 2. Most candidates provided the correct response – the eye.

In Part (b)(ii), candidates were required to state the other main features of the hurricane that could be seen in the photograph. This part proved to be challenging as candidates confused the vortex with clouds.

Responses credited – swirling winds, strong winds, winds, vortex.

In Part (c), a photograph taken during the passing of a hurricane through a Caribbean country (Figure 3) was provided. Candidates were required to draw an arrow on the photograph to indicate the direction in which the wind was blowing. This part was well done with most candidates drawing the arrow in the right direction.

In Part (d), data for wind speed and storm surges for hurricanes was provided in Table 2.

In Part (d)(i) candidates were asked to define a 'storm surge'. This proved to be somewhat difficult as few candidates were able to respond correctly.

Response credited – large waves.

In Part (d)(ii), candidates were asked to indicate how storm surges are produced. Again most candidates found difficulty in providing a correct response.

Response credited – produced by the force of the hurricane winds.

Part (e) provided Figure 4 which showed a ship that was washed ashore during a storm surge with the information that the anchor held until the wind speed reached about 200 kmh^{-1}.

In Part (e)(i), candidates were asked to make reference to Table 2 given in Part (d) and determine the approximate height of the storm surge when the ship was washed ashore. This was fairly well done with many candidates being able to interpret the graphical data correctly.

Responses credited – 2.5m to 3.5m.

In Part (e)(ii), candidates were asked to determine with reference to Table 2 in Part (d) the category of a hurricane with wind speed at 200kmh. This section was fairly well done with many candidates correctly interpreting this graphical data.

Response credited – Category 3.

In Part (f), candidates were asked to suggest one reason why the wind speed of a hurricane falls after it passes over a large land mass. This was fairly well done. Candidates were able to relate the energy conversion of the hurricane as it passed over land.

Responses credited were – Energy is converted, results, for example, in trees being uprooted, roofs blown off, over warm water the amount of energy in the hurricanes increases while over the cooler land it decreases, mountains on land reduces the speed of the hurricane and therefore decreases the energy.

In Part (g), candidates were told that in studying patterns of settlement in a certain Caribbean island, it was observed that large numbers of people have set up farms on the slopes of volcanic mountains.

In Part (g)(i), candidates were required to define a volcano.

Response credited – An opening in the earth's crust through which molten rock, rock fragments, gases are ejected from deep within the earth.

Some candidates gave descriptive explanations for the definition of the volcano and these were awarded partial credit.

In Part (g)(ii), candidates were required to suggest why farms have been set up on the slopes of volcanic mountains. This was fairly well done.

Response credited – Fertile soil from the emissions of volcanic ash is found along the slopes.

In Part (g)(iii), candidates were asked to state which component of the emissions from a volcano is most likely to damage the respiratory system. Generally, this was not well done.

Responses credited – ash, dust, smoke.

Question 4

The performance of candidates on this question was satisfactory. It tested candidates understanding of fossil fuels, sources of energy, energy conversion, principles of combustion and heat transfer.

Part (a) related to 'fossil fuels' as non-renewable sources of energy.

In Part (a)(i), candidates were required to name two fossil fuels. Performance on this part was satisfactory with most candidates correctly identifying one fossil fuel.

Responses credited – petroleum, crude oil, coal, peat.

In Part (a)(ii), candidates were asked to state what is meant by the term 'non-renewable' when describing a source of energy. This was generally well done by most candidates.

Response credited – Once it is used to supply energy needs, it cannot be replaced.

Part (a)(iii) was fairly well done with the majority of the candidates being able to identify one renewable source of energy.

Responses credited – solar energy, wind, biomass, geothermal, wave.

The stimulus, Figure 5, provided in Part (b) showed two burning candles, A and B, with Candle B covered with a jar.

The performance in (b)(i) was unsatisfactory with many candidates being unable to name the fuel that was burnt.

Part (b)(ii) required candidates to state the energy conversion that takes place as the candles burn. This was done poorly. Responses were primarily incomplete with candidates limiting their response to heat and light only. Chemical energy was for the most part omitted.

Response credited – Chemical → heat + light.

In Part (b)(iii), few candidates were able to name two substances that are produced while the candles burn. Most candidates incorrectly stated wax and smoke.

Response credited – Carbon dioxide + water.

In Part (c)(i), about half of the candidates suggested that the candle burns initially because there was some oxygen/air present.

Part (c)(ii) was satisfactorily done. Candidates responded that the candle stops burning because the oxygen or air that was present was used up or that neither oxygen nor air was present.

The stimulus in Part (d), Figure 6, showed a lighted candle between a black and white screen, with candle wax sticking two identical pieces of cork to the screens.

Part (d)(i) was poorly done with few candidates naming the process by which heat travels from the candle to the screens.

Response credited – radiation.

Part (d)(ii) a) was very well done. Most candidates were able to provide a correct response indicating that the cork would fall first from the black screen.

The performance in (d)(ii) b) was satisfactory. Most candidates provided answers that implied the cork falls first from the black screen because it absorbs radiated heat or energy more efficiently. Many candidates could not properly explain absorption of heat energy and many used words such as 'attraction' and 'draw in of heat'.

Recommendations

(i) Students need to perform, analyse and interpret experiments based on

- (a) effect of heat energy on light and dark coloured objects
- (b) combustion.

(ii) Students should be exposed to

- (a) audio-visual material on fossil fuels
- (b) field trips or tours of energy based companies or museum.

Question 5

This question tested candidates' understanding of the basic principles involved in production of colours and different components of the visible spectrum. This question also tested candidates' understanding of the importance of colour in the process of photosynthesis. The practical component of the question tested candidates' knowledge of the action of solvents in stain removal processes.

Generally the performance on this question was satisfactory.

Part (a) required candidates to state four of the colours seen when a prism is placed in the path of a ray of white light and the emerging ray is focused on a screen. This was generally well done. Responses credited – red, orange, yellow, green, indigo, violet.

The stimulus in Part (b), Table 3, presented some primary and secondary colours of light. Candidates were asked to classify the colours in Table 3 as either primary or secondary colours. This part was also fairly well done.

The stimulus in Part (c), Figure 7, showed a stage set with three coloured lights focused on a white screen. The performance in this part was fair.

In Part (c)(i), candidates were required to state the colour appearing on the screen when the red and blue lights were switched on.

Response expected – magenta.

In Part (c)(ii), candidates were required to state the colour appearing on the screen when the green and blue lights were switched on.

Response credited – cyan.

Part (d) required candidates to suggest two situations, other than stage lighting, where colour mixing principles are used. This was poorly done as most candidates could not identify any situation in everyday life.

Responses credited – television, photography, painting, decorating, dyeing.

Part (e) related to the process of photosynthesis in the leaves of plants. This part was poorly done by most candidates.

In Part (e)(i), candidates were required to name the green pigment in leaves.

Responses credited – chlorophyll or chloroplast.

In Part (e)(ii), candidates were required to complete the word equation for the process of photosynthesis.

Responses credited – carbon dioxide, glucose.

In Part (e)(iii), candidates were required to state the energy changes that take place during photosynthesis.

Response credited – light energy → chemical energy.

In Part (f), candidates were required to suggest an appropriate method for removing the green pigment stain from grass on clothes.

Responses credited – use of a suitable solvent or substance to remove or dissolve the stain; use of alcohol or non-solvent.

Recommendation

Teachers should conduct more laboratory sessions focusing on colour.

Question 6

This question tested candidates' understanding and ability to use knowledge relating to water sports and water safety, the feeding relationships among aquatic organisms, as well as the advantages and disadvantages of plastics.

Performance on this question was generally satisfactory with some candidates providing excellent responses.

Part (a) referred to Caribbean tourists who enjoy scuba diving and boating activities.

In Part (a)(i), candidates were required to name two hazards associated with scuba diving. Most candidates were able to provide a correct answer.

Responses credited – the 'bends' or air bubbles in the blood vessel, nitrogen narcosis, decompression sickness, damage to the eardrum.

In Part (a)(ii), candidates were required to identify two water-safety devices which should be kept on a boat. Most candidates were able to identify only one device.

Responses credited – life raft, life jackets and inflatable tubes.

A few candidates associated safety with general safety and gave responses such as 'first aid kit'. These responses were not credited.

Part (b) stated that a scuba diver observed the following organisms underwater: seaweed, shark, small fish, barracuda.

In Part (b)(i), candidates were required to construct a food chain using the organisms listed. Most candidates were able to construct the food chain correctly.

Response credited – seaweed → small fish → barracuda → shark.

In Part (b)(ii), candidates were asked to identify a carnivore, herbivore and producers in the food chain. This part was generally well done as most candidates were able to provide the correct answers.

Responses credited – one carnivore such as barracuda, shark; one herbivore such as small fish; one producer such as seaweed.

In Part (c), Figure 8 showed a river running through an industrialised town. The river contained garbage consisting mainly of assorted plastic objects. Dead fish were seen floating in the river.

In Part (c)(i), candidates were required to suggest a reason for the death of the fish. This part was poorly done as most candidates failed to use the stimulus diagram provided.

Responses credited – chemical pollution from the factories, effluent released, pollution of the water, fishes trapped in the plastic debris.

In Part (c)(ii), candidates were asked to suggest two ways in which the amount of plastic from the town may be reduced. This section was widely known.

Responses credited – recycle plastics/used biodegradable materials instead/use recyclable materials instead, for example, glass/proper disposal of garbage/charge a tax for pollution/educate residents about proper disposal and the effects of pollution.

Part (d) required candidates to state one advantage and one disadvantage of using plastics.

It was evident that most candidates did not know the advantages and disadvantages of plastic. They placed emphasis on the use(s) of plastic rather than the nature/properties of plastic.

Responses credited – Advantages – light, cheaper, readily available or non-corrosive;
Disadvantages – non-biodegradable or combustible.

Recommendations

(i) Practise the construction of food chains with arrows inserted correctly.

(ii) Use more stimulus materials in school assessments.

Paper 03 – 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 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 exercise 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.

- 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 from (a) and (b) as outlined in the syllabus.**

Observation, Reading, 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 laboratory exercises. Laboratory exercises must be carried out and the data generated analysed 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 to 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 as necessary.