EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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2024 CHIEF MARKERS REPORT

SUBJECT	**TECHNICAL SCIENCES**	
PAPER	**2**	
DURATION OF PAPER:	**1 ½ HOURS**	
PROVINCE	**EASTERN CAPE**	
DATES OF MARKING	**28 NOVEMBER-11 DECEMBER 2024**	

SECTION 1: (General overview of Learner Performance in the question paper as a whole)

- Rasch analysis reveals that the candidate's average score for the paper is 48,2% on the 100 scripts sample
- The seven point scale reveals that candidates perfomed at 38.0%,which is a slight improvement comparing with 2023 by 4% perfomance from a total **number of 2934** learners, who were registered for NSC 2024.
- Generally, the level distribution shows an improvement in the performance of candidates from level 5 to level 7(Level 5 improved from 2.7% to 4.3%, level 6 from 0.7 % to 2.4%, and level 7 from 0.2% to 0.6%).
- The graph (figure1) below represents the seven (7) point scale level distribution for the performance improvement of 3.7%.

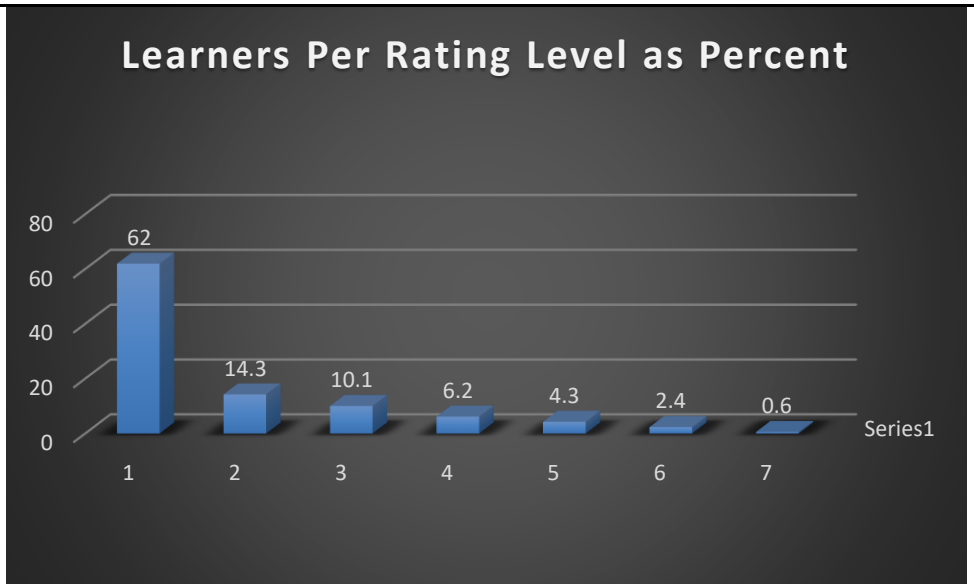


FIGURE 1 SEVEN POINT SCALE

- Seven Point Scale results align with the 100 sampled scripts tabled in the Rasch report.
- The graph below shows the learner performance as per Rasch report which ranged between 29% and 61.1% with electrolytic cell and organic reactions being the least performed topics at 29.2 % and 39.2%.

TABLE 1: OVERALL LEARNER PERFORMANCE FROM QUESTION 1-6

Question	Topic	Ave. performance %
1	ALL TOPICS IN THE TECH SCIENCE CONTENT	56.8
2	BASIC ORGANIC MOLECULES	54.2
3	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	52.6
4	ORGANIC REACTIONS	29.2
5	ELECTROLYTIC CELL	39.2
6	GALVANIC CELL	61.1
Total		**48.2**

FIGURE 2: QUESTION SUMMARY

TABLE 2 – LEVELS OF PERFORMANCE FOR 2022 – 2024

Levels of performance	2022	2023	2024
1	75,3	65,7	62.2
2	11,7	14,8	14.3
3	6,6	10,5	10.1
4	3,4	5,3	6.2
5	1,7	2,7	4.3
6	0,7	0,7	2.4
7	0,3	0,2	0.6

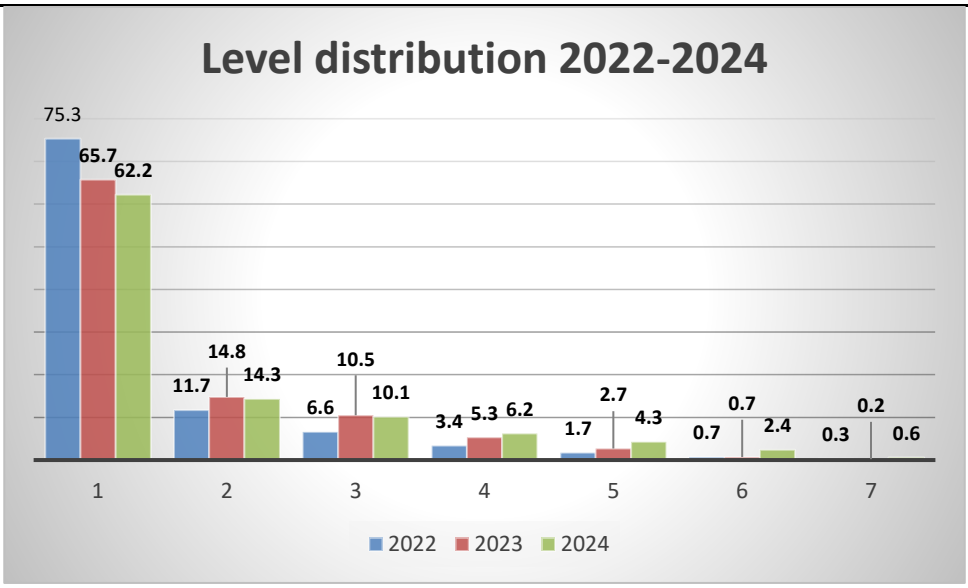


FIGURE 3

QUALITY OF RESULTS

The table and the graph below display the performance trend for the number of learners in each level (5-7) for the past three years. The performance seems to be diminishing especially in levels 2 to 5. The graph and table 2 (figure 3 &table 2) for the 2022-2024 overall performance display the improvement in 2023 results. Furthermore, table 3 also displays an improvement in the quality of results.

2022	2023	2024
24,7	34,3	38,0

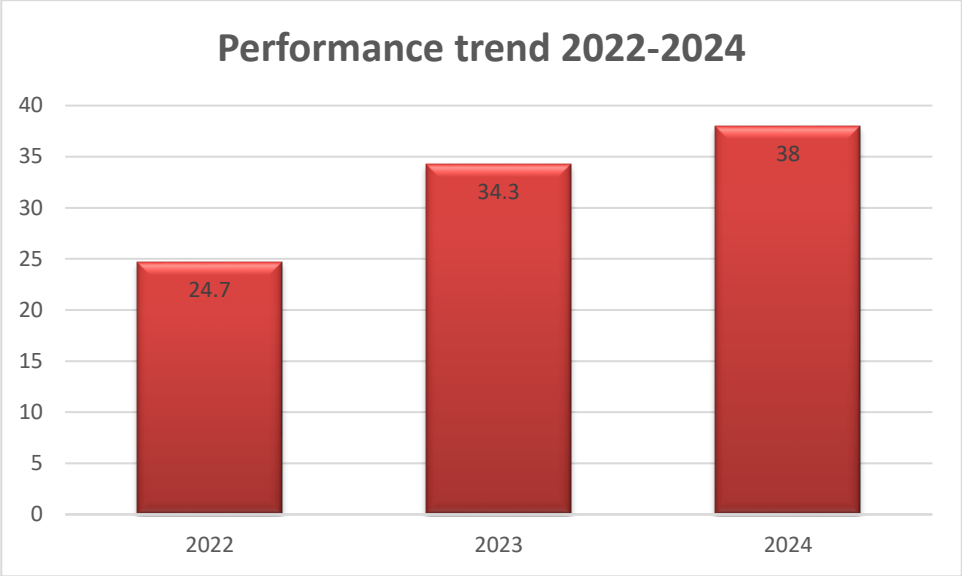


FIGURE 3

TABLE 3- QUALITY LEVELS (5-7)

Levels	2022 (number of learners)	2023 (number of learners)	2024 (number of learners)
L5	51	78	126
L6	22	21	72
L7	9	6	19

Table 3 exhibits a great improvement in the number of learners who passed at level 5 (4.3%) which is a 1.6% improvement and level 7 (0.6%) with a 0.4% increase.

The pocket of excellence is that the number of learners passing at level 6 is increasing significantly at 1.8% improvement rate.

TABLE 4- DIFFERENCE IN OVERALL PERFORMANCE (2022-2024)

Year	Overall Performance	Difference in % over 3 years (2022-2024)	Difference in % over 2 years (2023-2024)
2022	24,7%	13%	-6,8%
2023	45.5%	20.8%	+7.8%
2024	48,2%	2.7%	+18.1%

SECTION 2

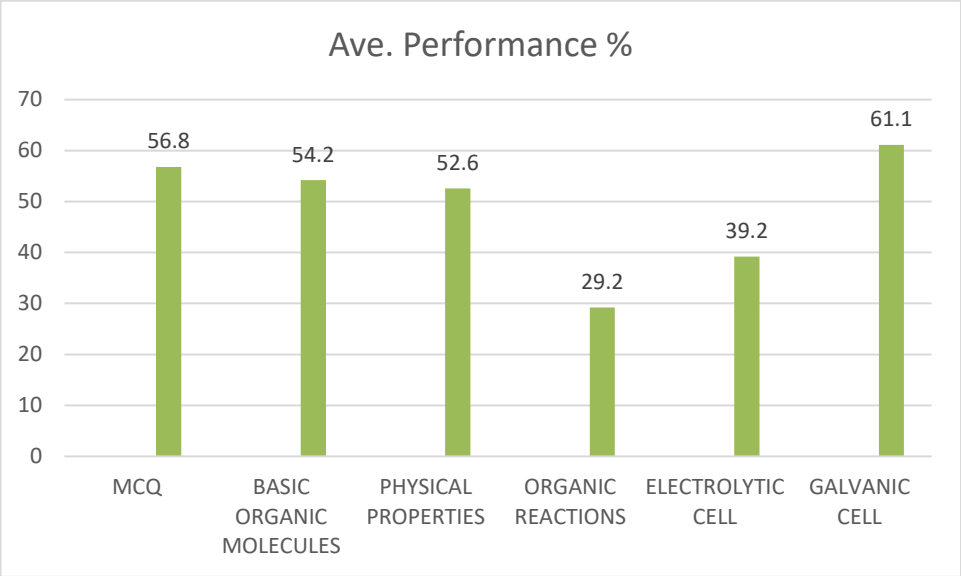


FIGURE 4

TABLE 5

Sub-question	Topic	Ave. performance %
1.1	BASIC ORGANIC COMPOUNDS	82.0
1.2	BASIC ORGANIC COMPOUNDS	67.0
1.3	ELECTRONIC PROPERTIES OF MATTER	16.0
1.4	ELECTROLYTIC CELL	78.0
1.5	FUEL CELLS	48.0
2.1.1	BASIC ORGANIC COMPOUNDS	82.0
2.1.2	BASIC ORGANIC COMPOUNDS	66.0
2.1.3	BASIC ORGANIC COMPOUNDS	59.0
2.1.4	BASIC ORGANIC COMPOUNDS	26.5
2.2.1	BASIC ORGANIC COMPOUNDS	68.0
2.2.2	BASIC ORGANIC COMPOUNDS	37.0
2.3.1	BASIC ORGANIC COMPOUNDS	11.0
2.3.2	BASIC ORGANIC COMPOUNDS	45.0

2.4.1	BASIC ORGANIC COMPOUNDS	86.0
2.4.2	BASIC ORGANIC COMPOUNDS	30.0
2.5	BASIC ORGANIC COMPOUNDS	55.0
3.1	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	84.0
3.2	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	37.0
3.3	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	21.5
3.4	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	58.0
3.5	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	49.3
3.6.1	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	74.0
3.6.2	PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS	61.0
4.1	ORGANIC REACTIONS	85.0
4.2.1	ORGANIC REACTIONS	62.0
4.2.2	ORGANIC REACTIONS	74.2
4.2.3	ORGANIC REACTIONS	4.0
4.3.1	ORGANIC REACTIONS	24.0
4.3.2	ORGANIC REACTIONS	18.3
4.4.1	ORGANIC REACTIONS	31.5
4.4.2	ORGANIC REACTIONS	22.0
4.5.1	ORGANIC REACTIONS	25.0
4.5.2	ORGANIC REACTIONS	35.0
5.1	ELECTROLYTIC CELL	51.0
5.2	ELECTROLYTIC CELL	29.0
5.3	ELECTROLYTIC CELL	83.0
5.4	ELECTROLYTIC CELL	90.0
5.5	ELECTROLYTIC CELL	38.0
5.6	ELECTROLYTIC CELL	12.5
6.1	GALVANIC CELL	90.0

6.2	GALVANIC CELL	5.1
6.3	GALVANIC CELL	61.0
6.4	GALVANIC CELL	88.0
6.5	GALVANIC CELL	57.0
6.6	GALVANIC CELL	43.0
6.7	GALVANIC CELL	55.0
6.8	GALVANIC CELL	67.5

FIGURE 6: BELOW SHOWS THE PERFORMANCE SUMMARYON EACHSUB-QUESTION

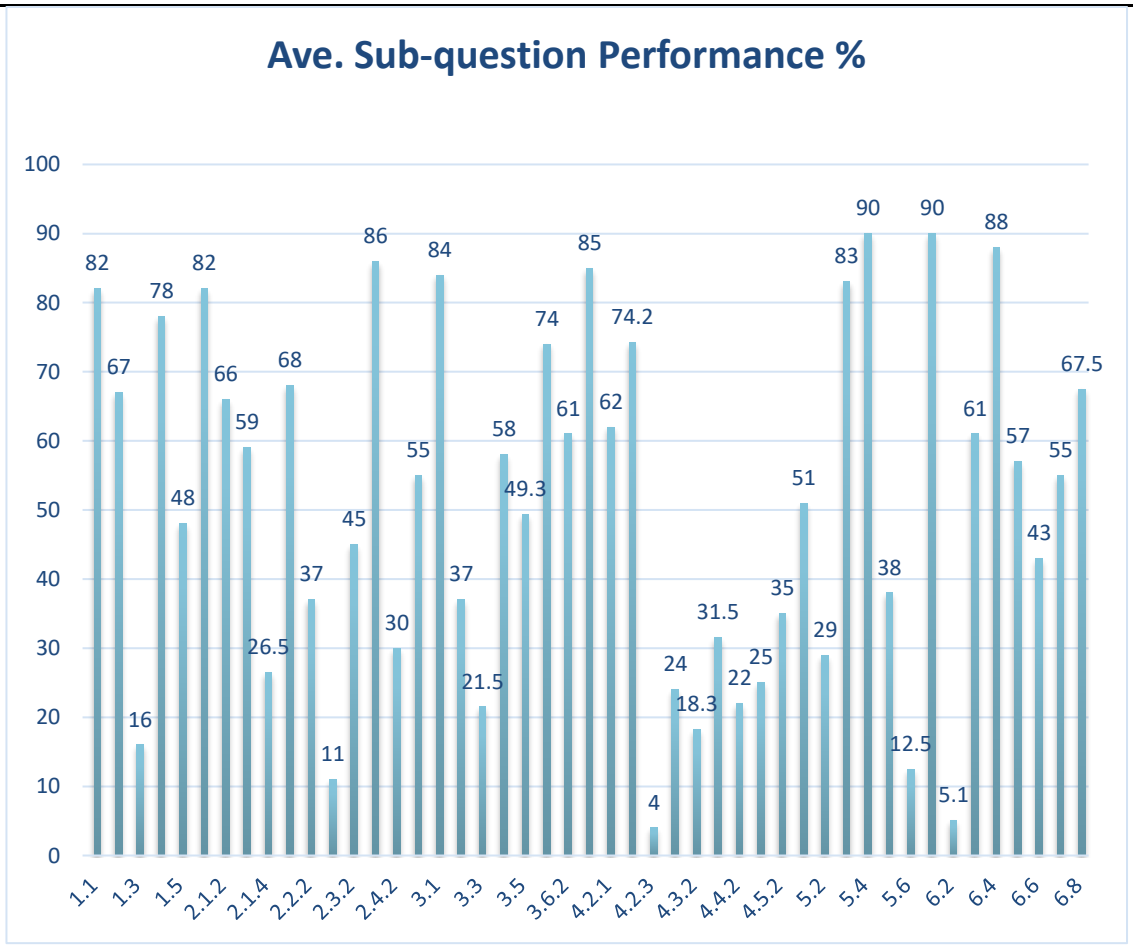


FIGURE 5

SECTION 2: Comment on candidates' performance in individual questions

QUESTION 1

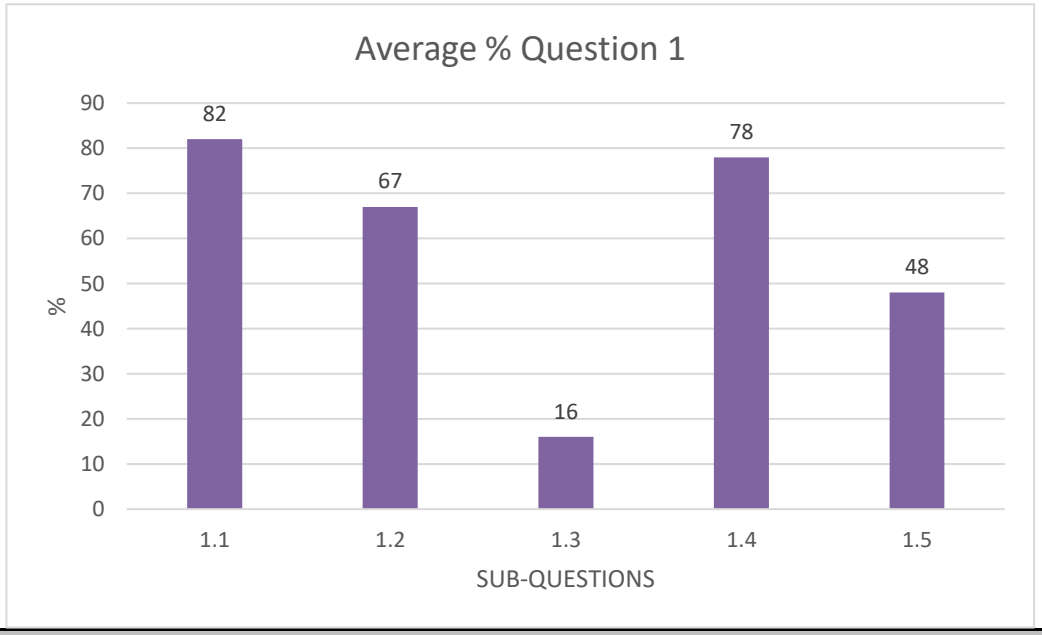
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

Most of the learners were able to achieve satisfactory results, with few learners achieving 70% in this section.

TABLE 6

Sub-question	Topic	Ave. performance %
1.1	BASIC ORGANIC COMPOUNDS	82.0
1.2	BASIC ORGANIC COMPOUNDS	67.0
1.3	ELECTRONIC PROPERTIES OF MATTER	16.0
1.4	ELECTROLYTIC CELL	78.0
1.5	FUEL CELLS	48.0

FIGURE 6



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

- Questions that threw most learners out were Q1.1 to Q1.3, and even the stronger learners struggled with Q1.3. In Q1.1, learners might have been confused by option D, which is not an incorrect response, because of the way the question was phrased.

- In Q1.2, learners were confronted with condensed structural formula, a topic that may only be skimmed over in class by many educators because the condensed structural formula was not

previously part of the Technical Sciences Curriculum.

- In Q1.3, it was unclear that the examiner was testing electronic properties of matter, rather many learners confused the given circuit with Ohms Law, and this was the worst poorly answered multiple-choice question by learners.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Curriculum advisors to organize workshops on organic chemistry and electronic properties.
- Condensed structural and molecular formulae of organic compounds must be taught well in the classroom.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- The issue with questions Q1.1 and Q1.3 does not stem from the learners' understanding but rather from the phrasing of the questions.
- The language used may not have been clear enough, and certain key phrases or words could have been included to provide better clarity about what the examiner was truly asking.

QUESTION 2

This was a very fair question as there were no unclear questions and most average learners performed well in question two. This question was one of the questions that was best answered by the learners.

TABLE 7: QUESTION 2 SUMMARY OF AVERAGE PERFORMANCE

Sub-question	Topic	Ave. performance %
2.1.1	BASIC ORGANIC COMPOUNDS	82.0
2.1.2	BASIC ORGANIC COMPOUNDS	66.0
2.1.3	BASIC ORGANIC COMPOUNDS	59.0
2.1.4	BASIC ORGANIC COMPOUNDS	26.5
2.2.1	BASIC ORGANIC COMPOUNDS	68.0
2.2.2	BASIC ORGANIC COMPOUNDS	37.0
2.3.1	BASIC ORGANIC COMPOUNDS	11.0
2.3.2	BASIC ORGANIC COMPOUNDS	45.0
2.4.1	BASIC ORGANIC COMPOUNDS	86.0
2.4.2	BASIC ORGANIC COMPOUNDS	30.0
2.5	BASIC ORGANIC COMPOUNDS	55.0

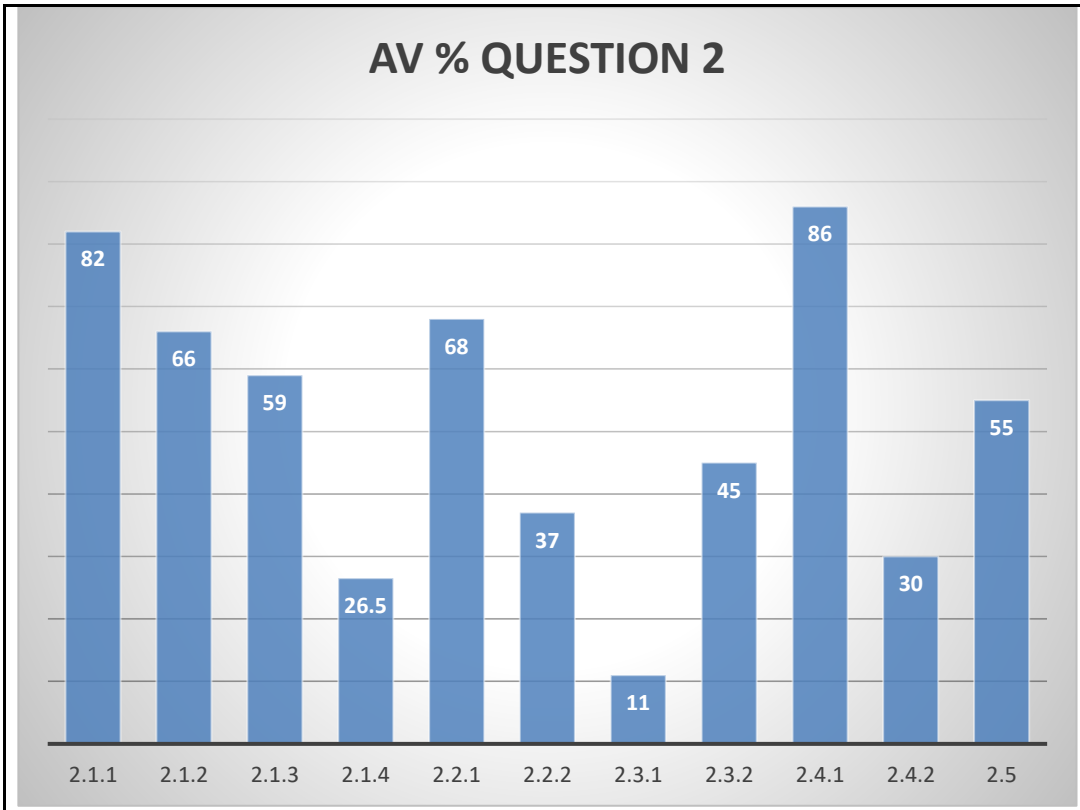


FIGURE 7

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

COMMON ERRORS AND MISCONCEPTION

- Most learners could not answer Q2.1.4 correctly. It is evident that most learners do not know what a combustion reaction is, and those who do have an idea, do not know what the products of such a reaction are.
- In Q2.3.1, learners did not know how to draw the structural formula of the functional group of carboxylic acid. Many learners would draw the whole structure of compound C, without circling the functional group of the compound.
- In Q2.3.2 most learners were struggling with the correct naming of compound C, hence it means that, not enough emphasis is placed on the skill of naming of organic compounds.

Common errors:

Learners do not know IUPAC rules of naming organic compounds.

- 1-Propanoic acid or Propan-1-oic acid.
- In 2.5 most learners wrote secondary instead of tertiary alcohol they could not see that they were given a branched carbon chain.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teach basics in organic chemistry well: definitions, formulae IUPAC naming. homologous series etc.

- Teachers should do more informal assessments with learners on different homologous series, isomers and organic reactions. Learners must be taught to name, identify and draw different isomers, organic compounds, and their functional groups.

- Organic Chemistry needs constant revision throughout the year by including it in assessments.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Learners should be encouraged to spend more time on studying organic chemistry, as it carries 45 marks out of 75 marks in this question paper. Thus 60% of the question paper is organic chemistry and for that reason, teachers should spend more time on adequately teaching this topic.

QUESTION 3

This was an underperformed question.

- Learners struggle with the physical properties of organic compounds. Learner do not know which intermolecular forces act between compounds from the different homologous series and they do not have the skills to adequately compare two substances scientifically.

TABLE 8: QUESTION 3 SUMMARY OF AVERAGE PERFORMANCE

Sub-question	Topic	Ave. performance %
3.1	PROPERTIES OF ORGANIC COMPOUNDS	84.0
3.2	PROPERTIES OF ORGANIC COMPOUNDS	37.0
3.3	PROPERTIES OF ORGANIC COMPOUNDS	21.5
3.4	PROPERTIES OF ORGANIC COMPOUNDS	58.0
3.5	PROPERTIES OF ORGANIC COMPOUNDS	49.3
3.6.1	PROPERTIES OF ORGANIC COMPOUNDS	24.0
3.6.2	PROPERTIES OF ORGANIC COMPOUNDS	61.0

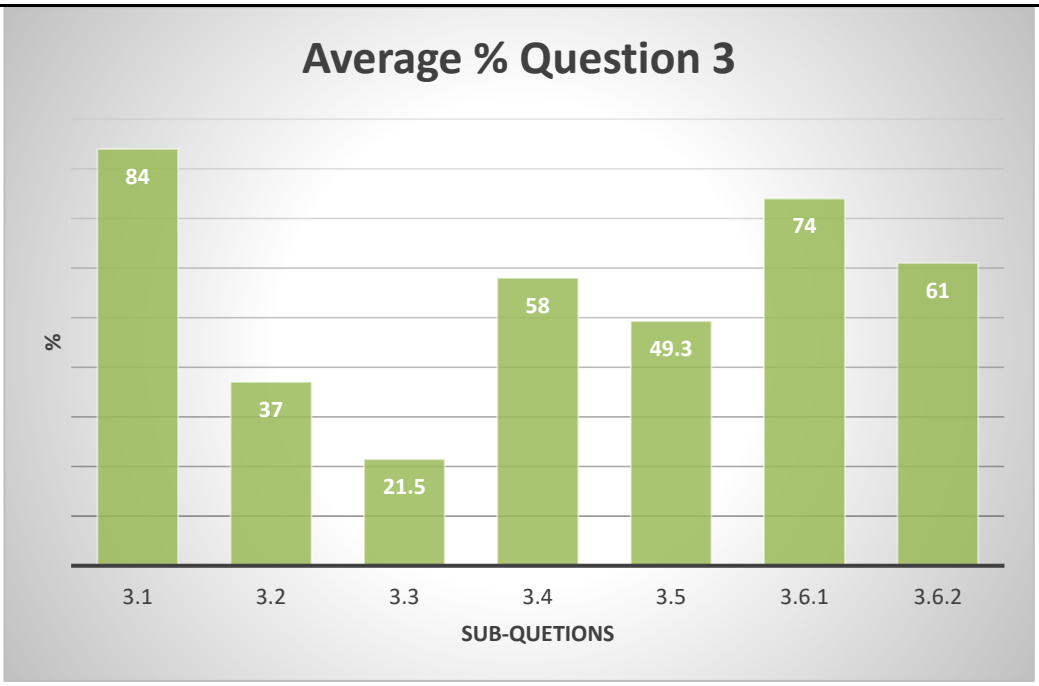


FIGURE 8

(**b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions**.

This question was performed poorly by learners.

COMMON ERRORS AND MISCONCEPTIONS

- In Q3.1.1, a lot of learners left out one key word, making the definition insufficient.
- In Q3.2, most learners could not interpret the question correctly and only wrote one compound.
- In Q3.3, learners did not understand the relationship between intermolecular force and boiling point. Many learners did not understand that the intermolecular force influences the boiling point and not the other way around. Some learners used the word "higher" instead of stronger to explain the strength of Intermolecular Forces.
- In Q3.4, learners did not understand the relationship between intermolecular forces and vapour pressure.
- In Q3.5, an alarmingly large percentage of learners could not identify and compare the strength of the intermolecular forces in halo alkanes and alkanes. Hence, learners were not able to answer 3.5 adequately when it came to reading and answering what was asked in the question. Learners fail to answer by making a scientific comparison of the necessary physical properties i.e., by identifying the intermolecular forces of the different compounds and comparing their strength to each other. Again, some of the learners write the right answer but fail to include the comparison between the compounds.
- In Q3.6 Learners do not know the difference between Chain, Positional and Functional Isomers

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teachers should encourage learners to study definitions from the exam guideline and teach learners how to identify and focus on key words. Teachers should also emphasize the importance of studying the definitions and to point out to learners the definitions that are frequently tested in Paper 2.
- Teachers should practice more past papers with learners to familiarise them with key phrases such as increasing/decreasing order

- Learners should be taught how to answer these questions in a scientifically structured manner. Teachers must emphasize the use of a scientific comparison between the compounds. When learners are asked to compare different substances' intermolecular forces, they should be taught to mention the compounds being enquired about in the question.
- Teachers must focus on working through various exam type questions on physical properties of organic molecules to train the learners to answer questions on intermolecular forces. The teachers must guide the learners on how to explain the trends in physical properties of organic compounds by using chain length/surface area/molar mass, strength of the intermolecular forces and energy needed in their answers.
- Teachers should make use of tables when comparing two organic compounds, most of the learners who received full marks in this question had tabulated their answers.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- The different intermolecular forces, and the strength of the intermolecular forces should be clearly explained to the learners and assessed regularly because of the large percentage of organic chemistry the question paper consists of.

QUESTION 4

- Question 4 was an underperforming question. The learners seem not to have the necessary knowledge of organic reactions to answer questions surrounding it.

TABLE 9: QUESTION 4 SUMMARY OF AVERAGE PERFORMANCE

Sub-question	Topic	Ave. performance %
4.1	ORGANIC REACTIONS	85.0
4.2.1	ORGANIC REACTIONS	62.0
4.2.2	ORGANIC REACTIONS	74.2
4.2.3	ORGANIC REACTIONS	4.0
4.3.1	ORGANIC REACTIONS	24.0
4.3.2	ORGANIC REACTIONS	18.3
4.4.1	ORGANIC REACTIONS	31.5
4.4.2	ORGANIC REACTIONS	22.0
4.5.1	ORGANIC REACTIONS	25.0
4.5.2	ORGANIC REACTIONS	35.0

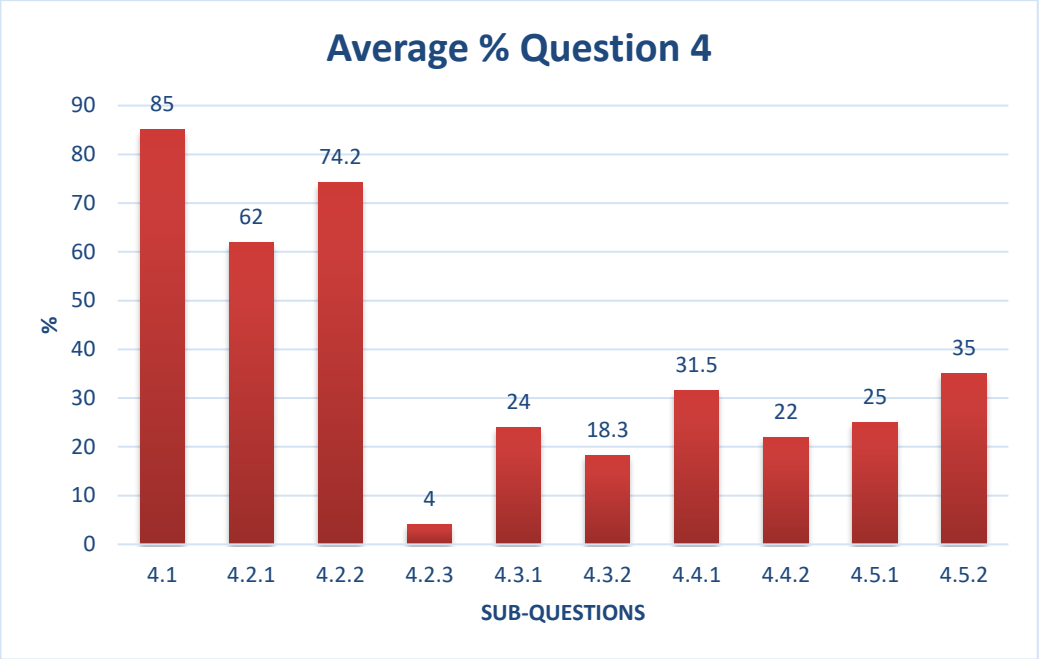


FIGURE 9

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

COMMON ERRORS AND MISCONCEPTIONS:

- In Q4.1, learners struggle to identify different type of homologous series.
- Q4.2.1 Learners do not know how to apply Markovnikov's rule to addition reactions.
- In Q4.2.2 learners struggled to sufficiently explain why Compound B was a tertiary halo alkane.
- Q4.2.3 was an unfair question as technical science learners are not expected to know WHY the reaction condition of not adding water in this hydrohalogenation reaction exists.
- Q4.3.2, was answered very poorly due to learners not being able to write a full chemical equation for the substitution reaction from compound B to compound C.
- In Q4.3 and Q4.5, learners once again neglected the key words/phrases such as writing the NAME or FORMULA of a specific compound.
- In Q4.4.1 learners got confused about **hydration** with **hydrolysis**.

(c). Provide suggestions for improvement in relation to Teaching and Learning
Interpretation of flow diagrams and understanding of reaction conditions should be the integral part in the teaching of organic reactions and should be assessed in all assessment tasks, both formal and informal.

- Emphasis should be placed on studying the different reactions, reaction conditions and catalysts for the different reactions. Learners must also be taught to write all words needed in the reaction condition such as concentrated/dilute base instead of just saying base and mild heat instead of writing just heat.
- Learners must practice using flow diagrams for chemical reactions in organic chemistry.
- Draw up exercises on organic reactions which allow learners to work backward from products to reactants.

- Teachers should use both informal and formal assignments to assess understanding of reactions, and not just teach out of the textbook but consult the exam guidelines.
- Teachers should teach learners how to write and balance chemical equations using structural and molecular formulae, with a focus on what the products will be.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Emphasis should be placed on key words in definitions, and learners should be drilled to study definitions, as it is a lifeline for many learners, and it is the foundation of being able to apply the content knowledge of technical science successfully.

QUESTION 5

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

- This was a fair question based on an experiment that should have been done by the learners in class, however learners still lack the necessary insight to answer this question sufficiently.

TABLE 10: QUESTION 5 SUMMARY OF AVERAGE PERFORMANCE

Sub-question	Topic tested	Ave. performance %
5.1	ELECTROLYTIC CELL	51.0
5.2	ELECTROLYTIC CELL	21.0
5.3	ELECTROLYTIC CELL	83.0
5.4	ELECTROLYTIC CELL	90.0
5.5	ELECTROLYTIC CELL	38.0
5.6	ELECTROLYTIC CELL	12.5

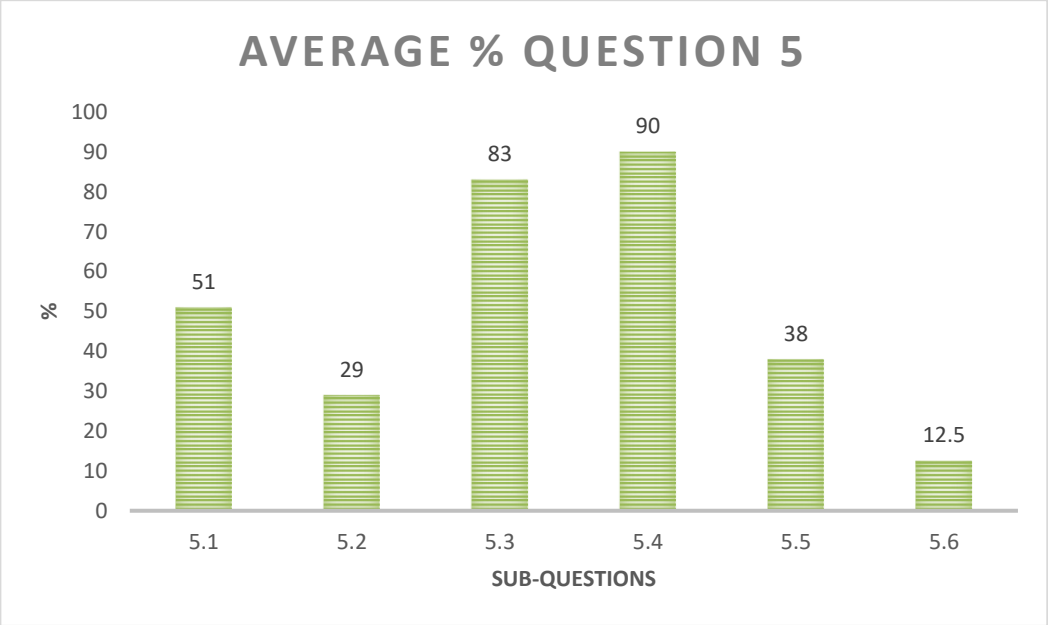


Figure 10

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Problem questions:

In Q5.1 many learners confused this definition with that of an electrolyte.

- Candidates have a challenge with terminology, as a result they could not differentiate between electrolyte and electrolysis. This was evident as some learners gave the answer for an electrolyte instead of electrolysis or mix the two concepts

In Q5.2, learners clearly do not know why they need to clean electrodes in an electrochemical cell, something that should be addressed by educators when doing their practical assessment tasks.

- This question required learners to give a reason why the metal must be cleaned before electroplating, very few learners provided correct responses as to why the metal must be cleaned. Most candidates gave the uses of electroplating, and some gave general responses which are not scientifical.

5.3 Learners attained an average of 83% in this sub-question.

In Q5.4, learners could not explain sufficiently why they chose X to be the anode.

In Q5.5, learners would give the symbol instead of the name because of the X^+ that is also in bold font in the question.

- 5.5 The focus here was on providing the NAME of X^+ ions, however learners gave chemical formula Ag^+ ions instead of SILVER ions.

In Q5.6, learners are not able to use the tables of standard reduction potentials to assist with writing oxidation and reduction reactions as needed.

- 5.6 The oxidation and reduction half-reaction were swopped around showing a lack of understanding of the Table of Reduction Potentials.

Common errors:
Use of double arrow

Ag+2e-	~~Ag~~	(multiplying by 2)
Ag+e	~~Ag~~	(omission of charges)

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teachers should do more exam preparation, especially in terms of reading, understanding and answering the questions properly. They should also practice using the tables of standard reduction potentials in class.
- Teachers should clearly explain the difference between the electrolytic cell and the galvanic cell and do some practical experiments or demonstrations in this regard or at least some videos with proper explanations of the experiments.
- Teach learner must be supplied with the data sheet and Standard Reduction Potentials at the beginning of the year.
- Conduct Practical work, demonstrations, use of Phet Simulations in class when teaching this section.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Teachers should always refer learners to the exam guidelines for the correct wording of definitions.

QUESTION 6

- This was a fair question based on an experiment that should have been done by the learners in class; however, learners still lack the necessary insight to answer this question sufficiently. This question was the best-answered question in the question paper.

TABLE 11: QUESTION 6 SUMMARY OF AVERAGE PERFORMANCE

Sub-question	Topic	Ave. performance %
6.1	GALVANIC CELL	90.0
6.2	GALVANIC CELL	5.1
6.3	GALVANIC CELL	61.0
6.4	GALVANIC CELL	88.0
6.5	GALVANIC CELL	57.0
6.6	GALVANIC CELL	43.0
6.7	GALVANIC CELL	55.0
6.8	GALVANIC CELL	67.5

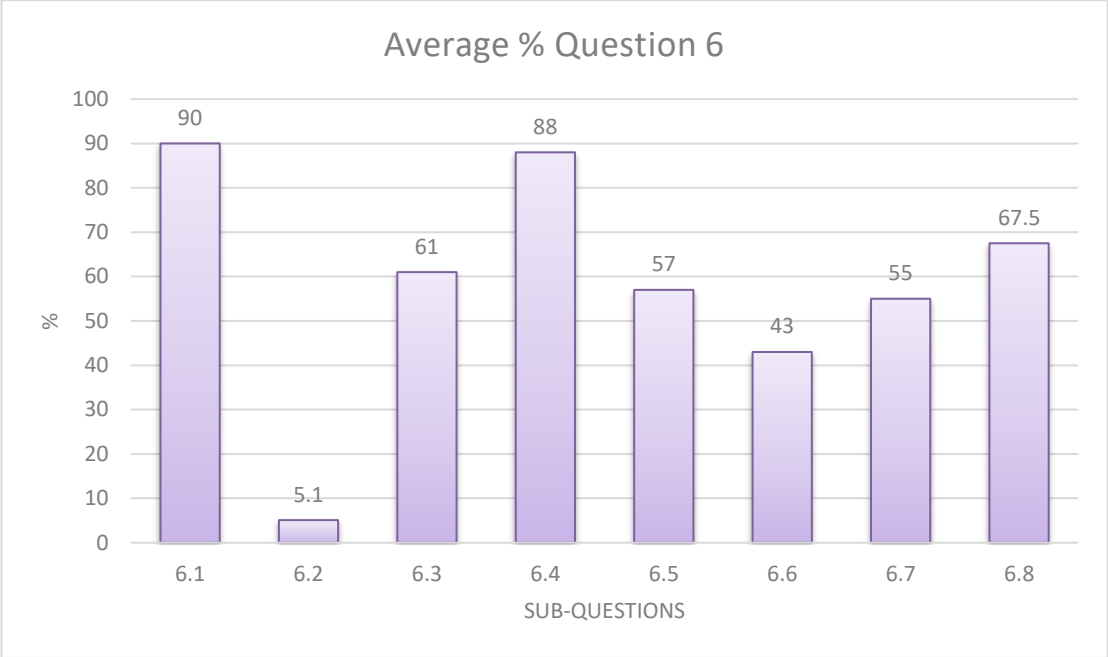


FIGURE 11

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

COMMON ERRORS AND MISCCONCEPTIONS:

- The question layout confused many learners, the question should have started with Q6.3, Q6.4 and Q6,5 followed by a statement informing the learner that the missing component is now added to the incomplete electrolytic cell, then only could Q6.1 and Q6.2 be asked.
- In Q6.1, many learners mentioned this was an incomplete cell, which was not an incorrect observation.
- In Q6.3, learners would continue to explain that the cell was incomplete because it was missing a salt bridge, again not an incorrect conclusion.
- In Q6.5, many learners know that a salt bridge completes the circuit, however, they would continue to add that a salt bridge facilitates the movement of ions leading to most learners receiving a maximum of one out of two marks in this question.
- In Q6.8 many learners struggle to copy the correct formula from the data sheet, most managed to substitute the correct values, others omitted the proper signs, and then left out the unit at the end.

(c) Provide suggestions for improvement in relation to Teaching and Learning

- Teachers should emphasize the differences between an electrolytic and galvanic cell. Teachers should teach learners what the two cells look like and point out in the diagrams what the differences are.
- Teachers should teach the correct functions of a salt bridge to include the reason why ion movement needs to be facilitated between the two half-cells with is to maintain electrical neutrality.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- More time should be spent on informal and formal assessments to train learners on how to answer these questions.
- Experiments can be done for the learners to observe the setup of these cells.

Learners in this section should be exposed to the following in this chapter:

- Drawing of electrochemical cells
- Complete incomplete diagrams of electrochemical cells
- Label complete electrochemical cells
- Identify electrodes in symbols and names
- Identify half reactions
- Oxidising and reducing agents

RECOMMENDATIONS:

Considering the challenges highlighted in sections 1, 2, and 6 above, which are summarized below, learner marks should be adjusted upwards by 10%.

1. **Under examination of topic (2,4% (2 marks) instead of 9% (7 marks) with low hanging marks**- electronic properties of matter which were to advantage learners if the whole 9% was examined instead of 2,4% (2marks). The topic was **5 marks** less which is equal to **6,7%.**
2. **Unfair question- 1.1 to 1.3 (6 marks-8%); 4.2.3. (2 marks-2,4%), 6.1-6. (3 marks -4%).**

Total marks that would have benefited learners is 21 marks, which is 28% of the paper. It is therefore highly recommended that the marks be adjusted upward by 10% based on the justifications detailed in this report.