Let the mind manage the body
Que l'esprit gère le corps

PSAC 2017

Grade 6 Science

Subject code: **P141**

Examiners' Report

MAURITIUS EXAMINATIONS SYNDICATE

March 2018

INTRODUCTION

The introduction of the Primary School Achievement Certificate (PSAC) in replacement of the Certificate of Primary Education (CPE) has prompted a major review of the end of primary cycle assessment. In particular, the assessment has been revisited in line with the new goals and objectives of the revised *2015 National Curriculum Framework, Grades 1 to 6* (NCF).

The Science paper design has consequently changed, with the focus now being on the assessment of scientific skills and competencies across the ability range. The assessment of learners' achievement in Science is based on the Expected Learning Outcomes stated in the NCF and detailed in the *Science: Teaching and Learning Syllabus Grades 1 to 6*.

AIMS AND OBJECTIVES OF THE SCIENCE ASSESSMENT

The **Aims** of the assessment in Science are:

- to provide the *basis* for *further* scientific learning;
- to encourage the development of *inquiry skills*; and
- to encourage the right *attitudes* and *values* with respect to Science by:
    - drawing correct conclusions and explanations from evidence;
    - demonstrating knowledge of the importance of preserving the environment and respecting and caring for animals and living things in general; and
    - demonstrate a knowledge of safety precautions that need to be observed.

The **Objectives** of the assessment in Science are weighted as follows:

- Knowledge with Understanding – 40%
- Application – 40%
- Scientific Inquiry – 20%

PAPER DESCRIPTION

Since 2017 was a transitional year in the implementation of the PSAC, a **one-off** assessment in Science was set for Grade 6 learners for that year. The assessment was based on the following units from Grade 5 and Grade 6 that candidates were expected to have covered:

Grade 5

- Plants in their habitats
- Transformation of energy
- The simple electric circuit

Grade 6

- Air
- Plants
- Animals

The assessment items were graded in terms of difficulty level within each question as well as across the paper. The questions were based on the learning objectives within the above units as given in the Teaching and Learning Syllabus. They also took into consideration the content of the textbooks. The questions also covered the three different assessment objectives.

This report contains details on the different items in the 2017 Grade 6 Science examination paper, on how candidates performed and highlight their strengths and weaknesses.

ITEM ANALYSIS

This report is largely based on the item analysis of a representative sample of scripts, with consideration given to reports of markers involved in the marking process and observations made during the marking. The performance in each item has been analysed and qualitative information is given.

GENERAL COMMENTS

The pass rate in Science for the PSAC 2017 examination session was 82.3% at first sitting for school candidates, which is a substantial increase of about 7.5% from the 2016 CPE performance in the subject. This is a definite break from the trend of past years. As usual, girls performed better than boys. The mean mark for the paper was around 60.

Many candidates were able to respond correctly to questions requiring a one-word answer, fill-in-the-blanks or the labelling of a picture. When they were required to produce a longer phrase or a sentence, candidates had much more difficulty. This shows that language continues to be a significant barrier in the Science assessment.

Throughout the paper, a number of direct knowledge and application questions were set. While candidates were often able to respond more or less correctly to the direct knowledge questions, they had more difficulty in applying their knowledge to the given context of the questions.

It was also found that a number of candidates lost marks due to careless reading of the questions. Keywords within the items are often given in bold so that candidates pay particular attention to what is being asked. However, a number of them still missed out on these key elements in the questions.

Some of the answers given provided an insight of the conceptual understanding that candidates had of the different Science topics. A deeper understanding of concepts was often lacking and while candidates were able to give answers related to observations, they found it more challenging to give the relevant explanations.

It is important that strong foundations in the learning of Science are laid so that pupils can build upon them and continue their learning process. Some of the key aspects in the learning of Science such as the use of classification or

the understanding of the Scientific Method are worth emphasising. As stressed in previous years' reports, learning Science by experimenting and having a hands-on approach will bring much more interest in the subject, will motivate pupils as well and will help in developing deeper conceptual understanding. Pupils should be given opportunities to build on their existing knowledge, experiment and test their ideas and draw their own conclusions from their experiments.

Pupils should also be encouraged to work more problem-solving activities and open-ended investigations where they can learn from successful experiments or from getting unexpected results. Trying to find explanations for unexpected results during hands-on activities is a great opportunity where pupils can further explore the concepts learnt.

Educators are also encouraged to build on the existing scientific knowledge of pupils. The latter might not be aware that their existing knowledge has a scientific dimension but it is useful to use their prior knowledge as basis to build on new concepts or understandings through constant questioning and reasoning.

At the end of this report, a list of materials is given which can be used in a Science room or corner at school. Making the maximum use of low-cost materials, dental models and charts can help pupils to visualise concepts which can otherwise be abstract.

The following sections give more details about the performance of candidates in the specific questions of the paper.

QUESTION 1 (5 marks)

This question consisted of 5 multiple choice items covering different topics in the syllabus.
On average, about 3 out of every 4 examined candidates answered the items correctly, so the questions were relatively accessible to most candidates.

Item 1 *Animals that give birth to their young ones are known as _____.*

This item assessed the candidate's knowledge of the identification and classification of animals according to their characteristics, in this case mammals. It is a basic test of recall, where a majority of candidates answered correctly.

Item 2 *Which one of the following food items is an example of food for growth?*

A significant number of candidates were confused between *food for energy* and *food for growth*, and incorrectly chose "Bread" as the answer. Many probably answered based on the common layman idea that eating bread makes one "grow up", while it is the presence of proteins in food that accounts for growth.

Item 3 *A _____ is used to open or close an electric circuit.*

This item is a basic recall test on the definition of a switch. Although it could be argued that a (functioning) bulb, a piece of wire and a battery, are all conductors of electricity and could be used to open or close an electric circuit, which could explain the frequency of candidates choosing one of the 3 distractors as answer, it is not the actual function of those circuit components. A significant majority of candidates from the low-ability groups chose "battery" as answer.

Item 4 *An example of a balanced meal is _____.*

Responses for items 2 and 4 indicate that a number of candidates struggled

with classifying food into different food groups, and thus failed to demonstrate an understanding of the concept of balanced diet. While a majority chose the correct answer for this item, more than half of those who answered incorrectly chose the first option. This is probably because soya bean comes from a plant (a legume species) and some candidates considered it as a food for health. Though soya bean contains vitamins they are primarily used as a source of protein in a vegetarian diet for instance.

Item 5 *Which one of the following is a safety precaution when using electricity?*

A significant number of candidates (1 out of 3), even from the high-ability groups, could not differentiate between *safety precaution* when using electricity and *energy saving/wasting*, thus ending up choosing the last option as answer. Only 1 out of every 2 candidates answered this item correctly.

Being able to describe the safe use of electricity at home is pitched at Achievement Level 1 in Grade 5. It is possible that, since the topic of energy is further expounded in Grade 6 while the subject of electricity and its safe use is only explained in Grade 5 that pupils might have overlooked it during their revision. It is thus recommended that Grade 6 educators spend some time reinforcing knowledge and understanding of certain ideas previously learnt when they cover topics closely related to what has been taught in the lower grades.

QUESTION 2 (15 marks)

This question covered the topics of Air and Animals, both from the Grade 6 syllabus. The mean mark in this question was around 13 which indicates that it was relatively accessible to candidates. This could also be related to the fact that all items in this question are of close-ended type, involving identification and classification. This supports the general observation that candidates lost marks because they had difficulty in writing simple phrases or sentences.

While language is not assessed in the Science paper, it was observed that for some candidates, even copying given words was a challenge.

Part (a) (3 marks)

In this item, candidates were required to label three sections of a pie chart each representing the proportion of some gase(s) in air. Candidates were given the names of the gases and had to match each to the correct section of the pie chart. Carbon dioxide was already given and that helped to avoid any confusion that candidates might have had between the amount of carbon dioxide and that of other gases, given that both are present in relatively low proportion. Some candidates confused nitrogen and oxygen, and ended up thinking that oxygen is present in greater quantity than nitrogen. This might be because they understood oxygen to be more important for sustaining life than nitrogen, so those candidates would infer that oxygen is more abundant in the air.

More than 3 out of every 5 candidates scored full marks on this part but at least 1 out of 10 did not score any mark.

Part (b) (6 marks)

In this item, candidates were assessed on their ability to classify different types of animals based on their characteristics, specifically their *covering*, which is covered in Grade 6. Six animals were given, and candidates were asked to classify them as to whether they have their body covered in hairs, feathers, or scales.

A majority of candidates scored full marks in this part. They were able to identify both animals in each category. Some candidates scoring less than 30 marks overall in the paper managed to score the 6 marks allocated to this part.

Part (c) (6 marks)

This item was also rather scoring for most candidates. Candidates were

required to classify animals according to their *eating habits*. A list of 7 words was given, and candidates were asked to complete a table containing 6 blanks. Some candidates did not understand that words had to be chosen from the list, and wrote food items which did not figure in the list. For instance, for the case of carnivorous animals, instead of giving "meat", some wrote "flesh" as answer, or instead of "grass" for herbivorous animals, the answers "leaves" or "plants" were given.

It is highly recommended that educators emphasise to learners that it is very important to read and follow instructions carefully before answering a question. Candidates were expected to complete the table using appropriate words from a list. While answers given in the examples above were technically correct, in other contexts, these answers might not have been appropriate. Copying mistakes were also noted in this item.

QUESTION 3 (8 marks)

This question was particularly challenging for most candidates. A majority of the candidates from high-ability groups managed to score most of the marks (6-8), while those from the low-ability groups struggled to score 3-4 marks.

Candidates were given four different situations where energy was being used, and they were asked to identify the **main** energy transformation taking place in each situation. Although the word "main" was written in bold for emphasis, many candidates gave intermediate energy transformations that were not main ones. Some candidates could find only part of the expected transformation of energy.

Quite a number of candidates could not find the correct usage of scientific language to express themselves well, for example some wrote "sun energy" instead of "solar energy", or "electricity" instead of "electrical energy". Educators need to ensure that learners have acquired and developed the right usage of basic scientific language.

It is strongly recommended to Grade 6 educators that they spend time reviewing the concepts of energy transformation as covered in Grade 5 when they teach forms and sources of energy in Grade 6. This helps the learners to consolidate knowledge and understanding of certain ideas previously learnt in topics closely related to what has been taught earlier in the curriculum.

Item 1 *Using wood to cook.*

The main energy transformation is *chemical* energy (in the wood) to *heat* energy (to cook). Although some candidates gave *chemical/heat* energy to *movement* energy, or *heat* energy to *light* energy as answers, these are not the main energy transformations in this case, and were given lower marks. A number of candidates from low-ability groups were not able to write "chemical" correctly.

Item 2 *A loudspeaker playing music.*

This was the most accessible of the four items. The main energy transformation is *electrical* energy to *sound* energy, or *electrical* energy to *movement* energy (of the loudspeaker diaphragm or air carrying the sound waves). Some candidates answered *electrical* energy to *heat* energy, which is not the main energy transformation, thus scoring partial marks.

Item 3 *A running horse.*

The main energy transformation is *chemical* energy (in the muscles of the horse) to *movement* energy (of the horse). Answers like *chemical* energy to *heat* energy (presumably either in the muscles of the animal, or the heat due to friction while running) or *chemical* energy to *sound* energy were given lower marks. Again, quite a few candidates from low-ability groups were not able to write "chemical" correctly, and some even wrote "*food* energy" to *movement* energy. Educators are encouraged to emphasise the difference between *sources* and *forms* of energy in their teaching.

Item 4 *Using a solar powered calculator.*

This was the most challenging of the four items, even to candidates from high-ability groups. The main energy transformation in this case is *light/solar* energy (from the sun) to *electrical* energy, or *chemical* energy (in the case where a battery is used to store the solar energy in the form of chemical energy) to *electrical* energy.

This item actually figures in the Grade 5 Science Pupil's Book, where the learner is asked to *describe the transformation of energy as light falls on the solar cells in the calculator*. The answer then would be solar energy to electrical energy, or solar energy to chemical energy if there is a battery that stores the electrical energy so that it can be used when there is no light falling on the solar cells. A solar-powered calculator has a Liquid-Crystal Display* (LCD) screen which does not emit light unlike in the case of a Light-Emitting Diode (LED) screen. In some cases the solar-powered calculator has a battery that provides some electrical energy to power a backlight in the LCD display so that the calculator can be used in the dark. [1]

QUESTION 4 (10 marks)

This question was on human teeth which is a topic covered in Grade 6. The mean mark was 5.5. Recurrent weaknesses were wrong spelling of words and difficulty in answering the open-ended items within the question. It was also noted that there is confusion between *premolars* and *molars*. The topic was not thoroughly mastered by some candidates, who demonstrated a limited understanding of the different types or teeth.

Part (a) (4 marks)

Less than 40% of candidates scored full marks for this item. Whereas in

[1] *https://en.wikipedia.org/wiki/Liquid-crystal_display

Question 2 candidates found it relatively easy to choose from a list of words to fill in a table, in this item candidates had to recall and identify the types of teeth without being provided that kind of help. Indeed, candidates struggled to write the correct names, especially "incisor/s". Some candidates knew the different names of teeth, but could not identify them on the given jaw, thus the teeth were incorrectly named. There was confusion in identifying and differentiating between "premolars" and "molars", and between "incisors" and "canines".

This suggests that though pupils can recite the names of the different types of teeth in a human jaw, they might not (i) know how to write these words and (ii) have been able to identify the types of teeth.

Part (b) (2 marks)

(i) More than 3 out of every 4 candidates were able to correctly deduce or guess that the jaw was showing part of a permanent set of teeth. This item was relatively easy as candidates only had to choose between 2 options by ticking the appropriate box, thus the likelihood of choosing the correct answer was 50%. Furthermore, candidates did not have to produce any writing.

(ii) While a majority of candidates were able to find the correct answer in part (i), they struggled in explaining the reasoning leading to their answer in part (i). This type of question, where candidates' higher-order thinking and writing skills are elicited, generally helps in demarcating among the candidates. The difficulties can be identified at different levels: there is the language problem and the lack of a deeper understanding of the topic.

Part (c) (2 marks)

More candidates were able to identify the teeth used to crush food than those used to bite food. To bite, both incisors and canines were accepted as correct answers while for crushing food, premolars and molars were correct answers. The correct corresponding letter (A, B, C or D) as given in the diagram was also accepted. Some candidates had similar difficulties as in part (a) where

writing the names of the teeth was found to be a challenge.

Part (d) (2 marks)

A significant number of candidates correctly attempted this item. It is a knowledge-based question with the information found in the textbook. Candidates from the average- to low-ability groups likely understood the question, but struggled in expressing themselves. Some candidates even wrote their answers in creole, which confirms that the difficulty was in writing the answer in correct English rather than in retrieving the knowledge.

QUESTION 5 (13 marks)

The mean mark for this question was 7, which is about half of the total marks. This indicates that certain items were not particularly accessible to a majority of candidates.

In general, candidates had difficulty in expressing their ideas in writing in the open-ended items. Learners should be constantly encouraged to practice reading and writing in class so that they can construct and cultivate their use of language and thus gain more confidence in expressing themselves in writing. Often, complete, grammatically and syntactically correct sentences or phrases are not strictly required or expected as answers, but the key idea should be clearly expressed. Learners having difficulty in expressing themselves in correct English found it challenging to convey their ideas.

Part (a) (3 marks)

This item consisted of pictures of three types of plants (*seaweed*, *water lilies*, and *fern*) that were to be matched with their natural habitats. This topic is covered in Grade 5, where learners are expected to be *able to list different habitats of plants growing on land and in water*, and to *infer that plants grow in habitats which are best suited to them*.

This question was a knowledge question where candidates were not required to infer about the habitats of the plants based on specific features given. Thus, the plants used in this item were those that are found in the Grade 5 Science textbook. Nearly 3 out of every 4 candidates got full marks on this item, so it was fairly well attempted by most candidates. In the case of *water lilies*, either "*In ponds*" or "*In damp forests*", or both, were acceptable answers, since ponds or wet/marshy lands containing water lilies can sometimes be found in damp forests. However, it is important that educators emphasise during teaching that the habitat is a place where a plant lives, and it provides the plant with what it needs to live. Educators should also encourage learners to present their work neatly since quite a number of candidates did the matching in ways that ended up being confusing.

Part (b) (3 marks)

This part was about the importance of protecting our forests. Items (i) and (ii) were generally well answered. However, some candidates did not manage to distinguish between the *why* and *how* questions. Educators should make sure that learners clearly differentiate between these two types of questions. Both require recall and application of knowledge. Candidates struggled to write simple sentences correctly and poor vocabulary was also noted.

One of the aims of the Science curriculum is to ensure that learners *develop an appreciation for the ecosystems in our forests*. The different aspects of forests are covered at the level of both Grade 5 and Grade 6, where learners are taught that forests provide food and shelter to plants (especially endemic ones) and animals (Grade 5), and that forests are dense areas of trees that absorb large amounts of carbon dioxide from the air and release oxygen, thus maintaining a balanced air composition and helping to moderate global warming.

In part (i), candidates were asked to give one reason *why* it is important to protect our forests. 2 out of 3 candidates managed to answer this question correctly. Acceptable answers were related to aspects of how forests (i)

provide food and shelter to a variety of plants and animals; (ii) help maintain a balance in air composition; (iii) beautify the environment; (iv) act as catchment areas for rainfall; (v) prevent soil erosion, thus maintaining the stability of top soil; etc.

In part (ii), candidates were asked to give two ways *how* we can protect our forests. This topic is well covered in Grade 6 where learners are expected *to identify threats to our forests and propose means to address them*, thus relating to the aspect of protecting or preserving our forests. Only about half of the candidates managed to secure the two marks, with more than a third failing to score any mark. Educators are strongly encouraged to identify learning difficulties in this topic, and to address them as much as possible during teaching. Of importance to educators is the necessity to teach learners to avoid giving telescoping answers, that is expressing the same idea but in different guises.

Part (c) (7 marks)

This is the part of the question that carries the most number of marks, and where most candidates lost marks. The question is about the cactus plant. Candidates were asked to observe and identify two characteristics of the cactus plant, then explain how each characteristic helps the plant to survive in its natural habitat. Finally, candidates had to deduce the likely natural habitat of the cactus plant. All these aspects of the question are comprehensively covered in Grade 5, specifically in the context of *plants in their habitats*. In general, candidates from high ability groups were better able at reading and understanding the questions, then answering those correctly in correct sentences.

Part (i) prompted the candidates to observe the picture of the cactus plant, and identify two characteristics or features of the plant. Only 1 out of every 4 candidates managed to score the 2 marks in this item. Half of the candidates did not manage to score any mark, which means that half of them were not even able to write down even one characteristic of the plant. This clearly

shows that many candidates did not understand what was being asked in that question, even though they are expected to be able to *explore a variety of plants by finding out the characteristics of their different parts* by end of Grade 5. Thus, it is very important that educators make sure that learners in Grade 6 are reminded of what was covered previously at lower levels in the syllabus, so that their knowledge is consolidated. Candidates from low ability groups struggled to use the right scientific language or find the right words in English to describe the features of the plant. Generally, instead of candidates saying what they observed as a physical characteristic of the plant, they gave the function of that characteristic when they were expected to do so in part (ii) of the question.

Part (ii) asked candidates to explain how each of the characteristics identified in part (i) helped the cactus plant to survive in its natural habitat. Typical acceptable answers were: (i) the spines helps the plant reduce water loss by evaporation and protecting the plant from predators; (ii) the thick stem stores water. Candidates were expected to *identify the function of the characteristics*, and *explain how such a function helps the plant to survive*, which is why each answer carried 2 marks each. Only 1 out of every 5 candidates, almost exclusively from the high ability groups, managed to score full marks for this item, while more than half did not score any mark. This indicates that a majority of candidates did not understand the question properly, and failed to provide even partial answers, that is either a function or an explanation. Educators should teach learners how to use their higher order cognitive skills to reason based on their knowledge of plants and the environment, and understand how plants evolve to adapt to their habitats.

Finally, in part (iii), candidates were asked to name the natural habitat of the cactus plant based on their observations, and how they answered parts (i) and (ii) of the question. Only 3 out of every 5 candidates, principally from the high ability groups, answered this part correctly.

QUESTION 6 (8 marks)

This question covered the topic of Air from Grade 6. It was based on skills which learners ought to have had acquired through their hands-on activities or at least through observation. Candidates who had previously carried out such activities would have found the items more accessible particularly when they had to explain what was happening.

The importance of conducting practical activities, experiments and demonstrations is highlighted in this question. Such activities help learners understand the concepts being taught in class through their own observations. They are also able to think about the different conditions under which an experiment is carried out, and try different arrangements that will further help to strengthen their understanding of the concepts. It is important that any error or unexpected observation during experimentation is carefully explained. For instance, for the burning candle experiment, learners should try the experiment with one burning candle covered with a jar, and another uncovered. Learners should be encouraged to come up with their own explanation for the observations they make. They can also experiment by holding the jar such that air can pass through, and then are asked to explain what is happening. The experiment with the straw can also be done in different ways. They can be asked to blow into the straw, or to suck in the air and explain the different observations.

Another weakness that has often been observed is that pupils have not developed basic drawing skills. Given that drawing is one way of communicating in Science, it is an important skill that candidates will be asked to demonstrate and they should be encouraged to practice it in their learning.

Part (a) (4 marks)

In part (i), candidates were assessed on their knowledge that oxygen is important for burning, and that carbon dioxide is produced from the burning of the fuel, in this case, the wax in the candle. This item is identical to an activity

that figures in the Grade 6 textbook, and should not have caused problems to candidates who have understood this activity. Candidates had to tick boxes to answer what will happen to the amount of oxygen and carbon dioxide inside the jar covering a lit candle. About 3 out of every 5 candidates ticked the correct boxes. It could have been expected that this item would have been more scoring since it did not require reproduction of language.

In part (ii), candidates were expected to answer that the candle flame will die out or be extinguished. For some candidates, the difficulty resided in expressing this idea in a simple sentence.

In part (iii), candidates were asked to show whether they understood that oxygen is important for burning to happen, and that it is thus used up in the burning of the flame, while carbon dioxide, the amount of which increases due to burning, replaces the depleted oxygen in the jar and acts as an extinguisher.

Part (b) (4 marks)

This part was based on the learning outcome of investigating air pressure and communicating findings. The diagram of a boy, Sam, drinking juice using a straw was given and candidates had to demonstrate their understanding of air pressure.

In part (i), candidates were asked whether the air pressure was greater inside Sam's mouth or at the surface of the juice. A large number of candidates could not answer this question correctly, leading to the conclusion that they had not well understood the concept of air pressure, e.g. how it arises, or its importance.

In part (ii), candidates had to draw an arrow to indicate the direction in which the juice moves inside the straw. An understanding of air pressure was not necessary for answering this item correctly since most candidates, if not all,

should have known from common life experience that the juice had to move up the straw to be able to reach Sam's mouth.

In previous years, it was observed that candidates have a lot of difficulties with drawing, even when they are required to only draw arrows. Apart from the importance of carrying out these activities in class, it is good practice that learners report their observations in the form of tables or drawings, or in other forms. Any experiment that is being carried out has to be reported and it is an important aspect that learners have to develop. Without this, they will continue to have difficulty with the writing part, communicating findings in the form of tables or charts or to illustrate their observations or findings through drawings.

Finally, in part (iii), candidates had to show their understanding of the application of air pressure and how it helps in this particular context. Less than 2 out of every 10 candidates were able to explain why the juice moves up the straw. Educators are encouraged to consolidate understanding of this topic and the concept of air pressure, what air pressure is, its importance and to demonstrate different situations where air pressure is important. This is a concept that can be quite abstract to learners.

QUESTION 7 (9 marks)

This question was on the topic of the *simple electric circuit*, which is covered in Grade 5. Items were based on the diagram of an open circuit which contains a cell labelled **X** and a bulb. The mean mark for this question was 4.3, which is less than half of the total number of marks. Only 1 out of every 25 candidates scored full marks, with 2 out of every 5 students scoring 6-8 marks. Candidates from middle to low ability groups found it hard to use language correctly to convey the important ideas or aspects.

Learners at this level are expected to be able to: *identify and name the different components of a simple electric circuit*; *demonstrate that electricity flows in a complete circuit*; *investigate how a switch can be used to open and*

close and electric circuit; and *identify and compare conductors and insulators*. All these learning outcomes were assessed in this question.

Part (a) (2 marks)

In part (i), 3 out of every 4 candidates managed to identify and name component **X**, which is a (dry) cell. Although "battery" is defined as consisting of many cells in the Grade 5 textbook, the term was tolerated as a correct answer. However, it is important that educators point out the difference between the two components during their teaching.

In part (ii), only about half of the candidates managed to correctly state the function of the cell in an electric circuit, which is to *provide electrical energy to the circuit*. In Grade 5, learners are taught that *a cell is a source of energy*, and that this energy is stored in the *form* of *chemical energy* in the cell, which is then *transformed* to *electrical energy* when the cell is used as a component of a closed electric circuit. Educators should make sure that the chain of knowledge and understanding of the energy source and transformation in a cell is correctly grasped by learners during teaching. This can be done through demonstrations in class using a simple electric circuit.

Part (b) (2 marks)

The purpose of this part, and part (c), was to assess what candidates understood by *open* and *closed* electric circuits. Candidates are told that the circuit in the diagram is an *open* circuit, and they are then asked what the definition of an open circuit is. Such definitions are well explained in the Grade 5 textbook, where it is given that an open circuit is one in which *electricity does not flow* and *the bulb does not light up*. There were thus 2 parts to the answer, which is why the item carried 2 marks. Almost half of the candidates did not manage to score any mark in this item, with only 1 out of every 7 candidates managing to give the correct definition and scoring full marks. Many candidates probably understood that there was a gap in the electric circuit, and that no electricity was flowing through it, but they struggled to find

the right words and language to express themselves. Educators should strive to help learners develop their linguistic and scientific vocabulary so that they are able to formulate sentences with the correct ideas to express themselves confidently. Finally, simply saying that an open electric circuit is *not closed* or *has a gap* or *is missing a component* does not amount to answering the question correctly.

Part (c) (2 marks)

In part (i), candidates were asked to *suggest one thing they could do to close the electric circuit*, which they were told in part (b) was open. Only half of the candidates, mostly from the high ability groups, managed to answer correctly, by either suggesting to put a conductor (a wire or some metallic object) across the gap, or to simply join the two unconnected ends to close the gap. Those who did not manage to answer part (b) most likely struggled to answer this part since both questions required the candidates to recall the definitions of closed and open electric circuits, and express themselves in writing.

Part (ii) follows on part (i) by asking how they would know that the electric circuit is closed when they close the circuit. Here, candidates were expected to understand that closing the electric circuit meant *completing* the circuit, thus allowing electricity to flow. This would mean that, as a result, *the bulb would light up*, thus indicating that the circuit was now closed. Only one third of the candidates managed to answer this item correctly. Yet again, this indicates that a majority of candidates faced language problems to read, understand, and express themselves.

Part (d) (1 mark)

Grade 5 pupils are expected to be able to *identify and compare conductors and insulators*. An electrical *conductor* is a material or object that allows electricity to pass through it. Educators normally engage in one or more activities in the classroom to introduce learners to conductors and non-conductors of electricity, for example a list of objects or materials are

introduced in an open circuit to test whether they conduct electricity or not, and these objects/materials are then classified into two groups: conductors and insulators. Unexpectedly, candidates had some difficulty in coming up with the correct answer. Educators are strongly encouraged to identify the difficulties learners face in this topic and remediate where necessary. It is only by doing this consistently that educators can ensure that their pupils are consolidating their knowledge and understanding.

Part (e) (2 marks)

The final part of this question required candidates to identify and circle *two* materials that *do not* allow electricity to pass through them, from a list that included 3 conductors (*iron*, *aluminium*, and *copper*) and exactly 2 insulators (*plastic* and *glass*). Only half of the candidates managed to identify the two electrical insulators. Educators are encouraged to make sure that learning takes place during such activities, since they are aimed at engaging the learners with the concepts and their applications in the real world.

QUESTION 8 (13 marks)

The items in this question were mainly based on the assessment objective knowledge and understanding and the topic being assessed was *plants*. It was relatively well attempted by candidates, with the difficulty residing mainly in answering the open-ended items.

Part (a) (3 marks)

This item was based on the diagram of a plant, where candidates were required to label the different parts, leaf, stem and roots. This item was expected to be within the reach of most if not all candidates. About 1 out of every 4 candidates did not obtain full marks. The advice to educators is simply to ensure that learners not only know the different parts of a plant, but that they can also write them correctly.

Part (b) (1 mark)

Only about half the number of candidates gave 'photosynthesis' as answer. The word was often wrongly written. Like for the previous part, it is important to ensure that learners can also write correctly. Some candidates confused the process with that of breathing. Some candidates described the process instead of only naming the process.

The understanding of the two concepts should be reinforced and the differences clearly highlighted to learners. It is also important that learners understand that all living things breathe but only plants can carry out the process of photosynthesis.

Another important suggestion to take away from this item is to clearly explain to learners the meaning and importance of command words. When the word "name" is used, it is only the name of the process that is expected as answer, while when words like "explain" or "describe" are used, a one-word answer is unlikely to be enough or satisfactory.

Part (c) (2 marks)

In part (i), candidates were asked to indicate in which part of the tomato plant food is manufactured. A number of candidates wrote the tomato fruit, thus confusing where food is manufactured (*leaves*) with where food is stored (*fruit*). This distinction should be properly emphasised in class.

When it comes to part (ii), if pupils had not understood the concept of photosynthesis, they would have had difficulty in understanding that the green part of the plant, the chlorophyll, captures light which is used to manufacture food in the plant. The word "chlorophyll" was also often wrongly written by candidates.

The process should be clearly described, and it is important to conduct experiments to reinforce the understanding of the concepts. Experiments such as keeping a green plant in the dark can be useful for learners to understand

the process of photosynthesis. When the plant is exposed to light, the leaves are green and more numerous than when a similar plant is kept in the dark. Learners should be encouraged to explain their observations, such as why the leaves turned yellow when in insufficient light. From there, learners can interpret their observations based on the knowledge they have acquired on the process of photosynthesis.

Part (d) (2 marks)

As further assessment of their knowledge of photosynthesis, candidates had to give two other conditions necessary for the process. Possible answers included water, minerals, sunlight, carbon dioxide and the right temperature. About 60% of candidates were able to identify two such conditions.

Part (e) (1 mark)

The correct answer for the gas released during the process of photosynthesis was oxygen. A number of candidates gave carbon dioxide as answer, which indicates confusion between photosynthesis and breathing.

Part (f) (2 marks)

It was challenging for many candidates to give a complete explanation as to why we avoid keeping plants in a closed bedroom at night. Where explanations were incomplete, candidates would only state that both plants and humans breathe out carbon dioxide, without pushing the reasoning to then say that both plants and human would compete for oxygen. Candidates from the lower-ability groups found it difficult to put their thoughts into words and the answers given were often unclear and lacking in precision.

Part (g) (2 marks)

This item, asked candidates to give two ways in which plants are useful to people, was within the reach of a number of candidates. However, where a short phrase was expected, a number of candidates gave only a one word answer such as "food" or "medicine".

QUESTION 9 (11 marks)

This question was on the subject of *air pollution*, which is extensively covered throughout the Grade 6 syllabus, where learners are taught about the *sources* and *dangers* of air pollution through various situations, as well as *measures* to curb or avoid air pollution. The mean number of marks scored by candidates in this question was 5.9.

In general, many candidates seemed unable to differentiate among the *sources*, *causes*, and *effects* of air pollution, and this led to a lot of confusion. Those from the low ability groups thus found it especially hard to understand what was asked in the questions – language problems remain a major issue in how candidates perform since many could not express themselves clearly. Many candidates did not read the questions carefully and did not pay attention to important words written in bold, and rushed to an answer having missed the point of the questions. A lack of knowledge or familiarity with the scientific language was also apparent.

Part (a) (2 marks)

In this item, candidates were asked to identify two sources of air pollution shown in a diagram depicting the following sources of air pollution:

1. Bins full of decaying rubbish/waste releasing bad smell.
2. Bus emitting harmful dark exhaust smoke and gases.

These were the only two sources that could be seen from the picture. Interpreting elements of the picture was an important prerequisite for candidates to correctly answer this question.

More than two thirds of the candidates managed to identify these sources, thus scoring full marks. A number of candidates did not read the question properly or carefully and answered by giving sources that do not figure in the diagram, e.g. dust from stone crusher, or pesticides in the air, or even dark

smoke coming from the factory. All these examples actually figure in the Grade 6 textbook, so it is likely that learners learnt those by heart.

Part (b) (4 marks)

This question related to the previous one, and candidates were asked to provide one way in which air pollution can be reduced from each of the sources identified in part (a). Almost half of the candidates did not manage to score any mark in this item, while only 2 out of every 5 candidates, which is roughly half of the number of candidates who managed to identify the two sources of air pollution in part (a), secured any mark. This means that correctly answering part (a) did not guarantee correctly answering part (b). This could be due to a number of reasons. Each answer carried two marks, so some candidates scored partial marks by not answering properly. For example, for the case of the bus emitting harmful dark exhaust smoke and gases, instead of a candidate writing "use filters in exhaust pipe of bus" or "use catalytic converters in exhaust pipes of bus", he/she would simply write "use lead free petrol" or "do not use the bus" and then he/she will get only one mark for that answer. Using lead-free petrol does not mitigate the issue of smoke emission causing air pollution. Also, most pupils did not relate or link their answers in part (b) to the identified sources of air pollution in part (a), e.g. some candidates wrote "put air filters on chimneys of factories" when they did not even identify the factory emitting smoke as a source of air pollution in part (a). Proper use of language was also an issue.

Part (c) (4 marks)

Here, candidates were asked to explain how air pollution affects both people and plants. About half of the candidates managed to say how air pollution affects people, while only a third of them scored full marks in part (ii), so it seems like candidates knew better the consequences of air pollution on people than on plants. Typical answers which scored full marks in part (i) were that air pollution:

- leads to people developing respiratory problems or even diseases, e.g. lung cancer.
- causes skin and eye irritation.

Candidates just saying that people fall sick or suffer from health problems, or get serious diseases, without mentioning which one(s) specifically, scored partial marks only.

Typical answers which scored full marks in part (ii) were:

- Plants cannot grow well and can die.
- Deposit of smoke/dust/soot on leaves prevents gas exchange.
- Plants do not get enough sunlight.

Some candidates obtained partial marks because they mentioned how plants are affected without giving consequences e.g. the element of "blocked pores affect the exchange of gases and/or photosynthesis" was missing.

Part (d) (1 mark)

The final item of this question asked candidates to give another source of air pollution not shown in the diagram. Slightly less than half of the candidates managed to answer correctly, with many even from high to middle ability groups, unable to identify another source of air pollution. Candidates did not pay attention to the words "another" and "not", and ended up giving sources depicted in the diagram, while there really are only two such sources in the picture. Typical acceptable answers would have been:

- Smoke from factory chimneys.
- Burning of wood/garbage.
- Dust from stone crushers.
- Excess pesticides/fertilisers sprayed in the air and carried by wind.

QUESTION 10 (8 marks)

Candidates had to apply their knowledge of ways to put out a fire to the given context of the question, namely a pan of oil on fire. For each of four proposed ways to put out the fire, they were required to tick whether the fire would be put out or not, and to give a reason for each of their answers.

While a number of candidates were able to tick the correct box in each case, in general, they struggled to give the reasoning underlying their choice. The context given is one which learners study in Grade 6 in the topic on *air*.

(a) Candidates were expected to convey the idea that by blowing air onto the fire, the flames are provided with more oxygen and thus will not be put out.

(b) More candidates were able to correctly answer this item as they learn about this specific way of extinguishing such fires. However, while some know of the method, they do not necessarily understand or recall why it works. Putting the metal lid on the fire deprives the flames of oxygen and without oxygen the fire will be put out. The importance of using a metal lid instead of a plastic lid can be explained in class. While doing so, the properties of different materials can also be explained and the link with the topic materials can be made.

(c) It was generally challenging for candidates to explain why water should not be used to extinguish oil on fire. Many were not able to explain that the oil would float and the fire would spread out further. This is an important concept for pupils to understand as it is about safety precautions that should be considered in the kitchen.

(d) The fire would be put out by throwing sand onto it for the same reason as covering it with a metal lid - the oxygen supply would be cut off. Candidates found it difficult to explain why this method was appropriate.

While pupils know the different ways of extinguishing different types of fire, they have not necessarily understood why these methods are being used. The first thing to ensure is that they understand the dangers associated with using the wrong methods to extinguish a fire. To be able to understand why some methods are appropriate and others not, they should understand how the fire was put out. The following are the main ideas behind extinguishing fires.

- Restricting the source of oxygen – This can be by putting a lid on the burning oil or putting a damp cloth onto an object which is on fire
- Removing the source of fuel – By closing the gas supply in a gas oven or removing the source of fuel or cutting down trees in a forest fire, the source of fuel is removed and thus the fire does not propagate and is put out.
- By using an extinguisher – Carbon dioxide gas is an extinguisher which can be used on fire. This concept can also be taught when carrying out the experiment with the covered lit candle. The reason why the flame goes out after a few moments is because carbon dioxide replaces the depleted oxygen.

CONCLUSION

Learners should be encouraged to try more hands-on experiments, to express their answers in writing, to investigate on their prior knowledge, to find plausible scientific explanations for their results and to understand the scientific method. Adopting a hands-on approach to the teaching of Science can help. It is also important to develop values such as precision and accuracy in understanding and communication.

Learners should also be encouraged to understand the scientific method and what is being done or the aims of the different methods to develop their

scientific literacy. The purpose of using the scientific method in each of their investigation should be emphasised.

- The first step is to make an **observation**. Based on this observation and their prior knowledge, the observation can lead to a question.
- **Forming a question** is thus the second step. In this step, learners do not know the outcome of their investigation. They only want to know about a specific problem or question, for instance would seeds need soil to germinate, or what will happen if a plant is kept in the dark, or what will happen if hot water is put to a temperature below 0°C?
- Following the above step, pupils can then come up with a **hypothesis** or a prediction. This is based on their prior knowledge, which allows them to make such a prediction. The outcome of the experiment can meet their prediction or it might not.
- It is only when the above steps are done that the actual **experiment** is conducted. During the conduct of an experiment, pupils should be encouraged to take the correct recordings or measurements and observations. They have to write down these information. This part will further develop another skill, which is about communicating the findings which can be in a tabular form or as drawings.
- Based on the observations made, a **conclusion** can be made where the hypothesis or the prediction is confirmed or not.
- If the expected outcome of the experiment is not achieved, it is interesting to **interpret** why it is so. This step will help in the deeper understanding of the different concepts.

All schools are encouraged to have a Science corner or a Science room where simple equipment and materials are readily available. The materials can be kept in different boxes, each box named for a particular topic, for example materials, soil, plants, energy & electric circuit, air etc… The following website gives a list of materials that each school can have:

http://ppds.pdst.ie/pcsparchive/science/equipmentreview.pdf . This list can be adapted according to the teaching and learning syllabus.

The following is a list of low cost materials that can be used:
(*Source: F Jeerooburkhan)*

Tools

A pair of scissors
A knife / a cutter
A pair of pliers
Screw drivers
A small hammer
A small hand saw
Measuring tape
A ruler

Materials

Plastic bottles-diff shapes & sizes
Plastic glasses
Plastic objects, sheets
Glass panes
Soap, glue, blutack, cellotape
Candles, paper clips, pins
Tooth paste
Transparent jars
Rubber balloons
Cotton reels
Cotton threads
Drinking straw
Elastic bands, raffia tapes
Pieces of wood
Pieces of metals
Cotton, rubber, wool, leather
Dry batteries,
electric wire, switch, bulbs
Empty cans – diff. sizes
Sponge, flannel
Transparent, translucent objects
Fertilizers – diff. types
Potted plants
Manure, compost, bagasse
Flour, sugar, colour powder
Seeds – diff. types
Pictures of plants, animals, foods
Nails – diff sizes, needles
Water colour, paint, paint brush
Matches, alcohol, paraffin (Danger!)
Metallic wires
Pieces of different types of fabrics
Picture of plants
Picture of animals
Salt, sugar, glucose
Coral, Sand, lime,
Soil – diff. types
Chippings, macadam, rock sand
Rocks – diff. types
Plastic & glass beads

Pieces of glass

Equipment

Plastic funnels

Transparent plastic tubes

A comb

A nail cutter

A hair brush

A tooth brush

A small aquarium

A hand lens

A thermometer

A small gas burner

An electric kettle

An electric torch

A small mirror

Test tubes, glass rod, beaker

The globe

Spoons

Pencils