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

MAURITIUS EXAMINATIONS SYNDICATE

NCE 2023 GRADE 9

SCIENCE

CHEMISTRY COMPONENT

Subject code: N530

EXAMINER'S REPORT

April 2024

INTRODUCTION

The Nine Year Basic Continuous Education (NYBCE) includes two national assessments namely the Primary School Achievement Certificate (PSAC), which is the first assessment at the end of the primary cycle and the National Certificate of Education (NCE), the second assessment which is taken at the end of Grade 9. The first cohort of candidates of Grade 9 sat for the NCE assessment in 2021-2022.

The NCE assessment in Science is in line with the philosophy adopted in the National Curriculum Framework (NCF) and detailed in the Teaching and Learning Syllabus (TLS). Science is assessed in three separate papers namely Biology, Chemistry and Physics. Each paper is based on the three assessment objectives as given in **Table 1**.

Table 1

Assessment Objectives		**Weighting**
AO1	Knowledge with understanding	45 – 50
AO2	Application	25 - 35
AO3	Scientific Inquiry	20 - 25

GENERAL COMMENTS:

The 2023 Chemistry component of the Science paper consisted of five questions which were based on the whole syllabus. The performance in the Chemistry component was generally satisfactory. The first three questions were considered as relatively easy with multiple choice questions, matching exercise, fill-in-the-blanks items and true/false items. The items were mainly objective-type ones and therefore were accessible to learners of all abilities. Candidates found question 4 and question 5 more challenging and some candidates did not attempt these questions although the answers to the open-ended questions were expected to be one or two sentences long. Expressing ideas in proper English seems to be problematic.

Question 1: Multiple Choice Questions (MCQ)

Question 1 consisted of 10 MCQ items which ensured the broad coverage of the syllabus of Grade 9. Table 1 summarises the key for the various items of this question.

Item number	Key
1	**A**
2	**A**
3	**B**
4	**D**
5	**C**
6	**A**
7	**D**
8	**D**
9	**B**
10	**D**

The MCQs were generally well answered. Candidates found **MCQs 1, 2, 3,4 and 7** accessible. **MCQs 5,6, 8, 9 and 10** were found to be more challenging.

The mean mark for this question was 7.26 out of 10 indicating that a fair number of candidates could attempt this question successfully.

Comment on Individual MCQs

Item 1 was well answered by the majority of candidates who easily identified beaker as the correct piece of apparatus.

Item 2 was about the process which caused the release of carbon dioxide in a factory.

Item 3 required candidates to identify a greenhouse gas. The correct answer was B – Methane.

Item 4 was a knowledge-based question that required the candidates to identify the molecule representing oxygen. This was one of the most scoring items on the paper.

5. **Fig. 1.3** shows a water molecule.

How many **atoms** combine to form a water molecule?

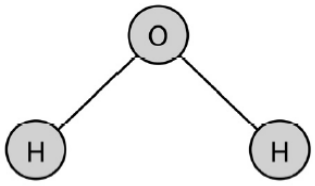

Fig. 1.3

A 2 **B** 4

C 3 **D** 6

For **item 5,** option A was the most common distractor chosen by candidates. The choice of the distractor indicates that there seems to be some confusion between the term 'atoms' and 'elements'.

6. What is the valency of hydrogen?

A 1 **B** 2

C 3 **D** 4

Many candidates could not recall the valency of hydrogen. A significant number of candidates chose B, which is an incorrect answer. The possible confusion could have been mistaking the subscript for the hydrogen molecule to be its valency. Since the periodic table is given in the examination paper itself, it is recommended that students be introduced to the identification of valencies of elements based on their position in the periodic table.

Item 7 was easily tackled by the majority of candidates. The burning of magnesium is an area of the syllabus that is taught from Grade 7. The majority of candidates easily identified the colour of the flame when magnesium burns.

8. Study **Fig. 1.5**.

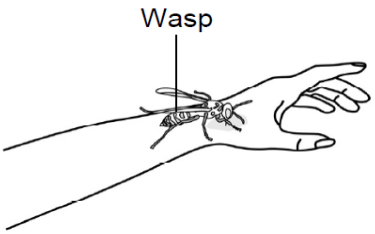

Fig. 1.5

Which one of the following can be used to treat a wasp sting?

A Baking soda **B** Quicklime

C Slaked lime **D** Vinegar

For **item 8,** very few candidates chose Option B and C showing that candidates know that quicklime or slaked lime cannot be used to treat insect stings. A significant number of candidates opted for A, which was an incorrect answer. Since candidates are required to learn about treatment for both wasp sting and bee sting, this may have given rise to the confusion. Attention of candidates should be drawn to the fact that wasp sting is alkaline in nature and hence require an acidic substance to neutralize it whereas bee sting is acidic and requires an alkaline substance to neutralise it.

9. Which salt is used to make the **plaster of Paris**, shown in **Fig. 1.6**?

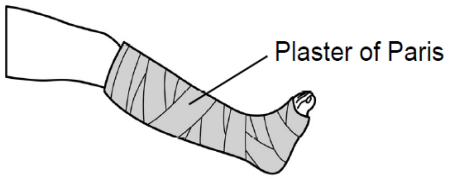

Fig. 1.6

A Ammonium nitrate **B** Calcium sulfate

C Magnesium sulfate **D** Potassium nitrate

Item 9 assessed knowledge about uses of salts and options C and D were popular incorrect choices for the salt used to make Plaster of Paris.

10. What are the products of a **neutralisation** reaction?

A Acid and base **B** Acid and salt

C Base and water **D** Salt and water

For **item 10**, a significant number of candidates opted for distractor A – acid and base which are the reactants of a neutralisation reaction. This is a clear example of misreading of question.

QUESTION 2

This question assessed students' knowledge of the unit 'Language of Chemistry'.

(a) Match the symbol of each element to its correct name.

You may use the Periodic Table on page 12.

Symbol	Name
N	mercury
C	hydrogen
Cl	nitrogen
H	sodium
Hg	chlorine
	carbon

[5]

This item was well-attempted by the good number of candidates. They could easily score 3 marks out of 5. The confusion was between hydrogen and mercury. It has been observed that candidates did not use a ruler for the matching exercise and produced zig-zag lines. It is to be

pointed out that marks are awarded for correct matching where one symbol is matched to one name. There have been instances where candidates matched a symbol of an element to two names. In such cases, no marks are awarded as the choice of the answer is left on the examiner. Candidates should be encouraged to use the periodic table in questions involving symbol and formula.

(b) Complete the following word equations by choosing the correct compound in brackets.

(i) calcium + oxygen ⟶ _____
(calcium oxide, calcium chloride)

(ii) sodium + chlorine ⟶ _____
(sodium oxide, sodium chloride)

(iii) sulfur + oxygen ⟶ _____
(sodium oxide, sulfur dioxide)

(iv) magnesium + sulfuric acid ⟶ _____ + hydrogen
(magnesium chloride, magnesium sulfate)

[4]

This part of the question was also generally well answered since a choice for the correct compound was provided for each word equation. Candidates had some difficulty with item(b)(iii) for the formation of sulfur dioxide. Sodium oxide was the common incorrect answer. Few candidates also wrote sodium chlorine for the formation of sodium chloride. Although pupils had to choose the correct name of the compound provided in brackets, some candidates gave the formula of the compound or added a '+' sign in between the name of the compound for instance, calcium + oxide instead of calcium oxide.

QUESTION 3

This question was well-attempted by the majority of candidates. The mean mark was 7.99.

(a) Identify the effects of **global warming** shown in each picture below. Fill in the blanks with the given words or phrases.

Melting of ice-caps **Depletion of ozone layer** **Droughts** **Flash floods**

1. _____

2. _____

3. _____

[3]

For this item, pictures were given on the effects of global warming and candidates were required to give a description of each effect from a given list of words. Candidates could easily identify melting of ice-caps for picture 2. The flooding picture in Port Louis could easily be identified, most probably because it was in the news and social media. However, the first picture depicting droughts proved to be challenging revealing that candidates could not differentiate between droughts and ozone layer.

(b) Circle the **two** air pollutants from the list below.

CFCs **Oxygen** **Smoke** **Nitrogen**

[2]

CFCs and smoke were properly encircled by most candidates. The common mistake was misreading of instructions which required circling and not ticking.

(c) Write down whether the statements given below are **TRUE** or **FALSE**.

(i) Sewage contains harmful bacteria. _____ [1]

(ii) During volcanic eruptions, sulfur dioxide is released. _____ [1]

(iii) Carbon monoxide is a water pollutant. _____ [1]

(iv) Oil spill is a cause of water pollution. _____ [1]

Item(c)(i), (ii) and (iv) was well done by the majority of candidates who scored more than 2 over 4 marks in this item. Whilst candidates understood that carbon monoxide is a pollutant, they did not pay attention that the statement was about water pollutant.

QUESTION 4

This question was mainly based on the separation techniques chromatography and sublimation. The questions were open-ended ones and proved to be rather challenging for candidates. A significant number of low ability candidates did not attempt this question.

Fig. 4.1 shows a chromatogram of four different food colourings, **P**, **Q**, **R** and **S**, containing different dyes.

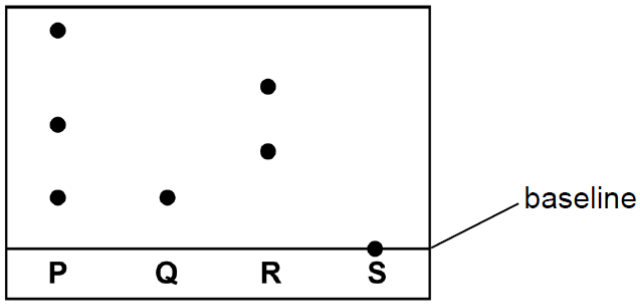

Fig. 4.1

For item (a), candidates failed to recognise that the food colourings contained different dyes. Hence, there was a general confusion regarding the terms ‘food colouring’ and ‘dyes’ for the part on chromatography. A significant number of pupils could identify that food colouring P contains three dyes.

In item (a)(ii), many candidates stated that Q contains/has/forms only one dye/spot/component. It was observed that some candidates failed to provide complete answers and merely mentioned 'one'. Others repeated the question stating that Q is a pure dye.

Item (a) (iii) posed major difficulty to a large number of candidates who could not relate that food colouring S has not been separated due to its insolubility in the solvent. The most popular incorrect answer was '*because S remains on the baseline or because it does not move as shown in the picture*'. This shows that candidates have not grasped the principles underlying the separation techniques and, in this case, that chromatography relies on the difference in solubility.

For item(b)(i), high ability candidates could explain that the spot of the food colouring should be small to prevent overlapping of the dyes on the chromatogram. Other candidates wrongly expressed their ideas using terms like smudging and spilling or providing vague answers such as messing/ruining/spoiling/affecting the experiment.

Item (b) (ii) was an open-ended question which proved to be challenging. The question was about precaution to be taken during chromatography. Many provided general laboratory precautions such as wearing gloves, goggles, lab coat or face mask, rather than stating precautions specific to chromatography. The popular correct precautions included 'use of lid to cover the container' and 'the startline should be drawn with a pencil and not with a pen'. Some pupils did not read the question carefully ignoring the term 'another' and hence repeated the same precaution stated in (b)(i).

. 4.2 shows an apparatus used for the sublimation process.

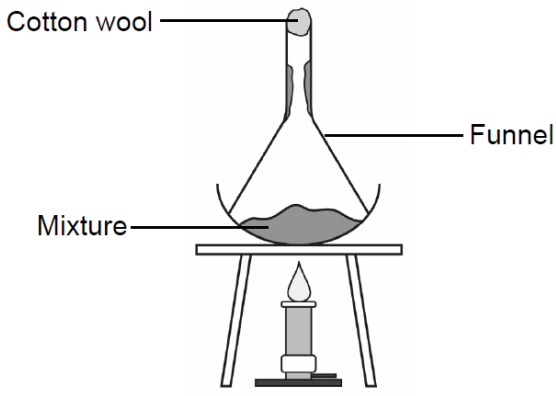

Fig. 4.2

In item (c) (i), candidates were expected to state the **change of state** that takes place during sublimation and many gave the correct answer which was '*solid to gas*'. The common mistake was to mention only one state of matter.

For item (c) (ii) Students were expected to give a mixture of two substances in which one sublimes and the other has a high melting point. Few students could give example of a mixture that can be separated by sublimation. Correct answers included iodine and sand; ammonium chloride and sodium chloride; dry ice and kitchen salt. A good number of candidates provided only one or two solids that sublime such as ammonium chloride and/or iodine. Examples of incorrect answers included 'iodine and sulfur' and 'ammonium sulfate and salt'.

Item (c) (iii) was poorly attempted by a significant number of candidates. Incorrect answers were '*to prevent the escape of the gas*' or '*to prevent air/oxygen from entering/going out*' or '*for the gas not to mix with air*' or '*to prevent the vapour from entering the funnel*'. There seems to be some confusion regarding the terms evaporation and sublimation.

Item (d) was a knowledge-based question which required candidates to recall the solubility table. This was a rather unpopular item in which a majority of candidates could not score. Common incorrect salts include sand, potassium/sodium carbonate and ammonium carbonate.

QUESTION 5

This question was found to be as challenging as Question 4. The unit 'Language of Chemistry' seems to pose major challenges to a good majority of candidates.

For item (a) candidates were required to write the formulae of aluminium sulfate and iron (III) nitrate. Only a small number of pupils could score both marks. Candidates who wrote small letter of oxygen in the radicals. For example, answers such as $Al_2(So_4)_3$ and Fe $(No_3)_3$ did not score marks. It was also observed that some candidates failed to recall the formula of the radicals and instead gave the formula for sulfide (AlS or Al_2S_3) and nitride (FeN or Fe_3N or FeN_3). A few candidates did not use the swap valency method and gave answers such as $Al_3(SO4)_{2,}$which was incorrect.

(i) $CaCO_3 + HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

(ii) $CH_4 + O_2 \longrightarrow CO_2 + H_2O$

(iii) $Fe + O_2 \longrightarrow Fe_2O_3$

Only a few candidates balanced all the three chemical equations and scored full marks for the above item. Fractions and multiples were also awarded full marks. Candidates found the first equation easy to balance.

(c) An iron nail is placed in a boiling tube containing copper (II) sulfate solution as shown in **Fig. 5.1**.

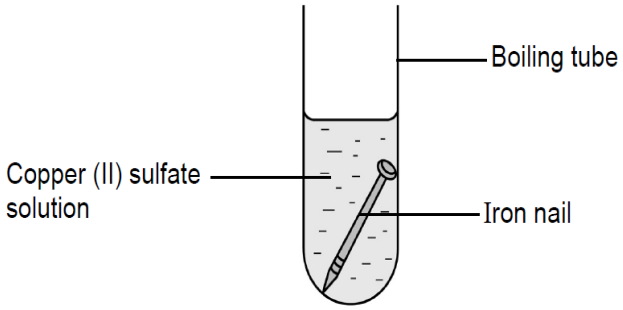

Fig. 5.1

Item (c) (i) was generally well-answered and candidates identified copper as the solid deposited on the iron nail. There were some candidates who gave the symbol Cu instead of the name. It is important that candidates recognise that naming an element and giving its symbol is different. Copper (II) sulfate or iron (II) sulfate were other popular incorrect answers.

For item (c) (ii), few candidates could identify displacement reaction as the type of chemical reaction between iron and copper (II) sulfate. Common wrong answers included rusting, neutralization, combustion and crystallization.

(d) A student investigates the reaction of magnesium with steam. The apparatus is set up as shown in **Fig. 5.2**.

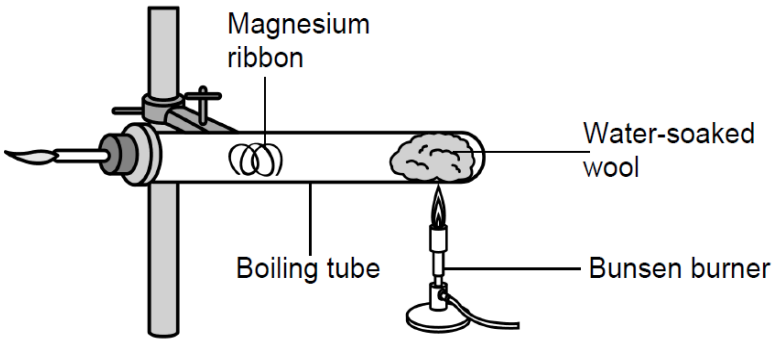

Fig. 5.2

For item (d) (i), a good majority of candidates could score the mark for stating the colour "white" for the solid (magnesium oxide) remaining in the boiling tube at the end of the experiment.

For item (d) (ii) where candidates were required to write the balanced chemical equation for the reaction of magnesium with steam, very few scored full marks. The common confusion was to write the equation for the burning of magnesium instead of the reaction of magnesium with water.

For item (d) (iii), candidates were expected to answer with a 'No' for the question '*Will a reaction take place when repeating the experiment using a copper strip instead of the magnesium ribbon?*'. Many scored only one mark for stating that 'No reaction takes place'. The second part of the question required candidates to justify their answer. It was expected that the justification refers to the position of copper in the reactivity series.